AURARIA SCIENCE BUILDING ADDITION AND RENOVATION

Program Plan Update

AndersonMasonDale
Architects

January 2007

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Acknowledgements

This Program Plan is the culmination of the efforts of many people including representatives from the Administration, Faculty and Staff of Auraria Higher Education Center, University of Colorado at Denver and Health Sciences Center (UCDHSC), Metropolitan State College (MSCD), and Community College of Denver (CCD). The Auraria Board of Directors oversaw the entire process, while the Committees listed below were formed to help guide and oversee the details of the Program Plan process. Many other individuals not listed contributed their time and ideas as well.

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NOTATION ON PROGRAM DATA

The information in this report has been developed using data from a broad variety of sources: the Auraria Office on Institutional Planning, direct interviews with faculty and staff, departmental data and institutional data from the three Auraria institutions. The programming team has vetted data to the greatest extent possible in the period of time over which programming has occurred. Inconsistencies certainly still exist and as the project evolves into design, these will be identified and resolved to the extent necessary for project planning purposes.

I.1 Preface and Summary

EXECUTIVE SUMMARY

This Program Plan describes the Auraria Science Building Addition and Renovation. It is an update to the Program Plan (of the same name, produced by different consultants) developed in 2oo4.

The Project described herein is intended to accommodate the current and future needs of certain of the science programs of the three institutions at Auraria Higher Education Center (University of Colorado at Denver and Health Sciences Center, Metropolitan State College of Denver, and Community College of Denver). Those science programs are:

Biology
Chemistry
Anthropology
Earth Sciences (MSCD)
Math and Computer Science (MSCD)

Additionally some shared Aruaria classroom space is included in the Program, as is the MSCD Dean's office.

Program spaces primarily include classrooms, offices, teaching labs, research labs, and the required support spaces.

The construction cost is estimated to be about $83.4 million. Total Project cost is $104.7 million.

The project involves the renovation of the existing Science Building (approximately 116,000 square feet), the construction of an addition to the Science Building (approximately 197,000 square feet), and the renovation of approximately 26,000 square feet of "backfill" space (space vacated by moving into the new or renovated Science building.)

The Addition to the Science building will be located generally to the north of the Science building (between Science and the North Classroom). The potential site extends east to the Auraria property line along Speer Boulevard.

The addition will be four or five stories tall and will connect to the current Science building at all three of the existing building's levels.

Generally, the new building will house teaching and research labs, as well as support spaces and research lab offices. The balance of the offices, along with non-major teaching labs and computer labs will be located in the renovated Science building.

The Science building renovations will include (at a minimum) window and roof replacement, installation of fire sprinkler system, elevator upgrades, restroom upgrades and expansion, and HVAC upgrades.

Backfill renovations involve creating classrooms, office space, and teaching labs in space vacated by its previous occupants moving into the expanded and renovated Science building.

The Project will be constructed by a Construction Manager / General Contractor who will determine the actual construction schedule, though it is anticipated that the Addition will be constructed first, beginning in January 2008. The Addition is expected to be complete in 18 months, by July 2009. Current occupants of the Science building will then move into the addition (for some it will be a temporary move) while the renovations of the Science building and the "backfill" space is performed. All construction is anticipated to be complete by March 2010.

1. GENERAL SUMMARY

The Auraria Science Building Facilities Improvement Plan was originally submitted to AHEC in the summer of 2004. This document generally defined Science needs for the University of Colorado at Denver (UCD, which is now University of Colorado at Denver and Health Sciences Center, or UCDHSC), Metropolitan State College of Denver (MSCD), and the Community College of Denver (CCD). The 2004 Program Plan identified a summary of spaces totaling 324,346 gsf, and identified a total project cost of $65M, with a construction cost of $49.2M. It was assumed that the project would consist of the renovation for Science programs of the existing Auraria Science Building (116,000 gsf) along the campus' north eastern edge, Speer Boulevard; the construction of 197,000 gsf of new Science space; and miscellaneous renovations in the North and South Classroom Buildings of 26,000 gsf.

In June 2006, the Auraria Facilities department submitted to CCHE an estimated escalation of the 2004 Program Plan project cost valued at $88M, with a construction cost of $65M. In August of 2006, Anderson Mason Dale Architects (AMD) was hired to verify the program plan for this project. Specifically, the architects were instructed to 'program the needs of sciences on campus' as well as to coordinate efforts with a simultaneously occurring update to the campus master plan. In September 2006, the programming team began work on the project. Since that time,
cost models of program areas have been developed. Current models indicate that the
2004 Program Plan, with appropriate costs for program areas escalated to the anticipated
start of construction (3Q 2007), has a project cost of $104M. This number was reviewed
with the Auraria Executive Committee and Auraria Board of Directors in December 2006,
and was the basis of the Auraria presentation for the project to the Capital
Development Committee of the State Legislature in January of 2007.

2. DEFINITIONS

2004 Facilities Improvement Plan – Program Plan developed by H+L, submitted to and approved by CCHE. Originally submitted in 2004 with a project budget of $65M. Resubmitted in June 2006 with project budget of $88M.

Justified Needs Based Program – Program Plan developed in Fall 2006 by AMD based on meetings and interviews of all institutions to determine programs to be accommodated, space needs required and justification for those needs based on projected enrollment and faculty headcounts developed from existing data amplified by departmental growth assumptions to 2011.

Master Plan Process – Ongoing update by Studio Insite/Sasaki of the Auraria Master Plan document last revisited in 2001. Current themes include public/private partnerships, connections to the city, campus space accounting strategies and institutional identity.

Backfill Space – Space vacated by programs currently located in North and South and Classroom to be relocated into the redeveloped Auraria Science Building project with potential for re-use for Science Program needs or other campus or institutional priorities.

Shelled Space – Space constructed but left unfinished pending further funding. Degree of shelling may vary, but assume typical tenant improvements and 25% of building systems are left unfinished.

ASF – Assignable Square Feet is the building floor area assigned to a particular program activity.

GSF – Gross Square Feet is the full building floor area to the outside face of exterior walls including corridors, mechanical spaces, and partitions.

Contact Hour – one 50 minute unit of instruction time per each student in a teaching space.

Utilization – percentage of contact hour capacity of a teaching space actually used for teaching.

The Program Plan for Sciences identifies multiple spatial types, each of which has a different primary function in the education delivery of the sciences:

Shared Classrooms – At the Auraria Campus, classrooms are typically seen as a shared resource for all institutions, scheduled through a central Auraria time grid. A few classrooms with special teaching setups are controlled by specific institutions or departments. Proposed Science Related classrooms vary in capacity from the existing 300 seat Science 119 to 180, 100, 50, 30 person classroom and 15 person seminar rooms. The classrooms vary in configuration and flexibility relative to size.

Research Active Faculty: Faculty who have ongoing research, which for some faculty is a condition of tenure or employment.

Laboratories: Instructional and research science spaces. There are two primary types of labs in the program plan:

Teaching Laboratory: These spaces are true labs (including fume hoods, sinks, lab casework) that are used almost exclusively for laboratory based instruction to undergraduate students. Science laboratory set up for leading undergraduate students, typically in small groups, through educational science experiments. Contemporary teaching laboratories are typically set up to allow classroom-style instruction to the entire lab. Teaching and research labs (below) are based on a laboratory planning module of 10'6" x 30'-0".

Research Labs: Labs used primarily for research. The types of research spaces in the building vary:

Student Research Laboratory – Research Laboratory set up for ongoing study of a specific topic led by a faculty member supported by graduate, doctoral (and some undergraduate) student research assistants. MSCD & CCD Student Research activity involves only undergraduate students. These research efforts are not typically grant-funded.

Funded Research Laboratory – Research laboratory set up for ongoing study of a specific topic approved for grant funding by an outside institution. Research efforts are led by a faculty member with support from research technicians and post-doctoral assistants. These labs, which the three institutions have agreed will be shared space (i.e., the labs may be utilized on a first come first serve basis for those with secured grant funding), will support grant funded research only.

Laboratory Support: In addition to lab instruction and research spaces, the program plan identifies lab support areas including prep rooms, instrument and balance rooms, animal vivarium, microscopy suite, lab coordinator offices, x-ray core, collections for specific departmental labs, herbarium and greenhouse, imaging suite, instrument repair, machine shop, nitrogen generation room, field equipment storage, etc.

Offices: Private or semi-private workspaces for faculty, adjunct faculty, part time faculty, and graduate students, and research assistants. Office support spaces (reception, conference rooms, records storage, waiting areas, copy/work rooms, faculty break rooms, general storage, etc.) are also defined in the program.

3. PROGRAM METHODOLOGY

The programming verification process was initiated in September 2006. It has been an interview and workshop based process in which:

- a group of stakeholders and decision makers were identified and a decisionmaking hierarchy was established.

The stakeholders included a Steering Committee, with (2) representatives of each of the three institutions plus ex-officio members of the AHEC staff, and a Building Committee, made up of (3) members of each institution, plus AHEC representation. Generally characterized, the role of the former has been to provide leadership in the pursuit of institutional mission and institutional sharing of resources, and the latter has been the development of the detailed space data and needs of the individual departments.

- goals and objectives for the three institutions for Science were defined.

Institutional mission, current and projected future educational programs, and potential synergies between the three institutions are the primary basis for the project goals and objectives. Considerations of the master planning team concerning institutional identity and future land use on the campus have been shared and reviewed as a part of the programming process where appropriate.

• existing scheduling and facilities capacity for Sciences has been verified and summarized based on contact hour utilization for all included institutional departments.
Auraria central scheduling data for Science spaces generally and labs specifically is incomplete. The programming team has interviewed and worked with each individual department to record the schedules and space needs for all, and to use this information as the basis for programming projections.

• a facilities assessment of the existing Science spaces on campus (Science, North and South Classroom Buildings) has been prepared to provide a basis for program cost modeling and design for future renovations

• an assessment of the 2004 Facilities Improvement Plan was prepared which identified areas of focus for the program verification process

• projections for institutional and departmental growth were developed based on institutional data, past and projected growth, and institutional mission

• a series of detailed, focused workshops with departmental faculty and staff has been held to develop departmental space needs and data

• regular interaction with and presentation to the Boards (Auraria Board of Directors, the Facilities Subcommittee of the Board, the Auraria Executive Committee and the three institutional boards) has occurred.

Based on the above process, a summary of program spaces referred to as the Justified Needs Based Program was been developed. This summary is included in Appendix VI.5.

4. ASSESSMENT OF EXISTING AURARIA SCIENCE FACILITIES

The following issues have been identified that suggest a serious need to upgrade, expand and/or replace the existing science facility:

• Serious occupant safety concerns related to ventilation of the existing Science Building, and with the safe delivery and handling of materials to and within the building.

• The building is in need of upgrades relative to the Americans with Disability Act (ADA).

• The building mechanical and electrical systems are at the end of their functional lives and in need of replacement.

• Significant problems with existing Science exterior skin, elevator, & building systems.

• Auraria classroom scheduling grid limits efficient use of labs and classrooms.

• Dearth of research space compromises faculty recruitment potential and ability to pursue research grants.

• Teaching and faculty space availability limit institutions' ability to grow science programs to meet demand.

• Lecture Hall space inefficiently utilized.

• Some fragmented institutions and departments create inefficiencies.

• Many teaching labs are utilized at significantly more than their capacity. Some current utilization statistics on Auraria Science Labs include:

  • 51% are currently utilized at more than 100% of CCHE Contact Hour capacity (80% of 40 hour week).

Of this 51%:

  • 32% are currently scheduled at more than 125% of CCHE capacity

  • 18% are currently scheduled at more than 150% of CCHE capacity

  • 8% are currently scheduled at more than 175% of CCHE capacity. These are typically core Biology labs for each institution.

5. 2004 FACILITIES IMPROVEMENT PLAN ASSESSMENT

The 2004 Program Plan is a broad overview of the Auraria Sciences at that time. As noted earlier, two versions of the 2004 Program Plan have been submitted to CCHE. Both have been approved. The original 2004 version was budgeted at $65M and the 2006 updated version included the same spaces and cost estimates escalated to 2006 construction dollars and budgeted at $88M. Figure 1.1a summarizes the evolution of the project budget.

The areas of greatest consequence to the current programming efforts are:

- The 2004 Program Plan included **inadequate budget** for required upgrades to the existing Science Building and for spatial types included in the program. Actual project cost of 2004 Facilities Improvement Plan would be $104M using current cost model.

- A **non-standard lab utilization rate** was used to develop the program -- 80% of 48 hour week (CCHE Standard = 80% of 40 hour week).

- Programmed **research space was less than existing** and it does not meet the statutory mission of UCDHSC.

- **Includes all programs** currently in the Science Building. This item is noted not as a shortcoming of the Plan but as a primary variable for the current one. All programs currently in Science must have space within the new program, as there is no place for these programs to go. Some of these programs (math and computer sciences, for example) are programs that would not typically be included in a Sciences teaching facility.

- **Includes MSCD Nursing and Health Professions**. These two programs represented a significant portion of the MCSD program space in the 2004 Program Plan. Per Auraria Executive Committee direction, the new program is focused on core sciences programs, and does not include these two programs.

- **Includes 27,000 GSF remodel of backfill space** in North Classroom, Dravo (the UCD Building), and the South Classroom.

- 2006 Update **does not account for 1% per month escalation** to 3Q2007 bid date or mid-point of construction.

	2004 Program Plan		Updated 2004 Program Plan		2004 Program Plan in Current Cost Model		2007 Program Plan	
Building Area	*324,346*		*324,346*		*324,413*		*357,407*	
a) New GSF	181,346		181,346		181,891		197,389	
b) Renovate GSF	143,000		143,000		142,522		160,018	
	Cost/GSF	**Cost Model**	**Cost/GSF**	**Cost Model**	**Cost/GSF**	**Cost Model**	**Cost/GSF**	**Cost Model**
Land Acquisition								
Land Purchase Cost	$ -	$0	$ -	$0	$ -	$0	$ -	$0
Professional Services								
Total Professional Services	$23.76	$7,704,899	$31.51	$10,219,401	$33.02	$10,713,182	$34.15	$12,204,281
Construction								
Total Construction Costs	$151.72	$49,210,852	$203.24	$65,920,150	$244.42	$79,293,520	$233.27	$83,373,722
Equipment and Furnishings								
Total Equipment and Furnishings	$14.51	$4,705,000	$21.76	$7,057,500	$26.55	$8,613,152	$9.00	$3,216,668
Miscellaneous								
Total Misc. Costs	$2.29	$742,109	$3.27	$1,059,202	$3.68	$1,192,935	$2.61	$933,737
Subtotal	$192.27	$62,362,860	$259.77	$84,256,253	$307.67	$99,812,789	$279.03	$99,728,408
Project Contingency								
Total Contingency Requested	$9.48	$3,075,678	$12.10	$3,923,508	$24.29	$7,879,251	$13.89	$4,963,633
Total Budget		**$65,438,538**		**$88,179,761**		**$107,692,040**		**$104,692,041**

Figure 1.1a – Project Budget Evolution

6. JUSTIFIED NEEDS BASED PROGRAM ASSUMPTIONS

Based on the above outlined program methodology, a summary of program spaces referred to as the Justified Needs Based Program has been developed. This is shown in greater detail in Appendix VI.5. This summarizes all spaces required to accommodate the departments included in the program.

The assumptions on which this program summary is based are:

• Focus on Biology & Chemistry programs at all three institutions.

• Provide 50% faculty and 30% enrollment growth in Biology & Chemistry. Faculty growth emphasis allows transition from adjunct faculty model and acknowledges current understaffing of faculty relative to enrollment.

• Include all programs currently in the existing Science Building.

• Lab utilization modeled at 80% of 40 hour week.

• Classroom space accommodates all projected science classroom contact hours, but does not include non-science classes currently held in the existing Science Building.

• Includes research component of UCDHSC Psychology and Anthropology.

• Provide 1 hour of Preparation or Recitation time for each lab section.

• Provide 630 ASF lab module plus 160 ASF equipment alcove for each funded research active faculty to match comparable institutions. Provide lab module plus 3.6 Graduate Research Assistant Workstations for each research teaching faculty.

• Allow flexibility to use backfill space to promote institutional consolidation.

	Existing Space		2004 Program		Justified Needs	
Department/Space Category	Existing ASF by Spatial Type (Incl. SI, SO, NC)	% of Non-Shared Space	2004 Program Plan ASF by Spatial Type	% of Non-Shared Space	Justified Needs Program	% of Non-Shared Space
University of Colorado at Denver & HSC	**23,140**	28.0%	**53,680**	34.4%	**59,173**	36.6%
Office	5,141		10,491		12,970	
Lab	17,999		26,368		45,853	
Classroom	0		0		350	
UCD Math & Other Backfill			16,821			
Community College of Denver	**8,601**	10.4%	**12,227**	7.8%	**18,201**	11.3%
Office	1,490		2,417		3,400	
Lab	5,747		9,810		13,405	
Classroom	1,364		0		1,396	
Metro State College of Denver	**51,007**	61.6%	**90,008**	57.7%	**84,281**	52.1%
Office	15,574		28,702		23,490	
Lab	28,662		50,110		54,669	
Classroom	3,269		0		6,122	
Nursing and HEP	3,502		11,196			
Auraria Sciences Shared Space	**26,601**		**46,194**		**66,211**	
Office	834		5,000		6,300	
Lab	11,161		14,578		25,261	
Classroom	14,606		26,616		34,650	
TOTAL BY SPATIAL TYPE	**109,348**	% of Total	**202,109**	% of Total	**227,866**	% of Total
Office	23,039	21.1%	46,610	23.1%	46,160	20.3%
Lab	63,568	58.1%	100,866	49.9%	139,188	61.1%
Classroom	19,239	17.6%	26,616	13.2%	42,518	18.7%
Other			28,017	13.9%		
			$104M		**$123M**	

Figure 1.1b – Justified Needs Program Compared to Updated 2004 Program Plan

7. DEVELOPMENT OF CONSENSUS SCENARIO

AMD was directed by the Auraria Board of Directors (with the full knowledge, cooperation and agreement of all Project stakeholders) to reduce the scope of the Justified Needs Program so that the construction cost and total project budget did not exceed the amounts calculated as the current true cost of the 2004 Program Plan. The resulting Program is described as the Consensus Scenario, in which all departments and institutions participated in agreed-upon reductions to project scope. The Consensus Scenario is the basis of the Program Plan presented in this document. The project cost reduction measures discussed and agreed upon are detailed in Section V.3, Project Cost Estimate.

II.1 Program to be Accommodated

Auraria is the largest campus in Colorado, where three separate higher education institutions enroll approximately 38,000 students. Community College of Denver, The Metropolitan State College of Denver and the University of Colorado at Denver and Health Sciences Center Downtown Denver Campus share classroom space and general services on the, mainly, commuter campus, located in the heart of downtown.

Auraria's cost effective, non-traditional environment allows students to select from a wide range of educational choices. Classes are offered from 7:30 a.m. until 10 p.m. Monday through Friday. Sessions are also held on weekends, at off-campus sites, and on-line.

The Community College of Denver is a two-year institution offering more than 90 programs that lead to an associate degree or certificate. CCD guarantees that general education core curriculum credits will transfer to any Colorado four-year college or university.

The Metropolitan State College of Denver is the largest undergraduate college in the United States. The college is a comprehensive, state-assisted four year institution offering 50 majors and 69 minors, as well as individualized and many unique degree programs.

The University of Colorado at Denver and Health Sciences Center is the only public university in the Denver metropolitan area. CU-Denver offers 36 undergraduate degrees, 43 master's degrees and Ph.D. degrees in public affairs, applied mathematics, health and behavioral sciences, civil engineering and educational leadership.

The programs included in this Project are primarily scientific in nature and include all three institutions. Most of the chosen programs are currently housed in the Science Building as well as the South Classroom and North Classroom Buildings. Following is a brief description of the programs.

University of Colorado at Denver (*from the UCDHSC course catalog*):

Anthropology - Anthropology is the study of human origins and evolution, the present conditions of human life, and the prospects for the future. It considers human beings as biological and social entities and seeks to explain both diversities and commonalities of peoples and cultures. For undergraduates, anthropology provides a rich overview of human life. It also introduces them to a variety of skills and practical research methods anthropologists apply in laboratory and field studies of the ecological constraints on human existence, the cultural bases of individual and organizational behavior, and the problems and circumstances relating to the maintenance of today's healthy, productive human action. Anthropological training provides entry to a variety of careers in archaeology, museology, education, community service, public administration, public health, international affairs, and business. The specific skills it provides are useful to students of environmental design, city planning, and community development, the medical and nursing professions and allied health sciences, law, public affairs, and secondary education.

UCDHSC's Department of Anthropology provides an outstanding graduate education in anthropology, giving students a broad yet thorough grounding in the three major subfields of anthropology, as well as specialized instruction in one or more research orientations and/or geographic area concentrations in which department faculty have substantial expertise. The graduate faculty in anthropology are particularly known for their research and publications in the areas of applied medical anthropology, biological anthropology, ethnicity, evaluation methods, food and nutrition, functional morphology, human ecology, political ecology and globalization, primate evolution, primate behavior, prehistoric political economy, sociopolitical evolution, Southwestern and

Mexican archaeology, and urban and community anthropology. Area studies emphases include Asia, Latin America, and the Arid American West. Students also have opportunities to study abroad, to participate in an archaeological field school, and to gain international research experience. Topical concentrations available include medical anthropology, archaeological studies, biological anthropology, sustainable development and political ecology. Area concentrations include Asia, Latin America and the arid American West.

Biology - The study of Biology introduces students to the diversity of life, the chemical processes and adaptations shared by species, and the interaction of species with their environment. By studying the differing fields of biology, the student begins to appreciate the characteristics of life and the remarkable evolutionary history leading to the present forms, and to understand the advances in biological technology that are transforming our society. Knowledge of the interrelationships between populations and their habitats leads to respect, concern, and a sense of responsibility for our environment. The biology curriculum is designed to provide a firm foundation in the life sciences. As such, graduates are well prepared for graduate study in biology, professional schools in the health careers, a variety of biologically oriented jobs in government and industry, teaching at various educational levels, or, as with any liberal arts major, for life itself.

Biology is a multifaceted program with students that will eventually pursue many different career paths. All medical professionals need at least a core education of biology and most likely, much more extensive studies. UCD is also a vital center for academic scientific research within the region by both students and faculty. Direct programmatic relationships that are vital to the program include chemistry and anthropology.

The master's program in biology is designed to prepare graduates for research and teaching positions, employment in business and industry, advanced training as secondary school science teachers, and for graduate work at the doctoral level. The MS in biology may be obtained with an emphasis in ecology, genetics, plant systematics, evolutionary biology, neurobiology, microbiology, animal behavior, cell biology, or molecular biology.

Chemistry - Chemistry is also a base program of most sciences and incorporates multiple disciplines within its own program. A drastic change in the field of chemistry is the use of computational lab simulations with super computers. With this innovation, the field of applied math is directly linked to the chemistry department, much like biology.

A practical reason to study chemistry is that our highly technical society faces many problems that can be solved through an understanding of the science of chemistry and its methods of solving problems. A more tangible reason is that chemistry is central to a variety of other disciplines and that many problems ultimately will have chemical solutions.

At the undergraduate level students can prepare for (1) careers in chemical and medical laboratories; (2) careers in nursing, medical technology, dental, hygiene, and other health-oriented fields; (3) post-baccalaureate programs in chemistry, biology, biochemistry, medicine, physical therapy, and dentistry. At the graduate level, an M.S. degree program is offered. Students with M.S. degrees have job opportunities in research and technical laboratory services. In addition, flexible programs can be designed to combine chemical knowledge and skills with other interest of the M.S. level student (e.g., biology or environmental science).

Math - The Department of Mathematical Sciences offers courses and research opportunities with an emphasis on applied and computational mathematics. Traditional courses such as calculus, linear algebra, probability, statistics, and discrete mathematics are offered regularly by the department. In addition, contemporary subjects such as continuous, probabilistic, optimization, and discrete modeling; supercomputing; numerical analysis; optimization; and operations research are also well represented by course offerings and faculty interests. In all of its activities, the department embodies the outlook that mathematics is a powerful tool that can be used to solve problems of immediate and practical importance. The study of mathematics with an emphasis on computers and applications can prepare students for careers in engineering, the sciences, business and management, actuarial science, public health, and all computer-dependent disciplines.

Metropolitan State College of Denver (*from the MSCD course catalog*):

Anthropology - Anthropology is the exploration of human diversity. The combination of cultural, archaeological, and biological perspectives offer a viewpoint that is unique in studying the problems related to the survival and well-being of the human species. The combination of cultural, archaeological, and biological perspectives offer a viewpoint that is unique in studying the problems related to the survival and well-being of the human species. From the living and vanished cultures of Colorado to those of New Guinea or South American, anthropology can be applied to assist our understanding of human differences.

Biology - Biology has a diverse student body, from non-majors taking an introductory course to future researchers and medical professionals. The Biology Department offers two majors, the Bachelor of Science in biology and the Bachelor of Arts in biology. Students may choose to emphasize botany, medical technology, microbiology, zoology, cell and molecular biology, or human biology. Supportive courses associated with paramedical studies and criminalistics, as well as general courses for enrichment of the non-science student's background, are offered by the department.

Chemistry - Chemistry The Chemistry Department is approved by the American Chemical Society and offers several degree programs: the Bachelor of Science in chemistry; Bachelor of Science in chemistry criminalistics concentration; and the Bachelor of Arts in chemistry. Minors in chemistry and criminalistics are also available.

Students who plan to pursue a career in chemistry after graduation or plan to attend graduate school in chemistry should choose the Bachelor of Science in chemistry program. The Bachelor of Arts in chemistry program is designed for students who plan a career in a field related to chemistry, but who do not intend to attend graduate school in chemistry. The Bachelor of Arts option, which requires fewer hours, may be especially attractive to those wishing a second major or to those students desiring secondary education licensure.

Chemistry at MSCD is unique because of the added major of criminology. This major is only offered at a handful of colleges across the United States.

Criminalistics is the scientific investigation, identification, and comparison of physical evidence for criminal or civil court proceedings. Criminalists must be trained in many disciplines including chemistry, biology, law enforcement, physics, and mathematics. The four-year criminalistics curriculum leads to a Bachelor of Science degree and includes a half-time internship in a criminalistics laboratory during the senior year. Graduates of this program are prepared for employment in criminalistics and have completed the requirements for admission to graduate school in chemistry or criminalistics, medical school, dental school, or law school.

Within the chemistry department currently there is a strong tie to biology and to the UCD chemistry program. Collaboration with the UCD graduate program is also a future possibility for research. An additional research component for undergraduates is being examined, again altering space needs for the program.

Earth and Atmospheric Sciences - The Earth and Atmospheric Sciences Department (EAS) is composed of three separate disciplines: geography, geology, and meteorology. The department offers degrees in environmental science, land use and meteorology, providing students with a strong background in the physical and quantitative aspects of the environment. Students will receive a Bachelor of Science degree except when their focused area of interest in land use is urban land use planning (Bachelor of Arts degree).

Minor programs are available in geography, geology, and meteorology. Students working toward teacher licensure in either science or social studies may take courses in geology, geography, or meteorology. Students working toward teacher licensure in secondary science should consult an advisor in environmental science. Students interested in earth space science may develop an Individualized Degree Program major through the Center for Individualized Learning.

Earth & Atmospheric Sciences is a conglomeration of numerous majors within the environmental sciences:

Environmental Science
The environmental science major is an extended major designed as an entry-level major for MSCD students as well as for students transferring at the junior level from the community colleges with backgrounds in hazardous materials or water quality or a degree in Environmental and Safety Technology. All students are required to complete a unified core. Students may choose from five options (concentrations) depending on their areas of interest. The multidisciplinary concentration provides students with a broad-based environmental science background, whereas the other concentrations in hazardous materials, water quality, ecological restoration, and environmental chemistry are more specialized.

Land Use
The land use major is an extended major that combines general planning courses with a focused area of study, including environment and resources, geographic information systems, geology, or urban land use planning, linked by the vital thread of land use management. It also equips students with a dynamic foundation for understanding issues and solving problems that confront the community and environment. The program is broad is scope and can be applied to a number of career objectives and graduate school programs. Opportunities exist in such areas as planning, cartography, geographic information systems, air photo and satellite imagery interpretation, geology, environment and resource management, transportation, mining and mineral resources, residential and industrial development, recreational land use, population analysis, environmental sciences, and a variety of other interrelated fields.

Meteorology
Meteorology is the science of the atmosphere. Meteorologists are employed in weather observation, forecasting, research, and dissemination of weather information to the public. They are also involved in the study of global weather and climate changes. The meteorology lab includes computers running McIDAS and GEMPAK weather analysis and display software, local weather observation, and online access to weather data. The Bachelor of Science degree conforms to the American Meteorological Society and National Weather Service recommendations for an undergraduate meteorology degree.

Math and Computer Science - The Mathematical and Computer Sciences Department offers Bachelor of Arts and Bachelor of Science degrees in mathematics and a Bachelor of Science degree in computer science. The department offers a mathematics and a computer science minor, which complement such majors as engineering technology, the other sciences, and economics. In addition, the minor program in computer science complements the mathematics major. In addition to the general mathematics major, the department offers a mathematics major in five concentrations encompassing a variety of significant mathematical ideas. The student may choose to complete a mathematics major in one of the following concentrations: General Mathematics, Applied Mathematics, Computer Science, Mathematics Education, Probability and Statistics, or Theoretical Mathematics. A degree in mathematics is useful in a variety of professional fields including, among many others, business, economics, computer science, government, education, technology, and science.

Community College of Denver (*from the CCD course catalog*):

CCD offers 2-year Associate of Science degrees in both Biology and Chemistry.

Biology – Examines the fundamental molecular, cellular and genetic principles characterizing plants and animals. It includes the study of cell structure, function and the metabolic processes of respiration and photosynthesis, cell reproduction, basic concepts of heredity,ecology, evolution, classification, structure, and function in plants and animals. The program includes laboratory experience.

Chemistry - Focuses on basic measurement, matter, chemical formulas, reactions and equations, stoichiometry and thermochemistry. This program covers the development of atomic theory culminating in the use of quantum numbers to determine electron configurations of atoms, and the relationship of electron configuration to chemical bond theory and molecular orbital theory. The courses include gases, liquids, and solids and problem-solving skills are emphasized through laboratory experiments. The course of study also presents concepts in the areas of solution properties, chemical kinetics, chemical equilibrium, acid-base and ionic equilibrium, thermodynamics, electrochemistry, nuclear chemistry, and organic chemistry. Laboratory experiments demonstrate qualitative and quantitative analytical techniques.

II.2 History, Role and Mission

UNIVERSITY OF COLORADO AT DENVER & HEALTH SCIENCES CENTER (UCDHSC) – DOWNTOWN DENVER CAMPUS

In 1912 the University of Colorado organized the Department of Correspondence and Extension in Denver, and offered the first courses. In 1964 the name of Denver Extension Center was changed to the University of Colorado - Denver Center. In 2004 the University of Colorado - Denver Center consolidated with the University of Colorado Health Sciences Center, and was consequently renamed as the University of Colorado at Denver and Health Sciences Center.

UCDHSC Downtown Denver Campus Role and Mission (*from the UCDHSC web site*):

The downtown Denver campus of the University of Colorado shall be an urban comprehensive undergraduate and graduate research university with selective admission standards. The downtown Denver campus shall offer baccalaureate, masters, and a limited number of doctoral degree programs, emphasizing those that serve the needs of the Denver metropolitan area. The Denver campus has statewide authority to offer graduate programs in Public Administration and exclusive authority in Architecture and Planning.

The fundamental purposes of the downtown Denver campus are to:

- Provide students with learning opportunities that will enhance the quality of their lives, make them well-educated citizens, lead to rewarding careers, and provide Denver and Colorado with a workforce able to compete in the global economy.

- Develop research, scholarship, and creative work that will advance the base of knowledge in our disciplines and that will contribute to the vitality of our culture and/or economy.

- Apply the University's skills and knowledge to real problems in the Denver metro area.

- Build and maintain an institutional culture of plurality, collegiality, integration, and customer service.

- Remain as a graduate center institution for the state of Colorado.
- Become a research university where faculty produces grant-funded research.
- Establish entrepreneurial partnerships.
- Provide for metro Denver in key economic areas: research, economic development and health care operations.
- Act as a portal for top tier educational opportunities for disadvantaged students.

Not only does UCDHSC have a broad vision for their institution, they have more specific strategic priorities for their science programs. These include:

10. Accommodation of the Biology, Chemistry, Anthropology, Math and Psychology programs.
11. Research facilities for the Biology, Chemistry, Anthropology and Psychology programs. UCDHSC estimates that 75 percent of the faculty produces research—grant-funded and non-funded. This research is conducted in cooperation with undergraduate students, graduates, doctoral and post-doctoral students as a vital part of their educational curriculum.

THE METROPOLITAN STATE COLLEGE OF DENVER:

History (*from the MSCD web site*):

Metropolitan State College of Denver was created by an act of the Colorado Legislature in 1965. By statute, Metropolitan State College of Denver is a comprehensive and baccalaureate-degree granting institution. Accessibility is reflected in the admissions requirements and is an important part of the college's mission. The focus on teaching is implicit in the restriction to undergraduate programs.

The state legislature created MSCD as Colorado's urban "College of Opportunity." Since then it has occupied an important niche in the state's system of higher education, because, by statute, it was designed to be unique.

- MSCD is required to serve adult students. First-time college students who are 20 years of age or older and hold a GED or high school diploma are automatically admitted to MSCD, irrespective of their academic record.
- MSCD is required to serve traditional-ages students of all levels of achievement and potential. As a result, the college enrolls a rich mix of recent high school graduates, many with excellent grades and test scores and others with more modest achievement.
- MSCD is required to be accessible to all citizens. That is why tuition has been and remains among the lowest in the state.

The college's role and mission are rooted in a commitment to excellence in teaching and learning. MSCD graduates praise faculty for their attention to teaching and willingness to help students succeed. According to a survey of college and university alumni conducted for the Colorado Commission on Higher Education (CCHE), MSCD alumni ranked the college number one in meeting their educational goals. In fact, 99 percent of the college's graduates said MSCD's programs and curriculum met their goals.

The college awards Bachelor of Science, Bachelor of Arts and Bachelor of Fine Arts degrees. Students can chose from 50 majors and 78 minors offered through three schools: Business; Letters, Arts and Sciences; and Professional Studies. Programs range from the traditional disciplines, such as history and biology, to contemporary fields of study, such as Chicano Studies and Health Care Management. The college offers several Bachelors' degree programs unique in Colorado, including Aviation Management, Health Care Management, Land Use, Meteorology, and Surveying and Mapping. Students may also design their own degree through the Individualized Degree Program.

Role and Mission Statement (*from the MSCD web site*):

Metropolitan State College of Denver is a comprehensive, baccalaureate degree-granting, urban college that offers arts and science, professional and business courses and programs to a diverse student population. Excellence in teaching and learning is Metropolitan State College of Denver's primary objective.

The mission of Metropolitan State College of Denver is to provide a high-quality, accessible, enriching education that prepares students for successful careers, postgraduate education and lifelong learning in a multicultural, global and technological society. To fulfill its mission, Metro State College of Denver's diverse college community engages the community at large in scholarly inquiry, creative activity, and the application of knowledge.

To supplement the role and mission of MSCD, the administration expressed to the design team that several institutional strategic priorities should be addressed in the program plan where applicable. These priorities involve:

- Accommodating rapid growth of 150 new faculty and 5,000 new students to 2010 (across all disciplines.)
- Accommodating science growth which has increased 47 percent since 2001.
- Supporting the notion that teaching and learning are predicated by research.
- Providing a strong liberal arts curriculum as the basis for moving on into other professions.
- Accommodating future growth in nanotech and biophysics.

MSCD administrators also acknowledged several specific science-related programmatic priorities for the Science facility to address. These include:

- Accommodation of the following science programs: Biology, Chemistry, Anthropology and Earth Sciences.
- Accommodation for departments that currently exist in the Science building and have no other relocation opportunities (Math and Computer Science and the Deans' Offices).

Community College of Denver History (*from the CCD web site*):

The Community College of Denver System was founded in 1967. It offers more than 125 programs that prepare students for a new career, job advancement or for transfer to a four-year school. CCD offers a variety of support services for all students, ensures job competencies and guarantees that credits earned at CCD will transfer to any Colorado public college or university. CCD provides access and opportunity for nontraditional students, workforce development and training resources for local organizations, and community partnerships that are improving high school graduation, college enrollment and career success. CCD is the leading point of entry to higher education for the City and County of Denver.

CCD Vision (*from the CCD web site*):

Community College of Denver will be a community cornerstone that inspires the transformation of lives through learning.

CCD Mission Statement (*from the CCD web site*):

The mission of Community College of Denver (CCD) is to provide open access and quality undergraduate education through a process and experience that affords every student the opportunities and services to succeed, graduate with a two-year degree and transfer to a four-year institution to complete a baccalaureate degree or join the workforce. Programs and strategies that promote access and success for underserved students are the foundation of CCD operations.

The Science facility program plan should maintain the vision and mission of CCD as well as abide by several institutional strategic priorities that were identified by CCD administration. These priorities involve:

- Maintaining and building upon connections/ pipelines to secondary education in metro Denver.

- Supporting research and grant-funding through the following avenues:
    1. NASA grant: work force entry program using NASA PM system (in collaboration with MSCD).
    2. NSF grant application (with UCDHSC) for bio science/nanotech/ photonics

- Providing weekend and evening access to instructional space.

During the program process, there were also science-specific programmatic priorities noted by CCD administrators. These priorities include:

- Accommodation of Biology and Chemistry departments.

- Building and continuing the CCD Science identity that exists in the South Classroom building, while reinforcing and building upon connections with MSCD and UCDHSC as future destinations for CCD science students.

- Student research space for accelerated student science education.

II.3 Program Needs and Trends

Science education is an increasingly critical part of the evolving culture and economy of the Denver metropolitan area and the State of Colorado. Sound science education feeds vital Health Science activities and other key drivers of the state economy. In addition to this growing demand, the new science education paradigm is shifting to take advantage of interdisciplinary teaching methodologies, critical to developing effective workforce skills.

The three institutions that share the Auraria campus leverage opportunities of shared resources, but also face challenges that improved facilities can help solve. Institutional identity is of vital importance to all of the programs for enrollment, retention, and way finding. Many science programs serving the institutions at the Auraria campus are dispersed and fragmented. Some faculty offices are isolated from teaching laboratories and research laboratories, disciplines are not typically consolidated to take advantage of shared resources, and spaces are not configured to facilitate interdisciplinary exposure and collaboration. New science facilities must respond to the new trends in science education, while giving each science program its own consolidated space and identity.

The quality of the laboratory spaces, both teaching and research labs, are a serious concern. The programs are currently occupying space that has become obsolete, the equipment is antiquated, and the teaching is hindered because of these spaces. The facilities are not being properly ventilated for the chemicals stored in each room. There are numerous life safety concerns resulting from the inadequacies of the current space. In the future, programs may even have difficulty attracting students with outdated equipment, classrooms, and lab spaces. Modern laboratories are flexible and can be customized to the user or to a specific experiment. The current facility does not support this essential flexibility.

The existing Science Building also does not support the technology that is becoming the standard of scientific education and research. Science teaching spaces today include effective multi-media to support evolving pedagogy. Today's research endeavors are more frequently international collaborations facilitated by leading edge technology. Access to these technologies can be a key determinant in recruiting and maintaining top faculty. At the same time, appropriate technology is essential to supporting the security of the valuable intellectual property at today's academic institutions. The location of Auraria at the edge of downtown Denver business community offers exciting opportunities for public/private partnerships that might be facilitated by updated technology. In all cases, new science facilities need to be constructed with flexibility to adapt to unforeseen technologies that will continue to evolve.

Institutions today recognize the importance of strong communities in supporting academic achievement and helping students develop life skills and important relationships. The new science building needs to create spaces for social interaction. This interaction could be between disciplines, students and faculty, various clubs and organizations, or even casual research collaboration. Auraria's history as a commuter campus makes these interaction spaces even more essential. Successful communities are built of diverse hubs of activity, collaboration, study and reflection.

To most effectively match the needs and trends described above, Auraria sought to accommodate all of the sciences on campus into one facility. Consolidation of science programs into a science district would maximize faculty and student interaction between the disciplines and institutions. It would also expose students and scientists to the broadest spectrum of opportunities in the sciences. Because of the challenge of limited resources in the state, the institutions elected to focus new science facilities on achieving excellence in two key disciplines: Biology and Chemistry. At the same time, programs that currently reside in the existing Science building with no ability to relocate need to be provided with a home in a new science facility. The resulting programs accommodated in the proposed program are summarized below:

UCDHSC	**MSCD**	**CCD**
Biology	Biology	Biology
Chemistry	Chemistry	Chemistry
Physics	Physics	Physics/Astronomy
Anthropology (labs only)	Anthropology (teaching labs)	Anthropology
Geology	Earth Sciences	Geology
Math (2 computer labs)	Math and Computer Science	Math
Psychology (research labs only)	Nursing	Nursing
	Health Professions	Radiology Technology
	Aviation Science	Veterinary Technology
	Deans' Offices	END Technology

Figure 2.3a – Summary table of departments included in the 2007 Auraria Sciences Program Plan (Auraria science/health science programs not included in this program are indicated in gray).

Growth Projections

Recent growth in the science education at Auraria has taxed the aging facilities. Enrollment growth since 2001 by major has increased by 74% and 33% for Biology and Chemistry respectively. There is no evidence that suggests this trend will not continue, except there is no space to accommodate this growth and students will have to be turned away from these programs without improved facilities. A summary of the enrollment growth by major/discipline for each institution is shown below:

To develop this program plan, 5 year growth assumptions by department were developed based on the statistics above blended with institutional strategic initiatives and campus priorities. The projections for the Biology and

HISTORICAL ENROLLMENT and GROWTH BY MAJOR / DISCIPLINE

	YEAR						
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**GROWTH F01 to F06**
Community College of Denver							
Biology	51	116	179	143	139	139	**174.17%**
Chemistry	13	22	24	30	30	30	**133.15%**
Metro State College of Denver							
Biology	678	739	846	875	904	999	**47.35%**
Chemistry	164	165	238	246	262	254	**54.88%**
Anthropology	87	97	101	95	113	131	**50.57%**
Earth Sciences	257	286	297	294	322	341	**32.68%**
Math and Computer Science	732	701	657	575	547	486	**-33.61%**
University of Colorado and Health Sciences Center							
Biology	431	492	548	621	723	758	**75.87%**
Chemistry	103	107	117	140	143	130	**26.21%**
Anthropology	97	100	115	99	93	111	**14.43%**
Total Science Enrollment	**2,612**	**2,825**	**3,123**	**3,118**	**3,275**	**3,378**	
Annual Growth		8.14%	10.54%	-0.14%	5.04%	3.14%	**5.34% average**

Chemistry departments reflect a larger growth increase for faculty (50%) than for the enrollment (30%) to acknowledge the increased demand for office space mandated by the transition from adjunct faculty to full time faculty. The institutions acknowledge that these growth projections may not adequately meet long term needs of the science programs. Further facility expansion will be required to address long term growth trends in the sciences at Auraria.

GROWTH ASSUMPTIONS BY DEPARTMENT

Department	Growth Assumption		Rationale/Source
	Faculty	Enrollment	
University of Colorado at Denver & Health Sciences Center			
Biology	50%	30%	Historic data, wait list, strategic emphasis; classroom growth under Shared Classrooms
Chemistry	50%	30%	Historic data, wait list, strategic emphasis; classroom growth under Shared Classrooms
Physics	5%	5%	Limited growth anticipated
Anthropology	0%	5%	Parallel MSCD Anthropology; classroom growth under Shared Classrooms
Math	0%	0%	No growth in space to be accommodated in Science
Community College of Denver			
Biology	50%	30%	All institutions grow in parallel; classroom growth under Shared Classrooms
Chemistry	50%	30%	All institutions grow in parallel; classroom growth under Shared Classrooms
Shared	10%	10%	Modest Growth in Biology/Chemistry focused model; classroom growth under Shared Classrooms
Metro State College of Denver			
Biology	50%	30%	Historic data, strategic emphasis; classroom growth under Shared Classrooms
Chemistry	50%	30%	Historic data, strategic emphasis; classroom growth under Shared Classrooms
Physics	5%	5%	Parallels UCDHSC program
Anthropology	0%	5%	Limited growth anticipated; classroom growth under Shared Classrooms
Earth Sciences	10%	10%	Modest Growth in Biology/Chemistry focused model; classroom growth under Shared Classrooms
Math & Comp. Sciences	10%	10%	Modest Growth in Biology/Chemistry focused model; classroom growth under Shared Classrooms
Auraria Sciences Shared Space			
Shared Classrooms		30%	Average of science program classroom growth

II.4 Relationship to Academic or Institutional Strategic Plans

At the time of writing of this Program Plan the Auraria Facilities Master Plan was in the process of revision and thus no current Master Plan was available to which this Program Plan could reference. The need for, and commitment to, expansion and renovation of the space dedicated to science education and research has been previously documented. This Program Plan is consistent with the previous Facilities Master Plan and the individual strategic plans of the 3 institutions affected.

The Auraria Facilities Master Plan, published in 2000, listed future Capital Construction Projects in a prioritized order. At that time the top two projects were: 1. improvements to the South Classroom Building and 2. Renovation and Addition to the Science Building. Neither project was completed, and, since that time, the Science Building project has become the top priority project. In 2004 a Program Plan was completed for the Science Building Renovation and Addition and was submitted to CCHE for review. CCHE subsequently recommended its funding.

II.5 Existing Programmatic / Operational Deficiencies

In general, the 13 academic programs accommodated in this Program Plan all share the same concerns and suffer from a lack of space and the use of outdated, unsafe facilities and equipment. The space deficiencies currently prevent the three institutions from fully achieving their key program goals. These deficiencies relate to existing student enrollment and faculty, and will be magnified with additional enrollment growth.

A full facilities audit is included in Section VI.2 but the most common operational deficiencies that affect the building users are:

- Building ventilation is poor throughout the entire facility. Chemical smells occur in hallways at some locations. Biology and Chemistry labs lack proper ventilation, including adequate air changes per hour to evacuate odors between classes.
- Some ducting at lab areas is noisy and appears to be improperly sealed.
- Acoustics in lab areas are very poor due to noise from mechanical systems, loud fume hood exhaust and open concrete ceilings. Acoustics in hallway areas are poor due to exposed concrete ceilings and hard surfaces on walls (gypsum board) and floors (vinyl tile).
- Quality and quantity of adequate lighting in classrooms, labs and prep spaces impacts learning effectiveness.
- Laboratory spaces are inadequately configured. They currently use outdated lab benches and equipment.

A specific list of deficiencies, broken out by institution and department, is listed below. Common issues regarding office space, classrooms, laboratories and lab service are universal problems, therefore addressed after the department-specific deficiencies.

UNIVERSITY OF COLORADO AT DENVER HEALTH SCIENCES CENTER (UCDHSC)

Biology
The Biology department is currently located in the North Classroom Building on the Auraria campus. The categories below list issues specific to the Biology department.

Teaching Laboratories

- Space Deficiency: The most significant deficiency in its location is the lack of laboratory space. UCD Biology runs 47 sections of courses in three labs. The space issue has been so significant that the faculty has been forced to schedule laboratory courses in the summer session that would have otherwise been scheduled in the fall or spring semester.
- Over-utilization: The average teaching lab utilization rate is 140 percent—almost double that of the target 80 percent utilization.
- Inefficient configuration: Of the three teaching laboratories, two are inefficiently configured. The lab module is significantly less than the typical 10'-6" that is standard in today's modern laboratories. Therefore, students are crowded in the space and instructional space is almost non-existent.

Figure 2.5a – UCDHSC Biology teaching laboratory in the North Classroom

Research Laboratories

- Space Deficiency: The Biology department is having a difficult time recruiting faculty members because additional research activity/office space cannot be accommodated. There is also a significant shortage of research lab office space for undergraduate, graduate, doctoral and post-doctoral students. In addition, grant-based area standards for research laboratories cannot be accommodated in the existing facilities because there is a lack of space.

Chemistry
The Chemistry department currently occupies space in the North Classroom Building and Science Building. All of the teaching laboratories are located in Science and the faculty offices and research spaces are in the North Classroom. The categories below list issues specific to the Chemistry department.

Teaching Laboratories

- Over-utilization: The Organic Chemistry teaching laboratory currently suffers the most from over-utilization. There are two of these labs in the Science building utilized at an average of almost 120%. The utilization target for laboratories is 80%. This over-utilization indicates a need for more laboratories.
- Inadequate chemical waste ventilation: Chemical waste is currently stored in a chemical fume hood. The fume hoods in the laboratories are not adequately ventilated.
- Inefficient room configuration: Some of the teaching labs in the existing Science building are configured to accommodate 24 students, yet the configuration of the lab benches are such that sightlines are not clear, so the labs can only accommodate 18 students. This inefficient configuration leads to an increase in the number of sections that are taught, resulting in a less efficient laboratory.

Research Laboratories

- Space Deficiency: Like the Biology department, Chemistry suffers in faculty recruitment because there are not adequate research laboratory facilities or office space.

- Inadequate ventilation: The research facilities in the North Classroom are not adequately ventilated. In some cases, researchers and their assistants must walk to other chemistry labs to utilize functional fume hoods.
- Inadequate lab configuration: There are many cases in which a column rests in the middle of a laboratory space—this creates blind-spots and makes it difficult for students and faculty to move efficiently around the space.

Figure 2.5b – UCDHSC Chemistry research laboratory in the North Classroom

Graduate Student Research Office Space

- Space Deficiency: There is a shortage of undergraduate/graduate student, doctoral and post-doctoral student desk space for laboratory outcome write-ups.

Anthropology

The Anthropology department currently occupies space in the Administration and Science Buildings. It was determined that the faculty offices (currently in the Administration Building) will not be accommodated in this program plan, but that teaching laboratories and associated lab service would be. The research laboratory will be housed in the new Science facility.

Teaching Laboratories

- Space Deficiency and Inadequate Configuration: The Anthropology department conducts various dissections throughout the semester. Currently the number of dissections performed is limited due to space constraints, where only one dissection per room can occur. There should be an ability to perform one dissection per lab bench. Morphometrics computer analyses and instrumentation is currently housed in the teaching laboratory. This expensive equipment cannot be located in a wet environment.
- Inadequate ventilation: The teaching lab ventilation is inadequate, especially when dissections are executed.
- Inadequate storage: The space for archaeological collections is deficient and high density storage is needed.

Research Laboratory

- Space Deficiency: There is currently no Anthropology Research Laboratory in existence and no space for one on campus. Due to the relatively new research mission of the university and a new Anthropological Doctoral program underway, a research laboratory is essential.

Laboratory Service

- Mechanical Deficiency: Anthropology's archaeological collections containing human remains require a temperature and humidity-controlled environment. The current collections space is not adequately controlled.

Math

The Math department currently occupies two rooms in the Science building—Rooms 130 and 132. One

Figure 2.5c – UCDHSC Math lab in existing Science

room is a computer laboratory / classroom and the other is a math assistance room. Both spaces will be accommodated in the space termed Backfill.

Computer Laboratory / Classroom

- Inadequate Configuration: The current laboratory is configured with rows of computer workstations that make student viewing of the teaching walls difficult.
- Space Deficiency: The laboratory accommodates up to 40 students per section which results in a square foot per student at 16 asf, less than 50% of the national standard.

Psychology

The Psychology Research labs are currently located in the North Classroom on the 5th floor. Only three faculty offices and research labs related to the animal facility will be moving into the new facility.

Research Laboratories

- Inadequate environmental control and monitoring: Different types of animals require very different environmental conditions which cannot be provided in current location.
- Inadequate Security: Access should be limited to animal researchers only. A two layer key card with access granted at the suite and individual room level is desirable.
- Excessive Distance from Loading: The research labs are currently located approximately 100 yards from the loading area. This is not acceptable.
- Remote Access: Safe and secure transport of animals within the building to lab areas is not readily achieved currently.

METROPOLITAN STATE COLLEGE OF DENVER (MSCD):

Biology

The Biology department is mainly located on the second floor of the Science Building with two labs on the third floor. The categories below list issues specific to the Biology department.

Teaching Laboratories

- Space Deficiency: The over-utilization of existing laboratories indicates that there is an inadequate supply of laboratories in the Science building. In the near future, the Biology department will instill a curriculum change requiring Non-Major Biology students to take one laboratory course. An additional three laboratories are needed for this course requirement—there is currently no space in which to accommodate this curriculum.
- Over-utilization: There are several Biology laboratories that are currently over-utilized by a great extent. The Anatomy & Physiology lab is being used at 130%, a General Biology lab at 150% and a Zoology lab at over 90%. The utilization target for laboratories is 80%. This over-utilization indicates a need for more laboratories.

Figure 2.5d – MSCD Biology teaching lab in existing Science

Faculty Research Laboratories

- Space Deficiency: Three Biology faculty currently conduct grant-funded research. Even though these grants are small, the faculty has no dedicated space in which to work. They have taken to working in empty classrooms or in their own homes.

Student Research Laboratories

- Space Deficiency: There are currently some Biology students that perform independent research for specific classes. The students and supporting faculty have been forced to find space in small closets in which to perform this research. In the near future, more student research space is required as a curriculum change will require seniors to take a "Senior Experience" course in which seniors will conduct experimental research. There is no existing space to accommodate this curriculum modification.

Chemistry

The Chemistry department is located on the third floor of the Science Building. They currently share one laboratory with UCDHSC—the Biochemistry Laboratory. The categories below list issues specific to the Chemistry department.

Office Areas

- Reception Area Space Deficiency: In addition to the copier, mail area, office storage and student waiting area, the 300 asf reception area houses a self-paced testing area. This is inadequate.

Teaching Laboratories

- Over-Utilization: The Organic Chemistry Laboratory currently suffers the most from over-utilization. The laboratory has a utilization rate of almost 120%. The utilization target for laboratories is 80%. This over-utilization indicates a need for more laboratories.
- Space Deficiency: The Criminalistics Microscope Teaching Lab cannot accommodate the number of microscopes and instruments they currently possess. Instruments are continually moved around and shifted to provide space for incoming/in-use equipment. This constant movement increases the likelihood of damage to the instruments.

Anthropology

The Anthropology department offices are located in the South Classroom. These spaces will not move into the new Science Building. Only the teaching lab that exists in the Science Building will be accommodated in this program. The categories below list issues specific to the Anthropology department.

Teaching Laboratories

- Inadequate Collection Space: Anthropology's collection space is growing and there is not enough existing space to accommodate the amount and type of collections that have been gathered. High density storage would be ideal.

Laboratory Service

- Space Deficiency: There is currently no dedicated prep space for the Anthropology teaching laboratory. All prep is performed within the laboratory, which leads to inefficient laboratory usage.

Earth Sciences

The Earth Sciences departmental offices are located on the second floor of the Science Building. Its Geology Teaching Laboratory and GIS Computer Laboratories are on the first floor while the Integrated Natural Sciences Laboratory is located in the South Classroom Building. The categories below list issues specific to the Earth Sciences department.

Teaching Laboratories

- Over-Utilization: The Integrated Natural Sciences Laboratory utilizes its room at 100%. The Geology Teaching Laboratory is over-utilized as well. Its utilization rate is currently almost 120%. The target laboratory utilization rate is 80%. This over-utilization indicates a need for more laboratories.
- Laboratory Inefficiency: The Integrated Natural Sciences Laboratory is located in the South Classroom, while the computer lab utilized by the same students (at the same time) is located in the Science Building.
- Open Computer Laboratory Deficiency: The GIS and Meteorology components of the Earth Sciences department schedule continuous student projects throughout the semester. Currently, the students cannot

Figure 2.5e – MSCD Meteorology computer lab in existing Science

work on these projects unless a class is out of session. Because the GIS computer labs have many classes scheduled in them during the week, it is difficult for students to schedule their time within these labs.

Math and Computer Science

The majority of the Math and Computer Science Department is located on the first floor of the Science Building. Some faculty offices are located on the second and third floors. The categories below list issues specific to the Math and Computer Science department.

Office Areas

- Adjunct Faculty Space Deficiency: There is a significant lack of space available for the adjunct faculty. Fifty adjunct faculty currently share two 135 asf offices.

Classrooms

- Over-Utilization: The utilization rate for the Math Education Lab is at 90% and indicates a need for an additional lab or a larger lab to accommodate more students.

Computer Laboratories

- Space Deficiency: The computer labs in existence now do not have adequate space for the varied equipment that is utilized.

Deans' Offices

The Science Building currently accommodates a suite of Deans' offices on the first floor. At the present time, there are offices and support space to support one dean. MSCD has recently divided the administration housed in existing Science into two areas and current space does not adequately house this administrative structure. The Dean's Office space will be located in Backfill.

Office Areas

- Space Deficiency: There is no available space in the Science Building to accommodate a second Dean, Associate and Assistant Deans with supporting staff, student work areas and support space. The existing support space, including the work/copy/print and file storage rooms, are too small and cannot accommodate the needs of the existing dean. The existing conference room is 217 asf and is not large enough to accommodate the 16 people who would commonly use the space.

UNIVERSAL SPACE DEFICIENCIES IN EXISTING FACILITIES

Anderson Mason Dale conducted interviews and workshops with all three institutions in which existing space deficiencies were discussed. These discussions revealed that the following issues are common among the institutions and need to be addressed in the new program.

Office Areas

- Inconsistent Standards of Faculty Offices: Faculty offices currently range in size from 92 asf to 345 asf. There is no consistency in the allocation of square footage to faculty members.
- Inadequate Space: There is a significant shortage of space for faculty offices. In fact, in many cases the institutions/ departments have not been able to hire full-time tenure track faculty and even adjunct faculty because there is no office space to accommodate them. In most cases, faculty offices within the Science Building are too small and can hardly accommodate visiting students during office hours. In other cases, the North Classroom faculty offices are adequately sized, but they are inadequately configured because a column exists in the middle of their space.
- Reception / Work / Copy / Break Deficiency: The reception areas are also inadequate because they are overcrowded and typically function as office storage areas, copy/print/ mail areas, student advising centers and break rooms.
- Lack of Conference Areas: There is one existing conference room in the Science Building for faculty use. It is in SI 226A and only specific departments can receive permission to use it.
- Adjunct Faculty Space Deficiency: Adjunct faculty offices are almost non-existent. In many cases, a department's adjunct faculty shares one desk.

Teaching / Research Laboratories

- Lack of Egress: Code issues with current laboratory spaces are common, due to the fact that storage space is in short supply and exits are blocked by equipment that would otherwise be located in other laboratories or prep space.
- Non-functional Fume Hoods: In some laboratories, there are adequate numbers of chemical fume hoods, however, not all of the hoods function. In other laboratories, there are not adequate numbers of hoods.
- Unsafe Chemical Waste Accumulation: AHEC currently accumulates chemical waste in vacant fume hoods within the teaching laboratories. In many cases, these hoods do not have functional ventilation.
- Space Deficiency: In some cases, the teaching laboratories are too large (SI 328, 330). These laboratories can accommodate a large number of students, but sightlines to the instructor are obscure and supporting materials are too far away to be seen by the students. Therefore, laboratory space is unused and wasted. In most cases, however, the laboratory space is too small. Overcrowding in the laboratories is an issue. Biology and Chemistry students average 35 asf per student while the state and national standards target 50-60

Figure 2.5f – MSCD Chemistry reception area

asf per student.

- Inadequate Space Configuration: The structural bay depth of the Science Building is the preferred 30'-0" dimension found in many of today's laboratories. However, the walls dividing the interior spaces are not based on modern lab module standards and create inefficient laboratories.
- Inadequate Lab Bench Configuration: Modern laboratory design dictates that laboratories are configured in lab modules that measure +/-10'-6" from centerline of lab bench to centerline of bench/wall. The laboratories in the Science Building are generally configured on a 9'-0" lab module. The existing lab benches are also fixed. This style of bench does not accommodate a variety of teaching styles. In modern laboratories, moveable tables with lockable feet are preferred.
- Lack of "Smart" Technology: A trend in science education is to conduct recitations within the laboratories so that the high-demand, difficult-to-schedule classrooms are not used. These recitations and other laboratory demonstrations require projection capability and the existing facilities do not support these activities.
- Student Storage Deficiency: Currently there is no student storage space for students' backpacks and coats. As a result, these items are scattered throughout the laboratories, making navigation of the teaching space difficult.

Laboratory Service

- Outdated Casework/Equipment: The laboratory prep spaces are generally inadequate as they have outdated casework and storage capabilities. In many cases the spaces cannot accommodate equipment and the number of students and faculty utilizing them.
- Space Deficiency: There is an inadequate supply of prep spaces and accompanying equipment rooms, balance rooms, cold rooms, etc. to support the teaching laboratories and research laboratories. Storage space is in great demand, as a majority of prep space accommodates the sciences' existing storage.
- Inconsistent Space Organization: The existing prep/support spaces are not based on lab modules as most modern laboratories. All prep spaces are configured differently and most are inefficient.

Figure 2.5g – MSCD Chemistry laboratory prep space

Classrooms

An issue that has become quite apparent through extensive user interviews is the lack of classroom space on campus. The average classroom utilization rate in the Science Building is 70%. While this rate is below the target 80% utilization rate, some classrooms are being over-utilized at a rate of 100% while other classrooms are being under-utilized at 33%. The classroom scheduling is performed by AHEC and priority scheduling is given to some institutions for specific classrooms. The classrooms within the Science Building are mostly dedicated to the science disciplines—non-related disciplines are also scheduled within the classrooms. This makes classroom scheduling difficult.

Figure 2.5h – Science 119, 257-person lecture hall

- Inefficient Scheduling: Priority scheduling of classrooms gives institutions first scheduling rights to specific classrooms. The institutions hold the classroom time even if classes are not being held within the room. In turn, there are a number of classrooms that are not being used, while others are over-utilized. SI 119 is the least utilized classroom at 33%. It seats 256 people, yet there are between 4-6 classes each semester that have 100 students or more. The remaining classes that use SI 119 have an average class size of 53. These classes could be conducted in smaller classrooms if scheduling would allow.
- Un-roomed Classes: There are a significant number of un-roomed classes at the beginning of each semester. In some cases, instructors don't find classrooms until the third or fourth week of the semester.
- Classes Taught in Labs: Because there is a lack of classroom space available, some departments teach classes in the laboratories that are utilized the least. MSCD Biology is one of these departments. In Spring 2006, 15 sections of students were taught in various laboratories.

Animal Care Suite:
UCDHSC Biology and Psychology departments are the primary users of this facility. The existing animal care facility located in the North Classroom is not adequate due to several factors:

- Lack of space: There are currently an inadequate supply of procedure rooms and holding rooms for the animals in holding. Many of the procedures currently performed on animals are performed within the laboratories themselves. This is not an ideal situation.
- Inadequate Environmental Control: AHEC currently controls the animal environments within the North Classroom building and this has caused problems in response times for the researchers. The different types of animals require specific environmental conditions and currently, this is difficult to accomplish.
- Lack of Security: The existing Animal Care Facility is located on the third floor, not adjacent to an elevator or loading dock. The traffic coming into and out of the suite is highly visible to the student population. This high visibility compromises the safe transport of the animals.

Chemistry Stockroom
The existing entrance to the stockroom is not configured well, therefore does not run efficiently for preparing chemicals for lab transport. The area does not have adequate ventilation, sinks or counter space.

Community Areas
The existing Science Building has one community space for student/faculty interaction—the student lounge. This area is highly utilized and noisy and there is concern that it is not conducive to student group studying or student/faculty interaction.

Greenhouse
The existing Greenhouse resides on the third floor of the Science Building on the roof of the second floor. UCDHSC and MSCD share the facility.

- Spatial Envelope: The existing greenhouse does not have a sound exterior envelop. The existing glazing systems leak air and moisture leading to unstable environmental conditions inappropriate for a scientific work.
- Inadequate Environmental Control: The existing facility does not have lighting controls or adequate watering and temperature controls.
- Lack of Research Space: There is currently no greenhouse for research experiments.

Architectural Issues
The current Science Building was built in the 1970s in the same modernist style as the rest of the original campus. The exterior is red brick with large bands of energy inefficient ribbon windows encircling the perimeter. The campus architecture of the time was based on a three-dimensional grid system utilizing thirty-foot square column spacing in plan, with 14' floor-to-floor heights that are less than required for contemporary laboratory environments. The existing building is a concrete structure, using the prescribed grid, which does not mesh well with the standard contemporary laboratory module between 10'6" and 10'8". Currently, there is an interior double-loaded corridor circulation scheme that makes a full circle within the building. It is highly efficient although it does not promote a healthy, positive learning environment.

Outdoor Areas
There are a few outdoor spaces for gathering that are under utilized. The entrances to the Science Building are not noticeable and architecturally become non-existent. This makes way-finding difficult. Mechanical equipment is housed in two black metal "towers" on the exterior of the building. These units face the main pedestrian mall of the campus and do not offer a welcoming view to the building.

Mechanical Systems
Although much of the HVAC equipment in this building was replaced or rebuilt in 1997, some equipment is more than 26 years old and is unreliable. The acid waste piping system needs major overhaul. Other systems including urinal piping and faucets need major corrections.

Figure 2.5i – Shared teaching greenhouse in existing Science

II.6 Program Alternatives

Several alternatives to the proposed program for sciences at Auraria have been evaluated. None are acceptable. The unacceptable alternatives involve additional cost, require unworkable programmatic adjustments by the institutions that share Auraria resources, or untenable compromise to the mission of one or two of the institutions in favor of the other(s). A summary evaluation of alternatives follows.

Although some off-campus locations are used by the institutions at Auraria for allied science disciplines, core science laboratory space—which is the key component of the proposed program—cannot be accommodated in generic space off-campus. Academic and research lab spaces are highly specialized and the cost of developing such space in another location would exceed the cost of construction on the Auraria campus.

As an alternative to the proposed program, attempts to maintain the status quo of sciences at Auraria will lead to long term life cycle costs for the campus and significant sacrifices by the institutions. The deteriorating condition of the existing science facility makes it a significant long term operating liability to the Auraria campus. Science classes have been displaced because overused lab spaces become unsafe to occupy. Continued use of the building without renovation will lead to a continued reduction in teaching and research capacity that will force reduced enrollment in the sciences at Auraria.

Accepting reduced capacity for sciences at Auraria is unacceptable and limiting growth is shortsighted given the potential economic benefits that could accrue by developing significant academic research and teaching space directly adjacent to Colorado's major economic center in Downtown Denver. All institutions at Auraria have demonstrated major enrollment expansion in the sciences and each projects a comparable trend into the future given facilities capable of accommodating growth. The alternative of facilitating the growth needs of one Auraria institution at the expense of the others would undermine the delicately balanced efficiencies of the shared Auraria campus.

III.1 General Description of Current Facilities

Figure 3.1a – Southwestern view towards existing Science building

SCIENCE BUILDING

The Science Building is owned by the Auraria Higher Education Center (AHEC) and maintained by Facilities Management which is a division of AHEC. The building is used by three separate institutions, the University of Colorado at Denver and Health Sciences Center (UCDHSC), the Metropolitan State College of Denver (MSCD), and the Community College of Denver (CCD).

Of the approximate 116,000 SF of space in the building, MSCD is the largest user at 43,010 SF (38% of total) dedicated to Chemistry and Biology labs and support spaces, Math and Computer Science classrooms, Earth and Atmospheric Sciences labs and support spaces, Anthropology labs and support spaces, the Dean's Office, department and faculty offices, classrooms and storage.

UCDHSC - is the next largest tenant at 8,438 SF (8% of total) dedicated to Chemistry and Biology labs and support spaces, Math and Computer Science classrooms, Anthropology labs and support spaces and teaching assistant office space.

Figure 3.1b – North Classroom building

These two institutions share approximately 6,752 SF (6% of total) for lab and support spaces, greenhouse, stock room and chemical storage facilities.

Auraria Higher Education Center has 2,049 SF (2% of total) for Facilities Storage space.

The remaining 48,718 SF (43% of total) is dedicated to general classrooms, student lounge space, shared storage, corridors and building services.

Other than the potential use of general classrooms and lounge spaces, CCD currently does not have any dedicated space in the building.

NORTH CLASSROOM

UCDHSC occupies approximately 18,955 SF at Level 3 dedicated to Animal Quarters, Biology / Chemistry teaching and research labs and support spaces. A shared Analytical Service Lab and departmental faculty and research assistant office space is also on Level 3.

A single Biology research laboratory at 494 sf is accommodated on Level 2 and two 90 sf Biology faculty offices are located on Level 4. Two UCDHSC Psychology labs are located on Level 5 for a total of 721 sf.

There are no dedicated Science Program spaces in the North Classroom Building for MSCD or CCD.

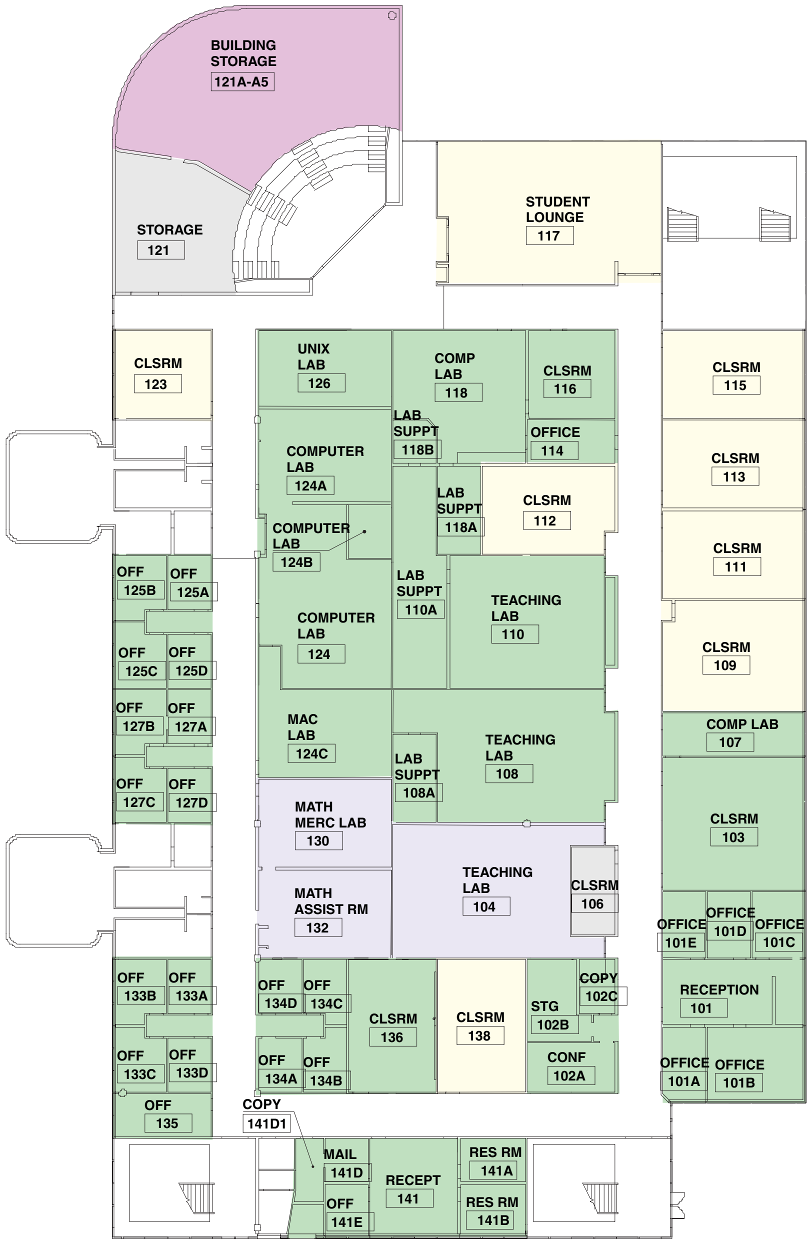
SOUTH CLASSROOM

MSCD and CCD share 9,311 SF in the South Classroom Building. CCD is the largest user at 8,468 SF dedicated to Wet Lab Classrooms, Microbiology Teaching Labs, Anatomy and Physiology Teaching Lab, Interdisciplinary Teaching Lab, General Chemistry Lab and support spaces, Departmental and Faculty office space.

MSCD has 843 SF dedicated to an Integrated Natural Sciences Lab.

There are no dedicated Science Programs in the South Classroom Building for UCDHSC.

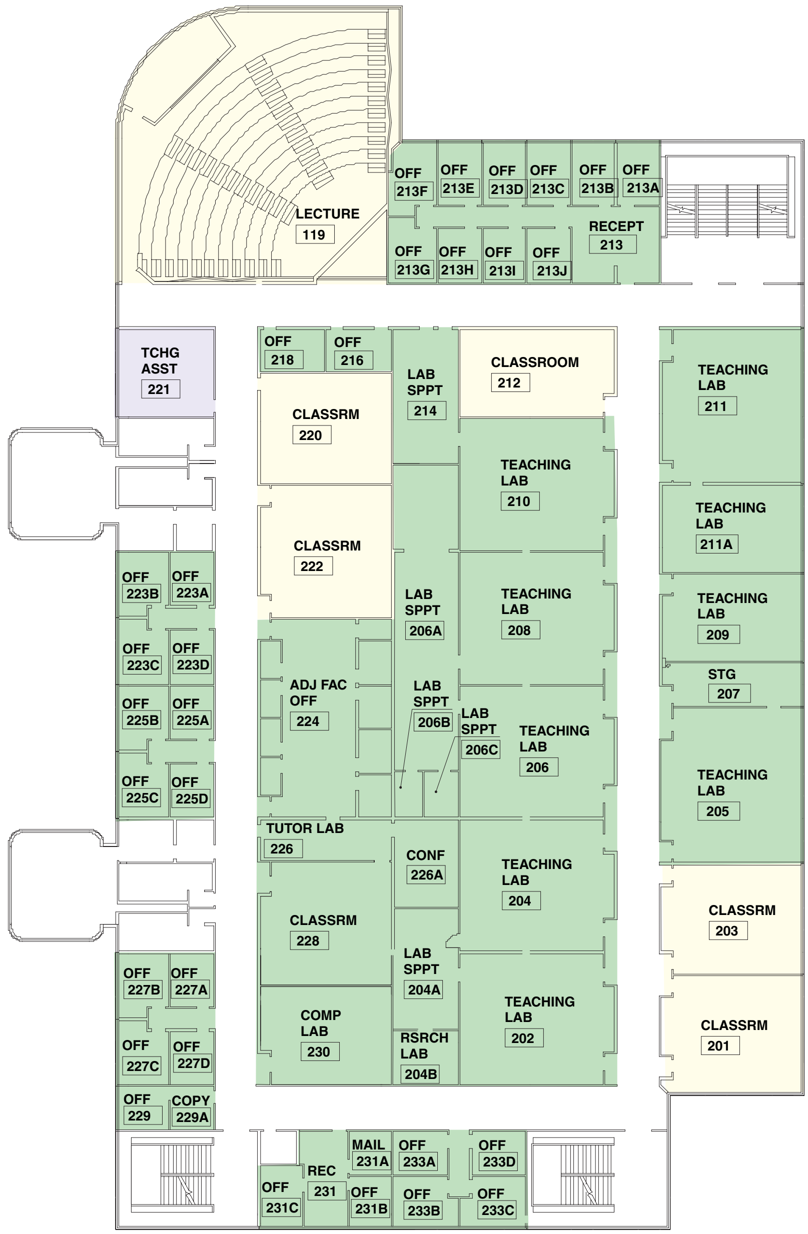
All science space that will be relocated in the new facility are shown in the proceeding pages.



Science Building Level One

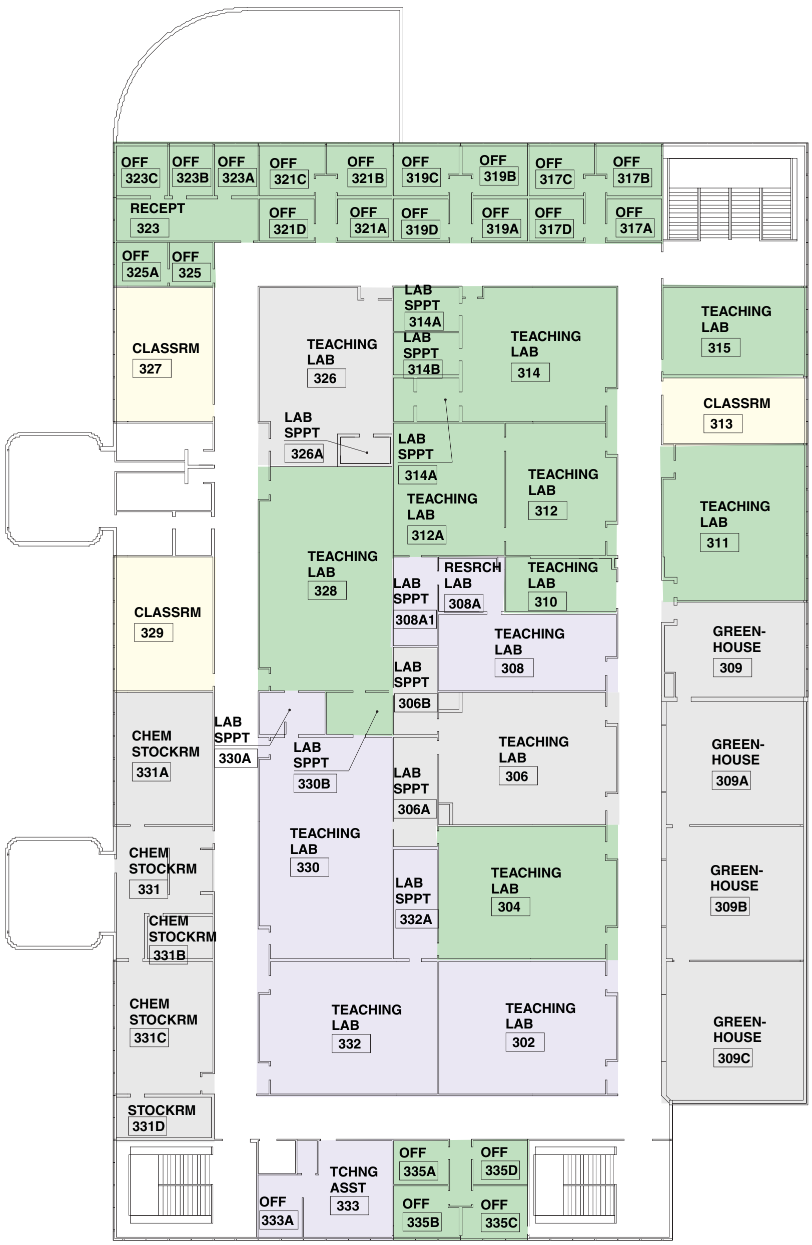
Not To Scale

General
MSCD
UCDHSC
MSCD / UCDHSC
AHEC



Science Building Level Two

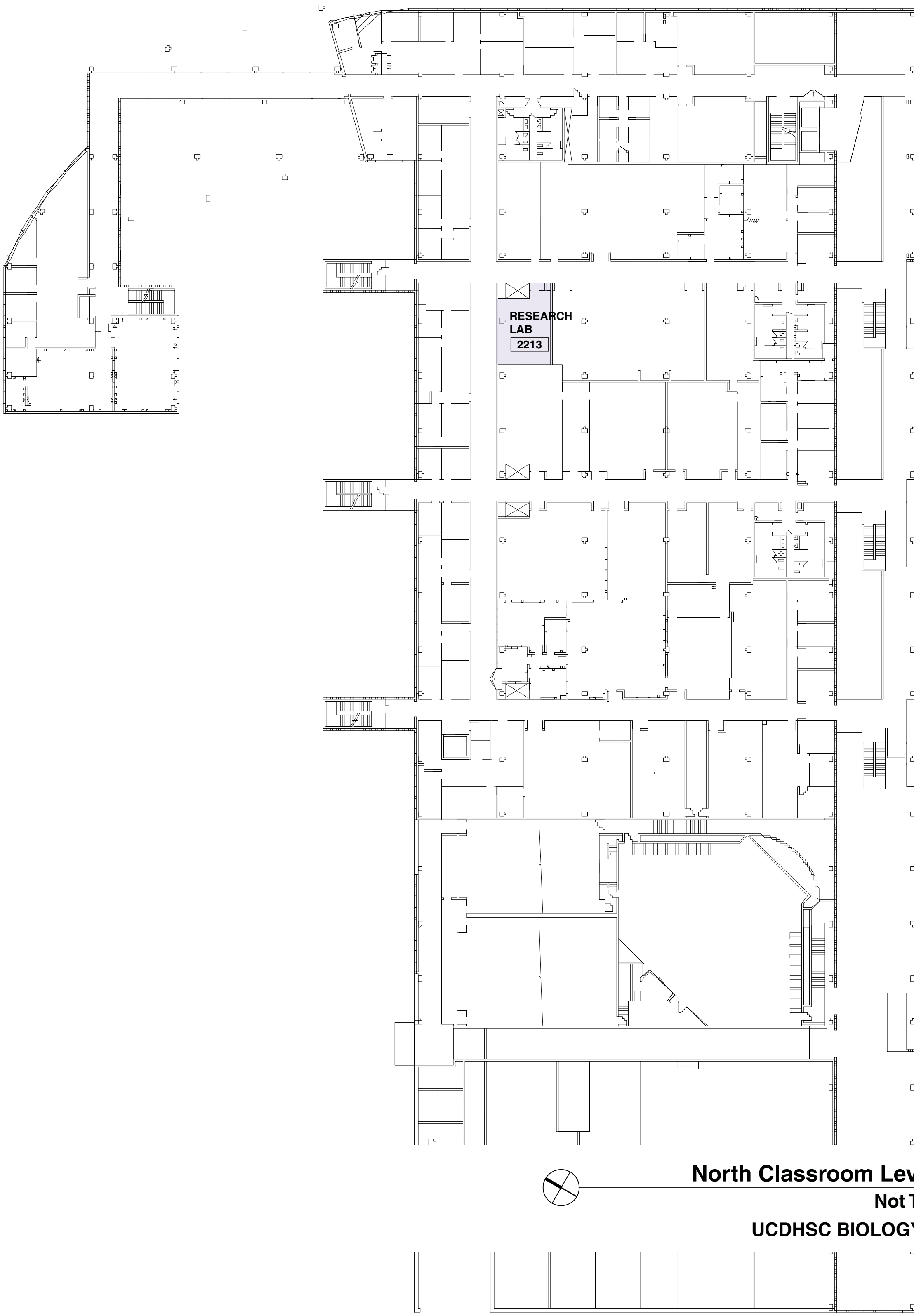
Not To Scale



Science Building Level Three

Not To Scale

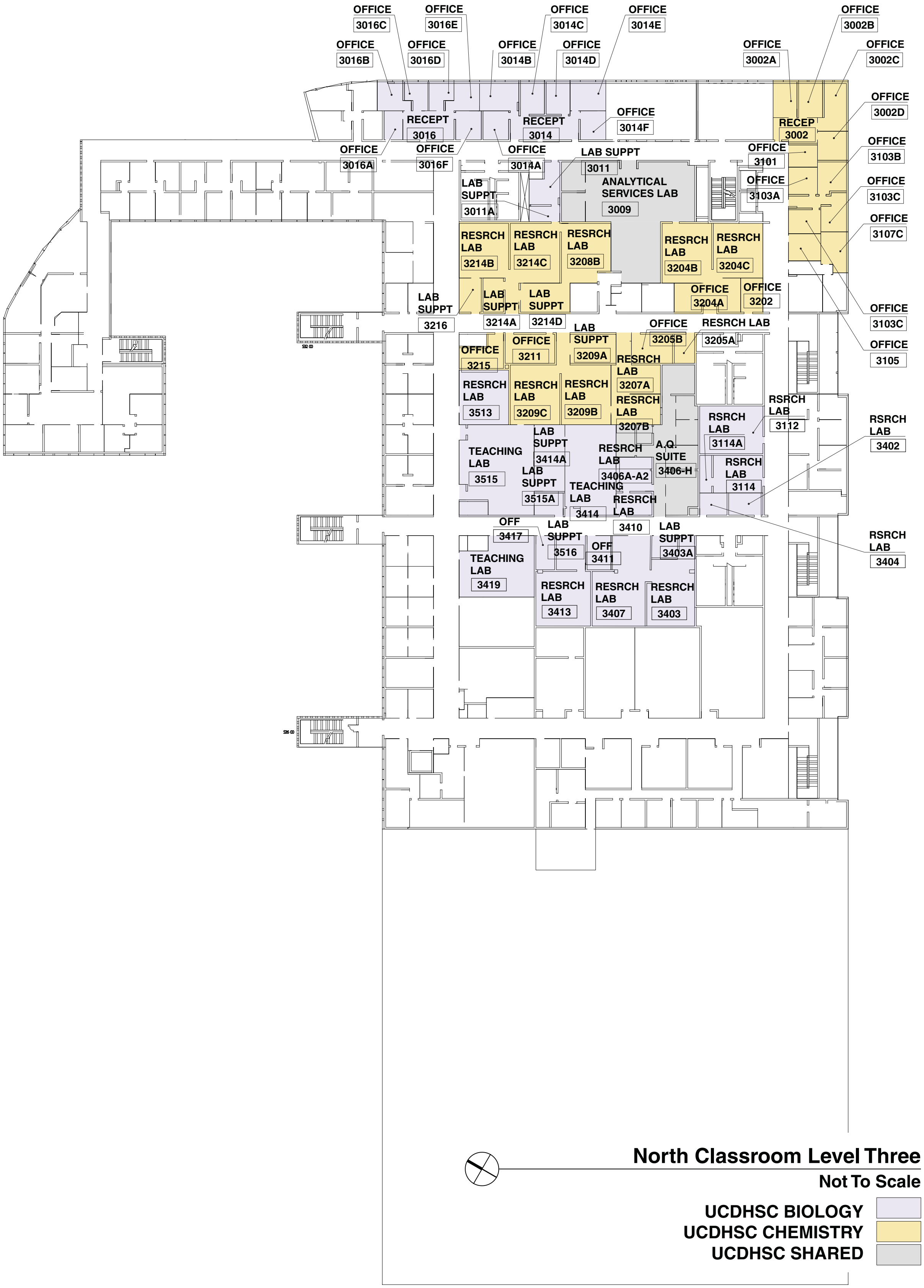
General	
MSCD	
UCD	
MSCD/UCD	



North Classroom Level Two

Not To Scale

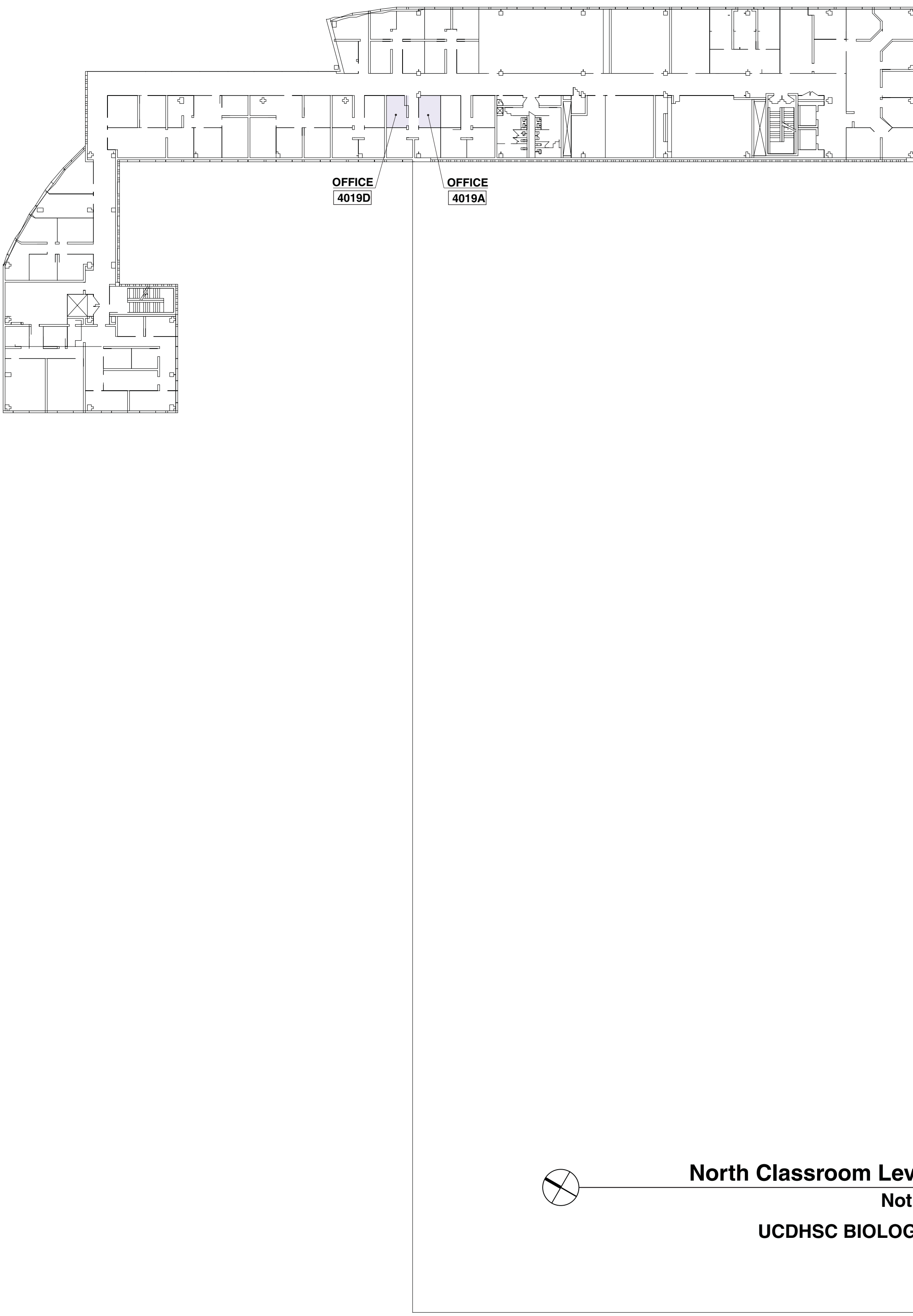
UCDHSC BIOLOGY



North Classroom Level Three

Not To Scale

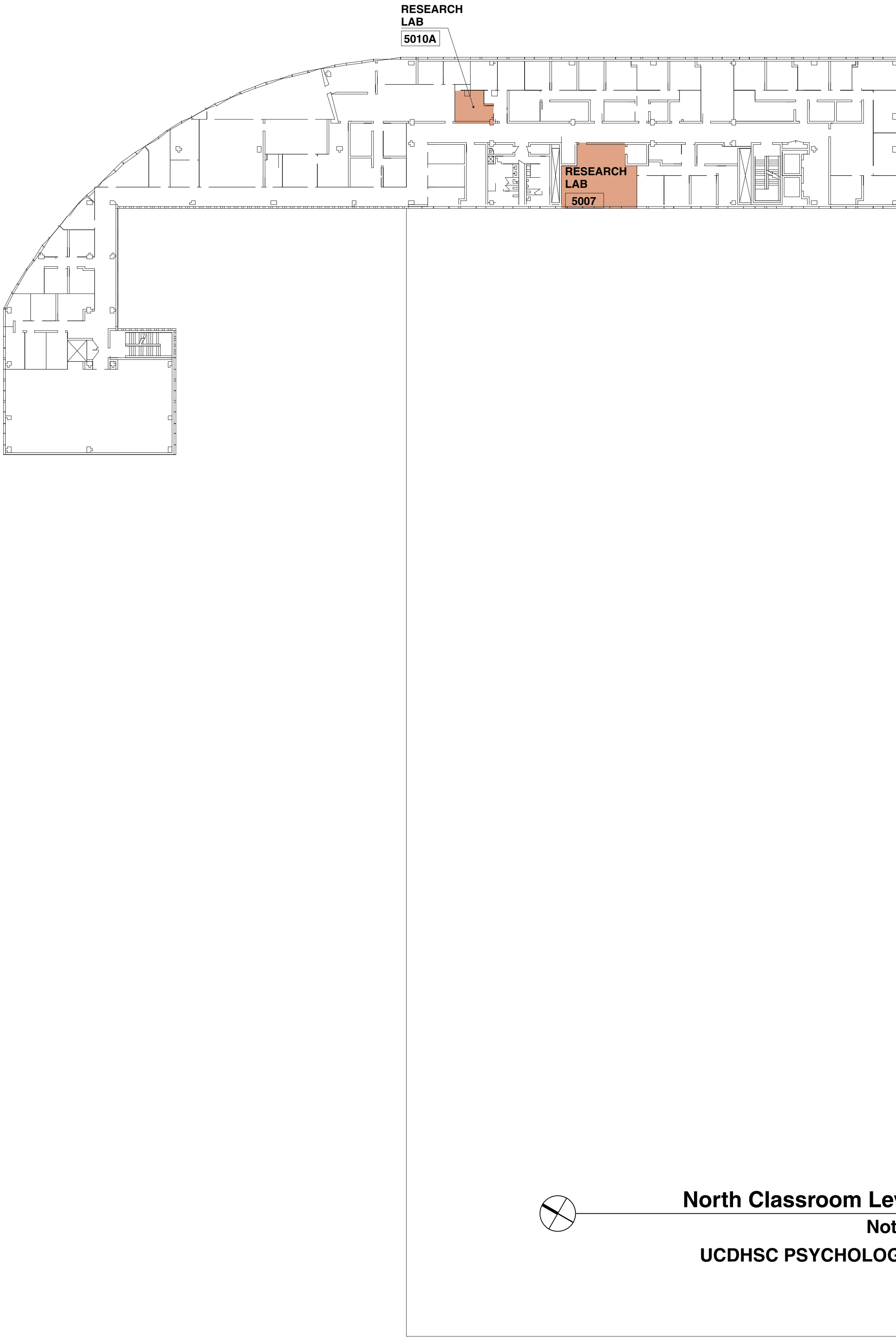
UCDHSC BIOLOGY
UCDHSC CHEMISTRY
UCDHSC SHARED



North Classroom Level Four

Not To Scale

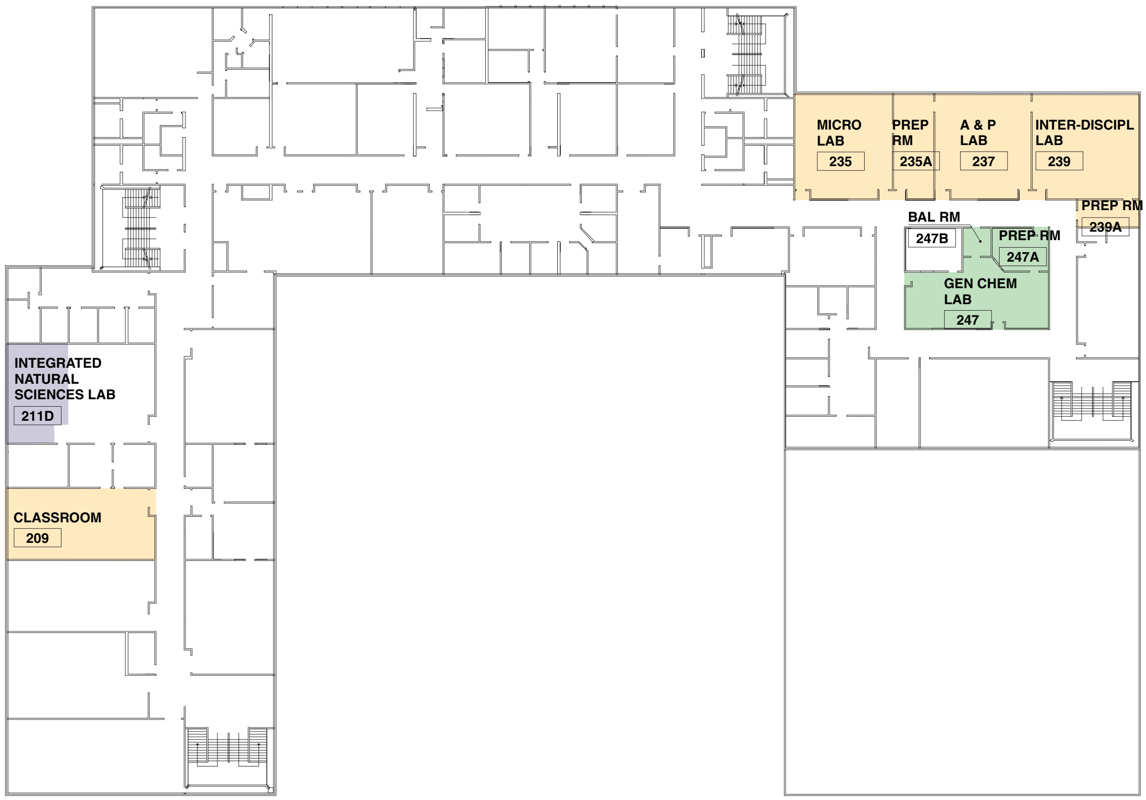
UCDHSC BIOLOGY



North Classroom Level Five

Not To Scale

UCDHSC PSYCHOLOGY



South Classroom Level Two

Not To Scale

CCD CHEMISTRY:
CCD BIOLOGY
MSCD EARTH SCIENCES

South Classroom Level Three

Not To Scale

CCD BIOLOGY
CCD CHEMISTRY
CCD CHEMISTRY / BIOLOGY SHARED

III.2.1 Architectural Narrative

The Science Building was completed in 1976 in the block bound by Lawrence Street to the north, Curtis Street to the south, 11th Street to the west and 12th Street to the east. Subsequent campus landscaping has removed the old city streets and the building currently is bound by a large pedestrian mall to the north, a large lawn area to the south, lawn area to the east and bordered by Speer Boulevard, and a parking area to the west shared with the Auraria Library.

The structure is composed of a cast in place concrete frame supported by a combination of 24" and 30" drilled concrete piers on a 30' square grid. All piers extend to bedrock approximately fifteen feet below the first floor slab (elevation 5204'-4"). The two mechanical towers at the north side of the building are framed in steel. According to the 1975 construction documents, there is no insulation or drainage indicated under the slab on grade and the water table is identified as 12' below the level 1 slab. This may account for the deteriorated condition of the vinyl composition tile (VCT) flooring at Level 1.

There is a basement area under each of the north mechanical towers comprising approximately 700 square feet each. The basement under the northwest tower is for the mechanical equipment and the sewage ejector and the basement under the northeast tower is for the electrical switch gear and the sump pump. Basement walls are 10" cast in place reinforced concrete; slabs are 4" reinforced concrete over a 4" gravel base. There is a 4" perforated drain line leading to the sump between the two towers. Floor to floor height from basement to first floor slab is 12'-0".

The basement level areaway between the two towers contains the transformer, an emergency generator, a diesel fuel tank for the generator and acid neutralization equipment.

The first floor is composed of a 4" cast in place reinforced slab on grade for the majority of the footprint and a 5-1/4" thick concrete slab on composite steel deck supported by steel beams at the two mechanical towers.

The second and third floors, and the roof slabs are composed mainly of cast in place concrete pan joist system with 52" wide pans, 12" deep with a 4-1/2" concrete slab depth. The floor and roof slabs at the two mechanical towers are 5-1/4" thick cast in place concrete slab over composite steel deck supported by steel beams. Original drawings indicate a design live load of 100 PSF.

Floor to floor heights are 14'-0" with 12'-8" clear to the underside of structure. This height is adequate for classroom spaces but is approximately 2'-0" too short of ideal for an updated mechanical system that will include ducted supply and return air, IT ladder racks, a sprinkler system and new lighting.

Exterior walls are composed of 4" modular brick veneer which follows the campus standard size and color and appears to be in good condition. The construction documents indicate that the veneer is supported at the slab on grade and ties back to a 4" metal stud back-up with ½" exterior gypsum sheathing, batt insulation and 1/2'" interior gypsum wall board. There is no vapor barrier indicated on the drawings and it was initially thought that there may be a moisture problem in the walls. To determine whether a vapor barrier would be needed, the architect, structural engineer and facilities management team removed bricks from the building in a few locations. It was observed that here was no damage to the wall assembly from moisture. It was determined that a vapor barrier is not needed. The R value of the insulation of the exterior wall is not known but appears to be approximately R-11. The possibility of increasing this to an R-19 should be considered. The exterior walls are not compliant with current energy standards. The exterior walls of the two mechanical towers are composed of 2" insulated metal panels and mechanical louvers supported on a metal frame. The painted finish on the panels is failing.

All windows are single pane glazing with a film applied shade coating that is deteriorating. Frames are non-thermally broken aluminum or hollow metal. Each window module is made up of a large fixed section with a small operable section above. The single pane glazing is a significant source of heat loss and heat gain and interior condensation. Replacement of the window systems should be considered essential in any remodel.

The interior character of the building is mostly defined by the corridors which have VCT floors, painted gypsum board walls and exposed concrete structure at the ceiling with exposed ducts, pipes etc. In plan, the corridors form a donut with most of

Figure 3.2.1a – Typical corridor of existing Science building

the classroom and office space at the exterior walls and the lab spaces at the interior of the building. At the northeast corner of the building there is a tiered lecture theatre that seats 257 in fixed chairs with entry from Levels 1 and 2. Interior partitions are gypsum board on metal stud construction generally in good condition. Throughout the building there are several types of lay-in ceilings many of the tiles due to their unusual shape and size are not available anymore. Replacement tiles have been installed on a piecemeal basis. Many ceilings have stained or damaged tile.

The building is served by three staircases that appear to comply with current codes in all but the railing and guardrail design. Code compliant railings must be part of any remodel plan. VCT flooring is worn and damaged in many locations.

There are two pairs of public restrooms at Levels 1 and 2 and a single pair at the third floor. Only one set of restrooms at each level is labeled handicap accessible but they do not have the required fixture spacing, floor clearances and entry turning radius dimensions to be fully ADA compliant. The required number of fixtures will need to be confirmed when the programming phase for the remodel is complete.

There is a single hydraulic passenger elevator that serves the building. The remodel should consider upgrading this passenger elevator and possibly add a service elevator. Ideally the service elevator should extend to the roof.

The lab spaces have been well used since 1976, they are outdated, undersized and overcrowded. The lab benches and casework are worn out and have reagent shelves and bars above that screen views to the teacher station and presentation wall. Fume hoods are a bypass type and are connected via manifold to a common exhaust hood. There are ongoing problems with how the hoods are vented and fume smells will be addressed under the mechanical section. The adjacent prep rooms are also outdated and worn out. They have outdated equipment and are generally undersized for the number of people who use them.

Chemical storage throughout the building must be addressed. It may be more advantageous from a code stand point to reduce the amount of chemicals stored in the building long term and only have small amounts of chemicals delivered on an as needed basis. Under the current International Building Code, maintaining an on-site chemical storage room may move portions of the building into a high-hazard Group H occupancy classification and this should be avoided if possible. There is currently no computerized system to account for the quantity or type of chemicals stored in the building.

Code Narrative

1. The original code analysis is not available for the building. The drawings are dated 1975, therefore, the assumption is that the building was reviewed under the 1973 Uniform Building Code. The renovation of the building will require the building to be updated to the 2003 International Building Code and other associated codes and standards currently in force in the State.
2. Based upon a review of the 1975 drawings for the building, it is presumed to be of Type II-A construction. (Concrete coverage and detailing will need to be verified). The building frame consists of concrete columns and tensioned floor slabs with concrete beams at 30'-0" spacing and concrete joists at 5'-0" spacing. Roof framing is similar to floor slabs. Currently mechanical towers are constructed of unprotected steel framing and a composite floor slab. For this area to qualify as Type II-A construction, the steel would need to be protected and composition of the composite slab verified.
3. The building has a mixed use occupancy classification. The main occupancy is type B. A type A-3 occupancy occurs at the large 2 story lecture hall at level 1. There is no required separation of occupancies between these two classifications. Egress from both occupancy types appears to be adequate.
4. Current building envelope may not meet current energy code requirements due to exterior wall construction type, single pane glazing, deteriorating glazing film and lack of vestibules at building entrances.
5. The building does not have a standpipe or fire sprinkler system. It is presumed that an automatic fire sprinkler system will be added throughout.
6. Many of the existing fire hose cabinets are empty.
7. Existing fire extinguisher cabinets are of varying types and sizes.
8. Emergency lighting in mechanical and chemical storage areas is inadequate. Emergency lighting in hallways and stair towers has been recently upgraded.
9. Light fixtures in chemical storage areas do not have adequate protective cages.
10. Hazardous material storage occurs in four rooms on level 3. Two of the three rooms have been modified with curbs, alarms, direct exterior ventilation, and ceiling blast panels similar to requirements for an H Occupancy. It appears that not all conditions conform to the requirements of an H Occupancy, including location within the building, exiting, and other issues. Quantities and types of chemicals stored may be an issue.
11. Chemical storage in labs and lab support areas does not appear to be following a defined plan consistent with management of allowable quantities.
12. Safety signage in lab areas is out of date. Emergency contact numbers are not current.
13. Stairways appear to be of adequate egress width. Door egress width also appears to be adequate. Stair railings do not meet requirements for maximum opening size or guardrail heights. One stair tower currently has a table and chairs located within the rated stair enclosure.
14. Interior corridors are generally constructed to a one hour rated condition.
15. Plumbing fixture counts appear to be adequate under the 2003 IBC, however, fixture accessibility needs to be verified.
16. All restroom facilities in the building are not currently accessible. Some restrooms on each floor have been modified with push button activation at the doorways in order to allow for wheelchair access.
17. Interior door hardware is a mixture of types, and is not universally accessible throughout the building.
18. All building entrances are not currently accessible.

PROGRAM BACKFILL

At the end of programming it was determined that areas in the North and South Classroom buildings would be utilized to accommodate program spaces not selected for either the renovated science building or the new science building addition. This backfill area is composed of approximately 17,500 square feet of classroom space; 3,465 square feet for UCDHSC Anthropology, Anthropology Labs, and Anthropology Teaching Labs; 3,060 square feet for UCDHSC Math, Math Labs and Assistance Room; and finally 2,260 square feet for the Metro State Dean's Office. A brief description of the North and South Classroom building follows.

North Classroom Building

The exposed concrete frame and two story open portal that punctuates the curved east elevation of the North Classroom Building creates a major campus entry point at the corner of Speer Boulevard and Lawrence Way. A large pedestrian mall to the south is shared with the existing Science Building.

The structure is composed of a cast in place concrete frame with 24" diameter columns on 30' bays north to south and 16' to 24' bays east to west. The first floor slab on grade is thickness is 4" typical and 6" at labs. Structured floor slabs are typically an 11" thick cast-in-place flat plate slab with 24" concrete beams. The third floor roof area is composed of 18" and 32" precast concrete double tees with a 3" concrete topping. The original drawings note the floor live load as 100 lbs.

The building is composed of three distinct sections, the first a five story office tower fronting Speer Boulevard. To the west behind the tower, a three story section houses three groups of double loaded corridors with classrooms to either side. Farther to the west, the last two story section houses a large lecture theater and mechanical spaces.

There are mechanical penthouses at the third floor and sixth floors.

Floor to floor heights are 14'-0" with 13'-1" clear under slabs and 12'-0" clear to the underside of beams. This height is adequate for classroom spaces. Exterior walls are composed of 4" modular brick veneer which follows the campus standard size and color and appears to be in good condition. In plan, the building is composed of five sections in the east west direction each with two staircases connected by a north-south corridor. Classrooms of various sized are grouped along the four north double loaded corridors.

At the upper levels departmental office suites line the exterior walls with classrooms at the interior of the building. Interior partitions are gypsum board on metal stud construction generally in good condition.

Seven staircases serve the building. Three of these occupy a two story space that runs the length of the south elevation and are open to Level 2; above level 2 they are enclosed.

There are four pairs of public restrooms at Level 1, three pairs at the Levels 2 and 3 and a single pair at Levels 4 and 5.

There are three hydraulic elevators that serve the building.

South Classroom Building

The South Classroom Building was completed in 1975. The building is bound by Champa Street to the north, West Colfax Avenue to the south, 10th Street to the west and St. Francis Way to the east.

The structure is composed of a cast in place concrete frame on a 30' square grid.
No basement. The first floor slab on grade is 4" thick with 8" thickened edge at the perimeter. Structured floors are a 1'-4-1/2" thick cast-in-place concrete pan joist system with 52" wide pans, slab thickness is 5".

Floor to floor heights are 14'-0" with 12'-8" clear to the underside of structure. This height is adequate for classroom spaces. Exterior walls are composed of 4" modular brick veneer which follows the campus standard size and color and appears to be in good condition.

There are three mechanical rooms, one at Level 2 and two at Level 3.

III.2.2 Laboratory Narrative

Figure 3.2.2a – (upper left) Existing MSCD Chemistry Instrumental Analysis Laboratory. Figure 3.2.2b – Corrosion of fume hood duct in UCDHSC Chemistry Research Lab Figure 3.2.2c – (bottom) Existing UCDHSC Chemistry Research Lab

The existing teaching laboratories, research laboratories and laboratory support spaces for UCD and MSCD are housed in the Science Building and the North Classroom Building. The majority of these laboratories have not been updated in any way since the buildings were built, and in some instances the laboratory casework was not new when the buildings were new, but was moved from a previous laboratory building. Deficiencies include lack of bench and storage space, little support and equipment space, inadequate ADA provisions, extremely poor ventilation, outdated and inefficient laboratory layouts, deteriorating casework and fume hoods, and limited ability to accommodate new faculty and programs. The laboratories are configured into small, interconnecting rooms that do not offer any flexibility in use or room configuration, and the laboratory planning module is not applied consistently.

The existing laboratories exhibit shortcomings particularly related to laboratory safety. Because many laboratory spaces were pieced together and carved out of available space, they do not always have appropriate exiting. Safety shower and eyewash devices were not provided in many locations, and do not meet current ADA requirements. The fume hoods in the existing laboratories are old, inefficient models and many are in dilapidated condition. The ventilation systems do not provide adequate exhaust to keep hazardous chemical fumes moving away from the students and researchers, or to exhaust equipment generated heat.

The existing teaching laboratories and associated laboratory support spaces for CCD are housed in the newer South building.

III.2.3 Information Technology

OVERVIEW

The original construction of the Science building took place in the 1970s, and the technology within the facility reflects an evolution of various systems and infrastructures over that time. There are few systems which are consistent throughout.

This narrative begins by describing the current systems and deficiencies and concludes with a short discussion on the viability of retaining some, all, or none of those systems going forward.

COMMUNICATIONS INFRASTRUCTURE

Communications Rooms

The existing EF/TR is located on the first level. There are no provisions for adequate environmental control (HVAC, etc.) within this space. Lighting is poor.

The existing Telecommunications Rooms (TRs) are greatly undersized per AHEC and ANSI/TIA/EIA standards. The largest TR visited was less than 50 square feet, approximately half the size of those found elsewhere on the AHEC campus and about one third of the size recommended for rooms of this nature. Additionally, the TRs are often shared with electrical and janitorial spaces; this is in violation of both AHEC and ANSI/TIA/EIA standards.

Figure 3.2.3a – TR Room with Electrical Equipment

Figure 3.2.3b – TR Room with Heavily Loaded Equipment Rack

Equipment racks exist within TRs; however, some are wall mounted units that are interspersed among non-telecommunications/technology related equipment. Wall-mounted racks limit both functionality and expandability.

Plywood backboards do not cover each wall within the TRs, thus limiting space for wall mounted equipment. AHEC typically covers all four walls with backboards.

The nine-foot racks in use, while helpful in minimizing the amount of floor space required for telecommunications, encourage overloading with equipment and patch panels, which in turn makes patch cord management and maintenance of the mounted equipment difficult, particularly as time progresses.

CABLING SYSTEM

Within the building, backbone cabling (both fiber and copper) appears to be inadequate both in terms of sizing and installation. Backbone cabling often takes circuitous routes, as determined by the conditions of the facility, and is improperly supported.
The existing horizontal (station) cabling consists of Category 3, Category 5, Category 5e and unrated

cabling, and is a combination of both plenum and non-plenum rated cabling. Category 6 cabling is the current AHEC standard. Horizontal cabling is often routed improperly or poorly and the support system is not compliant with current industry standards. Due to the location of the existing TRs, some cable lengths exceed that allowed by TIA/EIA standards (100m) and mandated by the manufacturer(s). The existing station outlets (jacks) consist of various varieties of port counts and cable types, many of which are not in keeping with current AHEC standards.

Abandoned telecommunications cable can be found throughout the facility, creating a situation that is not code compliant and hinders maintenance of the cabling system.

There are multiple cable termination schemes used within the building, which in turn complicate maintenance and support. Cables are terminated on an assortment of 66M1-50 blocks, 110 blocks and patch panels – 66M1-50 blocks are practically obsolete, except for use with Outside Plant copper cable.

Outside plant cabling to the building consists of a 24 multimode and 18 singlemode optical fiber cables with a redundant 16 multimode/16 singlemode optical fiber feed. There is also a 500-pair copper cable. This cabling will be insufficient to support both the renovated building and the new addition.

Many of the spaces within the facility are outdated, both in terms of cabling and electronic hardware. The laboratories are too congested and have little or no communications infrastructure –there are stand-alone PCs for equipment in these spaces that do have no connectivity to the network.

Figure 3.2.3c - Various Termination Blocks and Panels

Figure 3.2.3d – Lab example

Figure 3.2.3e –Existing MSCD Information Technology Computer Lab

Figure 3.2.3f – Typical Classroom AV Rack

Some of the classrooms are wired with data ports to each seat, but most classrooms have only one AHEC CIP outlet for the teaching space.

It appears that the Computer Labs have been renovated most recently, and they appear to be the only spaces which are close to current AHEC standards. They are wired to serve data for all computer workstation locations via wall outlets. From the wall outlets patch cords are routed through workstation furniture to connect to each of the computer workstations.

PATHWAY SYSTEM

The building is being fed via an underground conduit system from the Library/AMC Building. The conduit pathway serving the current Entrance Facility (EF) consists of (2) 4-inch ducts to a maintenance-hole located approximately 300 feet west of the building. Cables exist within both conduits; however, there may be some capacity for a limited quantity of additional cables in these conduits.

The existing cable pathways are typically located within ceiling spaces, but lack proper cable support per AHEC and ANSI/TIA/EIA standards. Cable trays do not exist. Conduits to support the backbone cabling are typically undersized where present and do not run continuously between TRs. Hangers, where present; do not offer the type of edge/bend support necessary for Category 5e and higher cabling. The lack of adequate pathway makes it difficult and costly to add communications outlets when needed.

GROUNDING/BONDING SYSTEM

There is no telecommunications grounding/bonding system. This system is an AHEC and ANSI/TIA/EIA requirement and necessary for the efficient operation of high speed structured cabling systems.

AUDIOVISUAL SYSTEMS

The existing AV equipment in a majority of the classrooms consists of a projector, projection screen, A/V switcher, various source equipment, wall mounted speakers and an AMX control system. The amplifier and speaker systems in the classrooms do not appear to be of the professional/commercial grade often found in institutional classroom settings. The remaining AV components are of professional grade, although aging, and some exhibit evident wear-and-tear.

SECURITY

Access Control

The existing Access Control System consists of "mag-swipe" style card reader devices at selected entryways – primarily laboratories, large classroom and sensitive storage rooms. The cards used for this system are the same cards used by Faculty and Staff for identification. This system integrates into a campus-wide control system.

VIDEO SURVEILLANCE

It does not appear that there is an actively monitored video surveillance system within the existing facility.

Figure 3.2.3g – Access Control System Components

RECOMMENDATIONS / CONCLUSIONS

In general, Technology has not been well integrated within the building, although this is not surprising given the age of the building and the rapid pace at which technology systems have advanced during that time.

Many existing areas are not equipped to meet the current technological demands in terms of cabling, equipment and floor space/arrangement.

COMMUNICATIONS INFRASTRUCTURE

The existing telecommunications infrastructure system does not meet current AHEC or industry (ANSI/TIA/EIA) standards – a new communications infrastructure system is necessary to bring this building up to those standards, nor will it adequately provide for the technological demands of AHEC over time.

An enclosed and secure Entrance Facility (EF) is recommended. Additionally, there should be at least one TR (possibly two TRs depending on location) on each level, vertically stacked if possible. Enlarged Telecommunications Rooms (TRs) will be necessary to house the new communications infrastructure system and AHEC equipment. New cable pathways (conduit, cable trays, hangers, etc.) are necessary to connect the various TRs together and to provide support for horizontal cabling. A new standards-based backbone and horizontal (station) cabling system is required, as is the addition of a telecommunications grounding/bonding system.

The existing copper, fiber, and CATV cabling from the vault to the building may be insufficient to support the new addition. New underground conduits may be required to provide adequate pathways into the EF from the Campus, should the existing EF be relocated. In addition, if there will be extensive site work associated with the renovation, we recommend increasing the quantity of dedicated telecommunications conduits into the building.

AUDIOVISUAL SYSTEMS

It is recommended that the AV equipment be removed prior to the renovation and preserved. This equipment should be evaluated for functionality against today's standards, for compatibility with the new equipment that will be installed in the new addition, and the degree to which the manufacturer continues to support (or will continue to support) the equipment. After evaluation, a determination can be made as to whether various components should be reused for the renovation/new addition or should be retained as replacement parts for like equipment used in other buildings on the campus.

With the above in mind, it should be noted that reusing AV equipment does not always realize the cost savings hoped for. Much like the computer industry, the Audiovisual industry undergoes continual product development, and the subsequent (and rapid) discontinuation of products. Manufacturers discontinue support for older products frequently – which in turn makes it more difficult and costly to reuse equipment going forward. This also necessarily makes it virtually impossible to purchase new equipment that will match the old.

Furthermore, there will be some measure of new AV equipment that will need to be purchased and installed regardless – the renovated facility along with its new addition will be nearly twice the size of the old. Reusing some of the existing AV equipment will result in a new facility that has both old and new AV equipment, resulting in non-standardized AV Systems from the outset, with differing control systems, divergent maintenance requirements, etc.

We do not recommend that the amplifiers and speakers be reused, nor any equipment with evident wear-and-tear and/or damage.

SECURITY SYSTEMS

It is recommended that the Access Control System equipment (head-end and door controllers) be removed prior to the renovation and preserved. This equipment should be evaluated for condition, as well as functionality and/or compatibility with new equipment (if any) to be installed in the new addition. After evaluation, a determination can be made as to the value of this equipment for reuse in the renovation/new addition or whether components should be retained as replacement parts for like equipment used in other buildings on the campus.

III.2.4 Structural Assessment

This assessment consists of a visual walk-through and limited engineering calculations to evaluate the structure of the existing Science Building at the Auraria Campus in Denver, Colorado. The purpose of this evaluation was to observe the general structural condition of the building, to express an opinion on its structural soundness, and to explore its ability to be structurally renovated as part of the new Science Building program.

The investigation consisted of a brief, visual examination of the Science Building (AHEC Building #11) and adjacent North Chiller Building on October 18, 2006. The original design/construction drawings for the Science Building were available at the time of the walk-thru, but the details for the Science Building and all drawings for the North Chiller Building were not available at that time. Since then, these documents were found and they were used during the review of the structural design. The Science Building construction documents consist of drawings S1 thru S5 and 8.5x11" General Notes and details numbered 1 thru 62. The drawings are dated September and October, 1975.

STRUCTURAL SYSTEMS

The main part of the building has three levels with the first level at grade. There are two basement areas under the mechanical room towers at the north side of the building. The basement walls are cast-in-place concrete. The foundation system is drilled piers under perimeter grade beams and columns. The slabs-on-grade are 4" thick supported on 4" of gravel.

The main floor and roof structure consists of cast-in-place concrete one-way pan joists supported on circular cast-in-place columns. The joist slab consists of a 4.5" thick slab over 12" deep joist ribs for a total thickness of 16.5". The beams are flushed formed with the joists and so they are also 16.5" thick. Joists are nominally 8" wide and spaced at 5' o.c. Beam width is typically 36". Joists and beams are reinforced with unbonded post-tensioning tendons and mild reinforcing bars.

The roof of the main building has the same concrete joist system and depth as the floors. There are many pieces of roof-top mechanical equipment and associated roof slab openings. The existing structural drawings do not depict the roof-top equipment and do not show most of the roof slab openings.

The floors of the mechanical towers consist of 5.25" total thickness concrete slabs on metal deck on steel beams supported on steel columns. The roof of the mechanical towers consist of 1.5" roof deck on steel beams. The slabs, beams, and columns are painted and do not have fireproofing.

There is an aluminum framed greenhouse at the third floor south west corner.

The exterior walls are 4" light gage metal studs with brick veneer. The windows are arranged in bands or ribbons around the building with the brick above the windows supported on a steel shelf angle welded to the metal studs. The brick has cells that are reinforced at cripple walls and parapets to provide structural integrity.

The structure's lateral system is a concrete moment frame with the columns acting with the floor beams and joists.

VISUAL EVALUATION

The building appears to be in generally good condition considering its age. Many of the structural elements are exposed as there are no ceilings in the stairs, corridors, and laboratories. The walk-thru was done with Pete Hagen of AHEC facilities. Pete was not aware of any structural distress, cracking, or structural repairs. Pete also indicated that no vibration concerns have ever been reported to AHEC facilities to his knowledge. He questioned some of the science faculty at part of this study and learned that floor vibration was a problem on one isolated occasion during the use of a microscope, but by far the general comment was that the structure does not have a vibration problem.

No unusual signs of structural problems, distress, or significant foundation movement were observed, and the few items observed do not represent a life-safety hazard to the occupants. The following are items which could affect the structural integrity, safety and life expectancy of the building if not addressed in the building maintenance program:

- The slab-on-grade has moved vertically relative to the columns at most first floor columns. A small offset is visible in the floor tile especially in the corridors. Some movement is expected between the floating slab-on-grade and the drilled pier supported columns, so this is not a structural concern. The offset may be a tripping problem for occupants, though. It can be reduced by removing the tile and grinding down the high spots.

- The mortar in the north exterior wall below the first floor windows is weak and crumbling and allowing moisture to enter the wall cavity. This and other similar areas should be tuckpointed.

- The steel beams are starting to rust from the moist environment in the west mechanical room basement. There is not a significant loss of structural capacity at this time, but the steel should be cleaned and repainted to protect it from further corrosion.

This report is based on conditions of structural elements that were readily observable at the time of investigation. No invasive testing or inspections were performed. Hidden structural deficiencies could exist. For example, it is not uncommon considering the age of the building and the type of construction for corrosion to have occurred in the masonry veneer ties, shelf angle, and post-tensioning tendons and anchorage. This report is intended to inventory existing conditions of the observed areas and is not intended to provide detailed, construction document level, recommendations for repair of noted deficiencies or damage.

DRAWING REVIEW

The structural drawings were reviewed to assess the original design relative to possible structural renovation. Items investigated include the fire rating of the structure, evaluating the floor structure for laboratory strength and vibration criteria, adding new floor and roof openings thru the concrete structure, and general requirements to upgrade the building to the 2003 International Building Code.

FIRE RATING

The fire rating of the existing post-tensioned structure is limited by the thickness of the floor slab and the thickness of the concrete cover protecting the reinforcing steel and post-tension tendons. The 4.5" floor slab thickness will provide approximately a 90 minute fire rating in accordance with IBC 2003 Table 720.1(3), Item 1-1.1. The cover to the post-tensioned tendons provides a 2-hour fire rating based on restrained construction (interior bays), but only a1-hour rating for the exterior bays (unrestrained condition).

The floor slabs in the mechanical rooms (4" slab on 1 5/16 metal deck) will provide approximately a 90 minute fire rating. The structural steel in the mechanical towers is unprotected and therefore has no rating. The roof assembly in the mechanical towers is unprotected roof deck and unprotected steel beams and columns, which also has no rating.

LABORATORY CRITERIA RELATIVE TO THE EXISTING FLOORS

The existing floor slabs were designed for a 100 psf live load, which exceeds the building code requirement for classrooms (40 psf), but is less than the 125 psf live load capacity recommended by the laboratory consultant. In our experience the 100 psf live load should be adequate for all but the heaviest labs.

The laboratory consultant has also provided preliminary recommendation relative to floor vibration due to people walking. Two criteria were provided, a velocity criteria and a center-bay stiffness criteria. The velocity criteria requires a corresponding speed of people walking adjacent to the laboratory in order to evaluate the structure. Since the layout of the laboratories relative to corridors and the associated walking speed of occupants are not currently known, this criteria was not used. The center-bay stiffness was used, though, to get a preliminary indication of the floor's susceptibility to vibration. The center-bay vibration parameter is k*f, where 'k' is the center-bay stiffness and 'f' is the fundamental frequency of the floor. This parameter is supposed to be greater than 6400 kips / inch-seconds. Our preliminary evaluation of the floor resulted in about half of this value, which indicates the existing floor does not satisfy this criteria.

NEW FLOOR AND ROOF OPENINGS

Preliminary evaluations of the existing floor and roof joist slab were performed and it was found to be structurally acceptable to place some new openings thru the 4.5" slab between joist ribs. The size and location of new openings is restricted so as to not greatly weaken the floor structure.

EXISTING STRUCTURE RELATIVE TO THE 2003 IBC

The building was designed in accordance with the 1973 UBC. The structure appears to comply with the 1973 UBC. We also performed a preliminary evaluation of the structure to see if it might conform to the current code, the 2003 IBC.

The fire rating of the structure may not comply based on the required construction type to be determined by the architect's code study.

The building structure generally complies with current code, except for the following:

- The shear strength of the concrete joists and beams is deficient; the stirrups do not extend far enough into the joist and beam span to satisfy the $\Phi V_c/2$ code provision for shear.
- The beams are not adequate to support patterned live load as required by code.
- The roof has very limited capacity to support roof-top equipment and the resulting weight of drifting snow around the equipment as required by the current code.
- The moment frame lateral system can only carry about a third of the seismic loads required by the current code.

Renovation of the existing building should be done in such a way that a code required upgrade to the building structure is not required. This upgrade is triggered if the lateral forces on the building increase by more than 5 percent of if the lateral system is weakened by more than 5 percent. Additions should be separated using an expansion joint to avoid adding new load to the existing and renovations should avoid weakening the columns, beams, and joists.

PROPOSED STRUCTURAL RENOVATION

The plan for the existing building is still being formulated, but it currently appears likely that a new elevator will be needed to serve the existing building. This discussion assumes a hydraulic elevator that will require a new rough opening of approximately 8' square. Placing the new elevator inside the existing building will be difficult since at least one existing joist will need to be cut, which requires the existing post-tension tendons to be anchored and cut. This will increase the stresses in the floor system in adjacent bays. Cutting stressed tendons is a labor intensive procedure that has a risk of tendon breakage; the floor being cut and the floor below will need to be evacuated for safety. The increased stresses in the neighboring floor areas may necessitate strengthening the floor by adding carbon fiber or structural steel reinforcing.

A much simpler and less costly location for the new elevator is outside the existing building, preferably in an adjacent addition where new construction is already occurring. A stand alone elevator shaft outside and adjacent to the existing building is also structurally feasible and preferred over an interior location.

NEW ROOF-TOP MECHANICAL EQUIPMENT

The existing roof is designed for 30 psf snow load. It is not clear that the roof was designed for the equipment currently on the roof as the structural drawings don't show this equipment nor the roof openings associated with the equipment.

New roof-top equipment will add load to the roof from the equipment and snow. The snow load may increase due to drifting around the new equipment. It is likely new equipment heavier than about 500 pounds can not be supported from the slab. It will be possible to add a steel framework on the roof that spans from column to column and have the new equipment supported on this framework. This will be costly and will raise the elevation of the equipment.

EXISTING CHILLER BUILDING

Structural Systems

This structure houses chillers and a cooling tower that serves the Science Building and other buildings. This building is a one-story load-bearing concrete masonry structure with precast concrete double tee and single tee roof framing. An adjacent enclosure with no roof contains a cooling tower. The foundation system is spread footings with perimeter grade beams. The slab-on-grade is 6" thick supported on 6" of gravel.

The building was designed in 1978 and is presumed to have been constructed shortly thereafter. The structure appears to be performing fine. No distress in the bearing walls or roof framing was observed. Slab-on-grade cracking is extensive, but no signs of vertical offset across cracks were observed. The slab supporting the cooling tower appears to have settled resulting in no support for the cooling tower at its east and west ends. This may affect the long-term performance of the tower and it should be addressed during building maintenance.

III.2.5 Mechanical, Electrical, Plumbing Assessment

HVAC Systems

The existing HVAC systems are original to the Building and they consist of two air handlers per each of three (3) levels providing conditioned air to variable air volume terminal units via a medium pressure ductwork system. Return air is ducted from the individual rooms to the mechanical rooms via a low pressure return-exhaust fan system. The return air is delivered into the mechanical rooms such that the mechanical room serves as a return air plenum. The air handlers dampers and relief dampers within the mechanical room are set up to provide a 100% air economizer control system.

Each AHU has a chilled water and heating water coil.

The perimeter of the building is provided with hot water fin tube radiation. Heating water piping (supply and return) serving the fin tube is routed vertically through the floors as a riser at the perimeter and is connected to the baseboard at each level.

A portion of the VAV terminal units have been retrofitted with heating water coils in order to accomplish minimum ventilation rates without overcooling the space. The heating water piping serving these VAV terminal units is separate from the fin tube radiation piping. This piping main riser begins at the pumps in the grade level Mechanical Room and is routed in the ceiling of each level.

Laboratory fume hoods are located on the third level and are provided with exhaust and make-up air from roof mounted units located directly over the laboratories. The combination exhaust/make-up air units (MAU's) are equipped with heat recovery (heat pipe), a chilled water cooling coil and a steam heating coil. These MAU's have been modified to be more current code compliant in a past project which extended the exhaust air from the MAU, to discharge it at a distance from and away from the O.A. intake.

There is a current project in the planning/design phase through AHEC Facilities which is studying these MAU's separately. These units have been determined to be delivering an exhaust air quantity that is below the original values and are below current safety standards. This is largely due to the heat pipe coils being plugged.

The Building is provided with chilled water from the North Central Campus Central Chiller Plant. Chilled water is routed to each mechanical room to serve multiple air handlers.

Steam for building heating source is provided from the Xcel Energy system. Steam is used for a steam-to-water heat exchanger for heating water service and a steam exchanger/storage tank for domestic water heating. The primary cooling and heating equipment is located in the lower level west mechanical room.

CAMPUS CENTRAL PLANT

The existing chilled water central plant is located north of the building on the West end. The Chiller Plant serves three (3) buildings on campus. The plant consists of two (2) 500 Ton electric centrifugal chillers with a primary pumping system that serves these three buildings. There are two corresponding Cooling Towers serving the Chillers at the Central Plant Building. There is no excess chilled water capacity available with the existing Equipment to serve a new addition to the Science Building. Piping is routed to the buildings through below grade supply and return piping in a pipe trench. The chilled water piping mains serving the existing Science Building is routed along the North side of the building. The size of the service piping is right sized for the present loads. The Chiller Plant operation was optimized by Control Updates during a Campus project in 1996.

Steam is provided from the Excel District Utility system. The Xcel HPS steam is routed to the Campus through a Master Meter and a high pressure steam "Underground" piping system. It enters the buildings and is reduced in pressure through a PRV Station and is distributed to the buildings at approximately 30 psig.

PLUMBING SYSTEMS

The plumbing system consists of a 4-inch domestic water service, 15-inch storm water service, 6-inch sanitary and 4-inch acid waste system which combine into an 8-inch sanitary service. The 4-inch acid waste system is routed through an acid neutralization basin prior to connection with the sanitary sewer.

Domestic water enters the building in the lower level west mechanical room and was provided with a new reduced pressure backflow preventor. Located within this mechanical room is the domestic water heating system and both domestic cold water and domestic hot water emanate from this point and are distributed throughout the building.

The natural gas system is dedicated to process uses, i.e. laboratory, and is not utilized for building services.

The building storm drain system consists of roof drains with piping routed in the interior of the building to an underground storm line that connects to the street storm system. This system is not provided with overflow roof drains and leaders.

The sanitary system consists of both an acid waste system and a sanitary system. The acid waste system primarily serves the laboratory spaces by a series of vertical risers located underslab of the first level. This system terminates in an outdoor acid neutralization basin prior to connect to the building sewer. The acid neutralization basin was replaced within the last five (5) years. It was provided with a solids interceptor upstream of the neutralization basin.

Other laboratory systems consist of DI water, compressed air, natural gas and vacuum. The DI System was upgraded “recently” by “Water Power Technologies”. The capacity of the system will be verified as well as water quality.

FIRE PROTECTION SYSTEMS

There are no wet fire sprinkler systems within the existing Science Building.

The chemical storage area located on the third level is provided with a local carbon dioxide fire suppression system.

LABORATORY HVAC SYSTEMS

Temperature control is accomplished by thermostat modulation of the VAV box serving the space. These boxes, which were revised in 1997, have been retrofitted with heating water coils. Facilities has indicated that a minimum position of the VAV terminal is provided, the heating water valve is modulated, and Johnson Controls has added a Lab control system, per Lab Room, to allow Lab pressure control.

General room exhaust is through the fume hoods, there is no general room exhaust or return air system.

The constant volume fume hoods appear to run continuously, however several hoods have a proximity switch control to cycle the hoods on when in use.

The laboratories are provided with some form of pressure control between the laboratory and the corridor. This was a retrofit by Johnson Controls after the original construction was completed.

Fume hood exhaust ducts are manifolded at the vertical riser which extends through the roof to the MAU/Exhaust Fans. This ductwork is constructed of stainless steel. This system has been modified over the years to “remote” the exhaust discharge from the O.A. intake. However, it has not provided an exhaust system which elevates the plume out of the Building envelope.

Energy Conservation is accomplished at the MAU/Exhaust Fans with a heat recovery system (heat pipe). No other heat recovery techniques are employed in the mechanical system.

CLASSROOM AND OFFICE HVAC SYSTEMS

Temperature Control: Temperature control is accomplished by thermostat modulation of the VAV box serving the space. These boxes have been retrofitted with heating water coils and assume that at minimum position of the VAV, the heating water valve is modulated.

Humidity control is not provided.

Ventilation control is not provided.

HVAC BUILDING DEFICIENCIES

The fume hood exhaust and make-up air intake are both located on the roof in the center of the building. This system is very susceptible to air re-entrainment.

There are no overflow roof drains.

There is not a consistent laboratory or building air pressure control system. It is a common occurrence when entrance doors are open that a general “wind” blows through the building.

In general, most equipment is beyond its useful life expectancy.

There is no fire protection system.

Plumbing fixtures are in poor condition and lack water saving devices.

Odors from floor drains are present.

ELECTRICAL SERVICE

The Electrical Service consists of a 1500KVA Primary Transformer feeding a 2500A, 480V/277Y, 3PH, 4W Main Switchboard in the basement. The 2500A Switchboard was provided with a 50% Neutral Bus. The Switchboard is original to the building and the manufacturer was Sylvania who is no longer in business. Each floor contains at least (1) 277/480V Branch Panel and (1) 480-120/208V Transformer feeding a 120/208V Distribution Panel. A small 17.5KW Kohler Generator is providing Life Safety Backup to the building.

ELECTRICAL BUILDING DEFICIENCIES

The Neutral Bus in the Main Switchboard is only 50% rated which does not meet today’s electrical requirements where most of the loads have switchmode power supplies.

The Switchgear is no longer manufactured so replacement parts will be difficult to obtain.

Most of the existing panels and transformers are over 30 years old and will need to be replaced. Replacement parts (mainly new breakers) for the panels will be difficult to obtain.

Most of the transformers currently installed in the building were not built to withstand the high harmonic loads in present day buildings. There is a high probability that these transformers will fail if they remain in use.

The entire Fire Alarm System should be replaced if the system is older than 10 years. The Fire Alarm industry has been changing rapidly where older systems are becoming obsolete after a short period of time.

All the internal wiring in the building should be replaced because the installation has probably started to break down (after 30 years of service.)

The wiring between the Main Distribution Gear and the Primary Transformer should be replaced because the insulation has probably started to break down (after 30 years of service.)

Any Fluorescent Lighting, which does not contain electronic ballasts, needs to be replaced.

III.2.6 Site Description

Figure 3.2.6a – Southwestern view of the existing Science building

The Auraria Science Building site is at the southwest intersection of Lawrence Street and Speer Boulevard on the Auraria Higher Education Center campus. The site boundaries are defined by Speer Boulevard on the northeast, the former alignment of Curtis Street on the southeast, the former alignment of 11th Street on the southwest, and the extension of Lawrence Street on the northwest. The site includes two existing buildings – the Science building, located at the southwest portion of the site, and an enclosed cooling tower, located north of the existing Science Building at the western boundary of the site.

EXISTING VEHICULAR AND PEDESTRIAN CIRCULATION AND ACCESS

Bounded by Speer Boulevard on the northeast, a service drive on the southwest, and dedicated pedestrian walkways on the northwest and southeast, the proposed Science Building site currently has limited vehicular access.

Typical vehicular movement around the site is limited to access from Speer Boulevard via St. Francis Way (to the south of the site) and through a gate-arm access point near the intersection of St. Francis Way and 11th Street. Handicapped parking and service vehicle spaces – along with a limited number of short-term parking spaces – are located along the 11th Street service corridor adjacent to the site. Service and emergency vehicle routes are located along the perimeter of the site (with the exception of Lawrence Street) connecting to a campus-wide framework for campus access. With the exception of limited access to campus service vehicles along pedestrian pathways, vehicular traffic is excluded through the site.

The Lawrence Street Mall at the northwest perimeter of the site is one of the campus' most important pedestrian circulation corridors, providing address to a number of campus academic and student support facilities (including the North Classroom, Events Center, Plaza Building, and Performing Arts Center). The Lawrence Street Mall also provides connecting walkways to additional important campus buildings and open spaces – including the existing Science Building, Library, and Arts Building – and provides a pedestrian link across Speer Boulevard to both Lawrence Street and Larimer Street in Downtown Denver.

At the southeastern edge of the site, the former alignment of Curtis Street also provides a dedicated axial pedestrian walkway providing access to the existing Science Building, St. Elizabeth's Church and across Speer Boulevard to

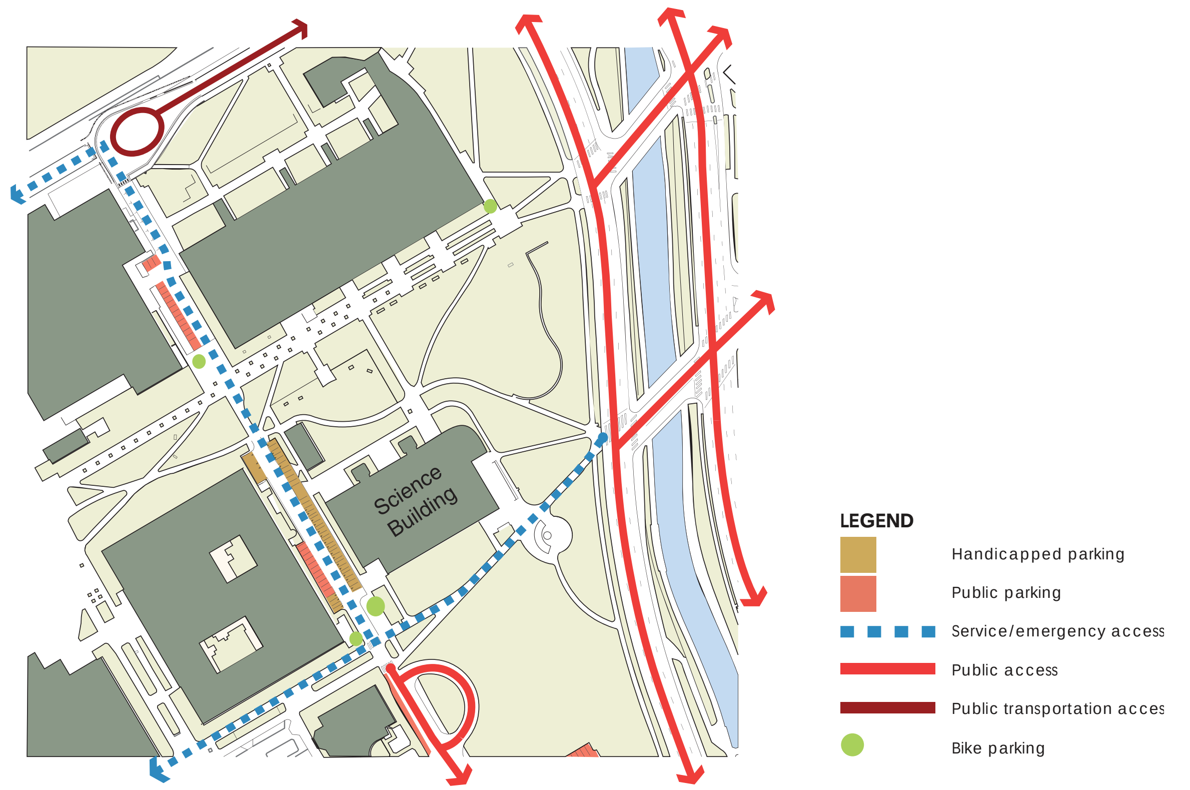


Figure 3.2.6b – Vehicular Access

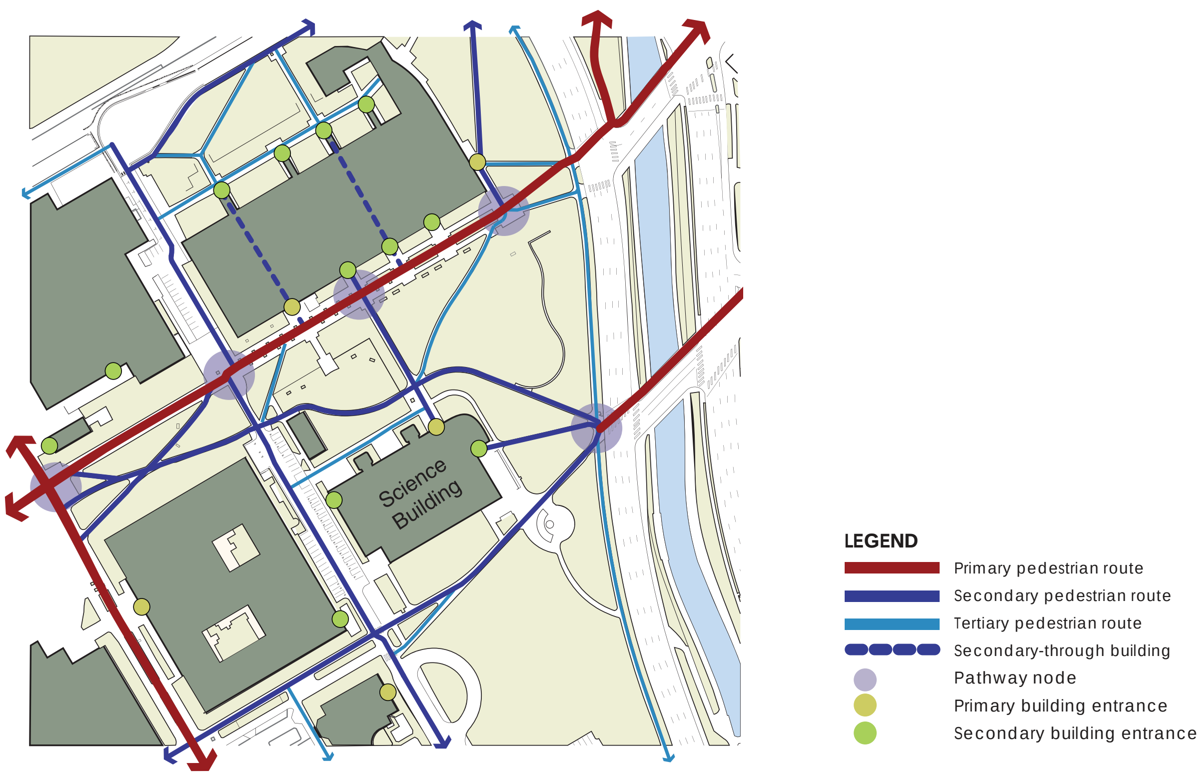


Figure 3.2.6c – Pedestrian Access

Arapahoe Street in Downtown Denver. Pedestrian traffic on the southwest of the site (along 11th Street) is related primarily to access to the existing Science Building, the Media Center at the northeast portion of the Library, and movement to and from parking along the corridor.

Within the proposed Science Building site, pedestrian circulation occurs primarily along a sinuous path that connects the northwest and southeast corners of the site, providing access to the primary entrance of the existing Science Building along the way. An axial connection from the main entrance to the existing Science Building north to the North Classroom bisects the site, while additional narrow pathways provide direct access from entrances to the existing Science Building to nodes near Speer Boulevard at both Lawrence Street and Curtis Street.

EXISTING LANDSCAPE CHARACTER

The character of the existing landscape of the site ranges from open areas intended for passive recreation and study, intimate spaces defined by landscape and art installation, and a formalized perimeter walkway.

The northeastern portion of the site, defined by the Lawrence Street Mall and a sinuous concrete seat wall that contains the space on the south and east, is a generally open lawn with shade trees interspersed near the perimeter of the space. This area serves campus storm drainage and has the capacity for storm water detention, as it gently slopes to a low point and drain near the center of the space. At the southern perimeter of this space, evergreen trees provide screening of existing Science Building from the site, while informally placed ornamental and evergreen trees provide screening of Speer Boulevard on the east.

The northwestern portion of the site is developed as a more intimate outdoor space (in contrast to the openness of the remainder of the site). This area includes an art installation in a small open turf space defined by a raised concrete seat wall, formal ring of ornamental trees, and heavy evergreen planting that serve as both a backdrop to the art installation and screening of the existing Science Building and enclosed cooling tower. Any changes to this portion of the site related to the Science Building expansion and renovation will need to consider the relocation of the art installation to alternative campus locations.

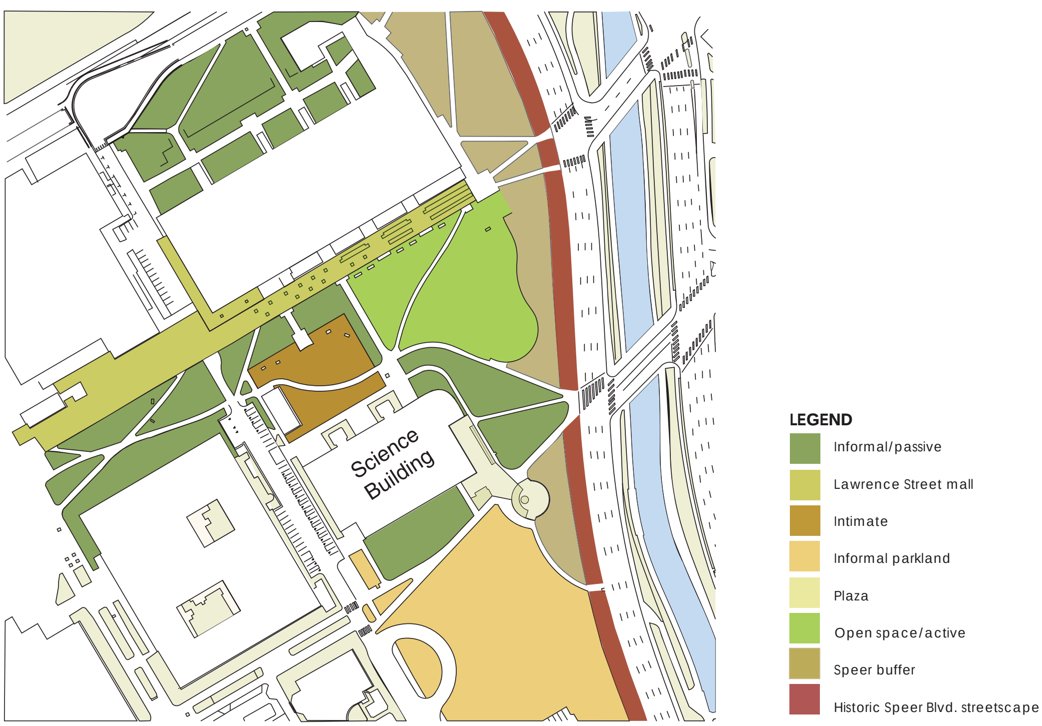


Figure 3.2.6d – Landscape Character / Open Space

The remainder of the site is typically comprised of irrigated turf grass, informally placed shade, ornamental, and evergreen trees. Small concrete plazas provide transition from the outdoor space to entrances to the existing Science Building. At the northwest perimeter of the site, the formally designed Lawrence Street Mall – with a triple row of shade trees – defines the primary east-west pedestrian route through campus.
The topography of the site is generally gently upward sloping from east to west, with raised landscape elements defined by concrete seat walls and the aforementioned site storm water drainage at the center of the open turf area.

Figure 3.2.6e – Downtown View from Lawrence Street Mall

Figure 3.2.6f – Downtown View along Arapahoe Street

VIEWS TO AND FROM THE SITE

Important views to and from proposed site include the following:

Axial views from Downtown Denver along Lawrence Street into the open space at the northeast corner of the site (these views are experienced only by the pedestrian, as vehicular traffic along the street Downtown is one way in the opposite direction from campus).

An axial view along Arapahoe Street from St. Elizabeth's Church on campus to the D&F Tower on the 16th Street Mall in Downtown Denver defines the southeastern perimeter of the site.

An axial view exists from the northern portion of the site to St. Cajetan's Church at the southwest corner of the intersection of Lawrence Street and 9th Street.

A regional axial vista exists from the alignment of Speer Boulevard south of Colfax Avenue to the site.

Views along the eastern and southeastern perimeters of the site address much of Downtown Denver, including the Denver Performing Arts Center, the Colorado Convention Center, and high-rise buildings at the core of Downtown.

LEGEND

- 2 story
- 3-4 story
- >4 story
- View axis from downtown
- View axis from Speer Blvd.
- View axis to St. Cajetan's
- Existing setback
- Proposed setback

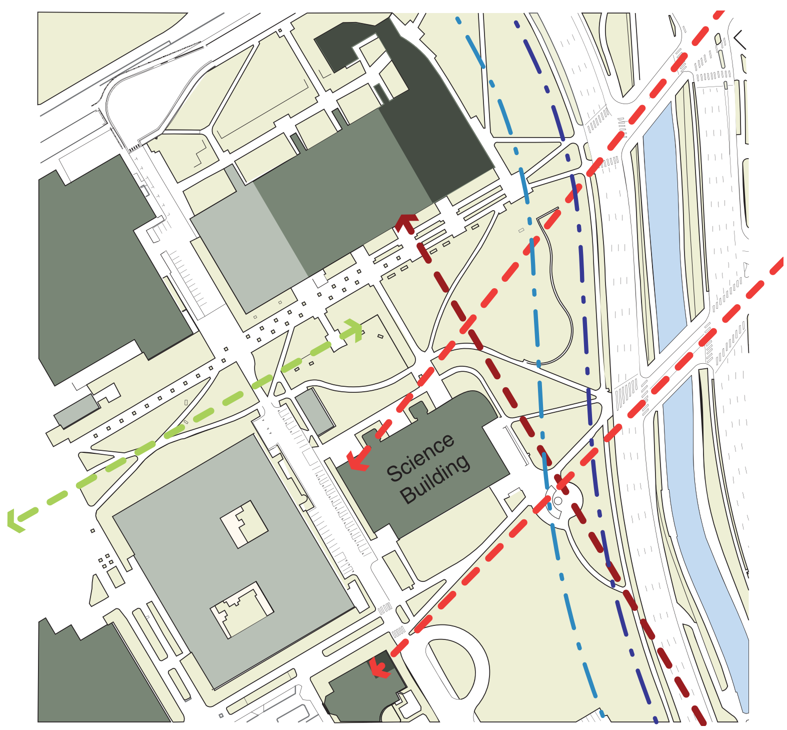


Figure 3.2.6g: Urban Design Influences

III.2.7 Civil Engineering Description

The civil infrastructure includes the following utilities; water (domestic and fire protection), sanitary sewer, storm sewer, stormwater detention and water quality. The evaluation consists of data collection, review of existing utilities, existing utility capacity analysis, development of future needs, and recommendations for utility upgrades. Individual utilities are evaluated in the following sections and have been schematically shown in the Existing Utility Plan at the end of the Civil Engineering section.

WATER AND FIRE

Water is provided by Denver Water's main lines adjacent to the Science Building. There is one existing 16-inch water main line running north-south within the II th Street service drive, one 12-inch water main running east-west in Curtis Street, and one 6-inch water main running eastwest in Lawrence Street. The building's existing 3-inch domestic water service is tapped into the 16-inch line in 11th Street. The service line is tapped northwest of the building, runs east to the existing meter in the sidewalk, and then enters the building from the north into the western mechanical room. Denver Water bills AHEC bi-monthly for domestic water usage on account 10201003-01-9, with the associated Tap Number is 237682 and Meter Number 439606. Based on conversations with AHEC's Facilities Management Staff the current 3-inch service is adequate for the existing building.

A review of the past five years water usage history shows that the maximum usage of 1,133,000 gallons (approximately 13 gallons per minute, or gpm) occurred for the period between 6/1/2001 and 7/31/2001, and the minimum usage of 149,000 (approximately 2 gpm) occurred from 12/2/2003 to 2/2/2004. Not surprisingly, the water usage spikes dramatically during the irrigation season (April thru October). Per AHEC Grounds staff, the landscaped areas north and east of the building are irrigated with water from the existing building's water service. Preliminary analysis shows that on average approximately 646,000 gallons every two months, or 7 gpm, is consumed during the irrigation season and 337,000 gallons, or 4 gpm, is consumed during non-irrigation periods. Therefore it appears that approximately 309,000 gallons are used every two months during the irrigation season. This data is summarized in the Water Usage History below.

Time Period	Water Usage (gallons)	Water Usage (gpm)	Comment
6/1/2001 - 7/31/2001	1133000	13	Maximum Usage with Irrigation
12/2/2001 - 2/2/2002	149000	2	Minimum Usage without Irrigation
60 Days	646000	7	Average Usage with Irrigation
60 Days	337000	4	Average Usage without Irrigation
60 Days	309000	4	Average Usage for Irrigation

Figure 3.2.7a – Water Usage History

sprinkler protected. The existing hydrants are Denver Water numbers 1027, 1028, 1029,1063 and 1822. Per Denver Water Hydraulics Department, these hydrants and main lines operate from 80-88 psi. Fire access is provided on I 1th Street and on super sidewalks north and south of the existing building.

SANITARY SEWER

The existing Science Building has a 4-inch sanitary service tied into an 8-inch sanitary main -- north of the building. The existing building utilizes a 500-gallon solids interceptor and dual acid neutralization basins for acid waste treatment before discharging into`999. The existing 8-inch sanitary sewer main line flows north from the existing Science Building site to an 8-inch sewer flowing west to east in Lawrence Street. This sewer line terminates at a 54-inch interceptor sewer main in Speer Boulevard and serves the Library and the Physical Education Building west (upstream) of 11th Street, and the North Classroom Building drains to this line downstream of the Science Building connection. There is a large, 28-inch by 42-inch, interceptor main running north to south in 11" Street west of the Science Building, but Denver Wastewater Standards typically do not allow service lines to tie into large mains such as this one if there are smaller active mains in the area.

STORM SEWER

There is an 18-inch existing storm sewer with inlets running east to west in Lawrence Street and smaller lateral lines and area inlets to drain the landscaped areas north and east of the existing Science Building. Also, there is an existing 39-inch brick storm sewer flowing west to east in Curtis Street south of the existing building that discharges directly into Cherry Creek under Speer Boulevard. This Curtis Street storm sewer drains a large portion of the south half of campus as well as large off-site areas from south of Colfax Avenue. Storm runoff from the existing Science Building roof drains and two small area drains in the stairwells on the north side of the building are collected and conveyed to the Curtis Street storm sewer in an existing 15-inch pipe. The storm system appears to function adequately for existing conditions: There is one spill containment area around the emergency generator on the north side of the building that collects stormwater, and because it does not have a drain holds runoff until it evaporates.

STORMWATER DETENTION AND WATER QUALITY

The existing Science Building and adjacent site does not have any formal water quality features or stormwater detention basins.

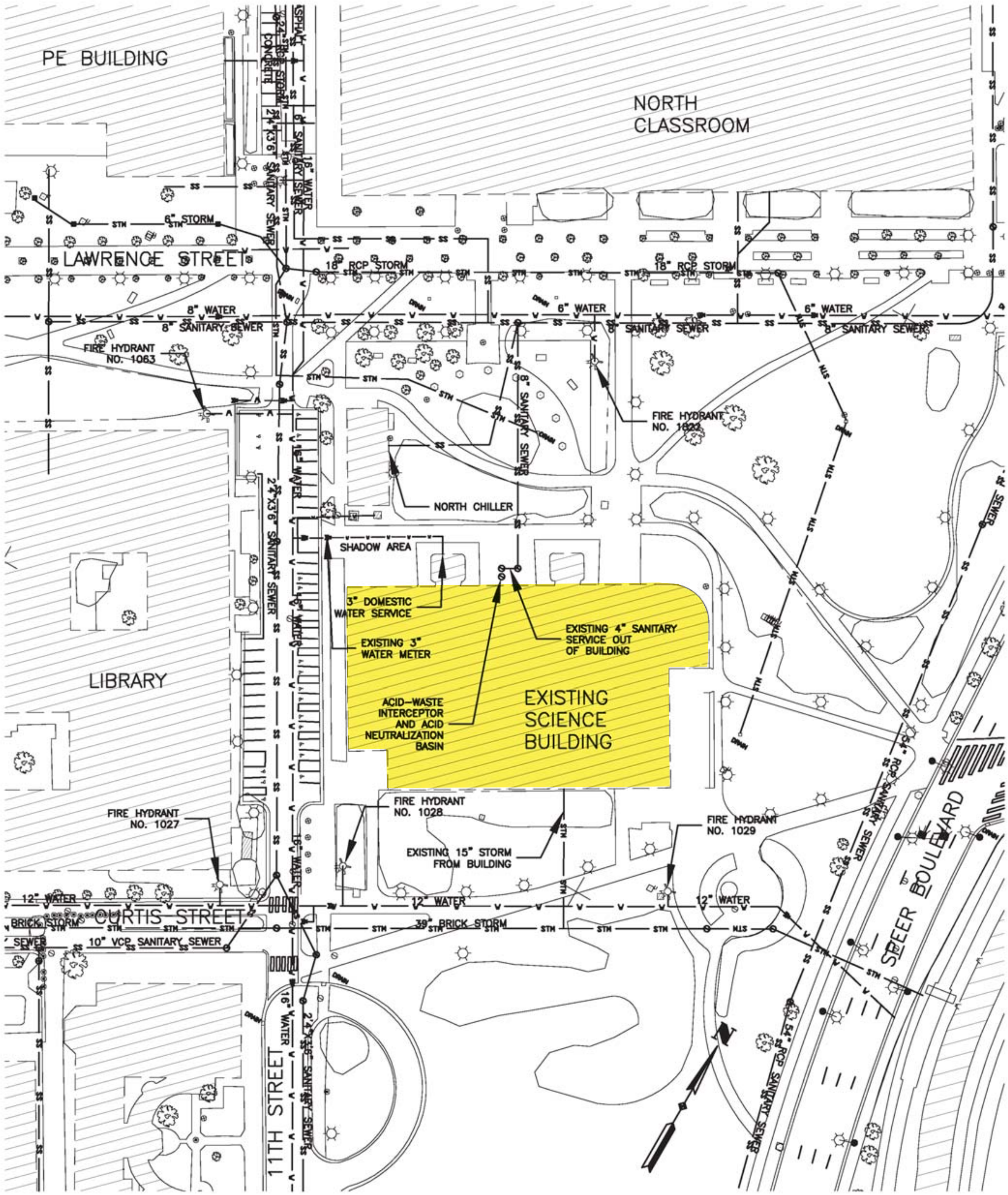


Figure 3.2.7b – Utility Plan

III.2.8 Science Building Energy Analysis

OVERVIEW

This report presents the energy benchmarking analysis completed for the existing Auraria Higher Education Center (AHEC) Science Building. The Auroria Science Building (ASB) is a three-story structure with a total floor area of about 114,000 square feet. The building accommodates a variety of spaces, including: laboratories, classrooms and offices. As part of the AHEC Science Building renovation and expansion project, the existing building will be renovated and a new building will be built on the AHEC campus.

As part of these benchmarking studies, a calibrated, computer simulation model of the existing Science Building was developed. The calibrated model is used to compare the existing building (As-Built) performance against a new/renovated building that is built following usual construction practice and represents a minimally-compliant ASHRAE 90.1-2004 building (Baseline). The analysis can be used to gain insight into the following:

- Estimated impact of new building(s) on existing central utility plant
- Energy use intensity of different building spaces
- Energy saving opportunities for renovation and new construction

In this memorandum, Section 1 presents the assumptions used in the DOE-2.2 energy model. Section 2 describes the building calibration process. Section 3 provides the simulated building energy performance results for the As-Built and Baseline models. Section 4 presents a review of energy intensities for a variety of building types. Section 5 identifies some energy savings opportunities for the renovated Science Building.

1 ENERGY MODEL

The DOE-2.2 computer simulation program predicts the hourly energy use and energy cost of a building given hourly weather data and a description of the building and its HVAC equipment and utility rate structure. For the AHEC existing science building model, all inputs and assumptions are based on as-built drawings and information obtained from the Design Team or facility management staff.

Building Geometry

The building geometry was determined from the as-built drawings. The building as represented in the DOE-2.2 program is shown in Figure 3.2.8a, below.

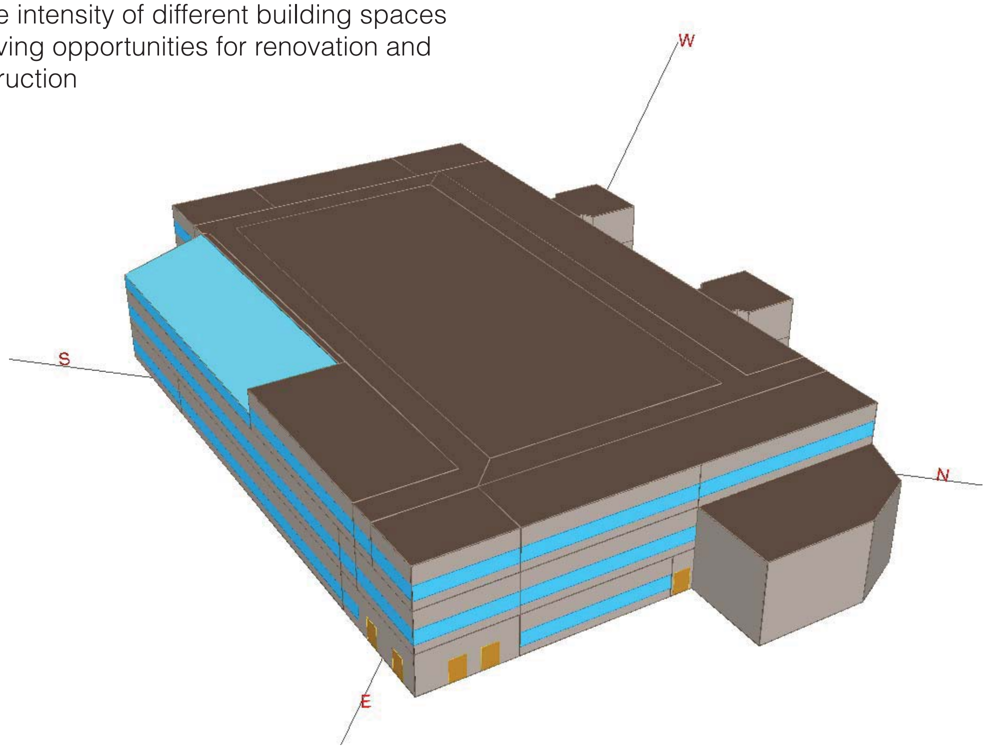


Figure 3.2.8a – 3-D Representation of the Existing Science Building in DOE-2.2

1.1 BUILDING ENVELOPE

Table 1 outlines the building envelope characteristics used in the energy model. Insulation levels for the Baseline represents minimally-compliant values according to ASHRAE 90.1-2004 criteria for building envelopes. The as-built wall insulation levels were determined from the original drawings of the exterior wall assembly, as shown in Figure 3.2.8b. The amount of roof insulation present in the as-built building was estimated based on information supplied by facilities management.

	Baseline	As-Built
Roof R-value [1/(Btu/hr-sf-F)]	R-15 c.i.	Estimated R-21, c.i.
Exterior Wall R-value [1/(Btu/hr-sf-F)]	R-13 (cavity), Maximum U-value 0.113	Overall effective U-value 0.107

Table 1: Building Envelope Specification

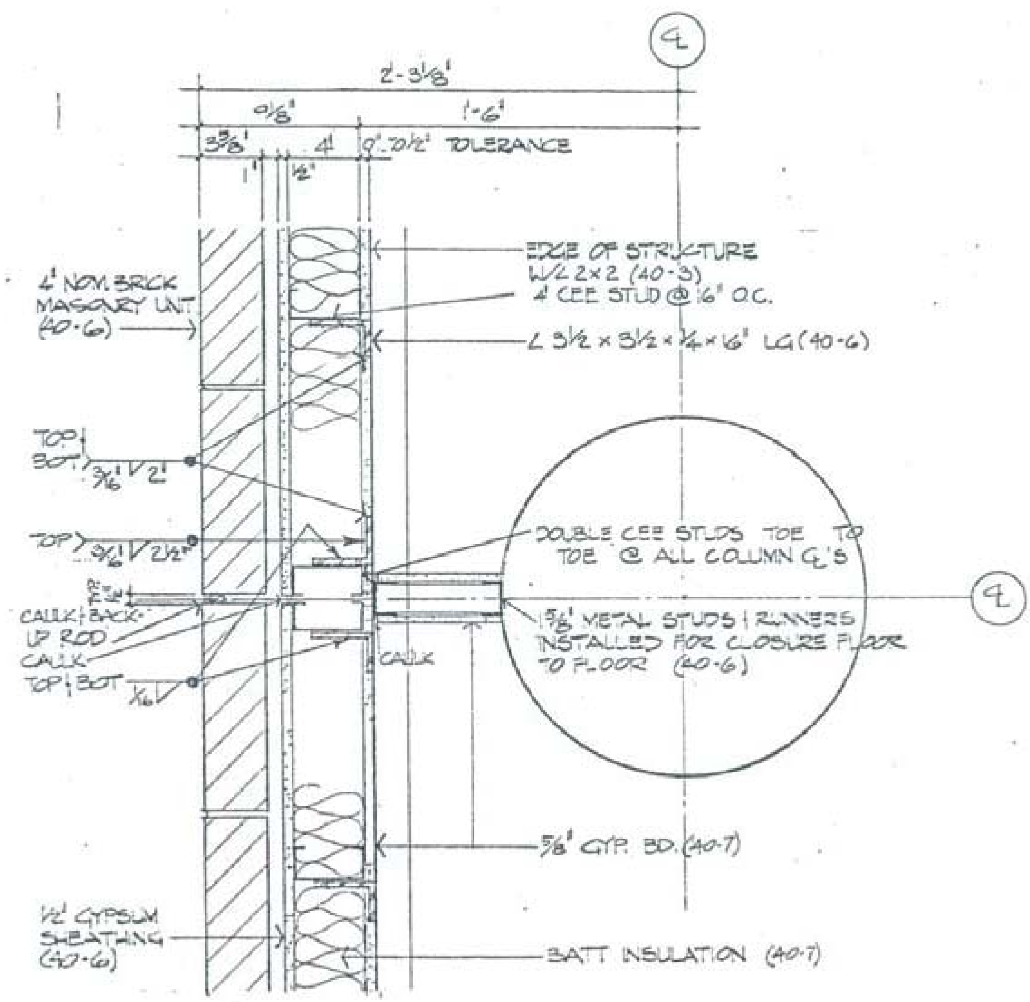


Figure 3.2.8b – Exterior Wall Section

Table 2 presents the Baseline glazing specifications, which meet the ASHRAE 90.1-2004 minimally-compliant criteria. The existing building has single-glazed windows (1/4'' thick clear glass) with aluminum frames without thermal break. The performance criteria for this window type are presented in the table for the As-Built model.

	Baseline	As-Built
Center-of-Glass U-value [Btu/hr-sf-F]	0.57	0.816 (1/4'' thick clear glass)
SHGC/SC	0.39/0.45	0.88/1.0

Table 2 – Glazing Specifications

1.3 OCCUPANCY AND INTERNAL LOADS

The occupant density, occupancy schedules, equipment power density, and outside ventilation air requirements are assumed to be the same for the Baseline and As-Built buildings. The values used in the energy model are presented in Table 3. The building is assumed to be occupied year-round for 10 hours per day (8:00AM-6:00PM) except on holidays. Outside ventilation air requirements and design occupant densities are consistent with recommended values presented in ASHRAE 62.1-1999.

The lighting power density (LPD) assumptions made in the analysis are also presented in Table 3. The Baseline values are those specified for an ASHRAE 90.1-2004 minimally-compliant building. The As-Built values were determined for the existing science building from the electrical drawings. Lighting system power is based on fixtures with T8 lamps and magnetic ballasts. Originally the building had T12 lamps but they were replaced with T8 lamps in a building-wide lighting retrofit. As evident from the table, the As-Built lighting system is slightly less efficient than the Baseline.

Space	Occupant Density [ft^2 /person]	LPD [W/ft^2]		EPD [W/ft^2]	OA Requirement [cfm/person]
		Baseline	As-Built		
Classrooms	Based on class schedule Fall-2006	1.6	1.8	0.8	15
Offices	200	1.5	1.4	0.8	20
Lab area	Based on class schedule Fall-2006	1.3	1.3	6.5[1]	Note 2
Corridors	n/a	0.5	0.7	n/a	0.1 [cfm/sf]

1.) ASHRAE Handbook-Fundamentals estimates the EPD of laboratory varies from 4.65 W/ ft2 to 25.1 W/ ft2. The energy models assume 90% lab area with 4.65W/ ft2, and 10% lab area with 25.1 W/ ft2.

2.) The exhaust and make-up air volumes were determined from flow data provided in the Test, Adjusting and Balance (TAB) reports for the existing Science Building.

Table 3 – Internal Heat Gain Specifications

As part of the simulation calibration procedure, the hourly lighting schedule (each hourly value represents the fraction of connected design lighting load) was adjusted so that the building total electric load shape reasonably matched the metered, whole-building electric. Appendix A presents the hourly lighting schedule assumed for a typical school day.

1.4 HVAC SYSTEM

This Section describes the existing HVAC systems and plant serving the Science Building. The systems were evaluated by conducting a walk-through audit of the building. Additional information was gathered from the project mechanical system narrative, TAB reports, and discussions with the facilities management staff.

- Plant: The cooling and heating sources for the Science building are campus chilled water and steam. The chiller plant is directly adjacent to the building. Steam is purchased from the city municipality.

- Air Handling Units (AHUs): The building is conditioned by typical Variable Air Volume (VAV) systems. Each floor is equipped with two air handling units (AHUs) located in two mechanical rooms. In addition, there is a dedicated AHU that serves the large lecture hall (Room 119). Return air is ducted from the building spaces to the mechanical rooms via a low pressure return fan system. The return air is delivered into the mechanical room, which acts as a return air plenum. The AHUs within the mechanical room are equipped with an air economizer control, and both return fans and supply fans have VFD's.

- Fume hood exhaust: Fume hood exhaust is handled by roof mounted variable-volume exhaust fans. The fume hood flow varies based on sash position. The unit is equipped with an occupancy sensor, which reduces the sash flow velocity by 50% when unoccupied. Heat recovery with a heat pipe occurs between the exhaust air system and make-up air system. The make-up air system also includes a chilled water cooling coil and a steam heating coil.

- Baseboard heating: The perimeter of the building is heated by hot water fin tube radiation. Hot water piping serving the fin tubes is routed vertically at the perimeter and connected to the baseboard at each level.

The HVAC systems as characterized above are included in the As-Built model. For the Baseline, the system type is defined according guidelines presented in Appendix G of the ASHRAE Standard 90.1-2004.

Table 4 summarizes the major differences between the Baseline and the As-Built systems. Appendix B contains additional information used to characterize the HVAC systems in the As-Built model.

	Baseline	As-Built
System Type	Packaged VAV system	Packaged VAV system
Cooling Type	Direct expansion	Campus chilled water/central plant
Heating Type	Campus steam	Campus steam

Table 4 – HVAC System Character

1.5 UTILITY RATE

The electric energy costs used in the building simulation analysis are based on an average blended rate determined from Science Building utility bills. Steam costs are based on published steam rates for Xcel Energy. Table 5 summarizes the utility rates used in the analysis.

	Winter	Summer
Electricity [$/kWh]	0.073	0.077
Steam [$/1000 lbs]	26.0	

Table 5 – Utility Rates

1.6 WEATHER DATA

In order to meaningfully compare the energy use estimated for the As-Built building with actual utility data, the simulation analysis used a modified TMY2 (Typical Meteorology Year) weather data set. The TMY2 ambient drybulb temperatures were modified based on recorded hourly values for Denver in 2005. The 2005 weather data were obtained from the National Renewable Energy Laboratory (NREL).

2 CALIBRATION OF BUILDING ENERGY MODEL

As part of the model calibration, the monthly energy consumption estimated for the As-Built building was compared to utility billing data. The utility data were provided by AHEC facilities management. Figure 3.2.8c and Figure 3.2.8d show the monthly electric and steam consumption based on the metered data. Total energy (electric and steam) consumption is compared in Figure 3.2.8e. The comparison excludes chilled water energy use since metered data for chilled water supplied by the campus chiller plant were not available.

It can be seen from Figure 3.2.8c and Figure 3.2.8d that the load shape predicted by the simulation model captures the general trend and magnitude of the metered data. Since the weather data in the simulation are based on 2005 temperature data, the correlation should be highest between the model estimates and 2005 utility data. The metered data shows an unusual spike in steam consumption in August 2005, but the reason for this has not been identified. Possibly it is due to a correction made to previously estimated monthly billings.

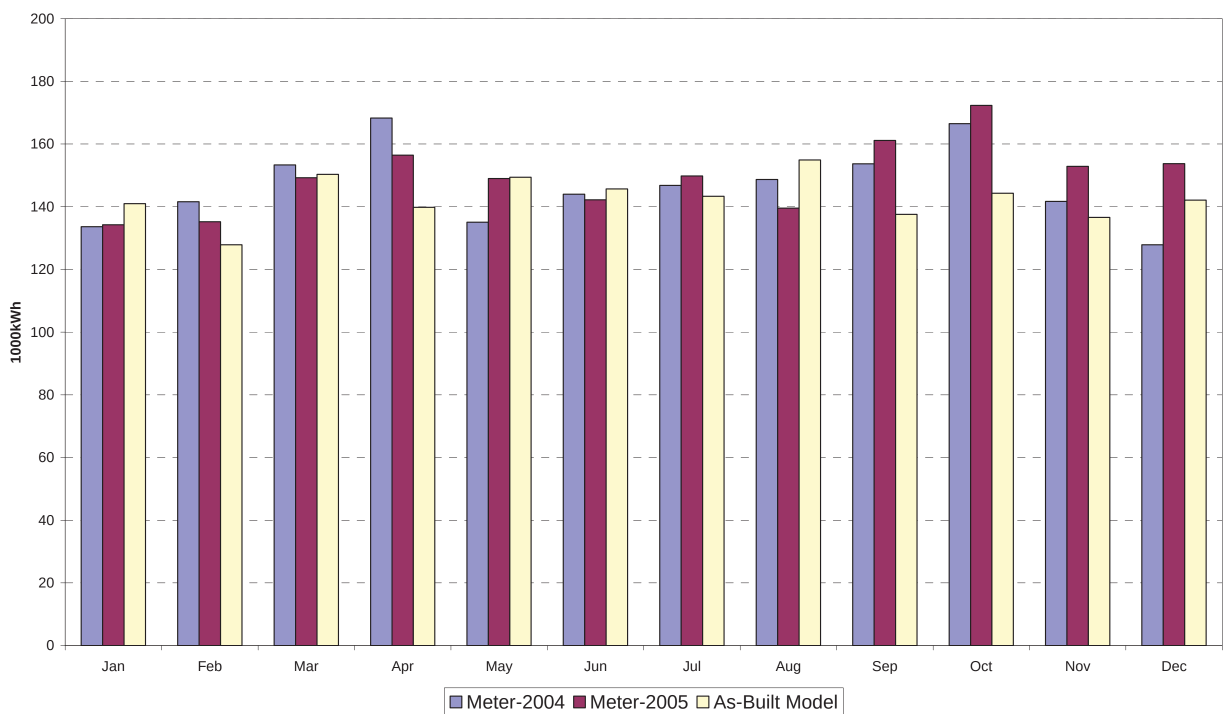


Figure 3.2.8c Comparison of Monthly Electricity Consumption and As-Built Model

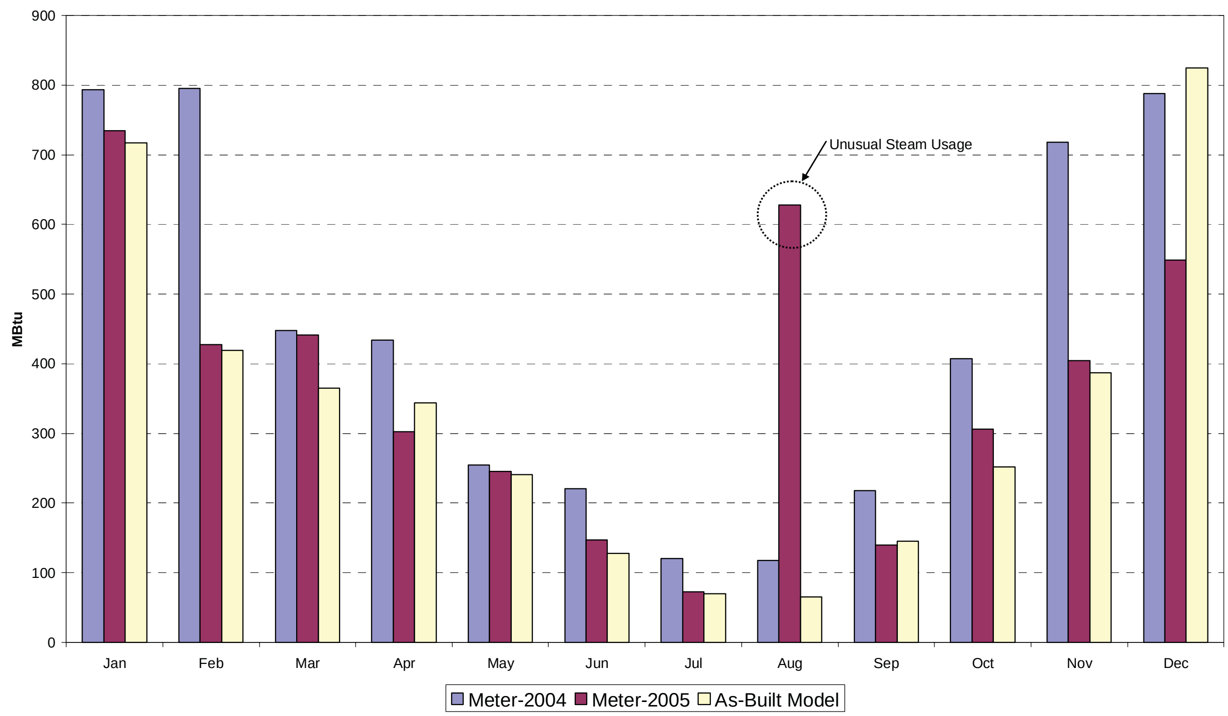


Figure 3.2.8d – Comparison of Monthly Steam Consumption and As-Built Model

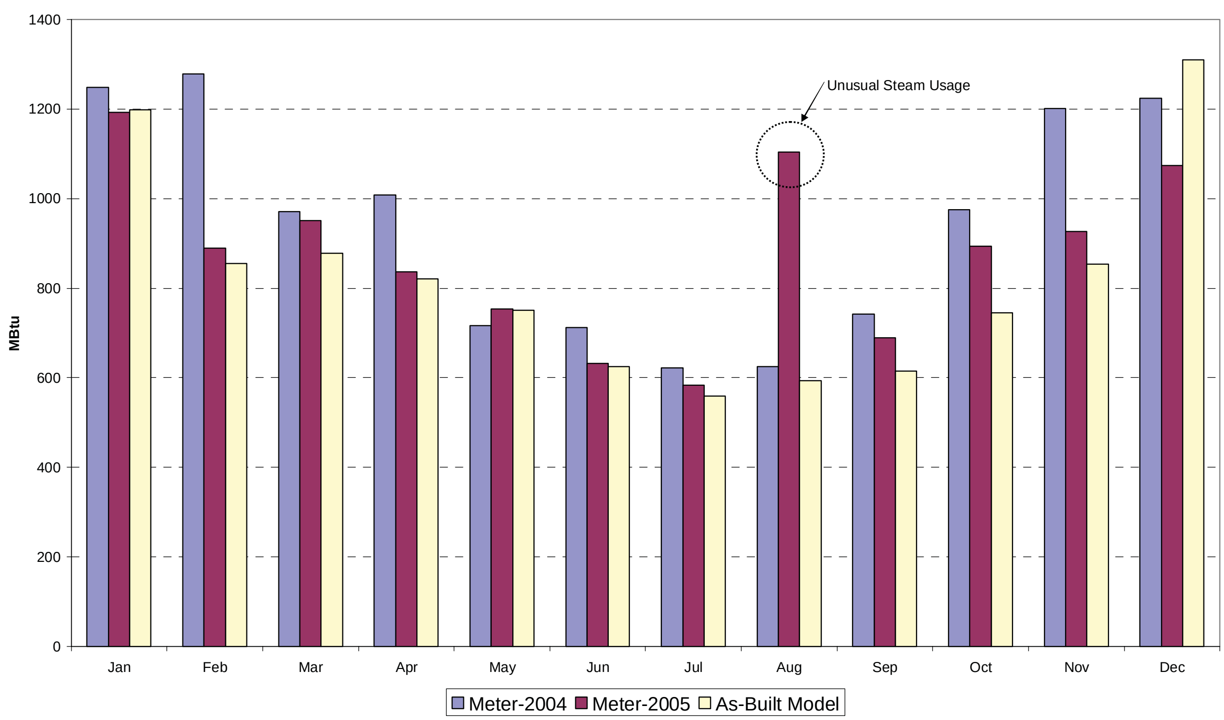


Figure 3.2.8e – Comparison of Monthly Overall Energy Consumption and As-Built Model

The annual energy use value estimated by the simulation reasonable matches the actual data. While the annual total values are within 5% (electric) to 10% (steam) of each other, there are several uncertainties regarding assumptions made as part of the model calibration. These uncertainties are present because sub-metered performance data were not available for chilled water and all major electric end uses. Some reasons that discrepancies may exist between the estimated and actual energy use, include:

- Weather data. The modified TMY2 weather file is adjusted based on temperature data from 2005. The adjustment is somewhat simplified (based on daily average temperature without an adjustment for solar transmittance) and may lead to some differences between it an the actual 2005 weather.

- Lighting Power Density / Plug Loads / Occupancy Schedule. The current assumptions regarding plug loads for the building is based on typical values specified by ASHRAE. Detailed information regarding plug loads and their schedule of use were not available. The operating schedule for lighting also was estimated and influenced by the calibration process. According to facilities management, lights in most spaces are controlled manually, and their operation is difficult to predict. Similar challenges exist for characterizing building occupancy. Class size was taken into account in specifying maximum occupancy but the variation of occupants over the day was estimated.

3 BUILDING ENERGY PERFORMANCE (As-Built vs. Baseline)

In order to benchmark the energy performance of the existing building against one built according to typical new construction practice, the As-Built building performance is compared to the Baseline performance. The As-Built model includes an energy-efficient chilled water plant that represents the campus plant. The chiller efficiency is assumed to meet the minimum required equipment efficiency specified in ASHRAE 90.1-2004. As noted in Table 4, the Baseline cooling system is direct expansion, which is not being considered for the project. In order to provide a more reasonable comparison, a modified baseline was created, that includes a central chilled water plant like that modeled in the As-Built building. Table 7 presents the normalized annual energy consumption by end use for the Baseline, Modified-Baseline and the As-Built buildings.

	2005 Utility Bill	As-Built Energy Model
Electric [kBtu/sf-yr]	47.8	45.6
Steam [kBtu/sf-yr]	34.3	30.9
Cooling Plant Electric [kBtu/sf-yr]	NA	11.2

Table 6 – Comparison of Normalized Annual Energy Consumption and As-Built Model

Normalized annual energy consumption [kBtu/sf-yr]	Baseline	Modified-Baseline	As-Built
Area Lighting	11.3	11.3	13.3
Process Loads	12.6	12.6	12.6
Heating	30.5	31.3	28.1
Cooling	18.4	10.7	11.2
Pumps	1.0	2.0	2.0
Fans	16.8	17.5	17.7
DHW	2.8	2.8	2.8
Total	93.5	88.3	87.7
Normalized annual energy cost [$/sf-yr]	2.49	2.36	2.33

Table 7 – Normalized Annual Energy Consumption / Cost of Energy Models

As shown in Table 7, less lighting energy is consumed by the Baseline than the As-Built due to the lower LPDs. The Baseline requires more energy for cooling than the Modified-Baseline due to the direct expansion (DX) systems, which have a lower COP than a central chiller plant. The inefficiency of the DX system outweighs the benefits of other Baseline design attributes, like improved windows and lighting, which decrease cooling loads. The benefits of these components are more apparent from the Modified-Baseline results, which has lower cooling energy use than the As-Built even though it has the same chiller plant.

In general, heating energy use is high for the building due to the high outside air ventilation requirements. The energy used for heating is lowest for the As-Built. This can be explained by the building having slightly higher lighting and solar loads.

4 ENERGY CONSUMPTION BY SPACE TYPE

The energy model can be used to determine the energy use intensity of different spaces in the building. Understanding this can lend insights into space scheduling and its impact on building energy use. Three space types were investigated including: classrooms, labs w/o fume hoods (general lab) and labs with fume hoods (special lab). The major assumptions used in the space characterizations are summarized in Table 8. Normalized energy use data determined from the simulation analysis are also presented.

	Office	Classroom	General Lab	Special Lab
Lighting Power Density [w/sf]	1.1	1.4	1.3	1.3
Equipment Power Density [w/sf]	0.8	0.8	6.5	6.5
OA Requirement [cfm/person]	20	15	Same as classroom	Based on actual MUA system flow rates
Normalized annual energy consumption [kBtu/sf-yr]	103.8	105.6	146.1	252.1
Annual energy cost [[$/sf-yr]	2.57	2.60	3.49	6.27

Table 8 – Normalized Annual Energy Consumption by Space Type

Based on the results, the general and special laboratory spaces consume about 39% and 139% more energy than the classrooms, respectively. The increase in energy use for the general lab space is due to the higher plug loads. The higher ventilation requirements associated with the special labs lead to a large energy increase due to (1) increased fan power consumption, and (2) increased heating and cooling loads. Incorporating occupancy sensor controls on the ventilation system for the special lab as well as reducing general class room use of these spaces will reduce building energy use.

Figure 3.2.8f and Figure 3.2.8g present national commercial building delivered energy consumption intensities for a variety of building types. Figure 3.2.8h presents energy intensities for a sampling of recent laboratory buildings nationwide. These laboratory buildings likely consist of lab spaces more similar to the special lab space type listed above. It is important to note that these building type energy use intensities do not directly correlate with the space type energy use intensities presented in Table 8. Whole-building energy use categorized by building type includes all building spaces, such as corridors, stairwells, mechanical rooms, in addition to the major building spaces. Thus, building-type energy intensities generally have a lower energy use intensity than one determined for a specific space type. The building-type energy-use values provide good minimum targets to strive for in the renovated building and the expansion.

1.3.10 1995 Commercial Delivered End-Use Energy Consumption Intensities, by Principal Building Type (1)

Building Type	Consumption (10^3 Btu/SF) Space Heating	Space Cooling	Water Heating	Lighting	Total (2)	Percent of Total Consumption
Office	24.3	9.1	8.7	28.1	90.5	21%
Mercantile and Service	30.6	5.8	5.1	23.4	69.6	14%
Education	32.8	4.8	17.4	15.8	75.0	12%
Health Care	55.2	9.9	63.0	39.3	176.4	10%
Lodging	22.7	8.1	51.4	23.2	99.5	8%
Public Assembly	53.6	6.3	17.5	21.9	81.7	7%
Food Service	30.9	19.5	27.5	37.0	241.2	8%
Warehouse and Storage	15.7	0.9	2.0	9.8	44.0	9%
Food Sales	27.5	13.4	9.1	33.9	202.2	4%
Vacant (3)	36.0	1.4	5.2	4.7	26.4	3%
Public Order and Safety	27.8	6.1	23.4	16.4	86.9	2%
Other (4)	59.6	9.3	15.3	26.7	144.0	3%
All Buildings	29.0	6.0	13.8	20.4	90.5	100%

Note(s): 1) Further detail can be found in Table 7.4.1. Parking garages and commercial buildings on multibuilding manufacturing facilities are excluded from CBECS 1995. 2) Includes all end-uses. 3) Includes vacant and religious worship. 4) Includes mixed uses, hangars, crematoriums, laboratories, and other.

Source(s): EIA, Commercial Building Energy Consumption and Expenditures 1995, April 1998, Table EU-2, p. 311.

Figure 3.2.8f – Published Performance Data by Building Type and End Use

1.3.6 2003 Commercial Delivered Energy Consumption Intensities, by Principal Building Type and Vintage (1)

	Consumption (10^3 Btu/SF)			Consumption (10^3 Btu/SF)	
Building Type	Pre-1990	1990-2003	Building Type	Pre-1990	1990-2003
Food Service	212.0	361.2	Education	83.8	80.6
Health Care	204.5	135.7	Service	77.7	74.8
Inpatient	248.5	253.8	Retail (Other than Malls)	67.5	86.4
Outpatient	103.3	84.4	Religious Worship	43.5	43.3
Food Sales	200.2	198.3	Public Order and Safety	N.A.	110.6
Lodging	103.9	88.1	Warehouse and Storage	N.A.	33.3
Office	94.2	88.0	Other	189.7	125.3
Public Assembly	84.7	119.7	Vacant	22.3	N.A.

Note(s): 1) See Table 1.3.4 for primary versus delivered energy consumption. Mall buildings are no longer included in most CBECs tables; therefore, some data is not directly comparable to past CBECs.

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, June 2006, Table C8.

Figure 3.2.8g – Published Performance Data by Building Type Pre- and Post-1990

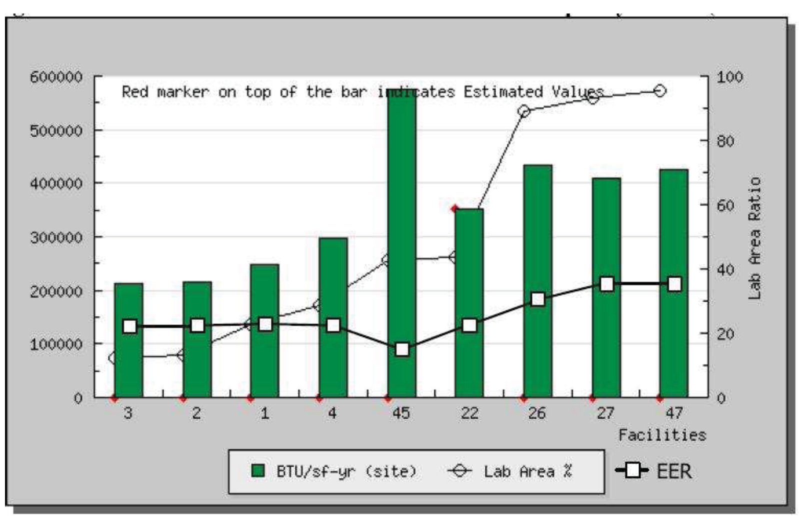


Figure 3.2.8h – Published Performance Data for Labs

5 ENERGY CONSUMPTION BY END-USE

The predicted energy use for the Modified Baseline is presented in detail in this section to gain insight into the dominating energy end uses and opportunities for improving energy efficiency. The Modified Baseline represents the Science Building built following typical construction practices. Figure 3.2.8i is a pie chart of the Modified Baseline annual energy use. Figure 3.2.8j is a pie chart of the Modified Baseline energy costs. The charts show that the high energy end uses are heating, fans, and process loads. Energy efficiency measures targeting these end uses should be considered for improving building performance.

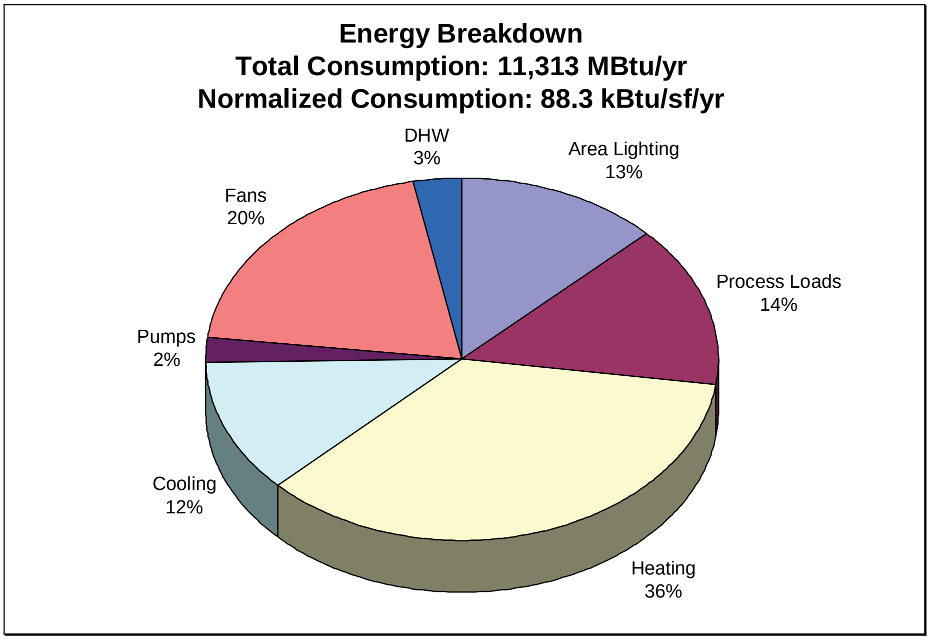


Figure 3.2.8i – Modified Baseline Energy Use Pie Chart

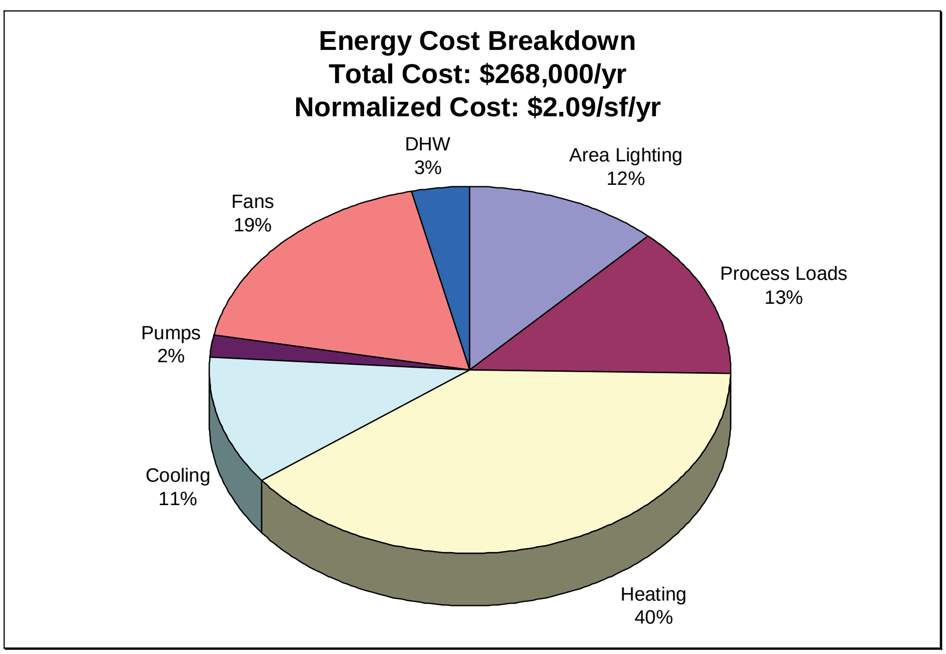


Figure 3.2.8j – Modified Baseline Energy Cost Pie Chart

6 ENERGY EFFICIENCY OPPORTUNITIES

The As-Built model was used to evaluate the impact of several energy efficiency improvements. The performance data can be used to support renovation design decision making. The building components that were evaluated include: glazing, envelope, lighting, and HVAC fans. The characteristics of each improvement are described in Table 9. The results of the analysis are presented in Figure 3.2.8k.

Table 9: Investigated ECMs

ECM	As-Built	Improvement
Glazing	Single pane 1/4'' thick clear glass U = 0.816, SC = 1.00	Double pane Low-e clear glass U = 0.38, SC = 0.79
Exterior Wall	½'' insulation board (Overall U = 0.107)	2'' insulation board (Overall U = 0.068)
Roof	R-21 c.i.	R-35 c.i. (increase 3'' c.i., R-4/inch)
Lighting	As-Built	20% better than ASHRAE/IESNA Standard 90.1-2004
Supply Fans	Average 0.001133 kW/CFM	0.0008 kW/CFM

Table 9 – Investigated Energy Conservation Measures

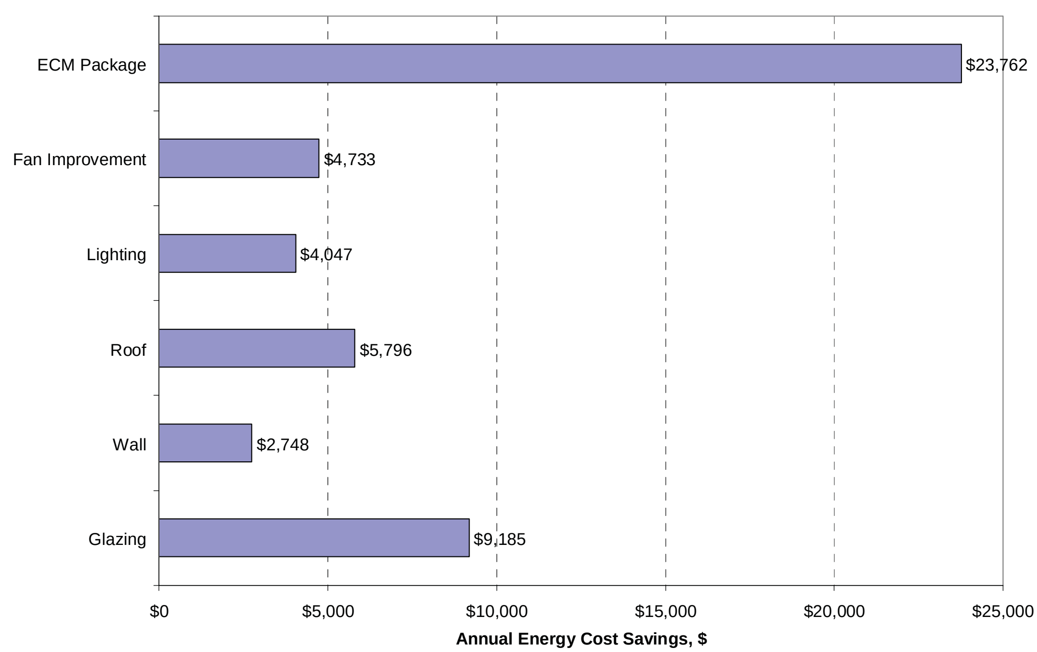


Figure 3.2.8k – Design Improvement Evaluation

SUMMARY

Based on the measures considered, the largest performance improvements are achieved by renovating the windows, roof, and replacing the HVAC fans. To assess the improvements that provide the best value, a simple payback analysis should be conducted. Additional strategies that should be considered for the project, include:

- Evaporative cooling
- Daylighting
- Energy recovery
- Alternative HVAC design
- Lighting and ventilation occupancy sensors
- Demand control ventilation
- High efficiency process equipment
- Renewable energy systems

Table 11 and Table 12 summarize the specifications of AHU fans and circulation pumps. The data documented in this section is from As-Built drawings, as well as a Testing, Adjusting and Balancing report when the building is retrofitted in 1998.

Hour	1	2	3	4	5	6	7	8	9	10	11	12
LPD faction[%]	5	5	5	5	5	10	50	90	90	90	90	90
Hour	13	14	15	16	17	18	19	20	21	22	23	24
LPD faction[%]	90	90	90	60	60	60	60	20	20	5	5	5

Table 10 – Lighting Power Density Hourly Schedule

AHU	NO.	CFM Rated	CFM Measured	Calculated [kW/CFM]	Delta P [inch H_2O]
			AHU Supply Fan		
AHU-1A		22350	24570	0.000955	2.82
AHU-1B		19350	19260	0.000783	2.41
AHU-2A		23900	25140	0.001281	4.95
AHU-2B		22250	24615	0.001311	4.75
AHU-3A		11000	14205	0.001504	3.58
AHU-3B		25050	28015	0.001144	3.77
			AHU Return Fan		
AHU-1A	RF-1	11000	9660	0.000308	0.68
AHU-1A	RF-2	11000	9055	0.000333	0.68
AHU-1B	RF-3	9500	7775	0.000375	0.7
AHU-1B	RF-4	9500	7010	0.000409	0.7
AHU-2A	RF-5	9900	9485	0.000414	1.65
AHU-2A	RF-6	9900	8775	0.0005	1.65
AHU-2B	RF-7	9800	8605	0.000507	1.52
AHU-2B	RF-8	9800	8965	0.000446	1.52
AHU-3A	RF-9	5300	5710	0.00024	0.72
AHU-3B	RF-10	9600	13000	0.000184	0.47
AHU-3B	RF-11				
			MAU Supply Fan		
MAU-1		8850	5010	0.001184	1.6
MAU-2		8495	7965	0.000422	1.04
MAU-3		5110			
MAU-4		6635	3095	0.001328	1.09
MAU-5		4755	3235	0.000559	1.5
			MAU Exhaust Fan		
MAU-1		13200	13030	0.000853	2.65
MAU-2		11275			
MAU-3		9350	10275	0.000735	2.18
MAU-4		11000	9405	0.000916	3.9
MAU-5		7715			

Table 11 – AHU Fan Hourly Schedule

Table 12: Main Circulation Pumps schedule

Pump Name	NO.	GPM	Head	H. P.
Hot Water Pump	HP-5	429	105	30
Hot Water Pump	HP-6	429	105	30
Chilled Water Pump	CP-6	600	60	40
Chilled Water Pump	CP-7	600	60	40

Table 12 – Main Circulation Pumps Schedule

IV.1 Space Planning Assumptions

Anderson Mason Dale Architects began the process of determining space requirements by reviewing the previous program plan created in 2004. It was unclear where many of the space standards were derived and the design team was given direction to start investigating other space standard resources. References for this programming effort were found in the Auraria Higher Education Center Facilities Master Plan of 2001, Council of Educational Facilities Planners International (CEFPI), Colorado Commission on Higher Education (CCHE), UCDHSC peer institutions and space standards established through work by the laboratory consultant, Research Facilities Design (RFD) with similar institutions. General planning assumptions used to determine the functional and space requirements for the proposed Auraria Science Building include the following:

General Assumptions

- Parking for the facility will be provided by the Auraria Higher Education Center in existing facilities with surplus capacity. The facility will acknowledge the increased access provided by Light Rail and FastTracks.
- The design of the facility will encourage interaction among the faculty and between researchers, administrators, and students of all institutions by creating space to gather and build community.
- The expansion and renovation of the ASB will support the mission of each institution, and capitalize on inter-institutional synergies while recognizing Auraria institutions as colleagues and competitors sharing a campus.
- Spaces will provide flexibility to meld diverse disciplines by accommodating growth, change, and evolution towards unforeseen pedagogy.
- Without compromising safety, the building will make an architectural statement about the importance of science to the campus, city, and beyond.
- The ASB will reinforce institutional identities that support effective way finding yet expose students to opportunities of diverse Auraria institutions.
- The building will welcome diverse students, including minority students, by helping them envision themselves in the sciences.
- Ongoing master planning efforts suggest the new science building will create opportunities to support public/private partnership on the Auraria campus including incubator space “for rent”.
- Program focus will be Biology & Chemistry with assurance that no function currently housed in the Science Building will be left without a new home.

Growth

- All institutions grow the same with 50% faculty growth and 30% enrollment growth for Biology and Chemistry projected through 2011.
- Other departments projected for 0 to 10% growth through 2011.
- To facilitate transition away from adjunct faculty model for Biology and Chemistry, the facility will accommodate 50% full-time faculty growth and limit adjunct faculty growth.

Interdepartmental Adjacencies

- The building will capitalize on Auraria efficiencies and shared resources, and facilitate multi-day science class schedule requirements and strategic institutional sharing of labs and lab support.
- The existing structure will be adequate for renovation into dry lab, classroom space, and offices. The renovation will also take advantage of reusing the restroom locations and preserving the lecture hall to reduce costs.
- At the expense of optimizing some adjacencies, office and classroom spaces will be concentrated in lightly remodeled existing construction to minimize costs.
- Wet sciences will be concentrated into the addition with new mechanical systems, since it will be significantly more expensive to retrofit the existing building for these functions.

Facility Layout/Design

- The new construction and renovation process must maintain ongoing existing lab functions.
- The project will be the core of an Auraria Science District rather than reinforcing the concept of institutional precincts that will be part of an updated Master Plan.
- Light remodel only of the existing Science Building is acceptable to mend operational deficiencies and for classrooms, offices and some labs.

Backfill Space

- Backfill is space vacated by programs to be relocated into the redeveloped Auraria Science Building project with potential for re-use for Science Program needs or other campus or institutional priorities.
- Because of budget limitations, flexibility to use strategic backfill to support institutional consolidation across the campus will be limited.
- Programmed classroom space is a likely candidate for backfill.
- UCDHSC Anthropology and Math Lab spaces in existing Science will be relocated to North Classroom backfill.
- MSCD Dean's offices will be relocated to Backfill in a location to be determined.

Planning Standards for Selected Program Areas

The program for the Auraria Science Building includes space for academic instruction, faculty and departmental offices, research space and related support areas. Assumptions for specific program areas are listed below:

Teaching Labs

- Teaching laboratories, which are used predominantly for undergraduate instruction, comprise the bulk of the program.
- The number and size of teaching laboratories are based upon analyses of existing student weekly contact hours for all departments plus 1/2 hour prep time per section plus projected growth.
- The number of teaching labs required for all institutions and departments are based on a CCHE target utilization rate of 80% during a 40 hour week.

AMD conducted numerous meetings with the users to determine the appropriate size and quantity of teaching laboratories for the new facilty. Table (Figure 4.1b) was used to determine the appropriate quantity of teaching labs based on the amount of recitation and/or prep time associated with the laboratories.

Research Labs

- The building will accommodate trends towards research at all institutions, including funded research.
- All Funded Research Labs are shelled (unfinished core and shell only) and the space count matches the projected demand of UCDHSC for 12 labs. Completion of funded research space will be paid for by the institution intending to use the space.
- The Student Research Lab Module is 175 ASF per FTE student for all three institutions.
- The Funded Research Lab Module is based on 1040 ASF per faculty including research assistant space, equipment alcove and allocation of shared lab service.

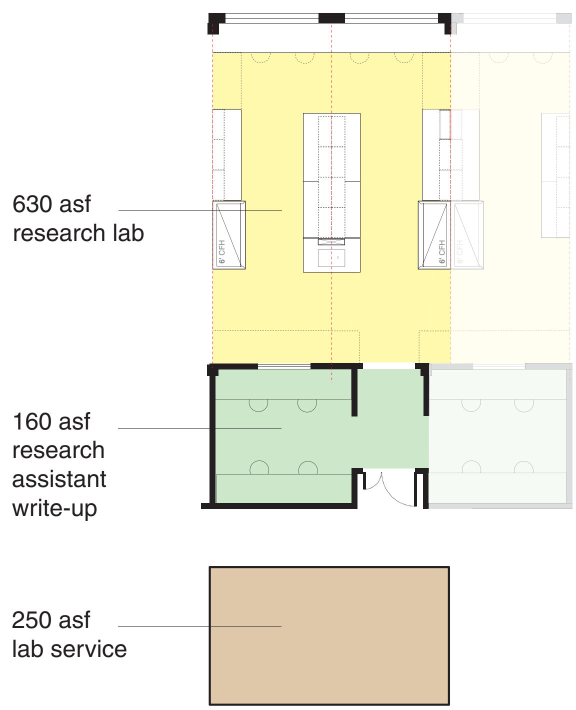


Figure 4.1a – Typical research laboratory configuration and associated lab service space

	Proposed Lab Characteristics		1 hr Recitation + 1 hr Prep		1 hr Recitation or 1 hr Prep		1/2 hr Prep		Prep included in 80% utilization of 40 hour week	
Lab Course Name	ASF per Station	Room Size (ASF)	Calculated Lab Quantity	Proposed Lab Quantity	Calculated Lab Quantity	Proposed Lab Quantity	Calculated Lab Quantity	Proposed Lab Quantity	Calculated Lab Quantity	Proposed Lab Quantity
UCDHSC BIOLOGY			9.19	12	7.31	10	6.37	9	5.43	8
Basic/Non-Lajor Biology Lab	53	1260	1.93	2	1.46	2	1.22	2	0.98	1
General Biology Lab	53	1260	4.24	5	3.39	4	2.97	3	2.54	3
Anatomy Lab	63	1260	1.19	2	0.95	1	0.83	1	0.71	1
Physiology Lab	53	1260	0.80	1	0.64	1	0.56	1	0.48	1
Microbiology Lab	53	1260	0.74	1	0.62	1	0.55	1	0.49	1
Molecular/Cellular Lab	53	945	0.29	1	0.26	1	0.24	1	0.22	1
UCDHSC CHEMISTRY			5.74	7	4.67	7	4.14	6	3.60	6
General Chemistry Lab	53	1260	2.70	3	2.16	3	1.89	2	1.62	2
Organic Chemistry Lab	53	1260	1.88	2	1.57	2	1.41	2	1.26	2
Analytical Chemistry Lab	70	945	0.56	1	0.46	1	0.41	1	0.36	1
Physical/Instrumental Chemistry Lab	118	945	0.61	1	0.49	1	0.43	1	0.37	1
MSCD BIOLOGY (Existing uses Spring '06)			13.72	18	10.95	15	9.57	13	8.19	13
Non-Major Biology Lab	53	1260	0.00	0	0.00	0	0.00	0	0.00	0
General Biology Lab	53	1260	3.58	4	2.86	3	2.51	3	2.15	3
Plant Physiology/Taxonomy Lab	53	1260	0.36	1	0.29	1	0.25	1	0.22	1
Anatomy & Physiology Lab	53	1260	2.77	3	2.25	3	1.98	2	1.72	2
Zoology Lab	53	1260	1.76	2	1.39	2	1.21	2	1.03	2
Botany Lab	53	1260	1.15	2	0.94	1	0.84	1	0.74	1
Molecular Lab	53	1260	0.18	1	0.15	1	0.14	1	0.12	1
Microbiology Lab	53	1260	2.55	3	1.98	2	1.69	2	1.40	2
Ecology Lab	53	1260	1.36	2	1.09	2	0.95	1	0.82	1
MSCD CHEMISTRY			6.78	10	5.30	9	4.55	9	4.82	10
General Chemistry Lab	53	1260	2.11	3	1.61	2	1.36	2	2.11	3
Organic Chemistry Lab	53	1260	1.89	2	1.50	2	1.30	2	1.11	2
Analytical Chemistry Lab	53	1260	0.78	1	0.62	1	0.54	1	0.47	1
Physical Chemistry Lab	79	945	0.65	1	0.51	1	0.44	1	0.37	1
Instrumental Analysis Lab	70	1260	0.33	1	0.27	1	0.24	1	0.21	1
Criminalistics Lab	70	1260	0.65	1	0.51	1	0.44	1	0.37	1
Criminalistics Microscope Lab	0	0	0.00	0	0.00	0	0.00	0		
Biochemistry Lab	59	945	0.39	1	0.29	1	0.24	1	0.19	1
TEACHING LAB TOTALS			35.4	47	28.2	41	24.6	37	22.0	37

Figure 4.1b– Teaching Lab Justification Chart

Lab Service

- Lab service area is roughly 24% of programmed teaching and research lab space, and based on unique requirements of each lab and related equipment.
- Funded research equipment alcoves will be shelled (unfinished core and shell only) like the labs they are to be associated with.

Classrooms

- Classrooms and other teaching spaces should include effective multi-media like whiteboards, periodic table, projection, and “hybrid” distance learning for sciences.
- Classroom count is based on total existing contact hour demand plus growth for all included science disciplines (including MSCD M&CS). The assignable area per student (ASF/station) varies per room type.

Offices

- Office counts match projected faculty and staff headcounts including growth.
- Standard faculty and staff office is 120 ASF; Director/chair offices are 160 ASF.
- Departmental consolidation of offices is preferred to foster collaboration.
- Adjacency of faculty offices to research labs is more critical than adjacency to teaching labs, but optimally, offices will be convenient to both lab types.
- Office locations should support convenient access of students to faculty.

Meeting Rooms

- Conference rooms within the building will be located to support interaction and institutional identity.

Receiving and Support

- Storage is modeled to meet declared need.
- Storage spaces will be provided for important collections and equipment.

Animal Holding

- Placement and access of animal facilities will be carefully planned to allow for convenient loading dock access, security and discrete relocation of animals within the building.

Community Space

- Community space within the building will be located to support interaction and institutional identity.

PLANNING ASSUMPTIONS BY BUILDING SYSTEMS

Sustainability

- Sustainability and sophistication of building systems should be balanced to ensure maintainability/reliability.

Structure

- The structural system of the existing Science Building will limit the feasibility of structural modifications.
- The floor to floor heights of the existing building are not optimized for contemporary lab facilities, and a floor height transition to new construction will be required.

Service/Trash/Materials Management

- Areas for hazardous operations should be clearly defined.
- Funds for relocation will be limited to large equipment relocation only pending final status of project contingencies.
- Existing service access occurs on 11^{th} Avenue between the existing building and the Auraria Library.

Access and Security

- Primary access to the existing building occurs from the west off of 11^{th} avenue adjacent to the Auraria Library.
- The existing facility does not meet contemporary ADA accessibility requirements. At a minimum, renovation of existing must accommodate these upgrades.
- Because the facility is on a prominent public edge of an intensively used, urban campus, after-hours visibility and security of lab and support spaces is a critical concern.

Environmental Control Systems

- The existing facility has significant deficiencies in its environmental control system. At a minimum, renovation of existing must accommodate appropriate upgrades.

Information Technology

- Top tier technology for academics will ensure the best science education for students.
- The facility will be a faculty recruitment tool with the technology to support international collaboration and security for intellectual property.
- All A/V systems will be deferred pending final status of project contingency or another funding source.

Electrical Systems and Lighting

- Lighting is a key deficiency in the existing building, particularly in the large lecture hall. At a minimum, renovation of existing must accommodate appropriate upgrades.

Mechanical Systems

- The existing facility has significant deficiencies in its mechanical system. At a minimum, renovation of existing must accommodate appropriate upgrades.
- There are ongoing deferred maintenance improvements in existing HVAC systems which will be integrated into the project.

Landscape

- All landscaping will be deferred pending final status of project contingency or other funding source. This leaves an $875K budget for sitework including site utilities.
- There is an important piece of sculpture existing to the north of the existing Science Building.

Furnishings

- All but 25% of a project appropriate furniture budget will be deferred pending the final status of the project contingency, other funding or re-use.
- Lab equipment will be carried in the construction budget and not effected by furniture deferral except shelled labs.

IV.2 Total Space Requirements

National guidelines and existing program operations helped provide the space requirements for each program. These were developed based upon the program and operational requirements of the activities to be carried out in the spaces and mandated by the rules and regulations that apply to each program relative to accreditation requirements. AMD also conducted numerous workshops to uncover the stated needs of each institution and department. These needs, in conjunction with the space standards listed in the previous section, informed the total space requirements listed in this section.

The space need allocation table contained within this section is a summary of the room-by-room space needs table found in IV.2a of this program plan. The program for the Auraria Science Building includes space for academic instruction, faculty and departmental offices, research space and related support areas.

There are three institutions with a total of 13 programs represented in this program plan. A majority of the program plan allocation is dedicated to the core science disciplines which focus on biology and chemistry. The other programs represented are UCDHSC Anthropology, Math, Psychology; and MSCD Anthropology, Earth Sciences, Math and Computer Science and Deans' Offices. Figures 4.2a through 4.2g summarize the program by spatial type and shows the total amount of space dedicated to the science building project as approximately 221,000 assignable square feet (ASF).

TOTAL BY SPATIAL TYPE		221,333
Office		**46,980**
Lab		**134,266**
Teaching		79,440
Wet Teaching		60,480
Dry Teaching		18,960
Research		28,205
Wet Research		18,725
Dry Research		0
Shelled Research		9,480
Service		26,621
Classroom		**40,087**
Flat Classroom		25,375
Tiered Classroom		6,550

Figure 4.2a – Total Program Area (Assignable Square Feet) by Spatial Type

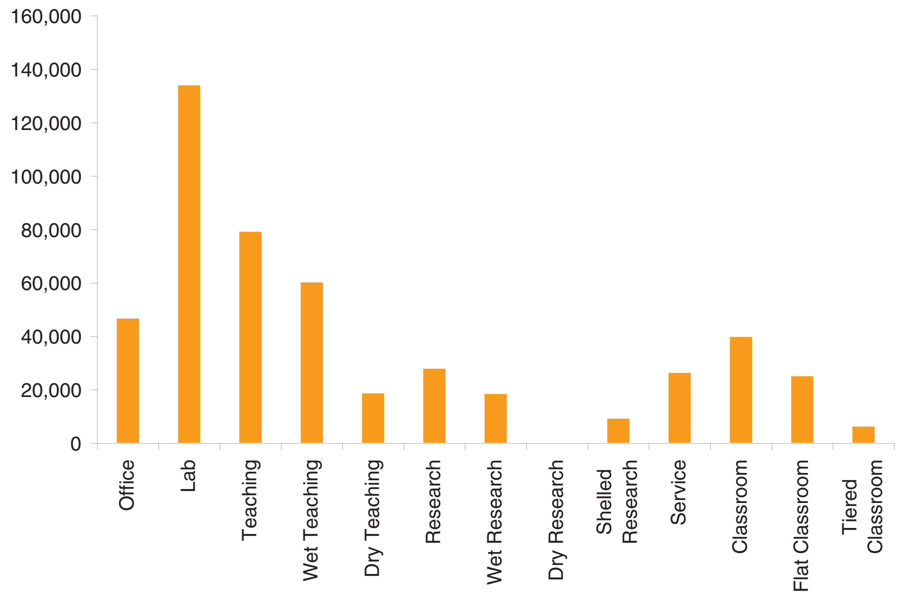


Figure 4.2b – Total Program Area (Assignable Square Feet) by Spatial Type

TEACHING LABORATORIES

Teaching laboratories for the disciplines of Biology, Chemistry, Earth Sciences and Anthropology are used for undergraduate instruction and comprise most of the program. Through user interviews, it was discovered that many teaching laboratory courses require a one-hour recitation for students before the laboratory begins. This recitation is ideally conducted within the laboratory so that it somewhat eases overall classroom need and the departments can control the scheduling. To allow the users greater flexibility in scheduling, a 1/2 hour block of time between each laboratory meeting was added to the contact hour analyses.

The teaching laboratories listed are defined as two types of laboratories—wet and dry teaching labs.

Dry Teaching Laboratories

The dry laboratory space type is a laboratory space that is specific to work with dry stored materials, electronics and/or large instruments with few piped services.

Dry teaching labs are required by UCDHSC Anthropology for their Morphometrics (computer imaging) and Anthropology teaching labs. The UCDHSC Mathematics department requires a computer laboratory which is comprised of 30 computer stations. MSCD Anthropology requires a 36-station teaching lab and MSCD Math and Computer Science requires two computer labs for their specialized equipment and one 36-station education lab. MSCD Earth Sciences requires three dry teaching labs and three dry computer labs. MSCD Information Technology (under MSCD Shared Space) requires one open computer lab that is utilized by all MSCD students.

Wet Teaching Laboratories

The wet teaching laboratories comprise the remaining laboratories in the program.
Wet laboratories are defined as laboratories where chemicals, drugs, or other material or biological matter are tested and analyzed requiring water, direct ventilation, and specialized piped utilities. The three institutions' Biology and Chemistry departments require wet laboratories.

RESEARCH LABORATORIES

Research laboratory space allocation was a topic of great discussion during the whole of programming. Each institution is placing a greater emphasis on research and values student exposure to research. It was projected that 75% of UCDHSC faculty will be research active—involved in grant-funded research and/or research with students. Research Funded Faculty refers to 25% of the UCDHSC research active faculty and 10% of MSCD faculty that obtain funding for all or a portion of their research. Research Teaching Faculty refers to the remainder of research active faculty that conduct non-funded research with students. Figure 4.2c below outlines the quantity of current and projected faculty and those who conduct research. This table informed the number of research laboratories that were allocated in the program listing.

The program in Section IV.2a lists research laboratories as two types of labs. There are student research laboratories and shelled/grant-funded research laboratories. Research labs (student and shelled/funded) are listed as Auraria shared space, and shown as “shelled”, or unfinished.

Shelled / Funded Research Laboratories

There are a total of 12 shelled research laboratories listed in the program. These laboratories will accommodate UCDHSC Psychology, Anthropology, Biology and Chemistry funded research. A total of 1,040 ASF is assigned to each research funded faculty member. The shelled research laboratories will have 630 ASF of pure laboratory and one 160 ASF research assistant space adjacent to the lab. Each laboratory also receives approximately 250 ASF of lab service that accommodates specialized equipment and support space.

Student Research Laboratories

CCD, MSCD and UCDHSC each have a number of student research laboratories that are accommodated in the program. To determine the size and quantity for the student research labs for each department, Full Time Equivalent (FTE) student calculations were used. Each FTE student in each Biology and Chemistry department receives a 175 ASF module of research space. Figure 4.2d shows the FTE calculations.

	Current	Projected	Remarks
UCDHSC BIOLOGY			
Total Faculty (including Chair & instructors)	**14**	**21**	
Research Active Faculty	10	16	75% of Total Faculty
Research Funded Faculty	3	4	25% of Research Active Faculty
Research Teaching Faculty	7	12	75% of Research Active Faculty
UCDHSC CHEMISTRY			
Total Faculty (including Chair & instructors)	**13**	**19**	
Research Active Faculty	9	14	75% of Total Faculty
Research Funded Faculty	2	4	25% of Research Active Faculty
Research Teaching Faculty	7	10	75% of Research Active Faculty
MSCD BIOLOGY (Existing uses Spring '06)			
Total Faculty (including Chair & instructors)	**17**	**25**	
Research Active Faculty	3	3	10% of MSCD Faculty
Research Funded Faculty	3	3	10% of MSCD Faculty
Research Teaching Faculty			
MSCD CHEMISTRY			
Total Faculty (including Chair & instructors)	**14**	**20**	
Research Active Faculty		2	10% of MSCD Faculty
Research Funded Faculty		2	10% of MSCD Faculty
Research Teaching Faculty			

Figure 4.2c – Percentage of faculty members who will conduct research. It was noted during various meetings that CCD faculty would only be conducting research with other institutions – therefore, CCD was not shown in this graph.

	Ratio To Faculty	Utilization	FTE Student
UCDHSC Teaching Research			
Faculty	1	0	-
Undergraduate Students	2	0.2	8.8
Master's Students	2	0.7	30.8
Ph.D. Students	1	0.8	17.6
Postdoctoral Students	0	1	-
Technicians	0	1	-
MSCD Teaching Research			
Seniors taking Senior Experience Course	1	0	-
Biology	65	0.2	13.0
Chemistry	18	0.2	3.6
CCD Teaching Research			
Research Students			
Biology	5	0.2	1.0
Chemistry	5	0.2	1.0

Figure 4.2d – FTE Student Calculation for Allocation of Student Research Laboratories

Department/Space Category	ASF	% of Total Space	% of Non-Shared Space
University of Colorado at Denver & HSC	**60,730**	**26.1%**	**36.3%**
Office	**12,970**	**5.9%**	
Lab	**44,020**	**19.9%**	
Teaching	23,850		
Wet Teaching	18,270		
Dry Teaching	5,580		
Research	15,400		
Wet Research	15,400		
Dry Research	0		
Service	4,770		
Classroom	**680**	**0.3%**	
Community College of Denver	**18,030**	**8.1%**	**11.3%**
Office	**3,400**	**1.5%**	
Lab	**13,270**	**6.0%**	
Teaching	10,710		
Wet Teaching	10,710		
Dry Teaching	0		
Research	350		
Wet Research	350		
Dry Research	0		
Service	2,210		
Classroom	**1,360**	**0.6%**	
Metro State College of Denver	**83,287**	**37.6%**	**52.4%**
Office	**23,010**	**10.4%**	
Lab	**54,155**	**24.5%**	
Teaching	43,935		
Wet Teaching	30,555		
Dry Teaching	13,380		
Research	2,975		
Wet Research	2,975		
Dry Research	0		
Service	7,245		
Classroom	**6,122**	**2.8%**	
Nursing and HEP			
Auraria Sciences Shared Space	**62,346**	**28.2%**	
Office	**7,600**	**3.4%**	
Lab	**22,821**	**10.3%**	
Teaching	945		
Wet Teaching	945		
Dry Teaching	0		
Research	9,480		
Wet Research	0		
Dry Research	0		
Shelled Research	9,480		
Service	12,396		
Classroom	**31,925**	**14.4%**	
Flat Classroom	25,375		
Tiered Classroom	6,550		
TOTAL BY SPATIAL TYPE	**221,333**	**100.0%**	**% of Total**
Office	**46,980**	**21.2%**	**21.2%**
Lab	**134,266**	**60.7%**	**60.7%**
Teaching	945		
Wet Teaching	945		
Dry Teaching	0		
Research	9,480		
Wet Research	0		
Dry Research	0		
Shelled Research	9,480		
Service	12,396		
Classroom	**40,087**	**18.1%**	**18.1%**
Flat Classroom	25,375		
Tiered Classroom	6,550		

Figure 4.2e – Space Requirements (ASF) by Institution and Spatial Type

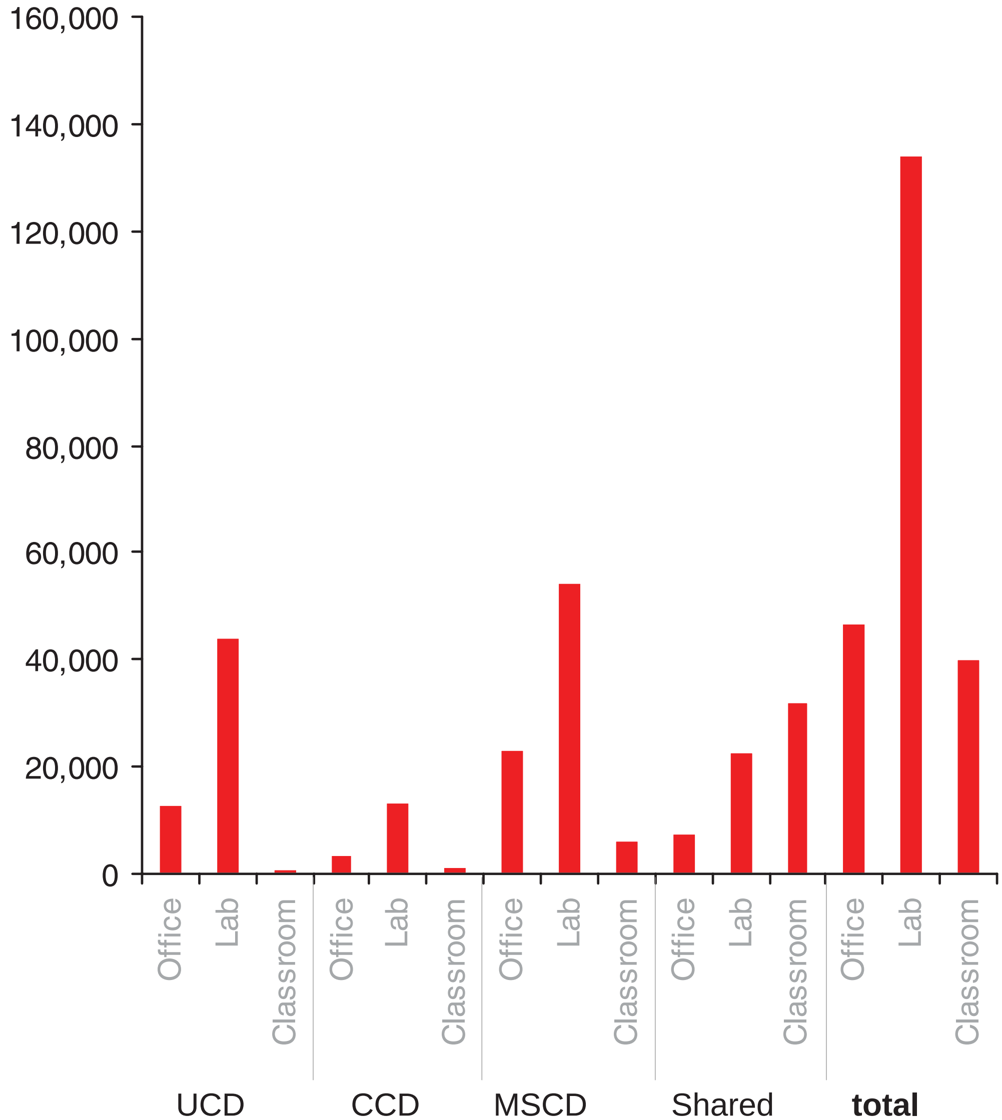


Figure 4.2f – Space Requirements (ASF) by Institution and Spatial Type

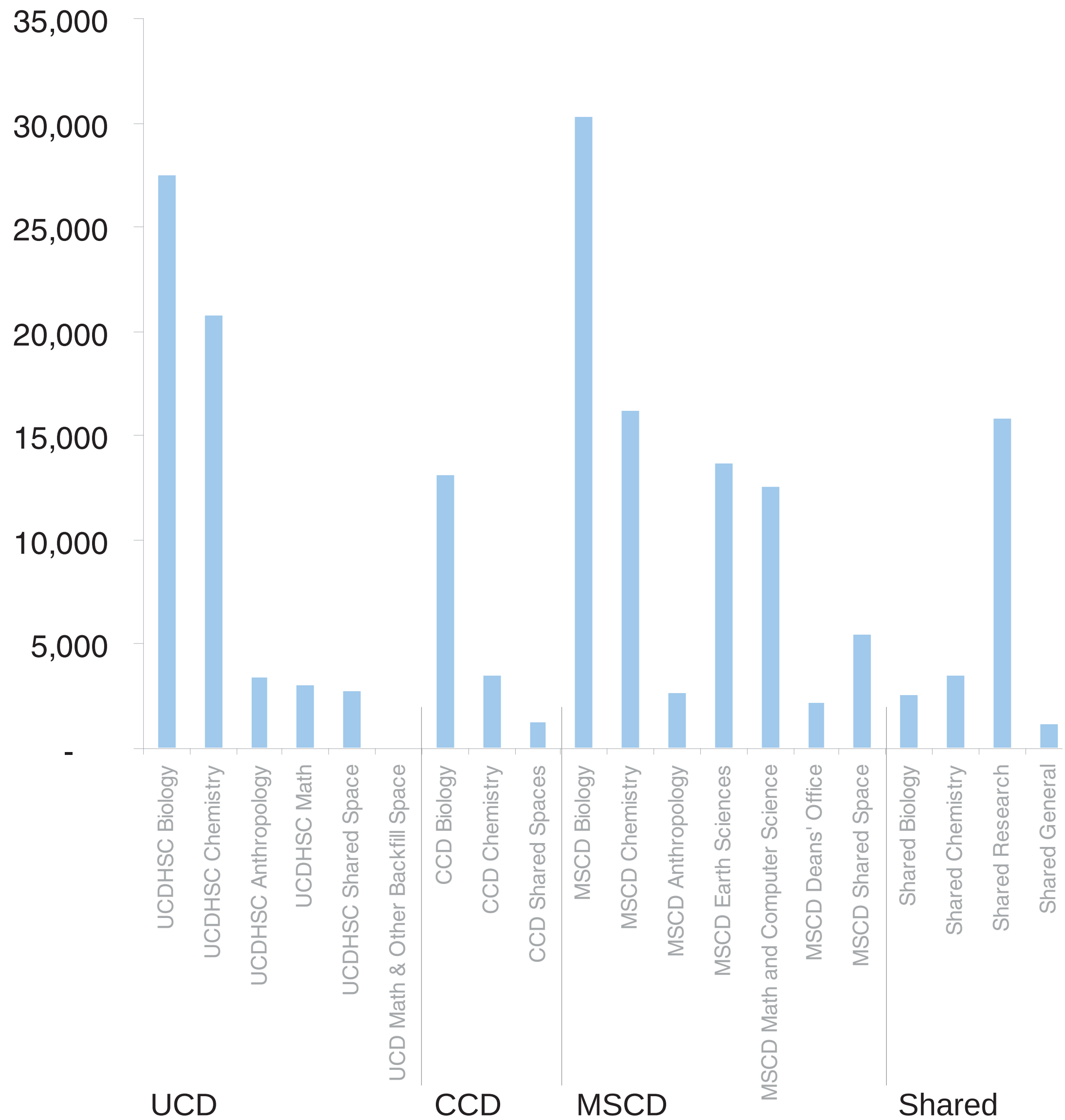


Figure 4.2g – Space Summary (ASF) by Institution and Spatial Type

IV.2a Complete Program Listing

The Program below and on the following pages lists each individual space, its size, and the number of such spaces to be provided. The *"Scenario per Space"* column indicates whether the space is envisioned in new, remodeled space, or in backfill space (space vacated in other buildings when those program areas move into the Science Building). The "**Backfill Space Created**" columns indicate if the listed space currently exists in another building (South or North Classroom buildings) and how much space will be vacated when the function moves into the Science Building or its Addition.

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	University of Colorado at Denver & Health Sciences Center									
	UCDHSC Biology					**27,510**		**44,157**	**-**	**8,109**
U.B.1.0	Office Space						Light Remodel	-	-	-
U.B.1.1	Chair/Director	160	1	160	3	480	Light Remodel	775	-	118
U.B.1.2	Faculty Office	120	1	120	18	2,160	Light Remodel	3,488	-	1,656
U.B.1.3	Adjunct Faculty	60	2	120	1	120	Light Remodel	194	-	-
U.B.1.4	Research Assistant Workstation	40	6	240	6	1,440	New	2,325	-	-
U.B.1.5	Undergraduate Teaching Assistant	40	6	240	1	240	Light Remodel	388	-	-
U.B.1.6	Lab Coordinator	120	1	120	1	120	Light Remodel	194	-	104
U.B.1.7	Lab Preparator	60	1	60	1	60	Light Remodel	97	-	-
U.B.1.8	Program Assistant	120	1	120	1	120	Light Remodel	194	-	113
U.B.1.9	Academic Advisor	120	1	120	1	120	Light Remodel	194	-	-
U.B.1.10	Administrative Assistant	120	1	120	2	240	Light Remodel	388	-	-
U.B.1.11	Conference	See UCDHSC Shared Spaces below					Light Remodel	-	-	-
U.B.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
U.B.1.13	Reception	40	4	160	1	160	Light Remodel	258	-	527
U.B.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
U.B.1.15	Breakroom	See UCDHSC Shared Spaces below					Light Remodel	-	-	-
U.B.1.16	General Office Storage						Light Remodel	-	-	-
U.B.1.19	Office Space Reduction			(5,500)	0%	-	Light Remodel	-	-	-
U.B.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
U.B.3.0	Laboratories						New	-	-	-
U.B.3.1	Basic/Non-Major Teaching	53	24	1,260	2	2,520	New	4,069	-	-
U.B.3.2	General Biology Teaching	53	24	1,260	3	3,780	New	6,104	-	681
U.B.3.3	Anatomy Teaching	63	20	1,260	1	1,260	New	2,035	-	633
U.B.3.4	Physiology Teaching	53	24	1,260	1	1,260	New	2,035	-	-
U.B.3.5	Microbiology Teaching	53	24	1,260	1	1,260	New	2,035	-	946
U.B.3.6	Molecular/Cellular Teaching	59	16	945	1	945	New	1,526	-	-
U.B.4.0	Research Laboratory						New	-	-	-
U.B.4.1	Student Research Lab	175	1	175	43	7,525	New	12,151	-	2,925
U.B.5.0	Lab Service						New	-	-	-
U.B.5.1	Prep Room	315	1	315	4	1,260	New	2,035	-	406
U.B.5.2	Microbiology Prep	475	1	475	1	475	New	767	-	-
U.B.5.3	Molecular Core Facility	600	1	600	1	600	New	969	-	-
U.B.5.4	Microbiololgy Equipment Room	165	1	165	1	165	New		-	-
U.B.5.5	Cold Room	160	1	160	1	160	New	258	-	-
U.B.5.6	Greenhouse	See Auraria Shared Space					New	-	-	-
U.B.6.0	Storage	200	1	200	4	800	Remodel	1,292	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	UCDHSC Chemistry							**33,620**	**-**	**4,652**
U.C.1.0	Office Space						Light Remodel	-	-	-
U.C.1.1	Chair/Director	160	1	160	1	160	Light Remodel	258	-	179
U.C.1.2	Faculty Office	120	1	120	18	2,160	Light Remodel	3,488	-	1,597
U.C.1.3	Adjunct Faculty	60	2	120	1	120	Light Remodel	194	-	-
U.C.1.4	Research Assistant Workstation	40	6	240	6	1,440	New	2,325	-	-
U.C.1.5	Undergraduate Teaching Assistant	40	6	240	1	240	Light Remodel	388	-	-
U.C.1.6	Lab Coordinator	120	1	120	1	120	Light Remodel	194	-	-
U.C.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	194	-	-
U.C.1.11	Conference	See UCDHSC Shared Spaces below					Light Remodel	-	-	-
U.C.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
U.C.1.13	Reception	40	4	160	1	160	Light Remodel	258	-	168
U.C.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
U.C.1.15	Breakroom	See UCDHSC Shared Spaces below					Light Remodel	-	-	-
U.C.1.16	General Office Storage	120	1	120	1	120	Light Remodel	194	-	-
U.C.1.19	Office Space Reduction			(4,880)	0%	-	Light Remodel	-	-	-
U.C.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
U.C.3.0	Laboratories						New	-	-	-
U.C.3.1	General Chemistry Teaching	53	24	1,260	2	2,520	New	4,069	-	-
U.C.3.2	Organic Chemistry Teaching	53	24	1,260	2	2,520	New	4,069	-	-
U.C.3.3	Analytical/Inorganic Teaching	70	18	1,260	1	1,260	New	2,035	-	-
U.C.3.4	Physical/Instrumental Teaching	118	8	945	1	945	New	1,526	-	-
U.C.4.0	Research Laboratory						New	-	-	-
U.C.4.1	Student Research Lab	175	1	175	36	6,300	New	10,173	-	2,590
U.C.5.0	Lab Service						New	-	-	-
U.C.5.1	Prep Room	210	1	210	4	840	New	1,356	-	-
U.C.5.2	Instrument Room	160	1	160	4	640	New	1,033	-	118
U.C.5.3	Balance Room	105	1	105	3	315	New	509	-	-
U.C.5.4	Stockroom Satellite	945	1	945	0		New	-	-	-
U.C.6.0	Storage	200	1	200	3	600	Remodel	969	-	-
	UCDHSC Anthropology					**3,465**		**5,595**	**-**	**-**
U.A.1.0	Office Space						Backfill	-	-	-
U.A.2.0	Classrooms						Backfill	-	-	-
U.A.3.0	Laboratories						Backfill	-	-	-
U.A.3.1	Anthropology Teaching	53	24	1,260	2	2,520	Backfill	4,069	-	-
U.A.3.2	Morphometrics Teaching	59	16	945	0	-	Backfill	-	-	-
U.A.5.0	Lab Service						Backfill	-	-	-
U.A.5.1	Prep Room	315	1	315	1	315	Backfill	509	-	-
U.A.6.0	Collections	630	1	630	1	630	Backfill	1,017	-	-
	UCDHSC Math					**3,060**		**4,941**	**-**	**-**
U.M.3.0	Laboratories						Backfill	-	-	-
U.M.3.1	Math Laboratory	30	60	1,800	1	1,800	Backfill	2,907	-	-
U.M.3.2	Math Assistance Room	53	24	1,260	1	1,260	Backfill	2,035	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	UCDHSC Shared Space					**2,815**		**4,546**	**-**	**-**
U.S.1.0	Office Space						Light Remodel	-	-	-
U.S.1.1	Special Events Conference	See Auraria Shared Spaces below					Light Remodel	-	-	-
U.S.1.2	Conference	25	8	200	2	400	Light Remodel	646	-	-
U.S.1.3	Breakroom	80	1	80	2	160	Light Remodel	258	-	-
U.S.5.0	Analytical Service Lab	1575	1	1,575	1	1,575	Remain	2,543	-	-
U.S.7.0	Interaction/Community						New	-	-	-
U.S.7.1	Departmental Display	50	1	50	7	350	New	565	-	-
U.S.7.2	Student Group Study	15	22	330	1	330	New	533	-	-
	UCD Math & Other Backfill Space									
						57,670		**92,859**	**-**	**12,761**

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	Community College of Denver									
	CCD Biology					**13,120**		**21,186**	**6,081**	**-**
C.B.1.0	Office Space						Light Remodel	-	-	-
C.B.1.1	Chair/Director	160	1	160	2	320	Light Remodel	517	219	-
C.B.1.2	Faculty Office	120	1	120	4	480	Light Remodel	775	219	-
C.B.1.3	Adjunct Faculty	60	4	240	4	960	Light Remodel	1,550	-	-
C.B.1.10	Administrative Assistant	See CCD Shared Spaces below					Light Remodel	-	-	-
C.B.1.11	Conference	See CCD Shared Spaces below					Light Remodel	-	-	-
C.B.1.12	Work/Copy/Print	See CCD Shared Spaces below					Light Remodel	-	-	-
C.B.1.13	Reception	See CCD Shared Spaces below					Light Remodel	-	-	-
C.B.1.14	Breakroom	See CCD Shared Spaces below					Light Remodel	-	-	-
C.B.1.15	General Office Storage	See CCD Shared Spaces below					Light Remodel	-	-	-
C.B.1.19	Office Space Reduction			(1,760)	0%	-	Light Remodel	-	-	-
C.B.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
C.B.2.1	General Biology Lecture	30	42	1,260	1	1,260	Light Remodel	2,035	1,231	-
C.B.3.0	Laboratories						New	-	-	-
C.B.3.1	General Biology Teaching	53	24	1,260	1	1,260	New	2,035	-	-
C.B.3.2	Microbiology Teaching	53	24	1,260	1	1,260	New	2,035	1,180	-
C.B.3.3	Interdisciplinary Teaching	49	32	1,575	2	3,150	New	5,087	1,326	-
C.B.3.4	Anatomy & Physiology Teaching	53	24	1,260	2	2,520	New	4,069	1,180	-
C.B.4.0	Research Laboratory						New	-	-	-
C.B.4.1	Student Research Lab	175	1	175	1	175	New	283	-	-
C.B.5.0	Lab Service						New	-	-	-
C.B.5.1	Prep Room	315	1	315	3	945	New	1,526	726	-
C.B.5.2	Microbiology Prep	315	1	315	1	315	New	509	-	-
C.B.5.3	Instrument Room	315	1	315	1	315	New	509	-	-
C.B.5.4	Equipment Room	160	1	160	1	160	New	258	-	-
C.B.6.0	Storage	See CCD Shared Spaces below					Remodel	-	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	CCD Chemistry					**3,570**		**5,765**	**1,556**	**-**
C.C.1.0	Office Space						Light Remodel	-	-	-
C.C.1.1	Chair/Director	160	1	160	1	160	Light Remodel	258	107	-
C.C.1.2	Faculty Office	120	1	120	1	120	Light Remodel	194	114	-
C.C.1.3	Adjunct Faculty	60	2	120	1	120	Light Remodel	194	-	-
C.C.1.10	Administrative Assistant	See CCD Shared Spaces below					Light Remodel	-	-	-
C.C.1.11	Conference	See CCD Shared Spaces below					Light Remodel	-	-	-
C.C.1.12	Work/Copy/Print	See CCD Shared Spaces below					Light Remodel	-	-	-
C.C.1.13	Reception	See CCD Shared Spaces below					Light Remodel	-	-	-
C.C.1.14	Breakroom	See CCD Shared Spaces below					Light Remodel	-	-	-
C.C.1.16	General Office Storage	See CCD Shared Spaces below					Light Remodel	-	-	-
C.C.1.19	Office Space Reduction			(400)	0%	-	Light Remodel	-	-	-
C.C.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
C.C.3.0	Laboratories						New	-	-	-
C.C.3.1	General Chemistry Teaching	53	24	1,260	1	1,260	New	2,035	1,010	-
C.C.3.2	Organic Chemistry Teaching	53	24	1,260	1	1,260	New	2,035	-	-
C.C.4.0	Research Laboratory						New	-	-	-
C.C.4.1	Student Research Lab	175	1	175	1	175	New	283	-	-
C.C.5.0	Lab Service						New	-	-	-
C.C.5.1	Prep Room	315	1	315	1	315	New	509	235	-
C.C.5.2	Balance Room	160	1	160	1	160	New	258	90	-
C.C.6.0	Storage	See CCD Shared Spaces below					Remodel	-	-	-
	CCD Shared Spaces					**1,340**		**2,164**	**831**	**-**
C.S.1.0	Academic Office Suite						Light Remodel	-	-	-
C.S.1.1	Adjunct Faculty	Included by departments above				-	Light Remodel	-	219	-
C.S.1.2	Science Advisor	120	1	120	1	120	Light Remodel	194	114	-
C.S.1.3	Lab Coordinator	120	1	120	1	120	Light Remodel	194	-	-
C.S.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	194	-	-
C.S.1.11	Conference	25	8	200	1	200	Light Remodel	323	-	-
C.S.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
C.S.1.13	Reception	40	6	240	1	240	Light Remodel	388	498	-
C.S.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
C.S.1.15	Breakroom	80	1	80	1	80	Light Remodel	129	-	-
C.S.1.16	General Office Storage	120	1	120	1	120	Light Remodel	194	-	-
C.S.1.18	Special Events Conference	See Auraria Shared Spaces below					Light Remodel	-	-	-
C.S.1.19	Office Space Reduction			(1,240)	0%	-	Light Remodel	-	-	-
C.S.1.20	Student Group Study	15	0	-	1	-	New	-	-	-
C.S.1.21	Departmental Display	50	1	50	2	100	New	161	-	-
						18,030		**29,115**	**8,468**	**-**

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	Metro State College of Denver									
	MSCD Biology					**30,310**		**48,944**	**-**	**-**
M.B.1.0	Office Space						Light Remodel	-	-	-
M.B.1.1	Chair/Director	160	1	160	1	160	Light Remodel	258	-	-
M.B.1.2	Faculty Office	120	1	120	24	2,880	Light Remodel	4,651	-	-
M.B.1.3	Adjunct Faculty	60	4	240	1	240	Light Remodel	388	-	-
M.B.1.4	Lab Coordinator	120	1	120	1	120	Light Remodel	194	-	-
M.B.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	194	-	-
M.B.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.B.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
M.B.1.13	Reception	40	4	160	1	160	Light Remodel	258	-	-
M.B.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
M.B.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.B.1.16	General Office Storage	120	1	120	1	120	Light Remodel	194	-	-
M.B.1.19	Office Space Reduction			(4,040)	0%	-	Light Remodel	-	-	-
M.B.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.B.2.1	Self Paced Testing Room	25	10	250	1	250	Light Remodel	404	-	-
M.B.3.0	Laboratories						New	-	-	-
M.B.3.1	Non-Major Teaching	53	24	1,260	3	3,780	Light Remodel	6,104	-	-
M.B.3.2	General Biology I & II Teaching	53	24	1,260	3	3,780	New	6,104	-	-
M.B.3.3	Plant Physiology/Taxonomy	53	24	1,260	1	1,260	New	2,035	-	-
M.B.3.4	Botany Teaching	53	24	1,260	1	1,260	New	2,035	-	-
M.B.3.5	Ecology Teaching	53	24	1,260	1	1,260	New	2,035	-	-
M.B.3.6	Anatomy & Physiology Teaching	53	24	1,260	2	2,520	New	4,069	-	-
M.B.3.7	Molecular Biology Teaching	53	24	1,260	1	1,260	New	2,035	-	-
M.B.3.8	Zoology Teaching	53	24	1,260	2	2,520	New	4,069	-	-
M.B.3.9	Microbiology Teaching	53	24	1,260	2	2,520	New	4,069	-	-
M.B.4.0	Research Laboratory						New	-	-	-
M.B.4.1	Student Research Lab	175	1	175	13	2,275	New	3,674	-	-
M.B.5.0	Lab Service						New	-	-	-
M.B.5.1	Prep Room	315	1	315	7	2,205	New	3,561	-	-
M.B.5.2	Microbiology Prep	420	1	420	1	420	New	678	-	-
M.B.5.3	Instrument Room	315	1	315	1	315	New	509	-	-
M.B.5.4	Equipment Room	315	1	315	1	315	New	509	-	-
M.B.5.5	Pour Room	105	1	105	1	105	New	170	-	-
M.B.5.6	Cold Room	105	1	105	1	105	New	170	-	-
M.B.6.0	Storage	120	1	120	1	120	Remodel	194	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	MSCD Chemistry					**16,230**		**26,208**	**-**	**-**
M.C.1.0	Office Space						Light Remodel	-	-	-
M.C.1.1	Chair/Director	160	1	160	1	160	Light Remodel	258	-	-
M.C.1.2	Faculty Office	120	1	120	19	2,280	Light Remodel	3,682	-	-
M.C.1.3	Adjunct Faculty	60	4	240	1	240	Light Remodel	388	-	-
M.C.1.4	Lab Coordinator	120	1	120	1	120	Light Remodel	194	-	-
M.C.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	194	-	-
M.C.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.C.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
M.C.1.13	Reception	40	4	160	1	160	Light Remodel	258	-	-
M.C.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
M.C.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.C.1.16	General Office Storage	120	1	120	1	120	Light Remodel	194	-	-
M.C.1.19	Office Space Reduction			(3,440)	0%	-	Light Remodel	-	-	-
M.C.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.C.3.0	Laboratories						New	-	-	-
M.C.3.1	General Chemistry Teaching	53	24	1,260	2	2,520	New	4,069	-	-
M.C.3.2	Organic Chemistry Teaching	53	24	1,260	2	2,520	New	4,069	-	-
M.C.3.3	Analytical Chemistry Teaching	53	24	1,260	1	1,260	New	2,035	-	-
M.C.3.4	Physical/Inorganic Chemistry Teachin	79	12	945	1	945	New	1,526	-	-
M.C.3.5	Instrumental Analysis Teaching	70	18	1,260	1	1,260	New	2,035	-	-
M.C.3.6	Criminalistics Teaching	70	18	1,260	1	1,260	New	2,035	-	-
M.C.3.7	Criminalistics Microscope Teaching	53	12	630	1	630	New	1,017	-	-
M.C.4.0	Research Laboratory						New	-	-	-
M.C.4.1	Student Research Lab	175	1	175	4	700	New	1,130	-	-
M.C.5.0	Lab Service						New	-	-	-
M.C.5.1	Prep Room	210	1	210	4	840	New	1,356	-	-
M.C.5.2	Balance Room	105	1	105	2	210	New	339	-	-
M.C.5.3	Instrument Room	105	1	105	2	210	New	339	-	-
M.C.5.4	Dark Room	315	1	315	1	315	New	509	-	-
M.C.6.0	Storage	120	1	120	1	120	Remodel	194	-	-
	MSCD Anthropology					**2,720**		**4,392**	**-**	**-**
M.A.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.A.3.0	Laboratories						Remodel	-	-	-
M.A.3.1	Anthropology Teaching	44	36	1,575	1	1,575	Remodel	2,543	-	-
M.A.5.0	Lab Service						Remodel	-	-	-
M.A.5.1	Prep Room	315	1	315	1	315	Remodel	509	-	-
M.A.6.0	Storage						Remodel	-	-	-
M.A.6.1	Collections	630	1	630	1	630	Light Remodel	1,017	-	-
M.A.6.2	Storage	200	1	200	1	200	Remodel	323	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	MSCD Earth Sciences					**13,700**		**22,123**	**843**	**-**
M.G.1.0	Office Space						Light Remodel	-	-	-
M.G.1.1	Chair/Director	160	1	160	1	160	Light Remodel	258	-	-
M.G.1.2	Faculty Office	120	1	120	13	1,560	Light Remodel	2,519	-	-
M.G.1.3	Adjunct Faculty	60	4	240	3	720	Light Remodel	1,163	-	-
M.G.1.5	Student Work Area	40	4	160	0	-	Light Remodel	-	-	-
M.G.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	194	-	-
M.G.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.G.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
M.G.1.13	Reception	40	4	160	1	160	Light Remodel	258	-	-
M.G.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
M.G.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.G.1.16	General Office Storage	120	1	120	1	120	Light Remodel	194	-	-
M.G.1.19	Office Space Reduction			(3,080)	0%	-	Light Remodel	-	-	-
M.G.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.G.2.1	GIS Classroom	30	30	900	1	900	Light Remodel	1,453	-	-
M.G.2.2	Meteorology Classroom	30	30	900	1	900	Light Remodel	1,453	-	-
M.G.3.0	Laboratories						Remodel	-	-	-
M.G.3.1	Geology Teaching	49	32	1,575	2	3,150	Remodel	5,087	-	-
M.G.3.2	Integrated Natural Science	49	32	1,575	1	1,575	Remodel	2,543	843	-
M.G.3.3	GIS Computer Lab	30	30	900	2	1,800	Remodel	2,907	-	-
M.G.3.4	Meteorology Computer Lab	30	20	600	1	600	Remodel	969	-	-
M.G.5.0	Lab Service						Remodel	-	-	-
M.G.5.1	Prep Room	630	1	630	1	630	Remodel	1,017	-	-
M.G.5.2	X-Ray Core	315	1	315	1	315	Remodel	509	-	-
M.G.5.3	Rock Collections	315	1	315	1	315	Remodel	509	-	-
M.G.5.4	Map Collections	315	1	315	1	315	Remodel	509	-	-
M.G.6.0	Storage	120	1	120	1	120	Remodel	194	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	MSCD Math and Computer Science					**12,600**		**20,346**	**-**	**-**
M.M.1.0	Office Space						Light Remodel	-	-	-
M.M.1.1	Chair/Director	160	1	160	1	160	Light Remodel	258	-	-
M.M.1.2	Faculty Office	120	1	120	37	4,440	Light Remodel	7,170	-	-
M.M.1.3	Adjunct Faculty	60	4	240	5	1,200	Light Remodel	1,938	-	-
M.M.1.4	Student Work Area	40	4	160	0	-	Light Remodel	-	-	-
M.M.1.5	Systems Administrator	120	1	120	1	120	Light Remodel	194	-	-
M.M.1.6	Part-Time Staff	40	1	40	1	40	Light Remodel	65	-	-
M.M.1.10	Administrative Assistant	120	1	120	3	360	Light Remodel	581	-	-
M.M.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.M.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	194	-	-
M.M.1.13	Reception	40	4	160	1	160	Light Remodel	258	-	-
M.M.1.14	Records	120	1	120	1	120	Light Remodel	194	-	-
M.M.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	-	-	-
M.M.1.16	General Office Storage	120	1	120	1	120	Light Remodel	194	-	-
M.M.1.19	Office Space Reduction			(6,840)	0%	-	Light Remodel	-	-	-
M.M.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.M.2.1	Math Group Learning Classroom	30	12	360	6	2,160	Light Remodel	3,488	-	-
M.M.3.0	Laboratories						Remodel	-	-	-
M.M.3.1	Math Education Lab	30	36	1,080	1	1,080	Remodel	1,744	-	-
M.M.4.0	Open Laboratories (CS only)						Remodel	-	-	-
M.M.4.1	Mac Lab	30	30	900	1	900	Remodel	1,453	-	-
M.M.4.2	Unix Lab	30	30	900	1	900	Remodel	1,453	-	-
M.M.6.0	Storage						Remodel	-	-	-
M.M.6.1	Archive Room	120	1	120	1	120	Remodel	194	-	-
M.M.6.2	Storage	120	1	120	1	120	Remodel	194	-	-
M.M.7.0	Interaction/Community	See MSCD Shared Space below					Remodel	-	-	-
M.M.7.1	Tutoring Lab	40	12	480	1	480	Remodel	775	-	-
	MSCD Deans' Office					**2,260**		**3,649**	**-**	**-**
M.D.1.0	Office Space						Backfill	-	-	-
M.D.1.1	Dean	240	1	240	2	480	Backfill	775	-	-
M.D.1.2	Associate Dean	120	1	120	2	240	Backfill	388	-	-
M.D.1.3	Assistant Dean	120	1	120	2	240	Backfill	388	-	-
M.D.1.4	Student Work Area	40	2	80	1	80	Backfill	129	-	-
M.D.1.10	Administrative Assistant	120	1	120	2	240	Backfill	388	-	-
M.D.1.11	Conference	25	12	300	1	300	Backfill	484	-	-
M.D.1.12	Work/Copy/Print	120	1	120	1	120	Backfill	194	-	-
M.D.1.13	Reception	40	6	240	1	240	Backfill	388	-	-
M.D.1.14	Records	120	1	120	1	120	Backfill	194	-	-
M.D.1.15	Breakroom	80	1	80	1	80	Backfill	129	-	-
M.D.1.16	General Office Storage	120	1	120	1	120	Backfill	194	-	-
M.D.1.17	Office Space Reduction			(2,260)	0%	-	Backfill	-	-	-

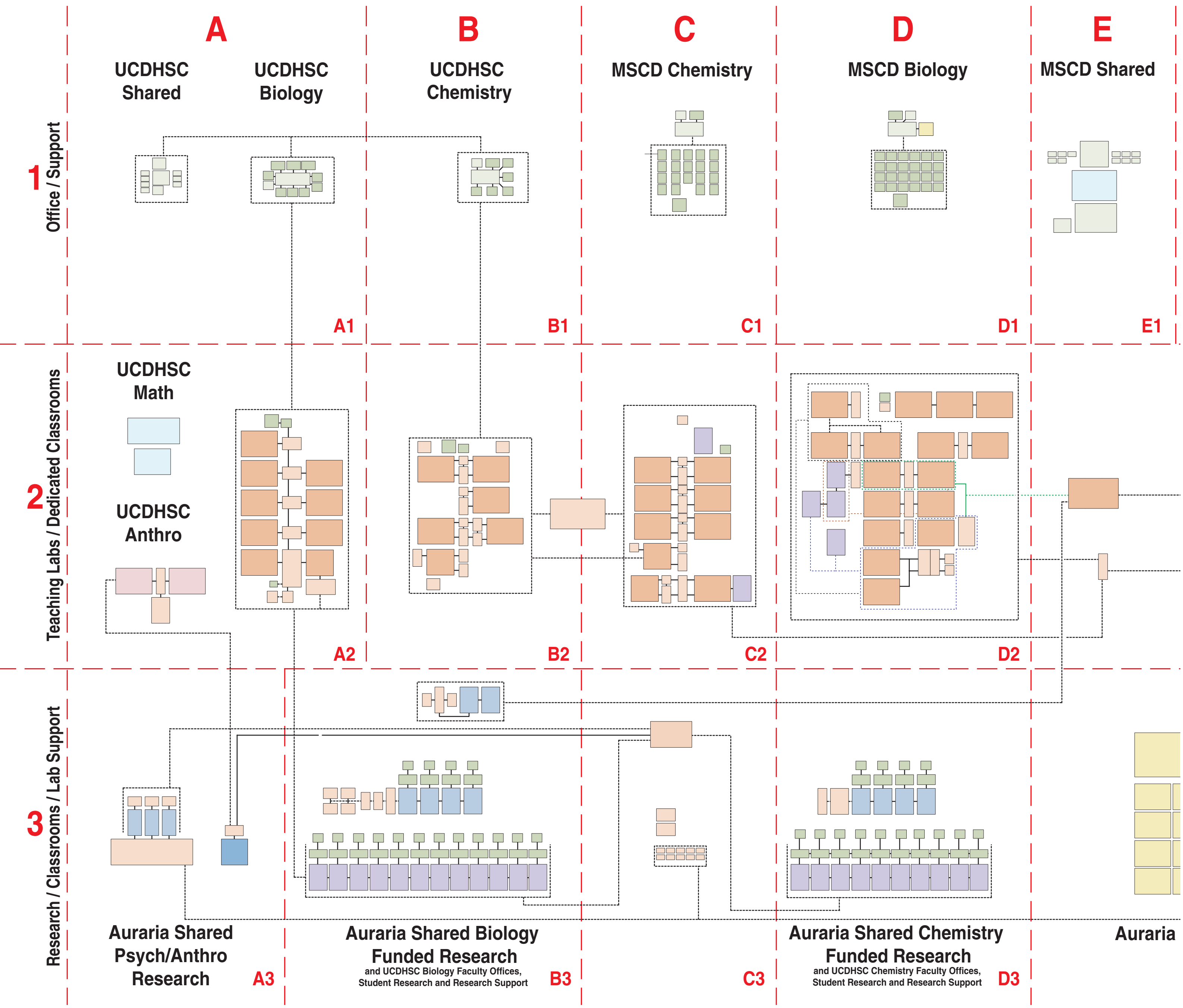
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	MSCD Shared Space					**5,467**		**8,828**	**-**	**-**
M.S.1.0	Office Space						Light Remodel	-	-	-
M.S.1.1	Special Events Conference	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.S.1.2	Conference	25	8	200	8	1,600	Light Remodel	2,584	-	-
M.S.1.3	Breakroom	80	1	80	4	320	Light Remodel	517	-	-
M.S.1.4	Adjunct Faculty	Included by departments above					Light Remodel	-	-	-
M.S.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	-	-	-
M.S.5.0	Lab Service						New	-	-	-
M.S.5.1	Scanning Electron Microscope	315	1	315	1	315	New	509	-	-
M.S.6.0	Storage						Remodel	-	-	-
M.S.7.0	Interaction/Community						New	-	-	-
M.S.7.1	Departmental Display	50	1	50	11	550	New	888	-	-
M.S.7.2	Student Group Study	15	59	882	1	882	New	1,424	-	-
M.S.7.3	Computer Lab	30	60	1,800	1	1,800	New	2,907	-	-
	MSCD Health Profession / Nursing									
						83,287		**134,491**	**843**	**-**

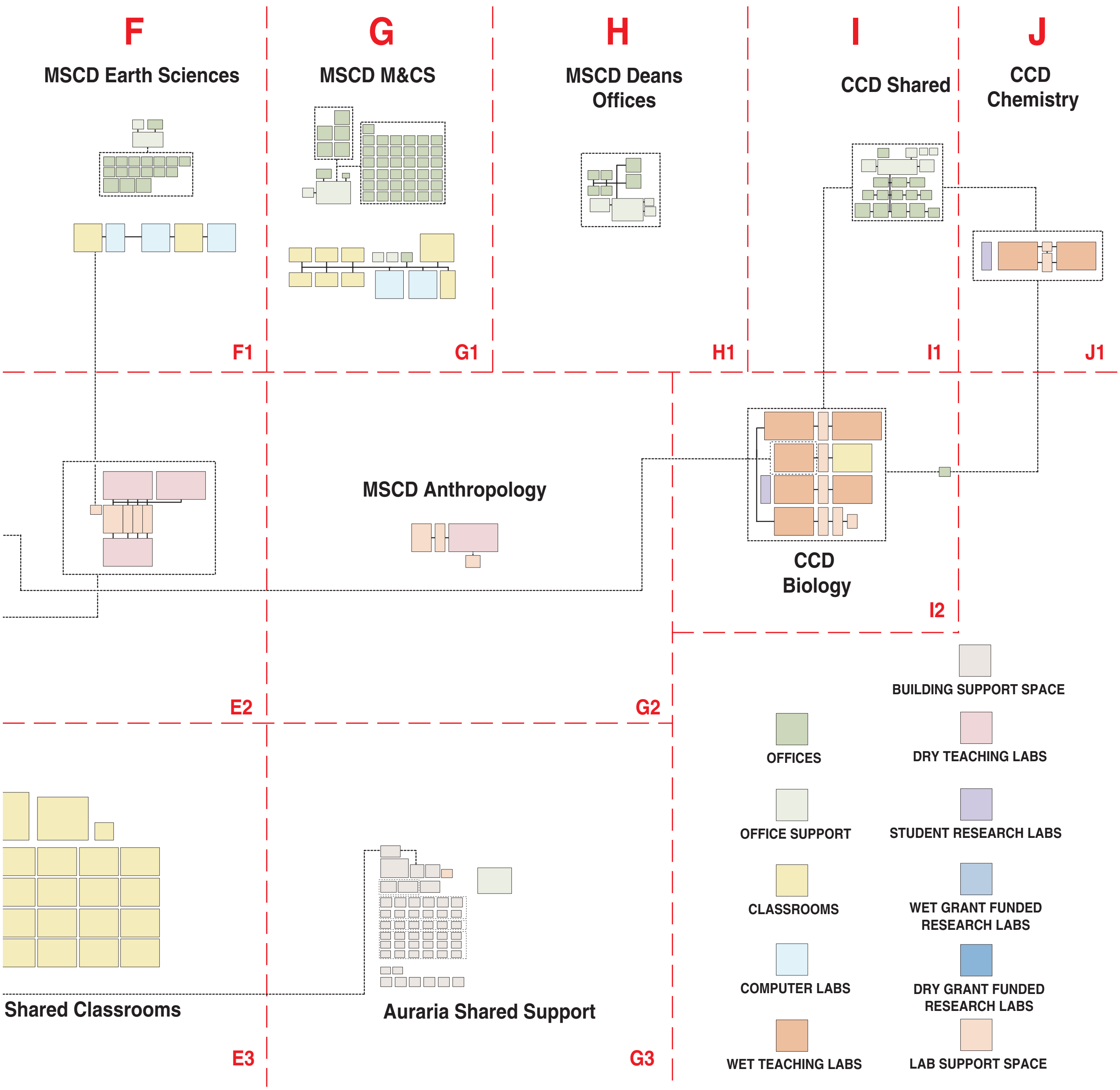
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
	Auraria Sciences Shared Space									
	Shared Biology					**2,630**		**4,247**	**-**	**-**
A.B.4.1	Herbarium	630	1	630	1	630	New	1,017	-	-
A.B.4.2	Greenhouse	2000	1	2,000	1	2,000	New	3,230	-	-
	Shared Chemistry					**3,570**		**5,765**	**-**	**-**
A.C.3.0	Laboratories						New	-	-	-
A.C.3.1	Biochemistry Teaching	59	16	945	1	945	New	1,526	-	-
A.C.5.0	Lab Service						New	-	-	-
A.C.5.1	Chemistry Stockroom Suite	2205	1	2,205	1	2,205	New	3,561	-	-
A.C.5.2	Biochemistry Equipment Room	105	1	105	1	105	New	170	-	-
A.C.5.3	Prep Room	210	1	210	1	210	New	339	-	-
A.C.5.4	Balance Room	105	1	105	1	105	New	170	-	-
	Shared Research					**15,886**		**25,653**	**-**	**4,222**
A.R.4.0	Funded Research Laboratory						New	-	-	-
A.R.4.1	Psychology Research Lab	475	1	475	0	-	New	-	-	721
A.R.4.2	Anthropology Research Lab	630	1	630	0	-	New	-	-	-
A.R.4.3	Chemistry Research Lab	630	1	630	0	-	New	-	-	1,182
A.R.4.4	Biology Research Lab	630	1	630	0	-	New	-	-	1,186
A.R.4.5	Shelled Research Lab	790	1	790	12	9,480	New	15,308	-	-
A.R.5.0	Research Lab Service					-	New	-	-	-
A.R.5.1	Animal Care Suite	2835	1	2,835	1	2,835	New	4,578	-	891
A.R.5.2	Imaging Room	210	1	210	1	210	New	339	-	-
A.R.5.3	Dark Room	210	1	210	1	210	New	339	-	73
A.R.5.4	Instrument Room	630	1	630	1	630	New	1,017	-	169
A.R.5.5	Plant Growth	158	1	158	2	316	New	510	-	-
A.R.5.6	Growth Chamber Room	315	1	315	1	315	New	509	-	-
A.R.5.7	Research Greenhouse	630	1	630	2	1,260	New	2,035	-	-
A.R.5.8	Equipment Alcove	160	1	160	0	-	New	-	-	-
A.R.5.9	Research Imaging	315	1	315	2	630	New	1,017	-	-
	Shared General					**1,235**		**1,994**	**-**	**-**
A.R.5.1	Instrument Repair	315	1	315	1	315	New	509	-	-
A.R.5.2	Machine Shop	315	1	315	1	315	New	509	-	-
A.R.5.3	Nitrogen Generator	105	1	105	1	105	New	170	-	-
A.R.5.4	Field Equipment Storage	50	1	50	10	500	New	807	-	-
	Shared Classrooms					**31,925**		**51,552**	**-**	**-**
A.C.2.0	Classroom						Backfill	-	-	-
A.C.2.1	600 Seat Lecture Hall	13.5	600	8,100	0	-	Backfill	-	-	-
A.C.2.2	300 Seat Lecture Hall	13.5	300	4,050	1	4,050	Light Remodel	6,540	-	-
A.C.2.3	180 Seat Tiered Classroom	25	180	4,500	0	-	Backfill	-	-	-
A.C.2.4	100 Seat Tiered Classroom	25	100	2,500	1	2,500	Backfill	4,037	-	-
A.C.2.5	50 Seat Classroom	25	**50**	1,250	8	10,000	Light Remodel	16,148	-	-
A.C.2.5.1	50 Seat Classroom	25	**50**	1,250	0	-	Remodel	-	-	-
A.C.2.5.2	50 Seat Classroom	25	**50**	1,250	12	15,000	Backfill	24,222	-	-
A.C.2.7	30 Seat Classroom	25	30	750	0	-	Backfill	-	-	-
A.C.2.8	15 Seat Seminar Room	25	15	375	1	375	Light Remodel	606	-	-
A.C.2.9	Lecture Prep Room	800	1	800	0	-	Backfill	-	-	-
	Shared Building Support					**6,100**		**9,850**	**-**	**-**
A.S.6.1	General Storage	600	1	600	1	600	New	969	-	-

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Gross Area (GSF)	SO Backfill Space Created	NC Backfill Space Created
A.S.6.2	Loading/Receiving	200	1	200	1	200	New	323	-	-
A.S.6.3	Vending	120	1	120	6	720	New	1,163	-	-
A.S.6.4	Recycling	80	1	80	6	480	New	775	-	-
A.S.6.5	Janitor	80	1	80	6	480	New	775	-	-
A.S.6.6	Main Telecom Distribution	120	1	120	6	720	New	1,163	-	-
A.S.6.7	Telecom Distribution	80	1	80	18	1,440	New	2,325	-	-
A.S.6.8	Shower	80	1	80	2	160	New	258	-	-
A.S.6.9	Dock	300	1	300	1	300	New	484	-	-
A.S.6.10	Mail	300	1	300	1	300	New	484	-	-
A.S.6.11	Hazmat Waste	200	1	200	1	200	New	323	-	-
A.S.6.12	Environmental H&S	200	1	200	1	200	New	323	-	-
A.S.6.13	Cannister Storage	300	1	300	1	300	New	484	-	-
	Shared Interaction/Community				**7%**	**1,000**		**1,615**	**-**	**-**
A.I.1.0	Special Events Conference	25	40	1,000	1	1,000	New	1,615	-	-
A.I.7.0	Interaction/Community						New	-	-	-
A.I.7.1	Departmental Display	50	1	50	0	-	New	-	-	-
A.I.7.2	Student Group Study	Included under Institutional Shar			1	-	New	-	-	-
A.I.7.3	Open Computer Lab								-	-
	SHARED SPACE TOTALS					**62,346**		**100,676**	**-**	**4,222**
					New	122,238		197,389		
					Remodel	16,150		26,079		
					Light Remodel	55,085		88,951		115,030
					Backfill	26,285		42,445		
					Remain	1,575		2,543		
	TOTAL ASSIGNABLE AREA (ASF)					**221,333**	**ASF**		**9,311**	**16,983**
					Efficiency	**61.9%**	**SF**			**9**
	TOTAL GROSS BUILDING AREA (GSF)					**357,408**	**GSF**	**357,141**		

IV.3 Space Relationship Diagrams

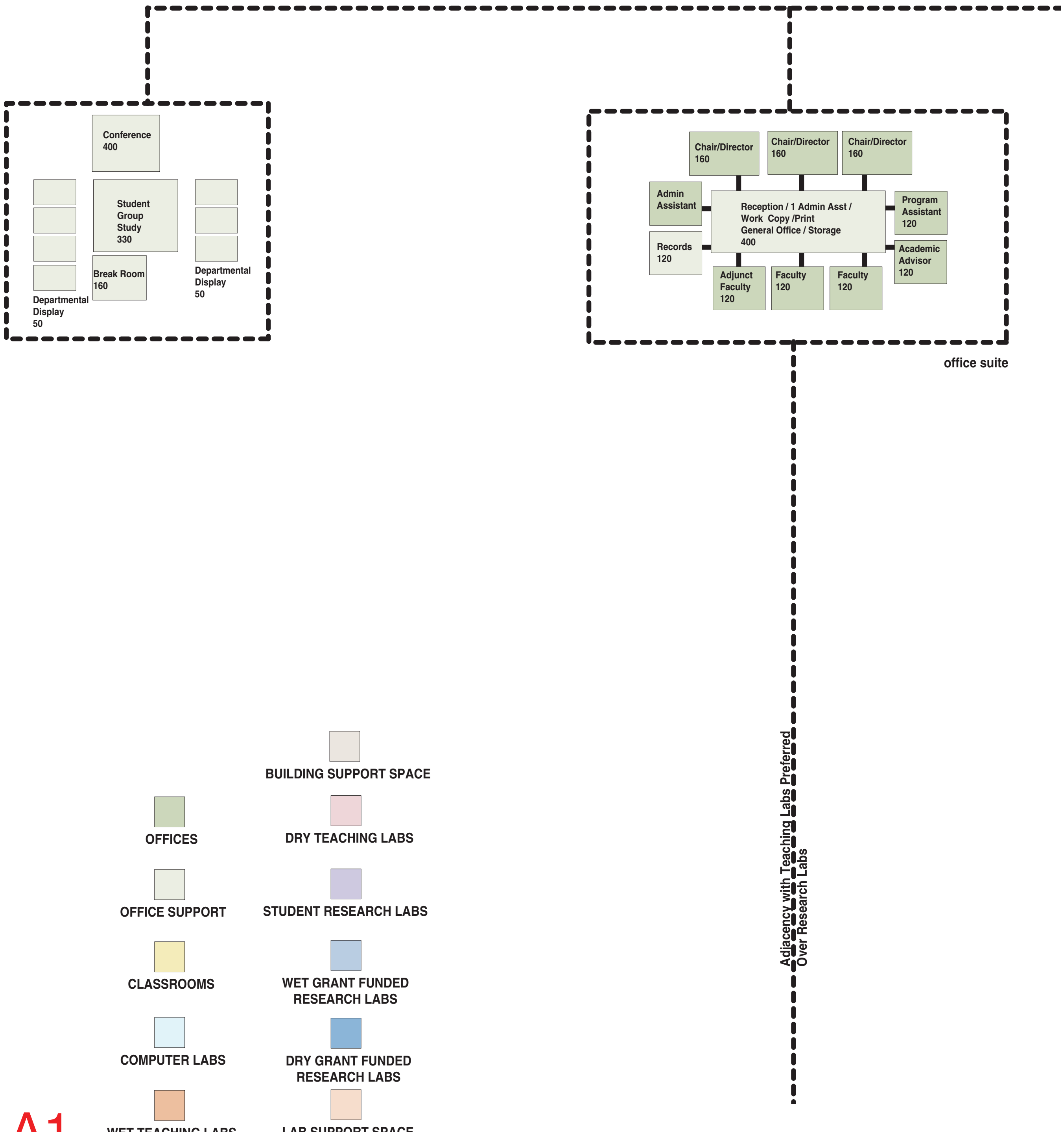
Following is a graphic representation of the Project program areas, and their desired adjacencies. The first page presents an overall look at the program areas, with key numbers in red. The key numbers relate to pages showing enlarged views of the overall diagram. In all diagrams the program blocks are drawn to scale relative to each other, and the color represents the spatial type as described in the color key on each page. On the overall diagram, dashed lines between groups of program elements indicate a desired relationship or proximity between those groups. On the enlarged diagram pages, desired adjacency between program elements is indicated by solid lines.


A
UCDHSC Shared
UCDHSC Biology
B
UCDHSC Chemistry
C
MSCD Chemistry
D
MSCD Biology
E
MSCD Shared
1 Office / Support
A1
B1
C1
D1
E1
2 Teaching Labs / Dedicated Classrooms
UCDHSC Math
UCDHSC Anthro
A2
B2
C2
D2
3 Research / Classrooms / Lab Support
Auraria Shared Psych/Anthro Research
A3
Auraria Shared Biology Funded Research
and UCDHSC Biology Faculty Offices, Student Research and Research Support
B3
C3
Auraria Shared Chemistry Funded Research
and UCDHSC Chemistry Faculty Offices, Student Research and Research Support
D3
Auraria


F
MSCD Earth Sciences
G
MSCD M&CS
H
MSCD Deans Offices
I
CCD Shared
J
CCD Chemistry
F1
G1
H1
I1
J1
MSCD Anthropology
CCD Biology
I2
E2
G2
Shared Classrooms
Auraria Shared Support
E3
G3
BUILDING SUPPORT SPACE
OFFICES
DRY TEACHING LABS
OFFICE SUPPORT
STUDENT RESEARCH LABS
CLASSROOMS
WET GRANT FUNDED RESEARCH LABS
COMPUTER LABS
DRY GRANT FUNDED RESEARCH LABS
WET TEACHING LABS
LAB SUPPORT SPACE

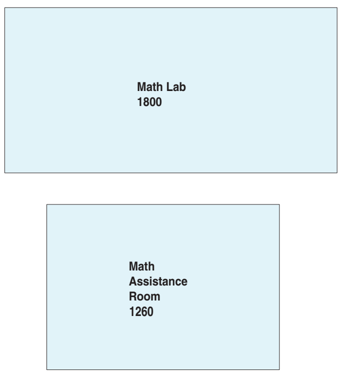
UCDHSC Shared

UCDHSC Biology

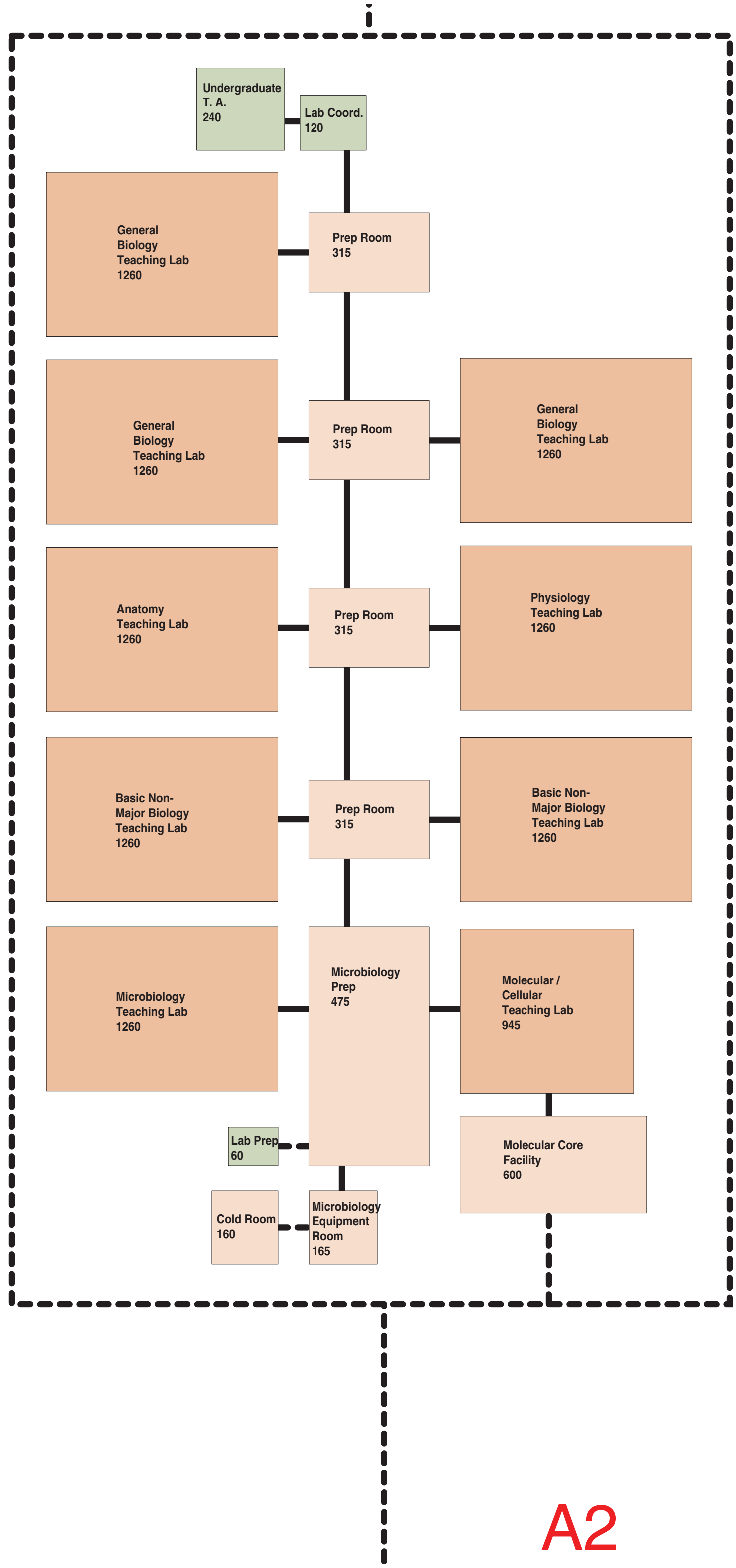


A1

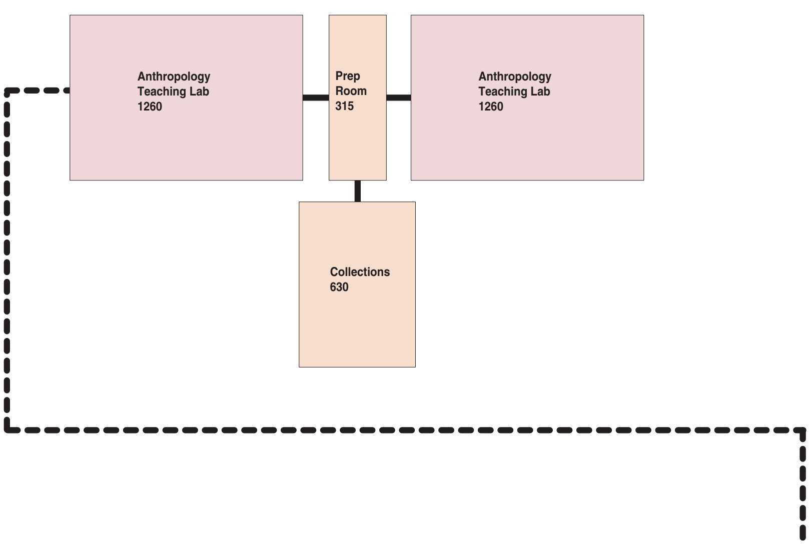
UCDHSC Math



UCDHSC Biology

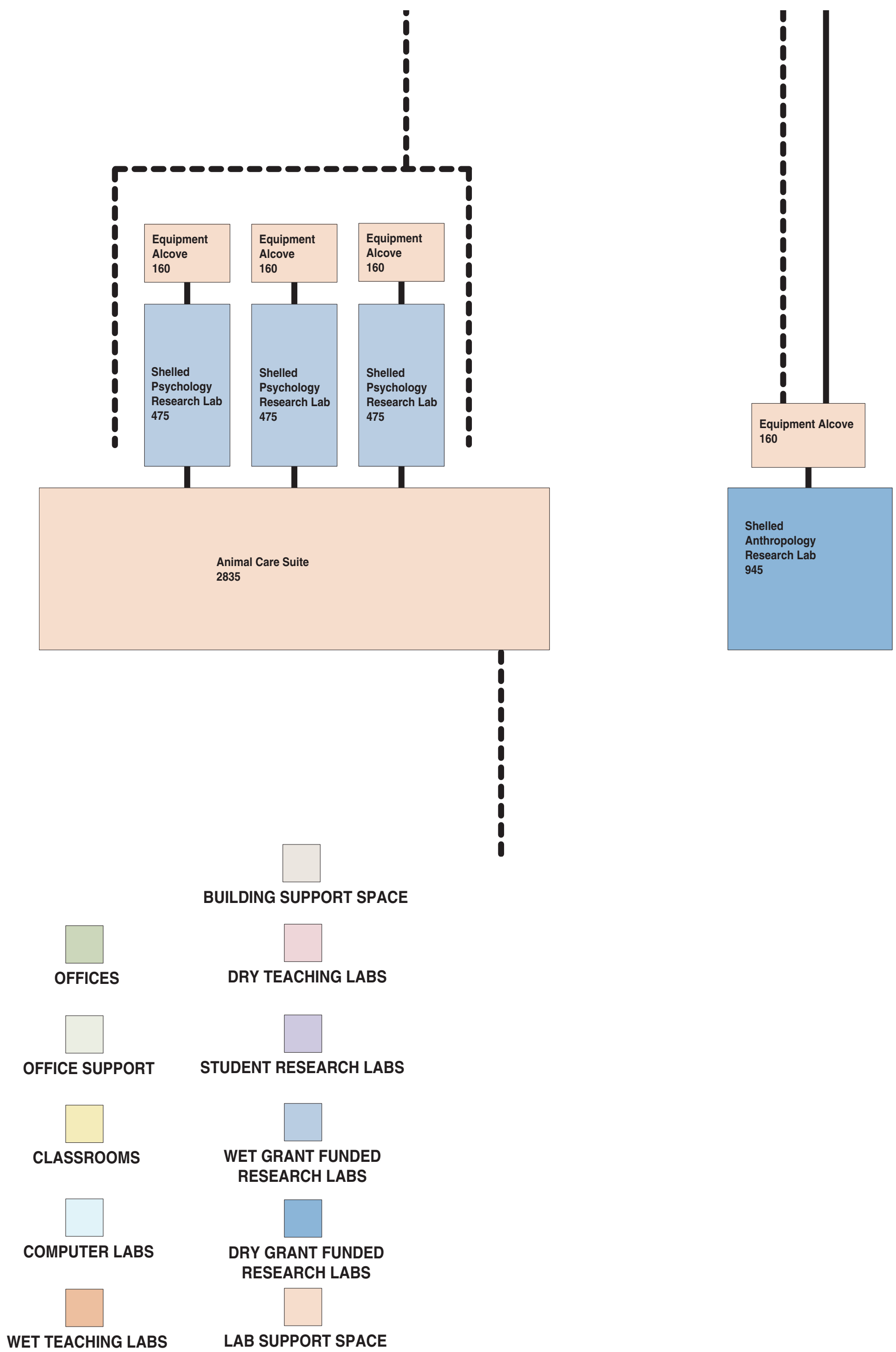


UCDHSC Anthropology



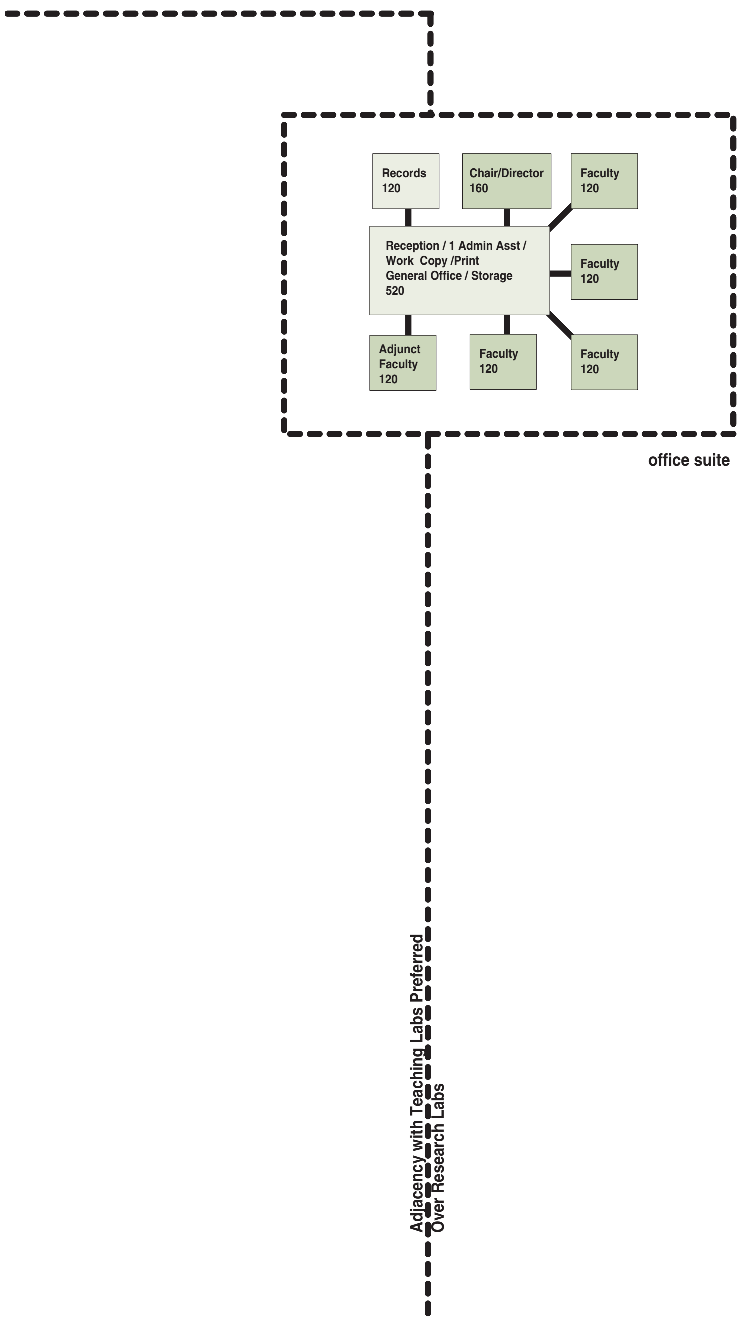
A2

Auraria Shared Psych/Anthro Research



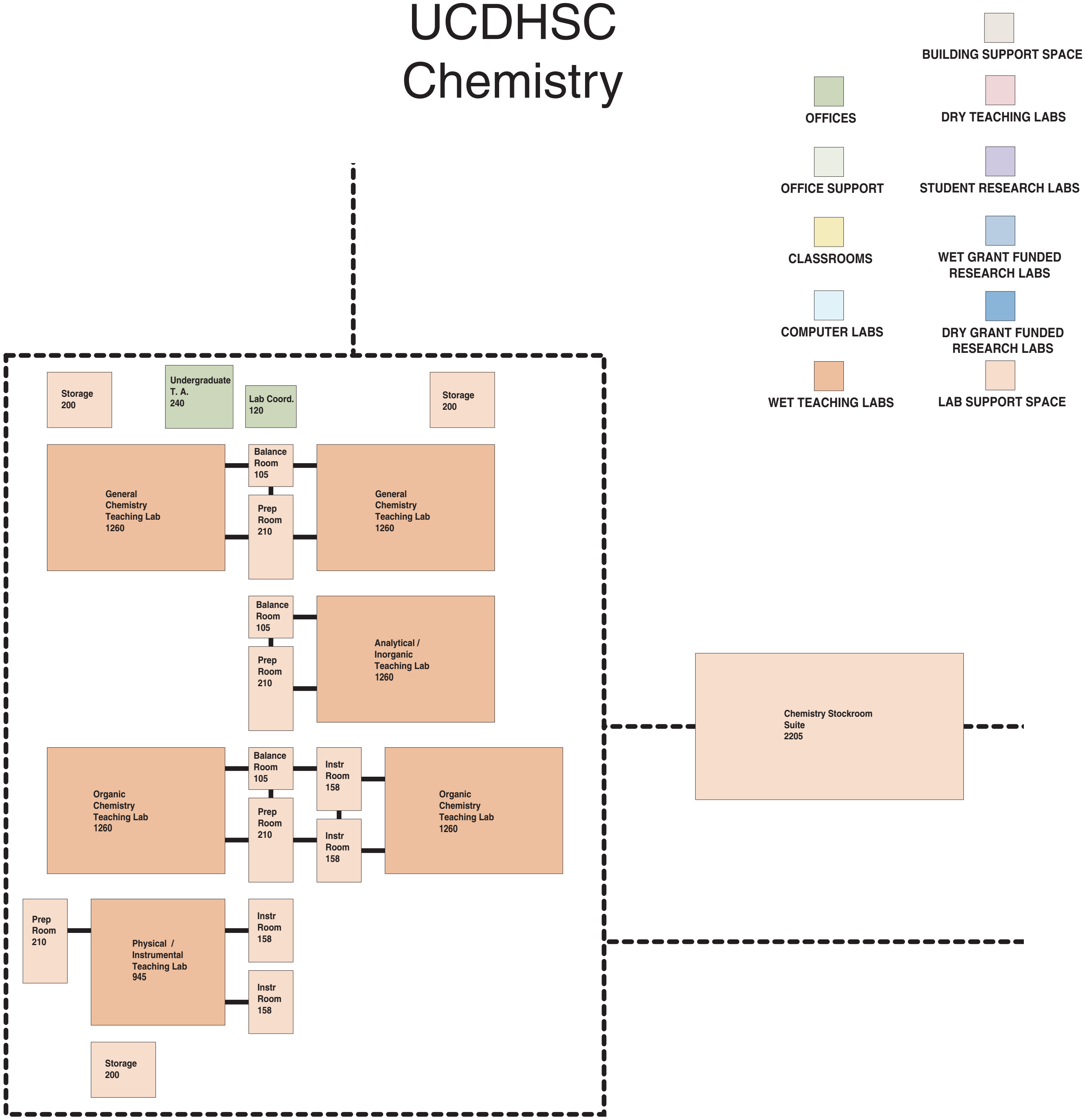
A3

UCDHSC
Chemistry



B1

UCDHSC Chemistry

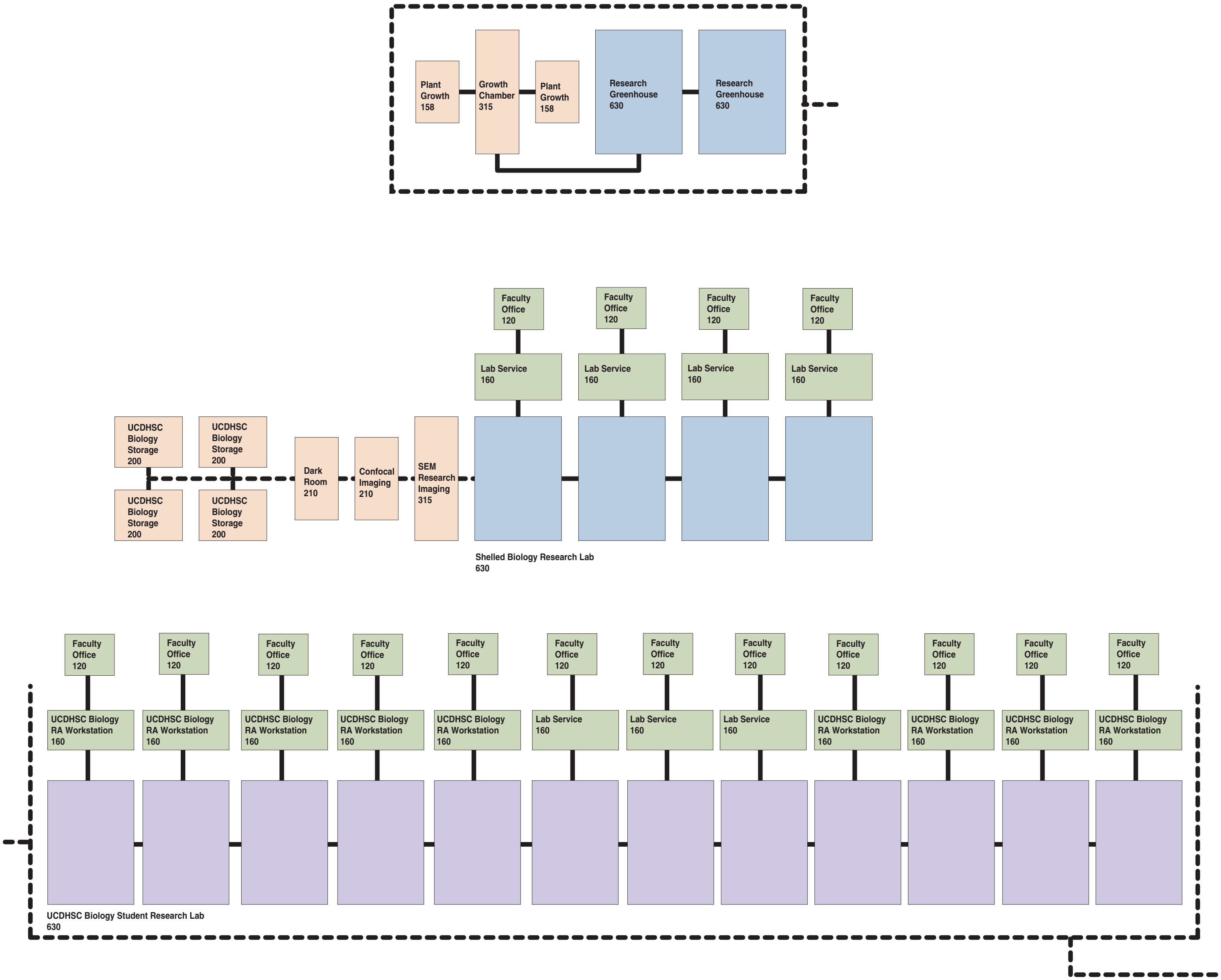


+ No relationship between biology/chemistry teaching labs required
+ Preferable if Research / Teaching Labs are on separate floors
+ Biology / Chemistry Research Labs should be on same floor

B2

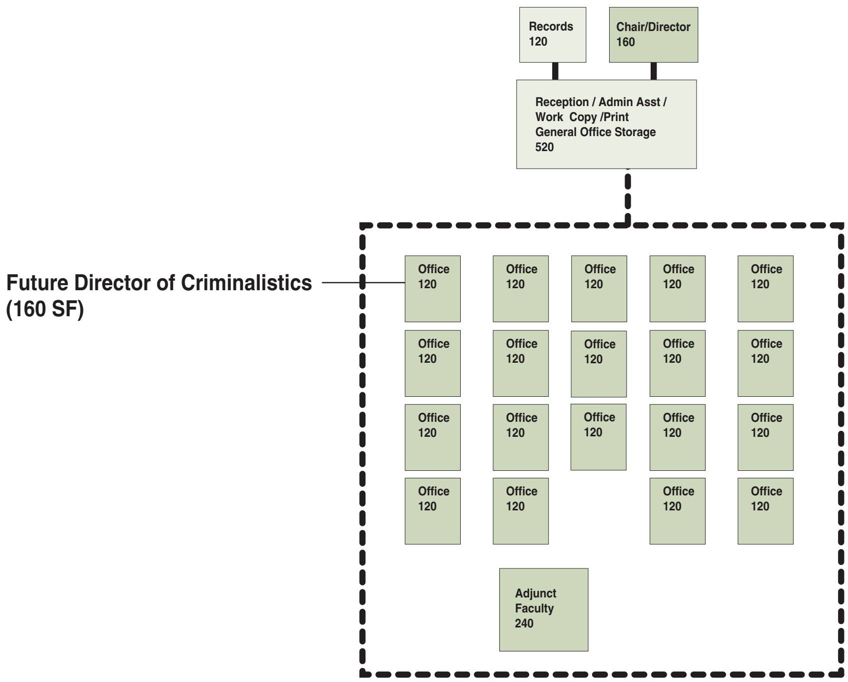
Auraria Shared Biology Funded Research

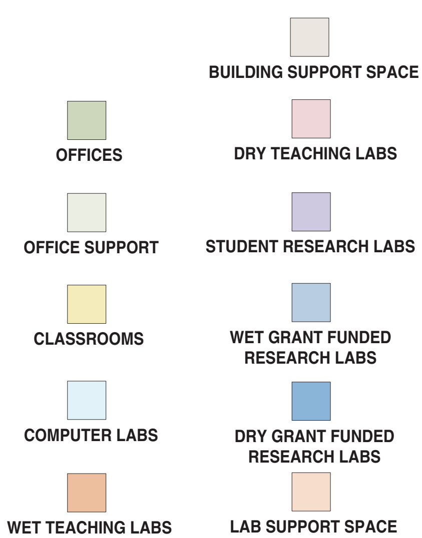
and UCDHSC Biology Faculty Offices, Student Research and Research Support



B3

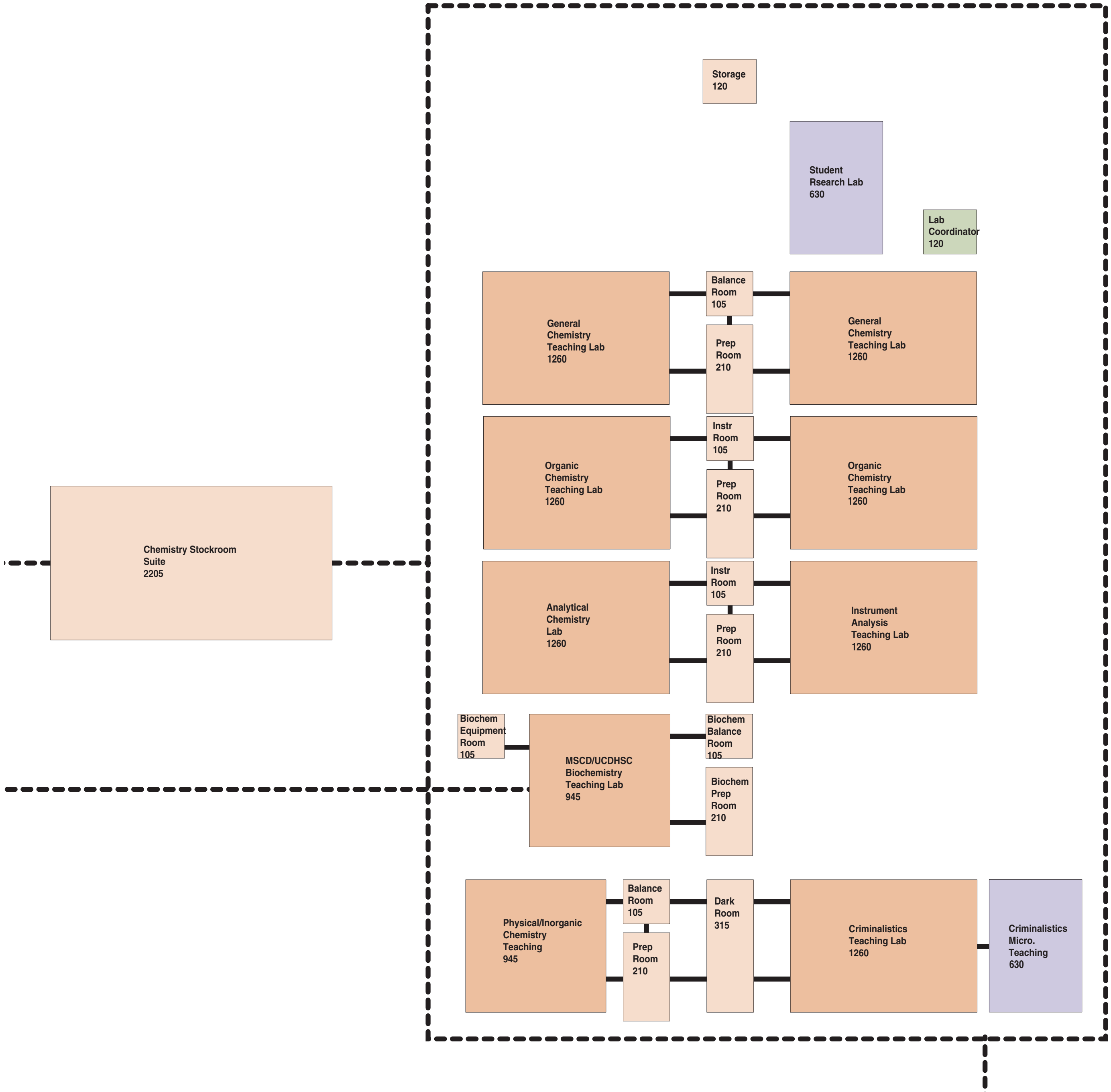
MSCD Chemistry





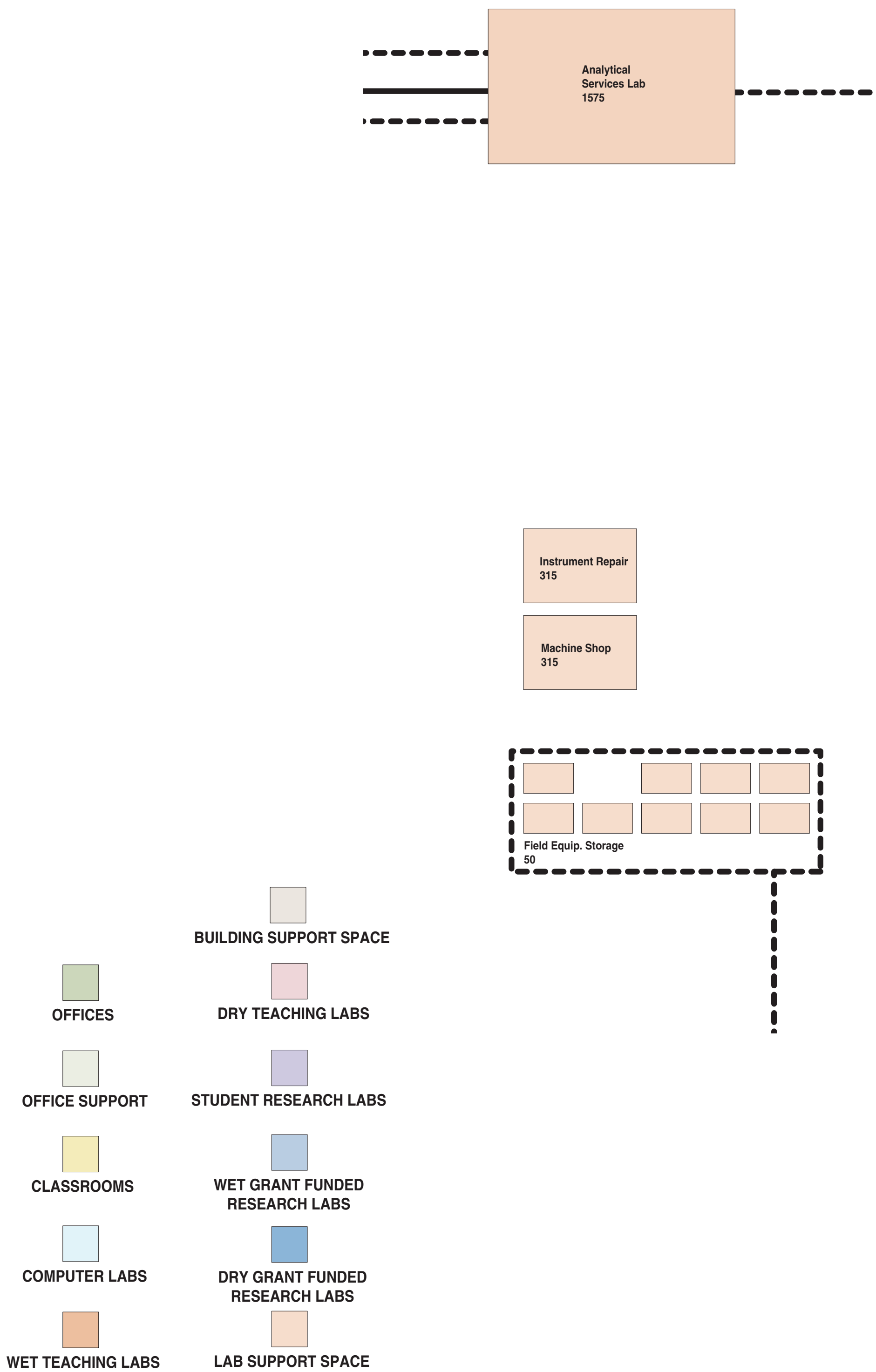
C1

MSCD Chemistry



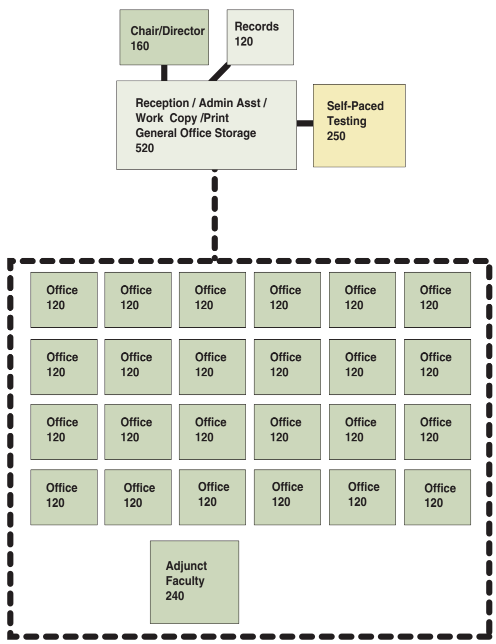
C2

Auraria Shared Research



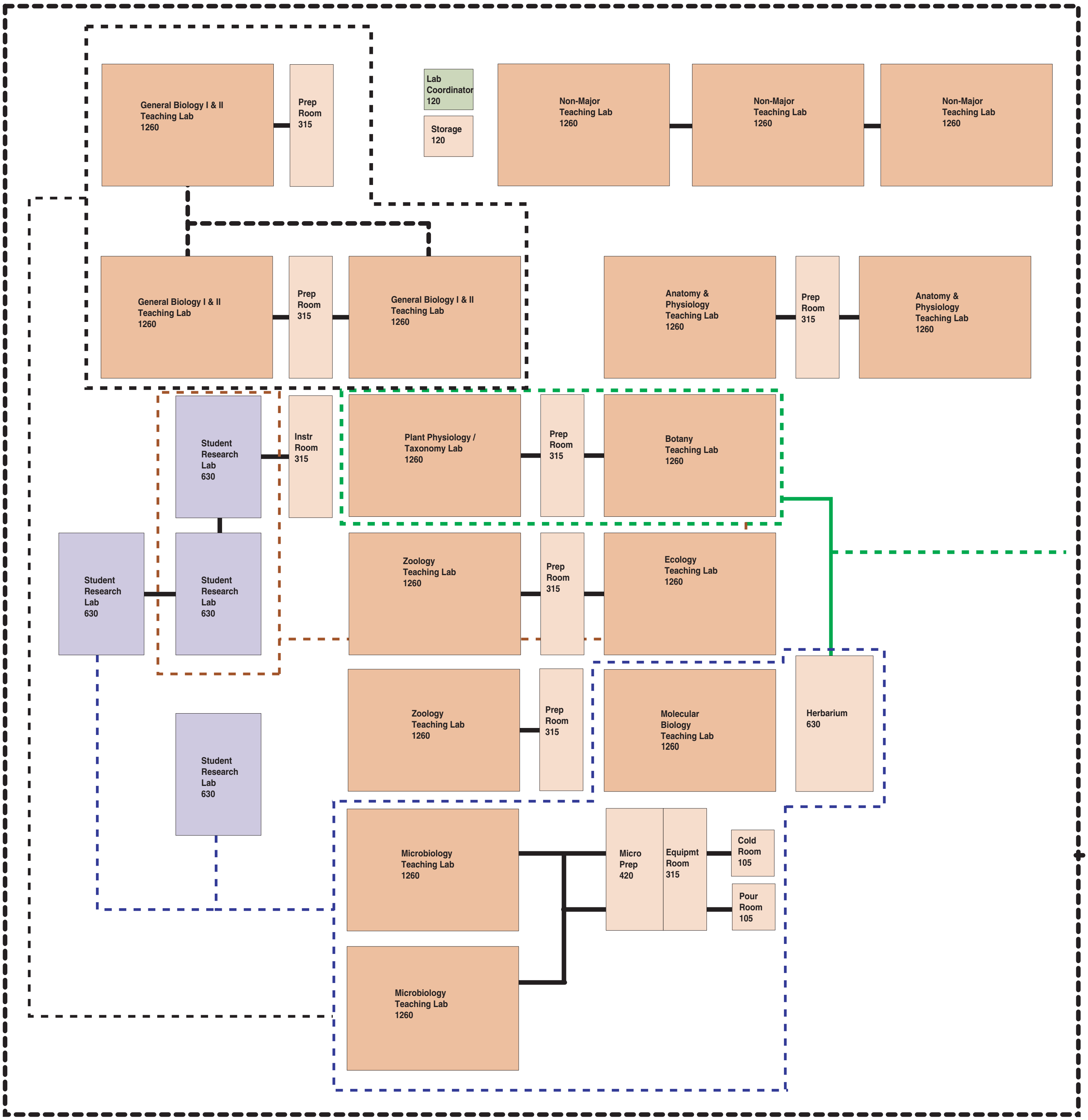
C3

MSCD Biology

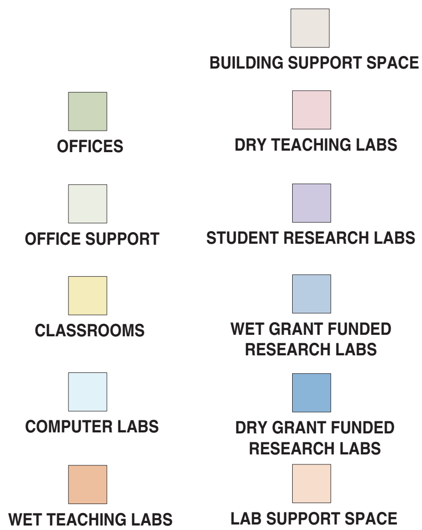


D1

MSCD Biology

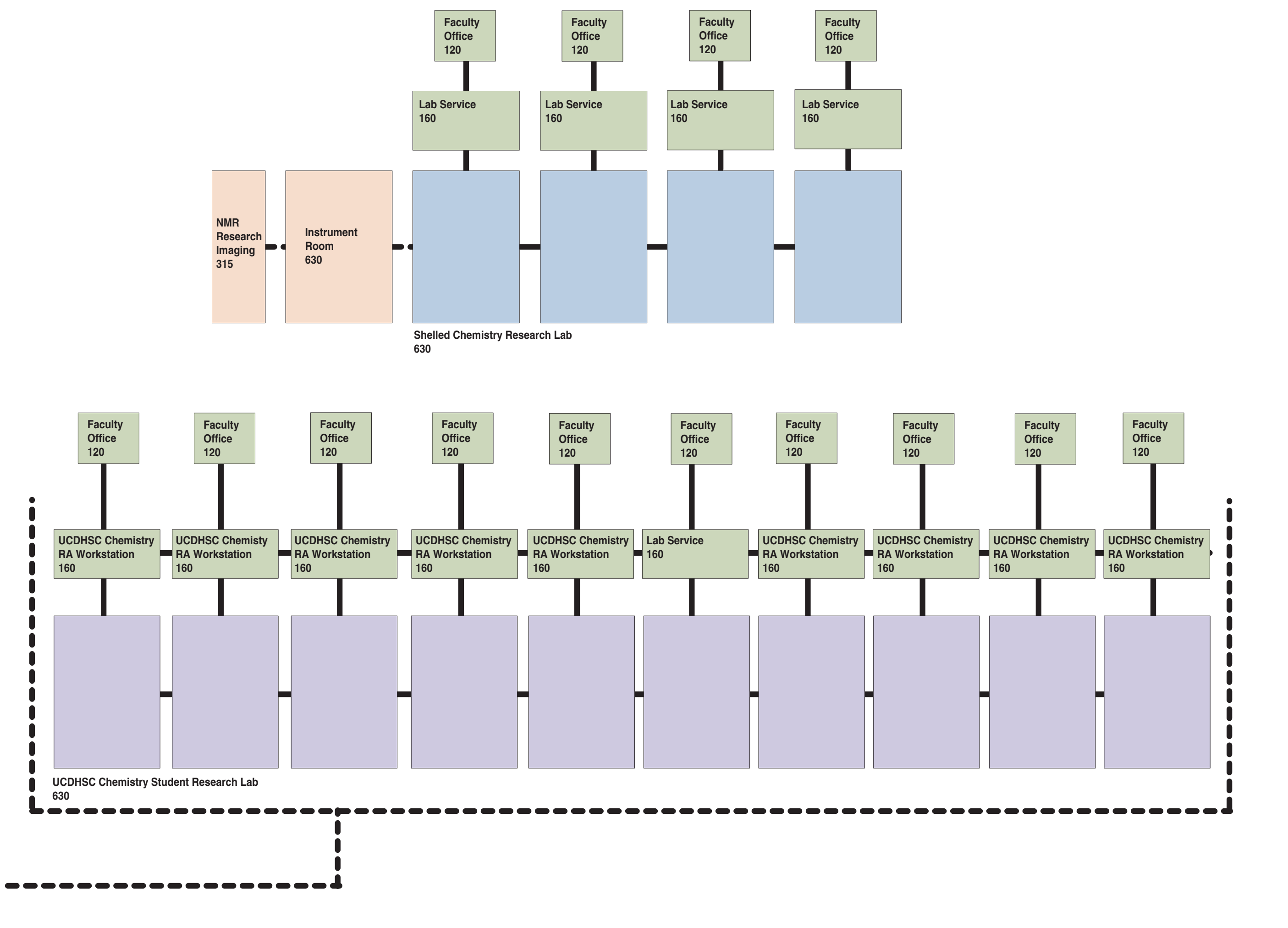


D2



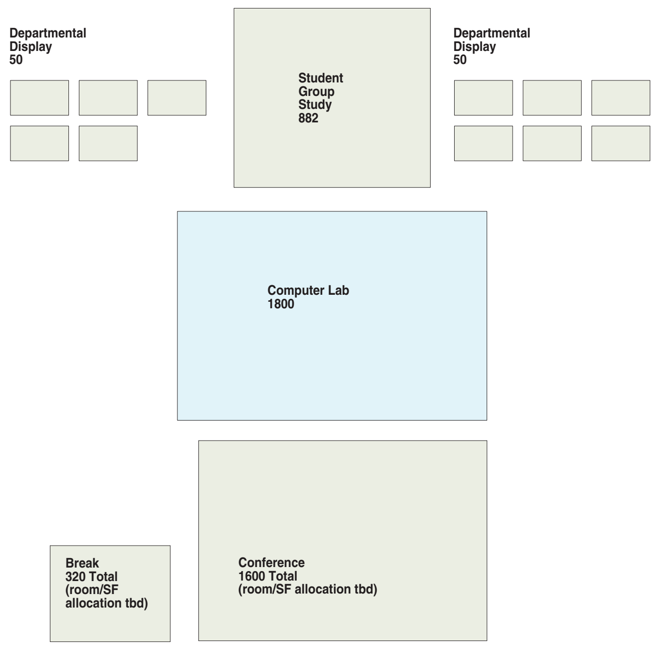
Auraria Shared Chemistry Funded Research

and UCDHSC Chemistry Faculty Offices, Student Research and Research Support

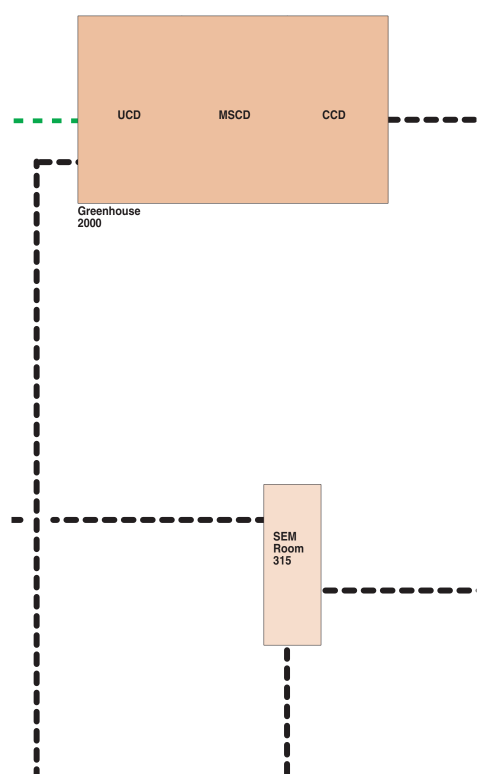


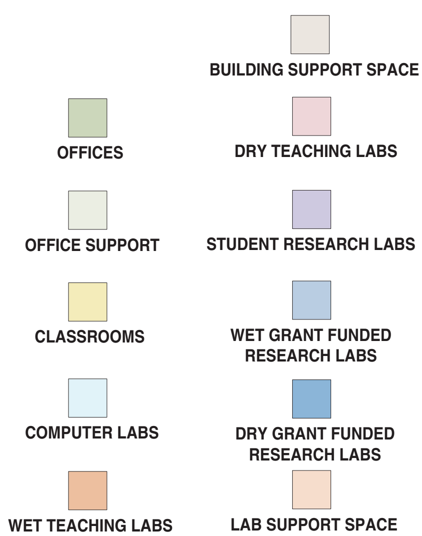
D3

MSCD Shared



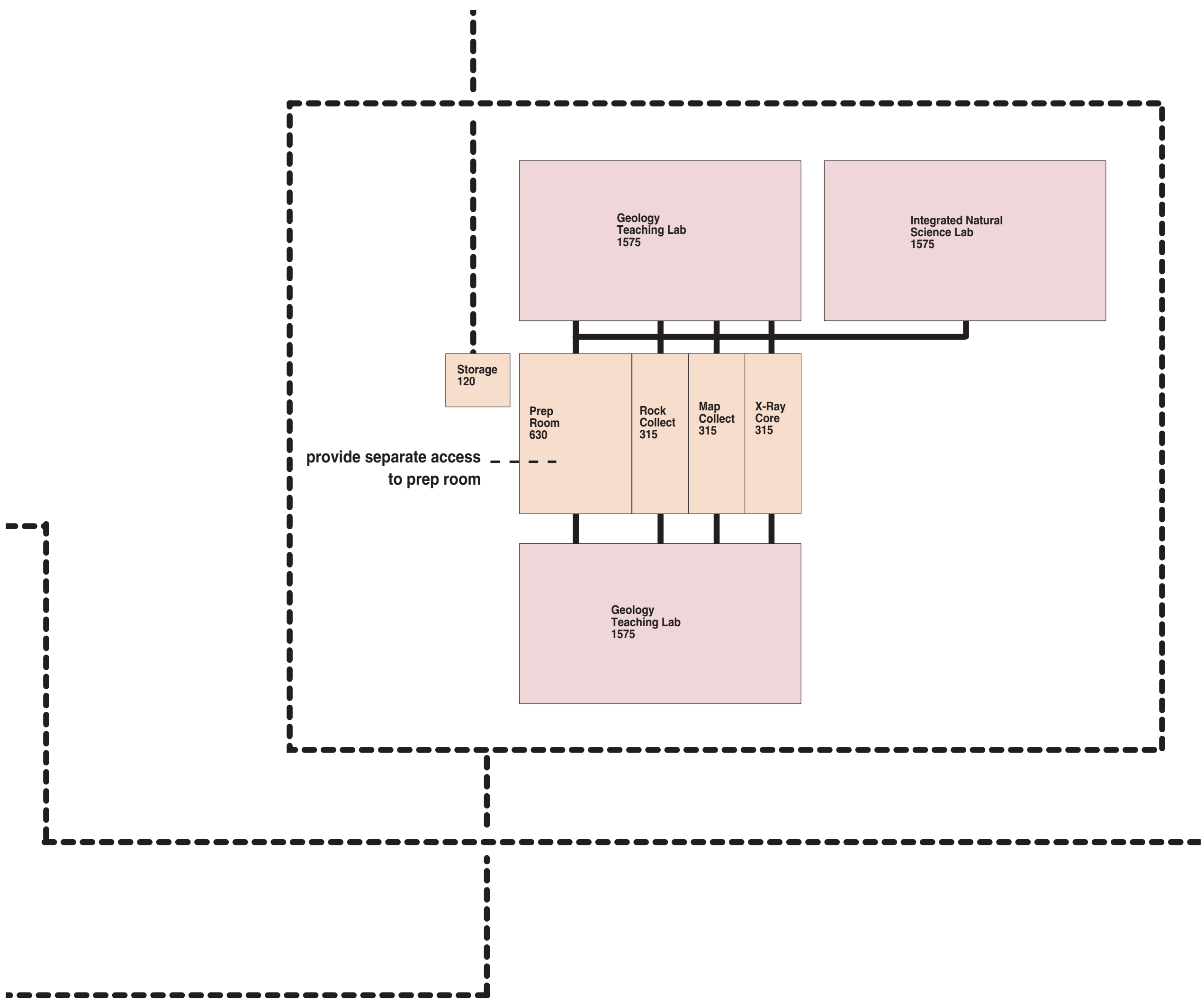
Auraria Shared





E1

MSCD Earth Sciences

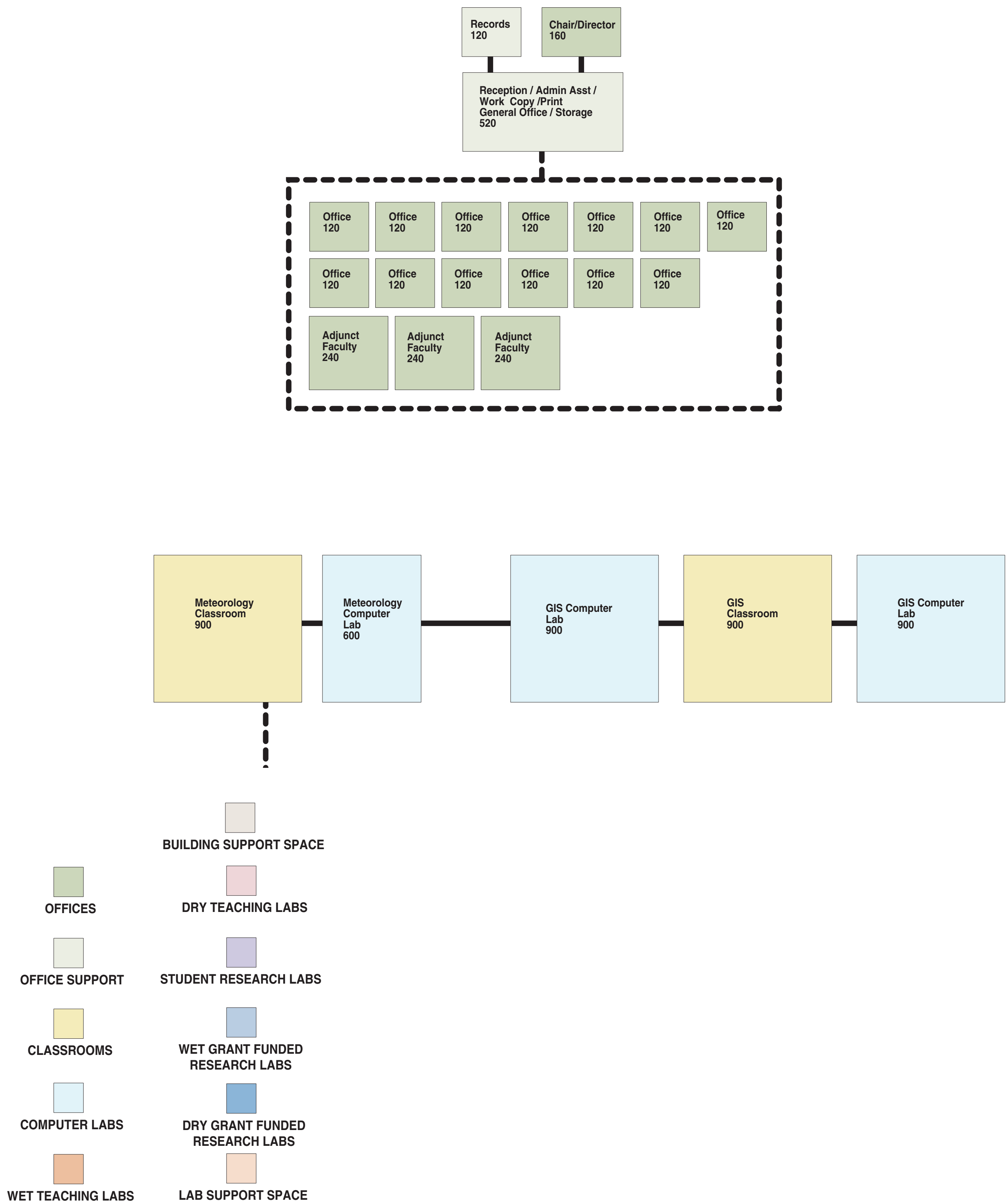


E2

Auraria Shared Classrooms

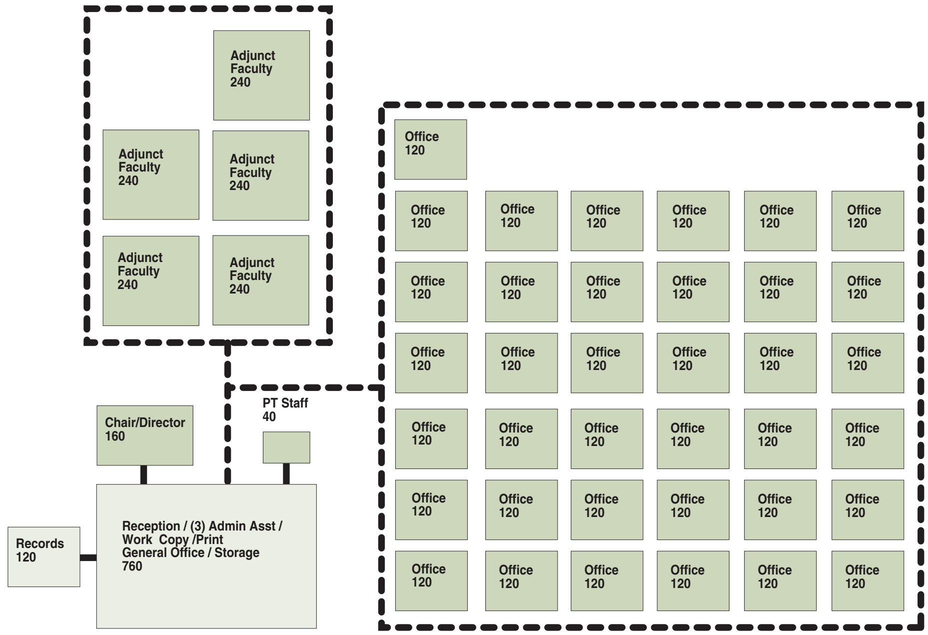
E3

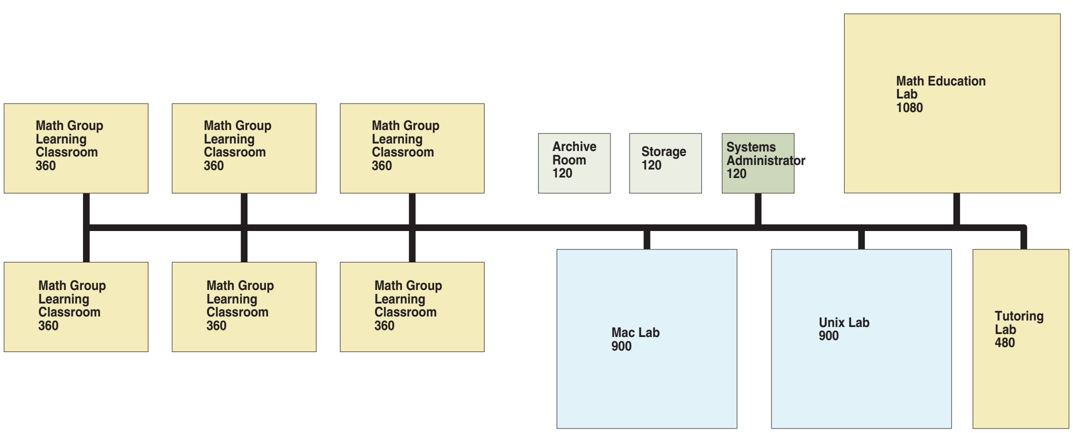
MSCD Earth Sciences



F1

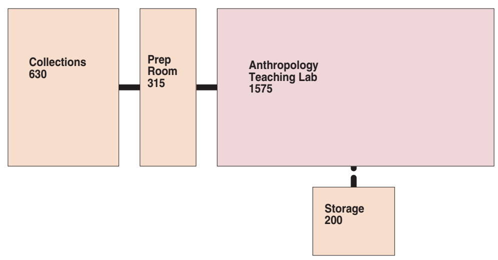
MSCD Math and Computer Science

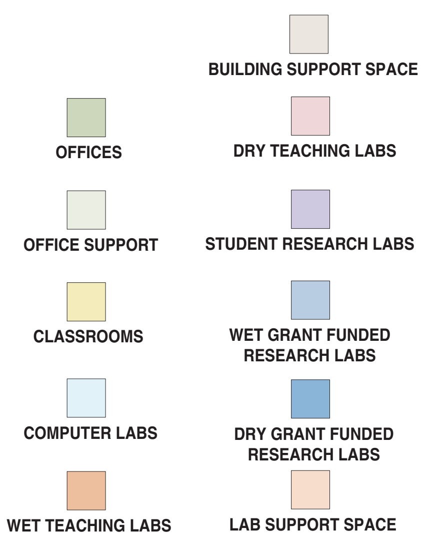




G1

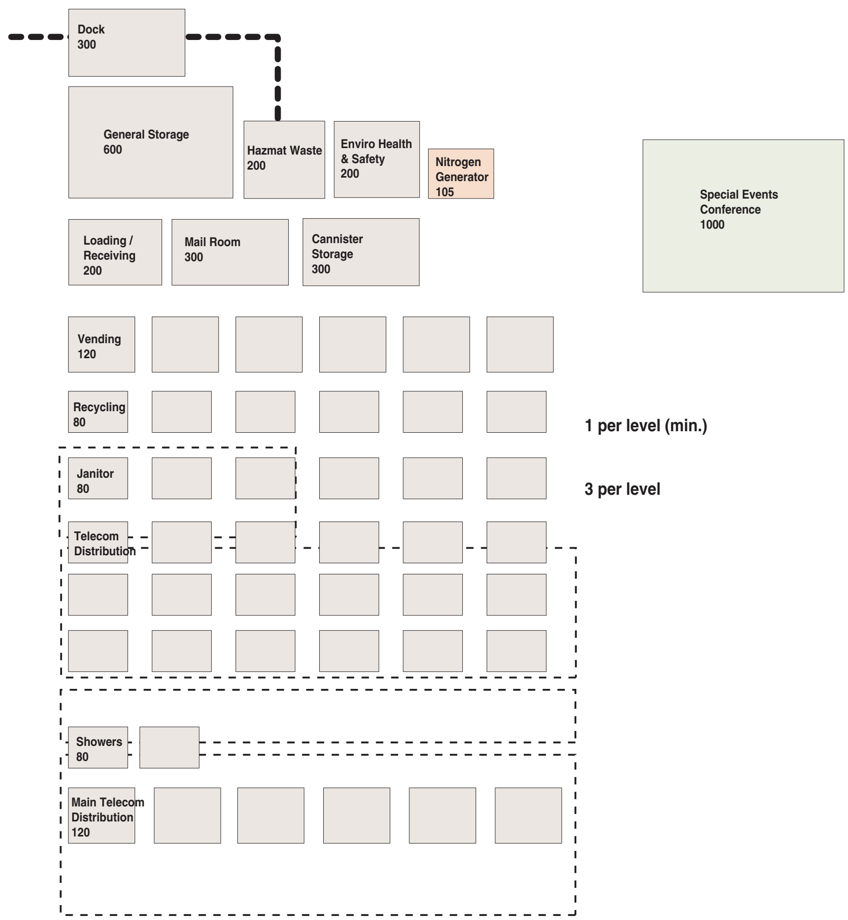
MSCD Anthropology





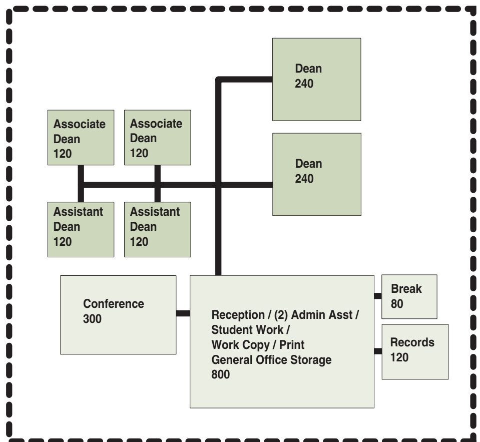
G2

Auraria Shared Support

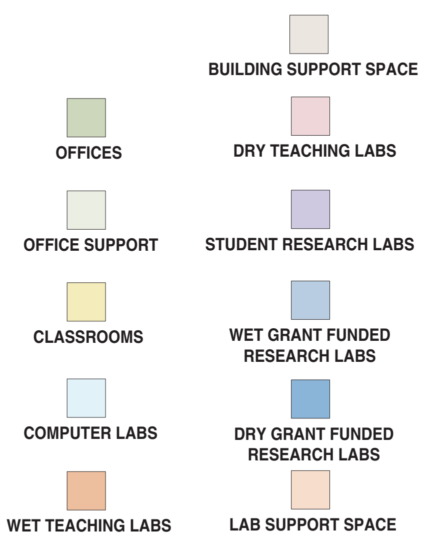


G3

MSCD Deans' Offices

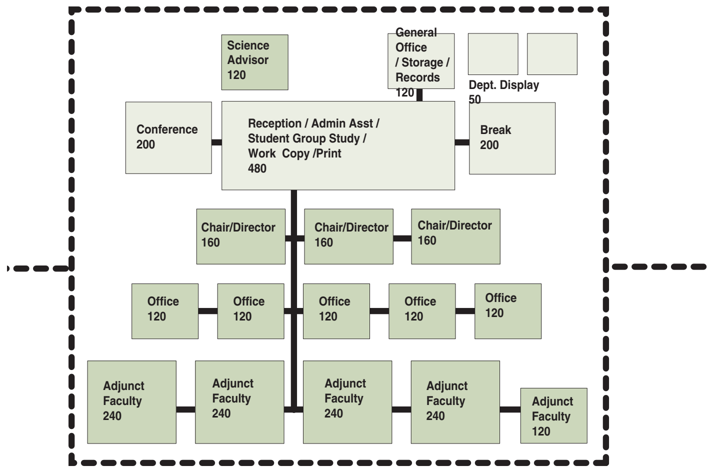


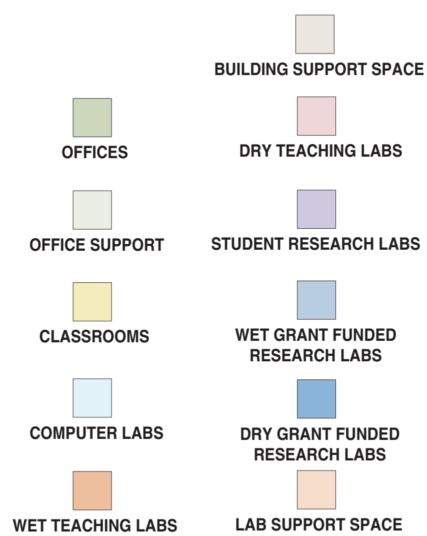
+ Can be located in Central or West



H1

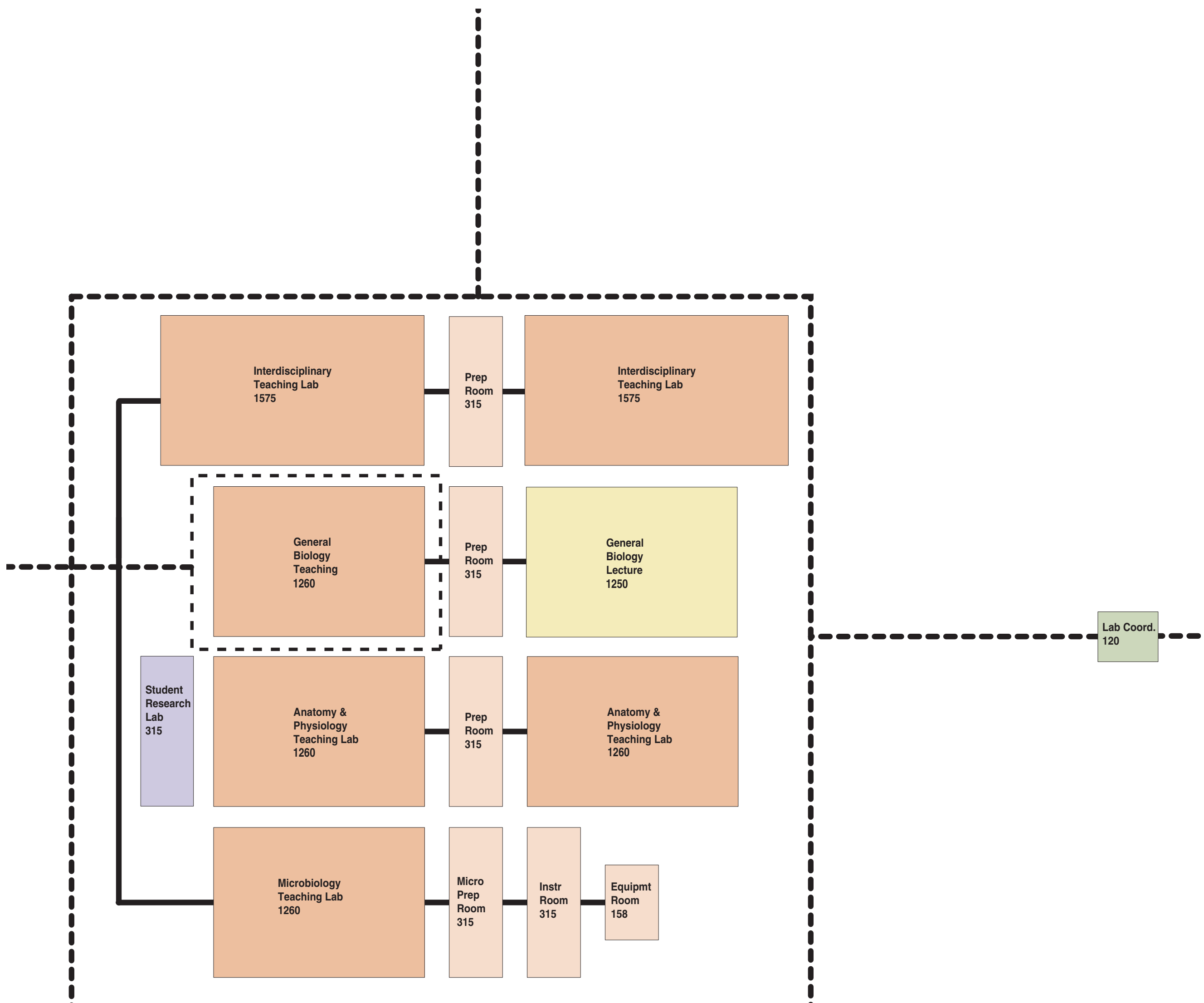
CCD Shared





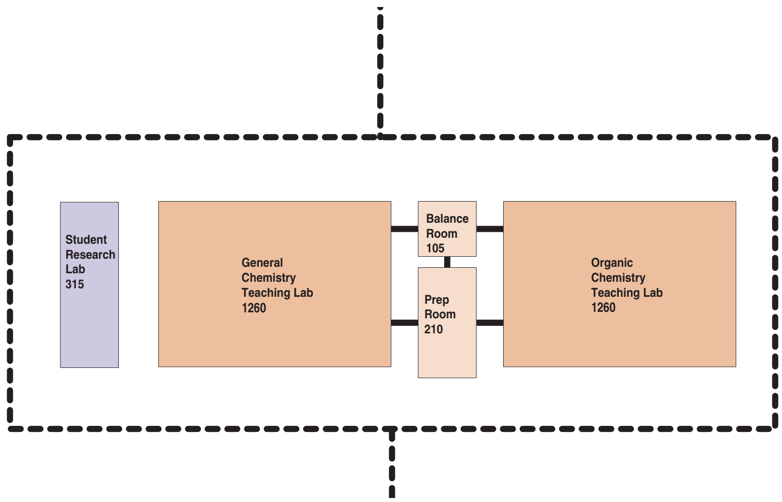
I1

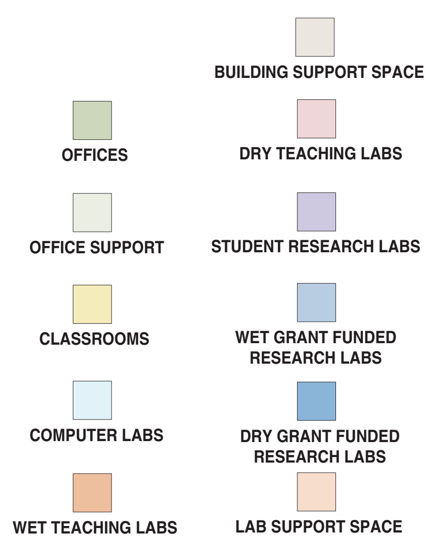
CCD Biology



I2

CCD Chemistry





J1

IV.4 Unique or Special Features

The most unique opportunity the Auraria Science Building offers is the opportunity for three distinctly separate institutions to co-locate their similar science programs within one state of the art science building. Also presented is the prospect of sharing certain facilities to the benefit of all, such as the Chemical Stockroom Suite, Biochemistry Teaching Laboratory and support space, Greenhouse space, and several specialized instrumentation rooms. Sharing these spaces reduces the number of redundant spaces, and offers efficiency in systems planning as well as operations and management.

By co-locating all three institutions' similar programs together, a synergistic and collaborative environment can be created, which will enhance learning, working, and research opportunities, and which will attract new faculty and students. The possibility of expanding growing programs into the space of declining programs will be increased, and the cost and complication of accommodating changes will be decreased.

Specific spaces which will improve the level of teaching and research programs are:

Animal Care Facility

The Animal Care Facility will be designed to meet the biological needs of several categories of animals including protection, adequate freedom of movement, rest and access to food and water, based on the ILAR guidelines. Separate holding rooms, procedure rooms and behavioral testing rooms will be incorporated in the design to ensure separation of species or isolation of individual projects when necessary. Cagewashing and sterilization accommodations will be provided to ensure compliance with NIH and AAALAC guidelines.

Molecular Core Facility

The Molecular Core Facility will be designed for adaptability. Accommodating future instrumentation requirements is provided by open bench space as well as open floor area with movable laboratory tables and ceiling mounted services. Exhaust connections for vacuum pumps and heat or fume generating instruments will be located in the ceiling at several locations, offering flexibility in how the Molecular Core Facility is utilized, with a minimum interruption of the room for reconfiguration.

Analytical Services Lab

The Analytical Services Lab will be designed for adaptability. Accommodating future instrumentation requirements is provided by open bench space as well as open floor area with movable laboratory tables and ceiling mounted services. Exhaust connections for vacuum pumps and heat or fume generating instruments will be located in the ceiling at several locations, offering flexibility in how the Analytical Services Lab is utilized, with a minimum interruption of the room for reconfiguration.

Multiple Greenhouse Environments

The Greenhouse will be subdivided into rooms which can be separately controlled for light, temperature and humidity to allow multiple environments. Separated areas also assist in containment of vermin and plant disease, as well as separation of genetically modified plants from non-GMO plants. Separate areas for teaching greenhouse and collections will also be provided.

NMR Facility

A nuclear magnetic resonance spectrometer (NMR) facility will be used to support the research work of chemists. The NMR consists of three major components requiring specific consideration in the construction: the super conducting magnet and probe to measure the sample; the console containing all the electronics to transmit and receive radio frequency pulses to the probe; and the computer from which the operator runs the experiments and processes the data. The facility must be constructed to accommodate the magnetic field, a substantial amount of cryogenic helium and nitrogen, and to have tight control (+/- 1-2 degrees F) of temperature. The NMR itself weighs over 3,000 pounds and has vibration control requirements, which may direct the location to a basement room. Locating the NMR in an area away from elevators, as well as MEP equipment, will be critical in it's performance.

Scanning Electron Microscope

A Scanning Electron Microscope (SEM) will be used to support the teaching and research work of all departments. The extreme vibration control requirements of such sensitive instrumentation dictates a slab on grade location which allows an isolated, thickened slab to provide 125 micro inches/second acceleration. The SEM should not be located near elevators or MEP equipment. Temperature and humidity must be tightly controlled, and the supply air will be HEPA filtered to minimize dust. Finishes in the room should be non-friable and easily cleaned.

Future Confocal Microscopy

The Confocal Microscope room will be designed to provide a flexible layout which can accommodate the instrument layout the faculty prefer. The temperature, humidity and vibration controls are less stringent than the SEM but will be tighter than a standard laboratory. Installation guides from proposed instruments will be utilized during the design phases to ensure the environment and services provided will accommodate the Confocal Microscope intended.

IV.5 Health, Life Safety and Code Issues

The following analysis for the new Science building is based upon this program and preliminary plan information, without a building design. A comprehensive code analysis will be completed during the Schematic Design, Design Development and Construction Document phases of the project.

Auraria Higher Education Center has overall jurisdiction for the Science Building project and will provide final interpretation on code issues. Within its jurisdictional authority, AHEC will employ the services of an independent code consulting firm to be responsible for review of the design and construction documents for compliance with applicable codes and standards. State inspections will be required during construction for elevators, electrical, and plumbing work.

This project falls under the State Buildings Programs (SBP). As such, the following list of building codes and standards shall govern this project:

2003 International Building Code (IBC)
2003 International Mechanical Code (IMC)
2003 International Energy Conservation Code (IECC)
2005 National Electric Code (NEC)
2003 International Plumbing Code (IPC)
2003 International Fuel Gas Code (IFGC)
2003 International Fire Code (IFC)
2001 ASME Boiler and Pressure Vessel Code
2001 National Boiler Inspection Code (NBIC)
2002 Controls and Safety Devices for Automatically Fired Boilers CSD-1
2001 Boiler and Combustion Systems Hazards Code, NFPA 85
1998 ICC/ANSI A117.1 Accessible and Usable Buildings and Facilities
National Fire Protection Association Standards (NFPA) as follows:
NFPA-1 (2000), 10 (1998), 11 (1998), 11A (1999), 12 (2000), 12A (1997), 13 (1999), 13D (1999), 13R (1999), 14 (2000), 15 (1996), 16 (1999), 17 (1998), 17A (1998), 20 (1999), 22 (1998), 24 (1995), 25 (2002), 45 (2004), 72 (1999), 231D (1998), 409 (1995), 705 (1997) and 2001 (2000)
ASME A17.1 (Safety Code for Elevators - 2000)

A. THE BUILDING

The Building is expected to be a maximum of 5 stories tall, which is allowed by the IBC for B Occupancies for all Construction Types except Type V. For this review, it is anticipated that the Building will be Type II-A construction.

An Occupancy Type B is possible by keeping Assembly (A) and Hazardous (H) Occupancies as accessory uses (less than 10% of the floor area). Use of hazardous materials in the labs must be kept below exempt amounts defined under IBC Section 307.

Continuous setbacks of 20 feet or more should be maintained from the property lines.

B. FIRE RESISTANCE

At this time the structural system is assumed to be steel; the final determination will depend upon a variety of factors including the vibration isolation criteria of the program spaces; the cost and schedule and how these two parameters interface, the architectural design and how conventional or unusual it must be to accommodate the program. Currently the fire resistance of building components is assumed as follows:

a) The fire resistance of structural members shall be 1 hour.
b) Fire resistance of exit routes shall be of not less than one hour fire resistive construction.
c) Fire resistance of vertical openings shall be of not less than 2 hour fire resistive construction.
d) Fire resistance of special occupancy enclosures—bulk hazardous material storage—shall be enclosed with the appropriate fire resistive construction.
e) Fire resistance of other building elements like partitions, doors and exterior openings shall be of the appropriate fire resistive construction for the required construction type and fire separation.
f) Sealing of penetrations through fire resistive construction separations shall be fire stopped.

C. FUEL CONTROL

Combustible building materials shall be limited per IBC 603. Interior finishes shall have a minimum Class C flame spread classification and Class B in exits.

D. MEANS OF EGRESS

The means of egress system is composed of the exit access, the exit and the exit discharge. Occupant Loads shall be calculated for each floor to determine exits and will comply with the following requirements:

a) The number of exits shall not be less than two (2) above the first story and in basements (except where the story has an occupant load of more than 500). Conference rooms and lecture rooms with an occupancy of 50 or more must have at least two exits.
b) The minimum width of exits shall be 0.2 inches per occupant in stairways and 0.15 in other exits.
c) The maximum travel distance to an exit is 300 feet for a B Occupancy.
d) The maximum allowable dead end corridor is 50 feet.
e) The maximum common path of travel shall be 100 feet.
f) All doors must swing in the direction of exit travel.
g) A place of refuge may serve as an acceptable means of egress.
h) Exit signage and exit access doors shall be marked by an approved sign.
i) Exit lighting at the means of egress shall be illuminated at all times.
j) An emergency power supply shall be provided.

E. FIRE PROTECTION SYSTEMS

The devices, equipment and systems or combinations of systems used to detect a fire, activate and alarm, extinguish or control a fire, control or manage smoke and products or a fire or any combination thereof will shall be provided as follows:

a) Portable fire extinguishers shall be provided.
b) An automatic fire sprinkler system shall be provided.
c) A standpipe system shall be provided where floors are located 30 feet above fire department vehicle access.
d) Fire department access will be maintained on building sides and suppression requirements shall be reviewed with the fire department.
e) Smoke resistance shall be provided in doors through fire resistive walls.
f) Manual pull stations shall be provided.
g) Automatic detectors shall be provided.
h) Occupant notification and alarms shall be provided.
i) Systems sequence of operation shall be in compliance with codes.
j) Smoke extraction shall be provided in stairways serving four or more floors.
k) Smoke, fire dampers and detectors shall be provided.
l) Stair pressurization is not required for four stories.
m) High rise building requirements do not apply.
n) Basement requirements for special smoke control do not apply.

F. SPECIAL HAZARDS

Flammable liquids and hazardous materials shall be handled and stored in compliance with applicable codes including but not limited to the following:

a) Hazardous material spill control shall be provided.
b) Hazardous material containment shall be provided.
c) Explosion protection and venting shall be provided.
d) Hazardous material detection systems shall be provided.
e) Hazardous lab ventilation systems shall be provided.
f) Special hazard suppression systems shall be provided.

G. BUILDING SERVICES

All building services shall meet applicable codes as follows:

a) An Emergency generator shall be provided.
b) Elevators shall be in compliance with codes.
c) Accessibility shall be in compliance with codes.

H. Plumbing shall be in compliance with applicable codes.

I. Ventilation and Exhaust shall be in compliance with applicable codes.

J. Electrical work shall be in compliance with applicable codes.

The following code summary is based on current assumptions about the building:

CODE SUMMARY

BUILDING		AHEC SCIENCE BUILDING	
LOCATION		DENVER, CO - AURARIA CAMPUS	
GENERAL		FIVE STORY PLUS PARTIAL BASEMENT FULLY SPRINKLERED 215,000 GROSS SQUARE FEET	

USE AND OCCUPANCY

OCCUPANCY CLASSIFICATION		B OFFICE, EDUCATIONAL ABOVE 12TH GRADE, LABORATORIES; TESTING AND RESEARCH	IBC 304.1, 303.1	
MIXED OCCUPANCIES				
	SEPARATED USES	Each portion of the building shall be individually classified	IBC 302.3.2	
		A-3 : B	1 HOUR	TABLE 302.3.2, IBC 302.3.2 EXCEPTION 1
		Occupancy separation for storage areas in B Occupancy is not required provided storage area is less than 10 percent of floor area		
INCIDENTAL USE AREAS		STORAGE / MECHANICAL ROOMS	IBC TABLE 302.1.1	1 HR SEPARATION OR PROVIDE AUTOMATIC FIRE-EXTINGUISHER SYSTEM

SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

HIGH-RISE BUILDINGS		NOT APPLICABLE			
ATRIUMS					
	USE	ANY APPROVED USED SO LONG AS SPACE IS PROVIDED WITH AUTOMATIC SPRINKLER SYSTEM	IBC 404.2		
	AUTOMATIC SPRINKLER PROTECTION	NOT REQUIRED AT CEILINGS MORE THAN 55 FEET ABOVE FINISHED FLOOR.	IBC 404.3		
	SMOKE CONTROL	REQUIRED	IBC 404.4		
	ENCLOSURE	ATRIUM SHALL BE SEPARATED FROM ADJACENT SPACES BY 1-HOUR FIRE BARRIER WALL	IBC 404.5	**GLASS FORMING A SMOKE CURTAIN IS ACCEPTABLE, SEE EXCEPTION 1**	
	TRAVEL DISTANCE	200 FT	IBC 404.8		
HAZARDOUS MATERIALS					
	CONTROL AREAS	SEPARATE INDIVIDUAL CONTROL AREAS BY 1-HOUR FIRE BARRIER	IBC 414.2,1		
	NUMBER / SEPARATION		TABLE 414.2.2		
		FLOOR LEVEL	MAX ALLOW QUANTITY PERCENTAGE	NUMBER OF CONTROL AREAS	FIRE RESISTANCE RATING
		LEVEL 1	100	4	1 HOUR
		LEVEL 2	75	3	1 HOUR
		LEVEL 3	50	2	1 HOUR
		LEVEL 4	12.5	2	2 HOUR
		LEVEL 5	12.5	2	2 HOUR

HEIGHT AND AREA

CONSTRUCTION TYPE	II-A	IBC TABLE 601	
ALLOWABLE HEIGHT	65 FT + 20 FT = **85 FT**	IBC TABLE 503	20 FT HEIGHT MODIFICATION, IBC 504.2
ALLOWABLE STORIES ABOVE GRADE	5 + 1 = **6 STORIES**	IBC TABLE 503	1 STORY HEIGHT MODIFICATION, IBC 504.2
ACTUAL HEIGHT	82 FT		16 FT FLOO-TO-FLOOR PLUS 3 FT ROOF
ACTUAL NUMBER OF STORIES ABOVE GRADE	5	PLUS BASEMENT AND	
ALLOWABLE AREA PER FLOOR (BASED ON B OCCUPANCY)	131,250 SF	IBC TABLE 503	

AREA MODIFICATIONS

ALLOWABLE AREA PER FLOOR	Aa	131,250 SF
TABULAR AREA	At	37,500 SF
AREA INCREASE DUE TO FRONTAGE	If	50 %
AREA INCREASE DUE TO SPRINKLER	Is	200 %
BUILDING PERIMETER WHICH FRONTS PUBLIC WAY OR OPEN SPACE HAVING 20 FT MIN WIDTH	F	985 FT
PERIMETER OF ENTIRE BUILDING	P	985 FT
WIDTH OF PUBLIC WAY OR OPEN SPACE	W	20 FT

$$A_a = A_t + \left[\frac{A_t I_f}{100}\right] + \left[\frac{A_t I_s}{100}\right]$$

equation 5-1

$$I_f = 100\left[\frac{F}{P} - 0.25\right]\frac{W}{30}$$

equation 5-2

ACTUAL AREAS (GROSS SQUARE FEET)

BASEMENT	25,000	
LEVEL ONE	**45,000**	**largest floor**
LEVEL TWO	40,000	
LEVEL THREE	35,000	
LEVEL FOUR	35,000	
LEVEL FOUR	35,000	
TOTAL	215,000	

FIRE PROTECTION SYSTEMS

SPRINKLER SYSTEM	THROUGHOUT PER NFPA 13	
STANDPIPE	CLASS 1, IBC 905.3.1 EXCEPTION 1	
FIRE PUMP		
GENERATOR		
FIRE ALARM SYSTEM		
SHUNT TRIP		
FIRE EXTINGUISHERS		
AUTOMATIC SPRINKLER SYSTEM INCREASE	YES	IBC 903.3.1.1
STANDPIPES	CLASS 1	IBC 905.3.1 EXCEPTION. 1
PORTABLE FIRE EXTINGUISHERS		IBC 906
FIRE ALARM		IBC 907
SMOKE CONTROL	REQUIRED AT ATRIUM	IBC 909
SMOKE AND HEAT VENTS	NOT REQUIRED	IBC 910

FIRE RESISTANCE RATED CONSTRUCTION

SHAFTS	2 HR	IBC 707.4	
FREIGHT ELEVATOR HOISTWAY	2 HR	IBC 707.4	
PASSANGER ELEVATOR HOISTWAY	1 HR	IBC 707.4	
HOISTWAY VENTILATION	NOT REQUIRED	IBC 3004.1 EXCEPTION 1	
STAIRWAY ENCLOSURES	2 HR	IBC1019.1	
STAIRWAY ROOF ACCESS	ONE STAIR EXTENDS TO THE ROOF		
FLOOR ASSEMBLIES	1 HR	IBC TABLE 601	
ROOF ASSEMBLIES	1 HR	IBC TABLE 601	
STRUCTURAL FRAME	1 HR	IBC TABLE 601	
EXTERIOR LOAD BEARING WALLS	1 HR	IBC TABLE 601	
INTERIOR LOAD BEARING WALLS	1 HR	IBC TABLE 601	
EXTERIOR NONBEARING WALLS AND PARTITIONS	0 HR	IBC TABLE 602	
INTERIOR PARTITIONS	1 HR	IBC TABLE 601	150 300
CORRIDORS	0 HR	IBC TABLE 1016.1	565
EXTERIOR WALLS	0-HR 1-HR	IBC SECTION 704 NON COMBUSTIBLE MATERIALS BETWEEN 20 AND 25 FEET FROM EXISTING SCIENCE	
EXTERIOR WALL OPENINGS	75% MAX AREA OF WALL, 45 MIN OPENING PROTECTION	20 to 25 ft	IBC TABLE 704.8
	UNLIMITED	GREATER THAT 30 FT	IBC TABLE 704.8

MEANS OF EGRESS

OCCUPANT LOAD FACTOR		TABLE 1004.1.2		
	SHOPS AND OTHER VOCATIONAL AREAS	1:50 NET		
	OFFICE	1:100 GROSS		
	STORAGE, MECHANICAL	1:300 GROSS		
OCCUPANT LOAD BY FLOOR	GROSS AREA	OLF	OCCUPANTS	
BASEMENT	25,000	300	**83**	GROSS
LEVEL ONE	45,000			
LABS	20000	50	400	NET
STORAGE/MECHANICAL	1000	300	3	GROSS
OFFICE	5000	100	50	GROSS
TOTAL			**453**	
LEVEL TWO	40,000			
STORAGE/MECHANICAL	4000	300	13	GROSS
LAB	20000	50	400	GROSS
TOTAL			**413**	
LEVEL THREE	35,000			
STORAGE/MECHANICAL	3000	300	10	GROSS
LAB	18000	50	360	GROSS
TOTAL			**370**	
LEVEL FOUR	35,000			
STORAGE/MECHANICAL	3000	300	10	GROSS
LAB	18000	50	360	GROSS
TOTAL			**370**	
LEVEL FIVE	35,000			
STORAGE/MECHANICAL	3000	300	10	GROSS
LAB	18000	50	360	GROSS
TOTAL			**370**	
TOTAL OCCUPANT LOAD			**2060**	
REQUIRED CORRIDOR WIDTH	200 / 2 = 100 OCC PER CORR X 0.15 IN	44 IN	IBC 1016.2	
CORRIDOR FIRE-FIRE RESISTANCE RATING	0 HR	IBC TABLE 1016.1		
REQUIRED STAIR WIDTH	370 / 2 = 185 OCC PER STAIR X 0.2 IN	44 IN	IBC 1009.1	
AREAS OF REFUGE	NOT REQUIRED	IBC 1007.3 EXCEPTION		
EXIT SIGNS	PROVIDED IN COMPLIANCE WITH	IBC 1011		
EXIT ILLUMINATION	PROVIDED IN COMPLIANCE WITH	IBC 1011		
EXIT ACCESS		IBC 1013		
EXIT THROUGH INTERVENING SPACES		IBC 1013.2		
NUMBER OF EXITS FROM ROOM	1 REQUIRED IF OCC LOAD < 50	IBC TABLE 1014.1		
	2 REQUIRED IF OCC LOAD > 50	IBC TABLE 1014.1		
MAXIMUM TRAVEL DISTANCE TO EXIT	300 FT WITH SPRINKLER SYSTEM	IBC TABLE 1015.1		
	200 FT AT ATRIUM	IBC 404.8		
DEAD END CORRIDOR	50 FT	IBC TABLE 1016.3		
EXITS REQUIRED PER FLOOR	2	IBC TABLE 1018.1		

INTERIOR FINISHES

INTERIOR WALL AND CEILING FINISH REQUIREMENTS

VERTICAL EXITS AND PASSAGEWAYS	B, IBC TABLE 803.5
EXIT ACCESS CORRIDORS	C, IBC TABLE 803.5
ROOMS AND ENCLOSED SPACES	C, TABLE 803.5

NFPA 45

PLUMBING COUNT

	OCCUPANT LOAD / 2	MEN	WOMEN	OTHER
BASEMENT	83	1 WC / 1 LAV	1 WC / 1 LAV	1 DF 1 SERVICE SINK
LEVEL ONE	453	6 WC / 5 LAV	6 WC / 5 LAV	5 DF 1 SERVICE SINK
LEVEL TWO	413	6 WC / 5 LAV	6 WC / 5 LAV	5 DF 1 SERVICE SINK
LEVEL THREE	370	5 WC / 4 LAV	5 WC / 4 LAV	4 DF 1 SERVICE SINK
LEVEL FOUR	370	5 WC / 4 LAV	5 WC / 4 LAV	4 DF 1 SERVICE SINK
LEVEL FOUR	370	5 WC / 4 LAV	5 WC / 4 LAV	4 DF 1 SERVICE SINK

IV.6 Equipment Requirements

There are three types of laboratory equipment subject to different budgeting and procurement strategies—Groups I, II, and III as described below. Together with furnishings and other non-lab building equipment, these components make up the building Furniture, Fixtures, and Equipment (FF&E). Some components of FF&E are budgeted with the construction cost and some are carried under an FF&E line item.

Laboratory spaces are filled with equipment and furnishings which are categorized within the construction industry as Group I Equipment. These elements include fixed and movable laboratory casework and benchtops, shelving and cabinets, sinks and faucets, piped service fittings, fume hoods and other exhaust devices, ventilated cabinets, controlled environment rooms, floor mounted autoclaves, glassware washers, and cage and bottle washers. Group I equipment is designed and specified during the design phases and included as part of the construction budget for a new building, and for the Auraria Science Building all Group I equipment is anticipated to be new. Other than the MSCD Non-major Teaching Labs, no existing Group I equipment has been identified as current equipment that will be re-used.

Group II equipment is thought of as “loose” equipment, meaning it is not attached to the building in any way, and includes refrigerators, freezers, incubators, centrifuges, lab stools, and other larger elements. Group II equipment may be identified as part of an FF&E budget for a new building, or as Owner Furnished Owner Installed (OFOI) which would include items currently owned and being relocated to a new building. New and relocated elements will be determined during the design phases, based on the limited FF&E budget and the needs for new Group II equipment defined by laboratory users.

Group III equipment is smaller specialized instrumentation such as microscopes, and teaching tools such as maps or skeletons. Similar to Group II equipment, some of it may be new and included in the FF&E budget, and some will be relocated from existing laboratories subject to clarification during the design phases.

The project budget includes new Group I laboratory equipment in all labs except lightly remodeled spaces for MSCD Non-major Teaching. Budget has been allocated only for 25% of the total projected FF&E need for the entire facility. During the design phases, allocation of the partial budget will be refined based on the needs for new Group II and III lab equipment and essential needs for new furniture. Pending final disposition of the project contingency, monies might be available to replace additional existing FF&E, including movable and built-in furniture. Furnishing and equipment in the existing facility, is in many cases, older than the building itself due to a lack of funds for the original construction. Old wood furniture and outdated laboratory equipment was relocated from downtown Denver when science programs moved to the Auraria campus over three decades ago. Ideally, all furnishings and equipment will be replaced, but the institutions have accepted the risk that some existing furniture will need to be re-used.

IV.7 Acquistion of Real Property

No property will need to be acquired for the Project described herein. The Project entails renovation of a current Auraria building and construction of a new building on Auraria property.

IV.8 Phases of a Larger Project

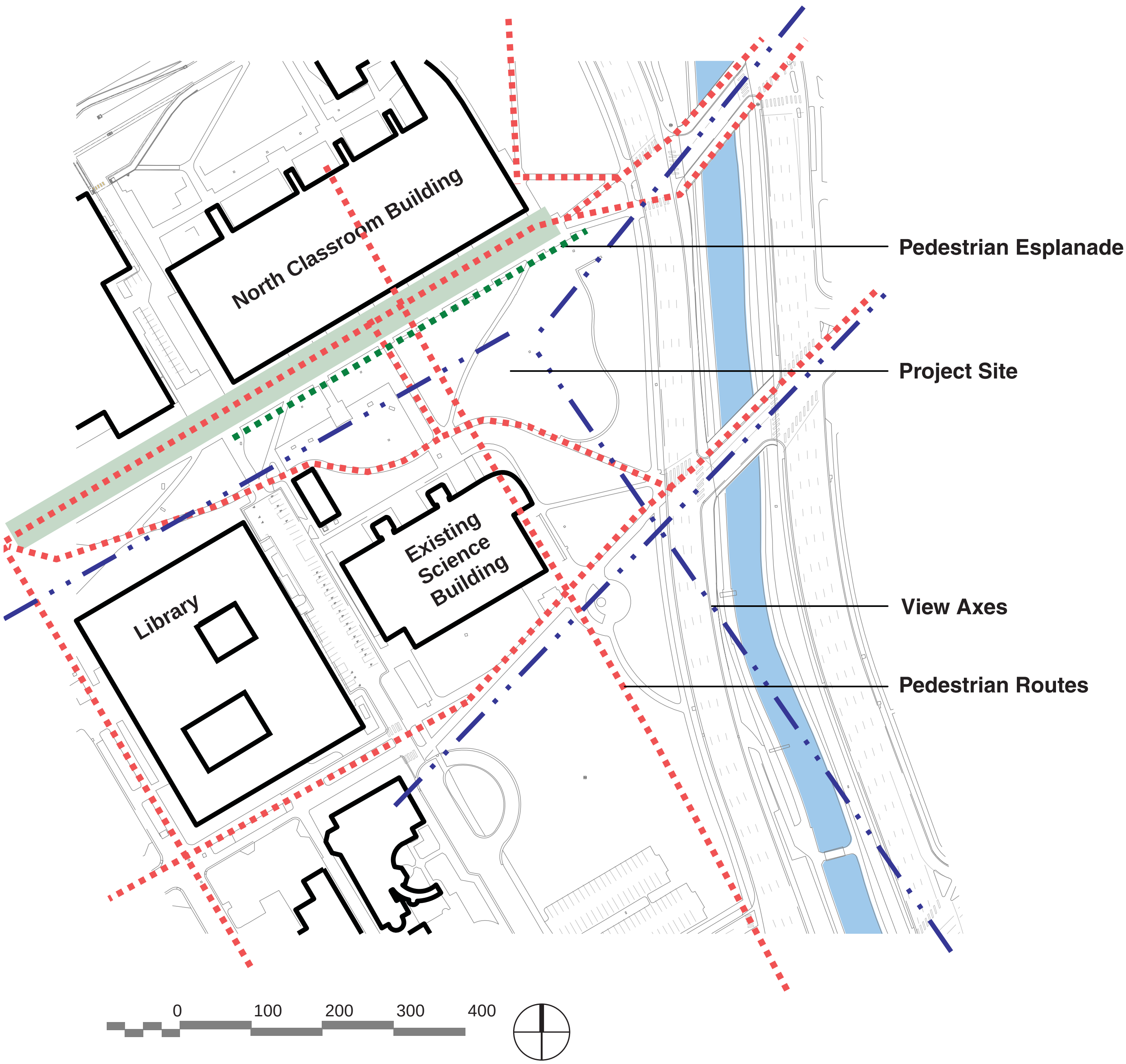
This project will not be designed in phases. However, because of space constraints, it is likely that the new construction will be completed first, followed by the renovation. In this way, occupants of the existing Science building may move into space in the new Addition (even if temporarily) while the existing building is renovated.

IV.9 General Site Description

The Project involves renovation of the existing Science Building and construction of a new Addition to the Science Building. The site site for the Addition is generally the area to the North and East of the existing Science Building. (See Campus Map in Appendix VI.4 for overall view of the Auraria Campus.)

The map below shows some of the known site constraints:

The map below shows some of the urban design influences on the site:



IV.10 Building Mass and Articulation

The most important architectural consideration for the Science building is functionality. A Science building has very specific requirements with types of space, circulation patterns, connectivity, and safety concerns. Especially when designing for three separate institutions with varying functionality concerns, this consideration becomes even more critical.

Appropriate site placement will be critical to the success of the project. This will include how the structure fits into its context and strengthens the overall character of the site. By taking into consideration setbacks, utilities, and Campus Master Plan, the Science Building will naturally become a piece of the Auraria Campus and the downtown area. The location of the Science Building makes it a defining feature of the Auraria campus facing downtown Denver. It must present Auraria sciences as a place of high technology, state of the art research facilities, and innovative learning techniques. The goal is to create this image while respecting the existing campus architecture. The structure needs to complement the campus, yet retain a strong identity as the Auraria Science Building.

Connectivity to the campus also includes outdoor space and entrances of the Science Building. Outdoor space becomes a place for informal gatherings, picnics, quiet study spots, outdoor cafes and vendors, and outdoor classrooms. These places add vitality and life to the campus. The relationship between natural walking paths building entrances is key to how a building will be used and how it will evolve.

The articulation of the interior space is essential to making an effective building. Spaces must be created where interaction can occur between faculty and students, both formal and informal. Flexible learning spaces will allow transformation of the building with changing teaching methodologies and technology.

V.1 Scope of Work and Intended Improvements

To fulfill the vision for the Auraria campus, to accomplish the programmatic missions of its three institutions, to provide facilities that promote a rich scientific education, and allow for cutting edge scientific research, the addition to and renovation of the existing Science Building will contain a variety of state-of-the-art spaces for the sciences. The teaching, research, and support spaces include:

Teaching Laboratories
Research Laboratories
Laboratory Service Areas
Classrooms
Offices
Student Community Spaces
Building Support Areas

The total project size is 221,333 Assignable Square Feet.

Utilizing an efficiency factor of 61.9%, the total size of the project is 357,408 Gross Square Feet.

The project involves the renovation of the existing Science Building (approximately 116,000 square feet), the construction of an addition to the Science Building (approximately 197,000 square feet), and the renovation of approximately 26,000 square feet of "backfill" space.

RENOVATION OF THE EXISTING SCIENCE BUILDING

The Science building will undergo renovations of two types. The first is a renovation of building systems, which is required for continued use of the building. The second is renovation of specific spaces due to change in function or arrangement.

The renovation of building systems will include:

- window replacement (with energy efficient insulated glass units)
- roof replacement
- new exterior doors and frames
- renovated restrooms to meet ADA requirements, and creation of additional restrooms
- stair railing modifications to meet current building code requirements
- elevator upgrades, including a new service elevator
- fire protection sprinkler system throughout the building
- HVAC upgrades

In order to maximize the amount of new space that can be constructed in the addition (due to a fixed construction budget), it is envisioned that many of the existing offices and classrooms in the current building will be re-used, some with minimal remodelling. Depending on the final design, the renovation of specific building spaces might include: new interior walls, lighting, flooring, ceilings, doors and frames.

In general, it is anticipated that most of the offices in the Program, along with classrooms and non-major teaching labs will occupy the renovated building. The tiered classroom in the existing building will remain,

It is envisioned that the Science addition will connect to the existing Science building at all 3 levels. It is anticipated that the addition will be four or five stories tall and will primarily house the research and teaching labs, along with required service and support space and offices for the research labs.

V.2.1 Architectural Narrative

The addition to the Science building presents many opportunities to enhance the Auraria campus and to “connect” with downtown Denver. Since its inception Auraria has turned away from the city, both by actual distance across Speer Boulevard and by the unexpressive architectural face it presented to the city. This Project (by virtue of the site it will occupy) will be highly visible to the city and closer to downtown than any other building on the campus.

The major site influences that will impact the placement of the building are Speer Boulevard and the Lawrence Way pedestrian walkway (which parallels the nearby North Classroom Building). The new building will embody a response to both of these forces. By its location along Lawrence Way (between the current Science Building and the North Classroom Building) the new building has the opportunity to create a pedestrian “gateway” to the campus. Additionally, the site is visible from a number sight lines, and will respond to these by embodying an architectural “marker”, or point of interest. The building will be visible along the Speer axis south of Colfax Avenue, and along Lawrence Street from downtown.

The building will be expressive, both in terms of revealing the character of the spaces within and by revealing activity in the building. The lower level of the building is expected to be highly transparent and inviting. Any building mass along the Lawrence Way pedestrian mall will be sympathetic to the glassy, transparent, active south facade of the North Classroom Building. The building will present a different scale and material detail on a side which faces Speer Boulevard (and is viewed at 40 miles per hour by passing motorists) than it presents to the campus and its pedestrians.

The building will not be constrained by the uniformity of material and “look” of many of the present Auraria buildings, though it will visually relate to them and appear to “belong” to the campus community of buildings. The addition will connect to the current Science building by a building mass that contains a bridge at each floor level and that will serve as an architectural transition between the bland Science Building and the more expressive addition to the Science Building. Because both the current Science building and its addition will house three intermingled institutions and multiple departments and is considered a shared building, it will likely not attempt to display institutional identity or appear as three distinct and joined masses. It is more likely that the building massing will express the functional groupings within its walls: classroom, teaching lab, research lab, and office.

Building entrances will be highly recognizable and inviting. This might be accomplished by use of entrance canopies, vertical elements or distinguishing architectural detailing, transparency and nighttime illumination.

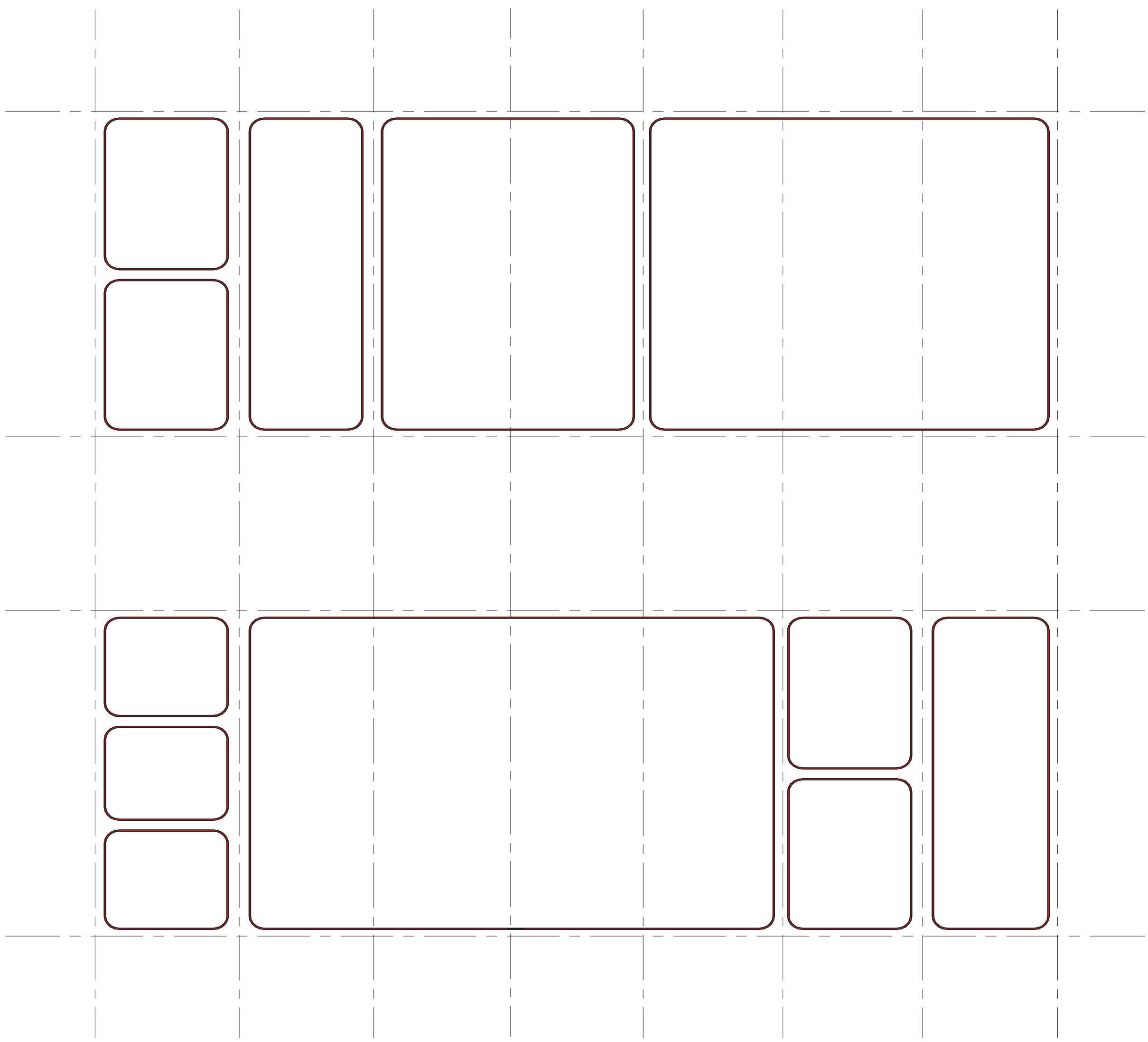
If the budget allows, it would be productive to attempt to remedy some of the shortcomings of the current Science Building. Entrances could be made more visible and inviting. Additional glass (particularly at the ground level) would make the building appear more active. Sunshades over the south windows would reduce cooling loads and soften the impenetrable flat facades that the building currently presents.

V.2.2 Laboratory Narrative

MODULAR PLANNING AND FLEXIBILITY

Laboratories should be organized around modular planning principles so they are constructed with standardized units or dimensions for flexibility and a variety of uses. Modular planning is used as an organizational tool to allocate space within a building. The module establishes a grid by which walls and partitions are located. As modifications are required because of changes in laboratory use, instrumentation, or departmental organization, partitions can be relocated, doors moved, and laboratories expanded into larger laboratory units or contracted into smaller laboratory units without requiring reconstruction of structural or mechanical building elements.

The planning modules may be combined to produce large, open laboratories or subdivided to produce small instrument or special-use laboratories.



The above description of the planning module also allows the organized and systematic delivery of laboratory piped services, HVAC, fume hood exhaust ducts, power and signal cables. If these services are delivered to each laboratory unit in a consistent manner, then changes in laboratory use requiring addition or deletion of services will be easy to accomplish because of the constant nature of the infrastructure.

The proposed laboratory planning module for the Auraria Science Building was derived by analyzing the laboratory bench, equipment, and circulation space required for the building functions, and appropriate aspect ratios for teaching laboratory boards and screens.

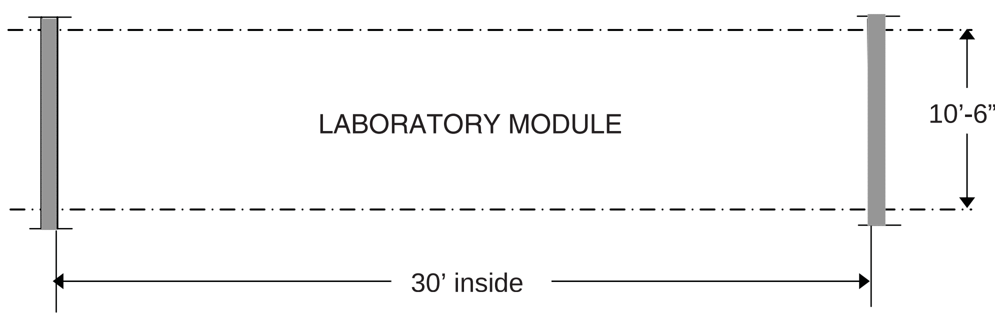
The module is based on the bench space (width and length) required for technical work stations, instruments, and procedures. The space required between benches is designed to allow people to work back-to-back at adjacent benches, to allow for accessibility for disabled and still allow for movement of people and laboratory carts in the aisle.

A planning module approximately 10'-6" wide by 30'-0" deep is recommended for the laboratory spaces. This module will provide adequate bench space plus space for floor standing equipment and fume hoods, and can be divided for smaller support spaces such as equipment and instrument rooms. The recommended module size will be tested against the column spacing and exterior wall locations of the proposed relocation site during the design phases, and may be adjusted accordingly.

Island benches which are 5'-0" deep and wall benches 2'-6" deep are recommended to accommodate the anticipated instruments to be used in the Auraria Science Building.

A 5'-0" minimum aisle between benches will minimize circulation conflicts and reduce potential safety hazards. It is critical in all laboratory spaces that carts be able to maneuver without conflict in all aisles.

The proposed module width will accommodate the above requirements and will provide sufficient space in laboratories when movable computer stations or equipment racks are used near laboratory benches.



CIRCULATION

Effective circulation is an important element in the design of the Auraria Science Building. Materials delivered to the facility will include chemicals, supplies and equipment. In addition to material delivery, the debris and waste generated by the laboratory's functions must be safely removed on a periodic basis.

Internal building circulation should provide safe pedestrian egress from each individual laboratory and laboratory support space through an uncomplicated path of egress to the building exterior at grade. The circulation system should accommodate the preferred adjacencies identified for the relationships between:

Laboratories and laboratory support spaces.
Research laboratories and teaching laboratories
Laboratories and offices.

Other features that should be considered in the design of the circulation system include:

At least one door into each laboratory space should have a minimum 54" wide clear opening. This can be accomplished using openings with 3'-0" active leaf and one 1'-6" inactive leaf.

Equipment lists should be carefully reviewed to verify that individual pieces of equipment can be transported and maneuvered between spaces. Future equipment should be anticipated.

Interior circulation corridors should be a minimum of 6'-0" in width.

Doorways accessing corridors should open into recessed alcoves serving the corridor. The doors should swing out from laboratories, in the direction of exit.

Circulation and fume hood locations within laboratory spaces should be coordinated to preclude exiting in front of the fume hoods.

NOISE CONTROL

Noise control requires specific attention to design and construction details. The following features should be addressed in the design of the mechanical and electrical systems:

Fan noise transmitted to spaces through the duct system or through the building structure. This noise is characterized by a low-frequency rumble and often includes annoying pure tones.

Noise generated by the excitation of duct wall resonance produced by fan noise, by pressure fluctuations caused by fan instability, and by high turbulence caused by discontinuance in the duct system.

Noise generated by air flowing past dampers, turning vanes, terminal device louvers, and comprising mid-to-high frequency energy.

Water circulation system noise caused by high velocities or abrupt pressure changes and is generally transmitted through structural connections.

Noise and vibration caused by out-of-balance forces generated by the operation of fans, pumps, compressors, etc.

Magnetostrictive hum associated with the operation of fluorescent lighting ballasts, transformers, or electric motors.

Elevator equipment noise from motor generators, hoist gear, and counterweight movement; or from hydraulic pump systems.

OTHER DESIGN PRECAUTIONS INCLUDE:

Conduits should not directly link noise-sensitive spaces, nor should they mechanically bridge vibrationally-isolated building elements using a rigid connection.

Flexible conduit must be used for connections to isolated floor slabs, walls, and vibrationally isolated mechanical/electrical devices.

Duct silencers will be considered when duct distance is not sufficient to provide adequate acoustical separation.

Generally, laboratory spaces should satisfy the following preliminary requirements:

Space	Noise Isolation	Noise Criterion
Laboratories	n/a	NC 45
Laboratory Support Room	n/a	NC 45
Imaging Rooms	STC 50	NC 40
Holding Rooms	STC 45	NC 40

These values do not take into account adjacencies that may be incompatible; the design should be evaluated for incompatibilities, and additional mitigation provided, as required.

Noise levels should be less than NC 50 at a distance of 36 inches from fume hoods.

VIBRATION

The nature of teaching and research activity being conducted in the Auraria Science Building requires structural dynamics consideration.

Footfall-induced vibrations on above-grade floors, should be reduced by:

- Confining heavily traveled areas to regions near column lines,
- Placing sensitive equipment near columns,
- Placing the equipment away from heavily traveled areas,
- Minimizing the length of spans.
- Increasing the stiffness of the floor slab alleviates vibration. Providing a combination of mass and/or depth for above grade slabs increases the stiffness.
- Air handling equipment and ductwork shall be designed to minimize vibration. Supply and exhaust air fans, compressors, pumps, and other noise and vibration producing equipment should be located in mechanical rooms with protective wall construction. Equipment should be isolated from supporting structure with resilient mounts. Vibration isolators should be selected based on floor stiffness, span extension, equipment power and operating speed.
- Instruments that are extremely sensitive to vibration (scanning electron microscope or transmission electron microscope, NMR, etc.) should ideally be located on slab-on-grade construction to minimize transient structure-borne vibration. Provisions of an isolated slab should be analyzed.
- Pneumatic and piezoelectric isolations should be used, as required, on specified highly sensitive equipment.

Vibration criteria for areas intended to accommodate sensitive equipment are based on rms Velocity Level as measured in one-third octave bands of frequency over the range of 8-100 Hz. Generic Vibration Criterion (VC) curves have been developed for different types of equipment. The results are shown in Table 1.

Criterion curves VC-A through VC-E are applicable to research facilities. International standards Organization (ISO) criteria for human exposure to vibration are also shown.

It is recommended that the structural floor system be designed to meet the VC-A criterion. The design should follow the AISC Guidelines of Design for Sensitive Equipment.

Seismic stabilization of the structure should be addressed. Natural frequency of floor and building structure should be determined in function of the Seismic Zone of construction site. A minimum building natural frequency of 8Hz is recommended for optimum operation of vibration isolating equipment unless seismic, or other criteria may impose a lower frequency.

NOT OTHERWISE VIBRATION-ISOLATED

Criterion Curve	V_{rms} Velocity Level		Detail Size	Description of Use
	(µin/s)	(dB) Ref:1µin/s	(µm)	
Workshop (ISO)	32,000	90	N/A	Distinctly felt vibration. Appropriate to workshops and non-sensitive areas.
Office (ISO)	16,000	84	N/A	Felt vibration. Appropriate to offices and non-sensitive areas.
Residential Day (ISO)	8,000	78	75	Barely felt vibration. Sleep areas in most instances. Probably adequate for computer equipment, probe test equipment and low-power microscopes (to 20X).
Op.Theatre (ISO)	4,000	72	25	Vibration not felt. Suitable for sensitive sleeping areas. Suitable in most instances for microscopes to l00X and for other equipment of low sensitivity.
VC-A	**2,000**	**66**	**8**	**Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.**
VC-B	1,000	60	3	Optical microscopes to l000X, inspection and lithography equipment (including steppers) to 3 micron-meter line widths.
VC-C	500	54	1	A good standard for most inspection equipment and lithography to 1 micron micron-meter detail size.
VC-D	250	48	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs, SEMs, AFMs) and E-Beam systems, operation to the limits of their capacity.
VC-E	125	42	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems.

Detail Size column expresses the minimum width of fabrication details or size of research particles that could be handled at a specific criterion value.

Table 1 – Generic Vibration Criterion (VC) curve results

HVAC DESIGN PARAMETERS

Safety

The laboratory HVAC system should promote the safe operation of the building and the health and comfort of the occupants. The laboratory environment may contain harmful chemical vapors, particulates and biological aerosols. These hazardous substances must be continuously removed from the breathing zone of the laboratory users. In addition, a safe environment should be maintained around the building.

The HVAC design will be based on regulatory requirements and guidelines along with good engineering practices. Code requirements are a minimum standard.

Primary Containment

The primary containment in laboratory ventilation consists of chemical fume hoods and other ventilated enclosures which operate under negative pressurization with respect to the laboratory. They are designed for preventing personnel exposure to hazardous materials.

Hoods should be located more than 10 feet from any door or doorway, with the exception of secondary exits, and should not be located on a main traffic aisle.

With the view of energy and capital savings, the hood should be normally operated at 18" vertical sash opening. Sash stops shall be provided and the normal operating sash position shall be labeled. The sash will be fully open only during set-up or take-down operations. Horizontal sashes or combination of vertical-horizontal sashes can be used.

All chemical fume hoods should maintain an average face velocity of 100 feet per minute ±10%. The constant volume hoods designed to operate at 18 inch vertical sash opening will develop lower face velocities when the sash is risen above this limit. Under no circumstances shall face velocities drop below 60 fpm. Lower velocities of 60 to 80 feet per minute can be employed in variable air fume hoods by using presence sensors providing adaptive face velocity control. In some applications the average face velocity might exceed 100 feet per minute.

Each fume hood shall be equipped with a flow-measuring device and should be monitored locally to allow convenient confirmation of adequate hood performance. All laboratory fume hoods must be equipped with visual and audible alarms warning of unsafe airflow.

Any fume hood which designated by the Environmental Health and Safety Authority as especially hazardous shall have a dedicated duct, fan, and if required, treatment system. Fume hoods in this category may include radioisotope hoods and perchloric acid hoods, which have not been identified as a requirement for the Auraria Science Building.

The primary containment for the hazardous agents generated by microbiological procedures is provided in biological safety cabinets by negative pressurization and high efficiency HEPA filters. This subject will be detailed in section: "Biosafety".

Secondary Containment

Secondary containment is provided by the negative pressure of the laboratory space relative to corridors and surrounding non-laboratory spaces. To effectively maintain the negative pressure in the laboratory the use of operable windows or doors to the exterior should be avoided. Doors to laboratories should be equipped with closers, must remain closed as much as possible and should not be held open. If the direction of airflow is deemed critical, monitoring devices shall be used to signal or alarm the inadequate pressure relationship of adjacent spaces.

The laboratory spaces will be continuously ventilated 24 hours per day.

Supply air shall be effectively distributed into all portions of the laboratory space by ceiling diffusers or perforated ceiling panels, without creating drafts at exhaust hoods. The maximum supply air velocity in the vicinity of fume hoods and biological safety cabinets shall be 50 feet per minute at 6 feet above the floor.

Air from laboratories and other spaces which might contain hazardous materials shall be exhausted

outdoors and not recirculated.
Air from offices and other clean areas may be recirculated or directed toward negative pressure laboratories.

Other Exhaust Devices

Canopy Hoods - Hoods over work areas or equipment used to capture heat or steam. The recommended design flow rate is 75 cfm per linear foot of open perimeter.

Snorkels: Small capturing cones attached to an adjustable exhaust arm, suspended from the wall or ceiling, to capture heat or fumes from equipment or processes. Typical flow rates are 100-200 cfm.

Vented Cabinets: Vented Cabinets used to store hazardous, corrosive, toxic and other health hazard storage cabinets may be connected to an exhaust system, providing a negative pressurization inside the cabinets. Venting of flammable liquid storage cabinets should be reviewed with the Authority Having Jurisdiction.

Slot Exhaust: Slot exhaust openings are used to draw away locally generated fumes.

Down draft units: Used for benchtop working station exhaust.

Equipment Vent Connections: Exhaust ports will be provided for equipment requiring direct exhaust connection. Some equipment may have a separate exhaust system.

Safety

Emergency and standby power considerations must be carefully analyzed in connection with laboratory systems. Measures involving emergency and standby power should be approved by the Fire Department.

Emergency power supply should be implemented if a definite potential for catastrophe such as explosion, fire, violent ejection of chemicals or other life-threatening situations is present. Fire detection and alarm systems, elevators, fire pumps, public safety, communication and monitoring systems and processes where current interruption would produce serious life safety or health hazard shall be on emergency power.
Standby power should be provided to serve loads such as heating, ventilating and refrigerating systems, smoke removal, sewage disposal systems, lighting systems, data processing, communication systems, and processes that, when stopped, could create a hazard, discomfort, serious interruption, damage to product or process.

Laboratory equipment involving tests and storage of research media under specific environmental conditions should be provided with standby power.

Standby power should be provided to exhaust manifold fans serving laboratory areas.

Specific standby power requirements will be identified in the Design Development phase.

ANIMAL FACILITIES

The American Association for Accreditation of Laboratory Animal Care (AAALAC) is accepted by the National Institutes of Health as an assurance that the animal facilities are in compliance with Public Health Service Policy. To meet these guidelines, several organizational features should be incorporated in the design to ensure separation of species or isolation of individual projects when necessary, to allow the reception, quarantine and isolation of animals, and to provide animal housing.

The Animal Care Facility will be designed to meet the biological needs of all categories of animals, protection, adequate freedom of movement, rest and access to food and water, based on the ILAR guidelines.

Animal Room Construction Features

Walls

Walls should be free of cracks, utility penetrations, or imperfect junctions with doors, ceilings, and corners. Surface materials will be capable of withstanding scrubbing with detergents and disinfectants and of withstanding the impact of 180 degree water under high pressure. Provision should be made for protecting walls from damage by movable equipment.

Ceilings

Ceilings will be smooth, waterproof, and free of imperfect junctions. Surface materials will be capable of withstanding scrubbing with detergents and disinfectants. Furred ceilings of plaster or fireproof plasterboard will be sealed and painted with a washable finish.

Floors

Floors will be smooth, waterproof, non-absorbent, non-slip, wear-resistant, acid and solvent-resistant, not susceptible to the adverse effects of detergents and disinfectants, and capable of supporting racks, equipment, and storage areas without becoming gouged, cracked or pitted. Depending on the functions carried on in specific areas, floor materials will be monolithic or have a minimum of joints.

Corridors

Corridors will be at least 6 feet wide to facilitate the movement of personnel and equipment. Floor-wall junctions will be coved to facilitate cleaning. Provisions will be made for curbs, guardrail, or bumpers to protect the walls from damage. Exposed corners will be protected with durable corner guards.

Doors And Windows

Doors will open into the animal rooms and should be at least 42 inches wide and at least 84 inches high to permit easy passage of racks and equipment. Doors will fit tightly within their frames and both will be completely sealed to provide a barrier to prevent the entrance and harboring of vermin. Self-closing doors are required for containment in rooms where hazardous agents are used. Doors will be provided with spring loaded sweeps to seal when closed. Doors shall be hollow metal or stainless steel, sealed, moisture proof, rust proof, and damage resistant.

The doors shall have recessed hardware and shall be self-closing and self-locking, designed to open from the inside without key.

Viewing windows with slides will not exceed 6” in width or 18” in height.
Exterior windows and skylights shall not be provided in animal rooms.

Cage Wash

This area will be designed for manual cleaning of cages, racks & accessories utilizing a hose-off area and large stainless steel sink, floor drains will be provided. 42” wide doors are required.

Ventilation

The ventilation system must provide adequate environmental quality to ensure the health and well-being of animals necessary to validate the results of experimental studies.

The design tasks of HVAC system are:

- Control of odors
- Control of airborne contaminants
- Prevention of cross contamination
- Temperature/humidity control
- Reliable operation

The animal facility and human occupancy areas should be conditioned by separate air handling units and exhaust systems. Offices and spaces of sole human activity in the animal facilities should be zoned separately from the animal spaces.

30% efficiency prefiltration and 90% final filtration of the supply air will provide a satisfactory quality of animal environment. A positive pressure of the animal facility with respect to the outside environment is recommended.

Ventilation flow rates should result from one of the following criteria:

- Cooling load from animals and equipment,
- Minimum air changes per hour required for each space.

A minimum ventilation of 15 air changes per hour is required in each animal room space for the purpose of odor control.

Supply air should be 100% fresh air in all areas, with no recirculation, provided by a constant volume terminal reheat device. Animal rooms may require

terminal booster humidification.
Supply and exhaust air systems should be sized to minimize noise level.

Controls

The Procedures Rooms, Holding Rooms and Cagewash Room will have individual temperature and humidity control. Other rooms will be zoned.

Piping And Plumbing

The following piped systems will be required for the new facility:

Potable Hot and Cold Water (HW, CW)

Potable water system should be looped through each floor of the building providing services as required by Programmatic Room Diagrams. All fittings shall be fitted with vacuum breakers. Piping should be copper. 140° F water is desirable for cagewashing equipment.

Reverse Osmosis Water (RO)

RO water should be available in the animal facility. The RO water system will meet the requirements of Class III water as defined by the College of American Pathologists. The RO water center should provide purified water for an automated bottle-filling station and for the animal watering system. No deionization should be used prior to or after RO treatment. The water source for RO center should be the pretreated facility potable water.

The RO system should include stainless steel pump, RO cartridges, flow block and control package for a fully automatic operation and interface with external equipment.

RO water will be held in a storage tank appropriately sized to meet the animals' drinking requirements as well as temporary interruptions of water supply.

RO water piping will be designed as a recirculating system. Water will be pumped in a closed loop and single line branches for automatic watering system in each Animal Room and Holding Room. Piping should be CPVC.

Sanitary Waste

Sanitary waste system should be cast iron.

Floor drains may not be essential in all animal rooms, particularly those housing rodent species. Floors in such rooms can be maintained satisfactorily by wet vacuuming or by sweeping and mopping with appropriate disinfectants or cleaning compounds.

If provided, floor drains should be at least 6 inches in diameter and will be primed. Floors will be sloped. The recommended minimal pitch of floors is 0.25 inches/yard. All drainpipes should have shorts runs to the main or be steeply pitched from the opening. When drains are not in use, they should be capped and sealed to prevent backflow of sewer gases. Lockable drain covers are advisable to prevent the use of drains for disposal of materials that should be swept up and removed by other means. Drains should have removable strainers for disposal of solid waste.

Power And Lighting

Each animal room should be supplied by a separate power panel located in corridor. Power distribution within the new facility should be conduit and wire from a main distribution panel to the room panel.

The electrical system should provide appropriate lighting, sufficient power outlets, and safety lighting. All outlets shall be standard type with waterproof covers to allow for cleaning. Light fixtures shall be sealed water tight units.

Standby Power

Standby power should be provided for HVAC system so that operation can be continued, even at reduced capacity, in event of failure of the primary system. Standby power should be provided by a generator sized to maintain operation of Animal Holding Room lighting, air supply, air exhaust, animal watering system and data gathering system. The capacity of the generator fuel supply should be discussed with Animal facility Director.

Emergency Power

Lighting and alarms associated with the life safety requirements will be provided with emergency power by a local generator.

Noise And Vibration

Excessive levels of noise and vibration could affect both human and animal activities.

Animal Cubicle Rooms and Holding Rooms should be located away from building sources of noise or vibration such as elevators or mechanical rooms. Cage washing and refuse disposal should be carried out in rooms separated from those for animal housing.

Magnetostrictive hum associated with the operation of fluorescent lighting ballasts, transformers or electric motors should be minimized.

Environmental Monitoring And Control System

An environmental monitoring system should be implemented providing the following minimal services:

- Temperature, humidity, lighting and air flow monitoring.
- Lighting control.
- Electric door locks control.
- Alarm notification to a central computer, telephone sets, system printer and visual and audible remote locations.
- Telephone communications linked to the building phone system.

Preferably, the environmental monitoring system is independent of the Building Management System (BMS). A BMS is designed to monitor and control the HVAC for the entire building and typically is not a true source of data or regulatory compliance. A vivarium environmental monitoring system is designed to collect data and provide alarm notification for specific environmental inputs. A vivarium system requires monitoring for each room. The data must be easily and readily accessed by animal care personnel, and have the ability to produce standard reports to satisfy regulatory requirements, and for the use of the investigators in the facility.

ANIMAL CUBICLE ROOMS

Ventilation

The cubicles will operate under negative pressure with respect to the aisle. Changing to positive pressure in the cubicles shall be possible by adjusting the air balance between cubicles and aisle, without changing the air flow of the terminal reheat box or the exhaust fan.

A higher quality microclimate separating selected small animals from the animal room or cubicle and the research personnel from animals, will be achieved in two ways:

Microisolator systems consisting of closed cages individually supplied with HEPA filtered air. Cages are provided with filter top frame and can optionally be connected to an exhaust unit.

Ventilated animal racks in which HEPA filtered air is distributed over cages. Exhaust air is released inside the room or into the room exhaust system.

Ventilation flow rates must remove sensible and latent heat from the animals as well as heat generated by electrical equipment. The species of animals, the animal weight and animal room population must be considered.

Recommended dry bulb temperature in animal holding rooms is 65° F to 79° F at a relative humidity of 40% to 70%

Recommended temperature difference between supply and return air temperature in cubicles is 7°F.

A minimum ventilation rate of 15 changes per hour is required for the purpose of odor control.

Supplied air to the room should be 100% fresh air.

Supply air should be provided by a constant volume supply air duct and terminal reheat device with terminal booster humidification serving each cubicle room.

Air distribution in cubicles should not cause drafts on research animals. Ceiling mounted low velocity, low throw, stainless steel diffusers should be used.

The exhaust air grills must be resistant to water and placed at minimum eight inches above the floor to minimize the possibility of contact with water used to clean the floor. Stainless steel grills with thumbscrew fasteners should be provided with minimum 30% efficiency disposable filters mounted behind the grill. Joints around diffusers and grills should be sealed and gasketed.

Exposed duct work should be avoided. Supply and exhaust air systems should be sized to minimize noise level.

Ventilation in the aisle and the changing station area serving cubicles should provide minimum 15 changes per hour 100% fresh air at a positive pressure relationship with surrounding spaces. Supply air from the room reheat device should be provided by stainless steel ceiling diffusers placed in the changing station area. Exhaust stainless steel grills should be placed in the ceiling at the end of the aisle.

Temperature should be controlled by room thermostats placed inside each cubicle on the front wall and in the changing area of the aisle, connected to the reheat coil control valve to maintain dry bulb conditions.

All cubicles and the aisle within a Cubicle Room are served by the same terminal reheat device. Temperatures cannot be varied selectively in each cubicle. The thermostats, identically set, should be connected in parallel to the Cubicle Room reheat coil control valve. The coil operation is therefore controlled by the most critical conditions in the cubicle where they occur. To limit the overcooling of the other under-loaded cubicles, supply air temperature should not be less than 62^{o} F in animal cubicle rooms.

As an alternative, in very stringent cases, the temperature could be separately controlled in each cubicle and aisle. In this case each cubicle should be served by separate reheat coil.

Each cubicle room should have individual humidification control. A room humidistat in the animal room aisle, should maintain the relative humidity of the space by modulating the control valve of the individual room humidifier placed in supply air duct, downstream of the reheat device. The humidistat and aisle thermostat should have the same location.

Piping And Plumbing

The following piped systems will be required for animal cubicle room:

- Potable Hot and Cold Water (HW, CW). Each animal cubicle room should be provided with a scrub sink supplied with hot and cold water. The sink should be stainless steel, sealed to the wall with no exposed pipes or case work underneath.
  Each animal cubicle room will contain a hose bib with hot and cold water. All fittings shall be fitted with vacuum breakers.

- Reverse Osmosis Water (RO). A single line branch will be connected from RO distribution system for each Animal Room for automatic watering system .

Power And Lighting

Two 120-Volt waterproof duplex receptacles and two stand-by power duplex receptacles should be mounted in each cubicle on the side wall 60 inches off the floor.

All outlets shall be 120 Volt with waterproof covers to allow for cleaning of the room.
Light will be uniformly distributed in each cubicle. Ceiling light fixtures of fluorescent, diffuse type, should be recessed mounted, triple gasketed and sealed water tight.

Lighting will provide a two-stage light intensity. The lower light intensity of 30 foot candles three feet off the floor is adequate for routine animal housing. The higher intensity of 60 foot candles three feet off the floor would be utilized while observing the animals or servicing the room. Light timing capabilities shall be provided by the environmental control system, allowing programming of various light cycles. A 30 minutes override switch shall be provided.

ANIMAL HOLDING ROOMS

Ventilation

Holding rooms should be designed to provide either positive or negative pressure relative to the corridor. The air flow rate will not change regardless of the balance inside the holding room. The minimum supply air required for each room should be ensured regardless the balance.

A higher quality microclimate separating selected small animals from the animal room or cubicle and the research personnel from animals, will be achieved in two ways:

- Microisolator systems consisting of closed cages individually supplied with HEPA filtered air. Cages are provided with filter top frame and can optionally be connected to an exhaust unit.

- Ventilated animal racks in which HEPA filtered air is distributed over cages. Exhaust air is released inside the room or into the room exhaust system.

Ventilation flow rates for the total air flow must remove sensible and latent heat from the animals as well as heat generated by electrical equipment. The species of animals, their weight and animal room population must be considered.

Recommended dry bulb temperature in animal holding rooms is 65° F to 79° F at a relative humidity of 40% to 70%

Temperature difference between supply and return air temperature in cubicles should be maintained below 7° F.

A minimum ventilation rate of 15 changes per hour is required for the purpose of odor control.

Supplied air to the room should be 100% fresh air.

Supply air should by provided by a constant volume supply air duct and terminal reheat device with terminal booster humidification serving each holding room.

Air distribution should not cause drafts on research animals. Ceiling mounted, low velocity, low throw, stainless steel diffusers should be used.

The exhaust air grills must be resistant to water and placed at minimum eight inches above the floor to minimize the possibility of contact with water used to clean the floor. Stainless steel grills with thumbscrew fasteners should be provided with minimum 30% efficiency disposable filters mounted behind the grill. Joints around diffusers and grills should be sealed and gasketed.

Exposed duct work should be avoided. Supply and exhaust air systems should be sized to minimize noise level.

Temperature should be controlled by a room thermostat placed inside the animal holding room and connected to the reheat coil control valve to maintain dry bulb conditions.

Supply air temperature should not be lower than 62°F.   A room humidistat should provide a minimum relative humidity of the space by modulating the control valve of the individual room humidifier placed in supply air duct, downstream of the reheat device. The humidistat and thermostat should have the same location.

Piping And Plumbing

The following laboratory piped systems will be required for the new facility:

- Potable Hot and Cold Water (HW, CW).
  Each animal room should be provided with a scrub sink supplied with hot and cold water. The sink should be stainless steel, sealed to the wall with no exposed pipes or case work underneath.
  Each animal room will contain a hose bib with hot and cold water. All fittings shall be fitted with vacuum breakers

- Reverse Osmosis Water (RO). A single line branch will be connected from RO distribution system for each Animal Room for automatic watering system.

Power And Lighting

Two 120-Volt duplex receptacles per each cage rack should be mounted in each room on the side wall at least 60 inches off the floor. One standby receptacle should be provided for each cage rack in the cubicles.

All outlets shall be standard type with waterproof covers to allow for cleaning.

Light will be uniformly distributed in each room. Ceiling light fixtures of fluorescent, diffuse type, should be recessed mounted, triple gasketed and sealed water tight.

Lighting will provide a two-stage light intensity. The lower light intensity of 30 foot candles three feet off the floor is adequate for routine animal housing. The higher intensity of 60 foot candles three feet off the floor would be utilized while observing the animals or servicing the room. Light timing capabilities shall be provided by the environmental control system, allowing programming of various light cycles. A 30 minutes override switch shall be provided.

BIOLOGICAL SAFETY CABINETS

Biosafety Barriers

Primary and secondary biological barriers should be used to reduce or eliminate exposure of laboratory environment and the outside environment to potentially hazardous agents. Primary Barriers protect the personnel and the laboratory environment from exposure to infectious agents. Only laboratory equipment is discussed in this biosafety level analysis. Secondary Barriers represent facility design criteria providing protection for persons working inside and outside of the laboratory within the facility and for persons and animals in the outside environment from infectious agents which may be accidentally released from the laboratory. The combinations of primary and secondary barriers will be described for Biosafety Levels Two, Three and Four.

In all instances, the U.S. Department of Health and Human Services Publication number (CDC) 93-8395 “Biosafety in Microbiological and Biomedical Laboratories”, 4th edition, May 1999, shall prevail in specifying and defining safety equipment, primary barriers, and architectural or laboratory facility secondary barriers.

BIOSAFETY LEVEL TWO

Biosafety Level Two is suitable for work involving agents of moderate potential hazard.

Primary Barriers

Biological safety cabinets, Class II, are required for procedures with a potential for creating infectious aerosols or splashes and those where high concentration or large volumes of infectious agents are used.

Secondary Barriers

Laboratory sink for handwashing.

Autoclave or other decontamination methods should be available.

Bench tops impervious to water and resistant to acids, alkalis, organic solvents and moderate heat.

Sturdy laboratory furniture, with easily cleaned surfaces.

An eyewash facility should be readily available.

The HVAC criteria includes:

100% outside air system.

10 to 15 changes per hour.

Directional air flow into the laboratory rooms.

PURIFIED WATER SYSTEMS

A Central Purified Water System will be designed to satisfy the present and future laboratory requirements. Initial cost, operating cost, environmental consideration, minimization of chemical use, reliability, and constructability will be considered.

The level of water purity, defined by regulatory agencies as "Type", will be selected based on laboratory users requirements. The minimum water specifications for reagent types of water are shown below:.

REAGENT WATER SPECIFICATIONS

	CAP Type College of American Pathologists			**NCCLS Type** Nat. Committee for Cllinical Lab. Standards			**ASTM Type** American Society of Testing and Materials			
	I	**II**	**III**	**I**	**II**	**III**	**I**	**II**	**III**	**IV**
Specific Resistance (megohms.cm)	**10**	**2**	**0.1**	**10**	**1**	**0.1**	**16.6**	**1**	**1**	**0.2**
Silicate (mg/l)	**0.05**	**0.1**	**0.1**	**0.05**	**0.1**	**0.1**	**-**	**-**	**-**	**-**
pH	**-**	**-**	**5 to 8**	**-**	**-**	**5 to 8**	**-**	**-**	**6.2 to 7.5**	**5 to 8**
Bacterial Growth (cfu/ml)	**10**	**10,000**	**-**	**10**	**1,000**	**-**	**-**	**-**	**-**	**-**
Heavy Metals (mg/l)	**0.01**	**0.01**	**0.01**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Carbon Dioxide (mg/l)	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ammonia (mg/l)	**0.1**	**0.1**	**0.1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Sodium (mg/l)	**0.1**	**0.1**	**0.1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Particulate Matter (micron)	**0.2***	**-**	**-**	**0.2***	**-**	**-**	**-**	**-**	**-**	**-**

cfu/ml - colony forming units per milliliter.
* 0.2 micron = Less than 500 particles of this size, or smaller, per liter.

Type II water will be required in the Auraria Science Building.

Purified water which meets the requirements of most routine clinical laboratory methods in chemistry, immunology, hematology, etc. It is the type of water used in reagent preparation and glassware rinsing. When lower bacterial growth is required the water will be specified as Type II NCCLS.

WATER PURIFICATION METHODS

The basic methods used for water purification are:

Reverse osmosis, producing RO water.
Distillation, producing distilled water.
Deionization, producing deionized water.

A combination of these methods and additional purification processes is necessary to meet levels required by Type I water.

Removal effectiveness of water contaminants by each available water purification technology is shown in the Table below:

EFFECTIVENESS OF WATER PURIFICATION METHODS	Reverse Osmosis	Distillation	Deionization	Screen Filtration	Depth Filtration	Ultrafiltration	Adsorption	UV Oxidation
Dissolved Ionized Solids	G	E/G	E	P	P	P	P	P
Dissolved Ionized Gases	P	P	E	P	P	P	P	P
Dissolved Organics	G	G	P	P	P	G	E	G
Particulates	E	E	P	E	E	E	P	P
Bacteria	E	E	P	E	P	E	P	G
Pyrogens	E	E	P	P	P	E	P	P
E= Excellent G= Good P= Poor								

SYSTEM DESIGN

Reverse osmosis, RO, water will be provided to Auraria Science Building and stored in a storage tank with highly retentive hydrophobic vent filter or inert gas or nitrogen blanket. The tank content will be recirculated in the building distribution loop through DI water unit.

DEIONIZED WATER UNIT will remove the remaining ionic impurities downstream of RO unit. Continuous electrical regeneration of the DI resin is recommended to eliminate the needs for chemical regeneration, producing continuous deionization on CDI.

Additional equipment can be included such as:

BIOCIDE INJECTION, SODIUM METABISULFITE ($Na_2S_2O_5$) injection, ULTRAVIOLET FILTRATION and FINAL FILTRATION.

SANITIZING EQUIPMENT is mandatory in purified water systems in order to control microbiological contamination.

Ozone batch sanitization will be used.

A logic controller will be used to control, monitor and record major parameters. As a minimum, water quality and water flow rates should be connected to an alarm system.

PIPING DISTRIBUTION SYSTEM

The building distribution system should be designed as a continuous loop without dead legs. The system will be run to each point of use. Connections to the faucets should be limited to maximum 6 pipe diameters.

Velocities through distribution system should be minimum 4Mg pressure in purified water system should not exceed 60 psi feet per second.

Selection of piping materials for purified water systems is critical, involving water quality and cost criteria.

PP - Unpigmented Polypropylene, fused socket weld piping, valves and fittings are recommended as a basic material for purified water systems.

V.2.3 Information Technology Narrative

OVERVIEW

This narrative provides an overview of the technology systems planned for the new addition as well as the existing facility. This document will begin by providing a general technical overview for each system and component, will then describe the planned systems and components applicable to the primary rooms, components, and spaces, and will conclude by providing Cost Models for both the renovated facility and the new addition.

Technology Systems

'Technology' is a broad term – for the purposes of this document this term will be used to collectively refer to the following system categories: Communications, Audiovisual, Security and Networks. These categories will be further divided into component parts, each of which will be described herein.

The technology systems which will be discussed in this document are listed in Table 1 below. The categories mentioned above – as well as the components which make up each category – are listed within the table. Technology systems other than those shown in the table are either assumed to be outside of the scope of this narrative, are to be provided by others (or the Owner), or are considered to be outside of scope of this project altogether.

The recommendations within this document, when consistently applied, should result in standards-based, non-proprietary technology systems, with ample capacity for future expansion, flexibility, and adaptability.

Project Delivery

Given the multitude of technology systems which could be included in a project of this nature, as well as the varied parties responsible for design, procurement, and construction, it can sometimes be difficult to determine who is responsible for what system, or even if a particular system is to be included. Table 1 below defines the current understanding of the technology systems to be provided, as well as the parties responsible for

	Technology Consultant	Owner	Construction Contract (A/E Design Documents)	Owner	Electrical Contractor	Telecom Contractor	AV Contractor	Owner
Technology Systems	**Design**		**Procurement**		**Construction**			
Communications Infrastructure								
Communications Rooms	•		•			•		
Cabling	•		•			•		
Pathways	•		•		•			
Grounding/Bonding	•		•		•			
Audiovisual								
Cabling	•		•				•	
Pathways (see Comm Infrastructure above)	•		•		•			
Sound Reinforcement	•		•				•	
Video Projection	•		•				•	
Video Display	•		•				•	
Control	•		•				•	
Video Conference	•		•				•	
Security								
Video Surveillance		•1		•1				•1
Access Control		•1		•1				•1
Networks								
Cabling (see Comm Infrastructure above)	•		•			•		
Pathways (see Comm Infrastructure above)	•		•			•		
Data Network Equipment		•		•				•
Wireless Network Equipment		•		•				•
Voice/PBX Equipment		•		•				•

1 *Not in project at this time; will be added as Additive Alternate if funds become avilable*

Table 1 – Responsibility Matrix

design, procurement, and construction of those systems.

For those systems to be procured under the Construction Contract, specifications will be written in the 2004 CSI MasterFormat[tm] standard under Division 27, and drawings will be provided under the T-series of drawings. Some materials and equipment traditionally considered more "Electrical" in nature, such as raceway, will be specified under Division 26 and will be shown on the ET-series of drawings – a set of drawings that will immediately follow the E-series of drawings.

The Owner will be responsible for those systems for which Owner responsibility is indicated in the table. The Owner will also coordinate the design of those systems with the A/E Design Team as needed to ensure that building components (such as power, communications outlets, etc.) necessary for the support of those systems are provided as part of the project.

Communications Infrastructure

The communications infrastructure system – which includes communications rooms, cabling and termination equipment, raceway, and grounding/bonding – provides the communications media system necessary to support various data, voice, CATV, and other low voltage systems and applications.

The communications infrastructure system will be used as the common cabling system for as many other "low voltage" systems as possible – in other words, technology systems which are able to make use of the common infrastructure system provided will be given preference over those that require proprietary cabling.

Unless otherwise noted herein, the communications infrastructure system will be designed and constructed to TIA/EIA and Owner standards (the ACTC Standards Manual – Network Construction Standards for Project Managers, Architects, Contractors and Network Professionals), and will adhere to the principals outlined in the BICSI Telecommunications Distribution Methods Manual (TDMM).

Communications Rooms

Communications rooms primarily consist of Telecommunications Rooms (TRs) and Entrance Facilities (EFs), with some facilities also equipped with Equipment Rooms (ERs) – more commonly known as Server Rooms or Data Centers (depending upon the application). Properly sized, located, and provisioned Communications Rooms are critical to the ability of the facility to grow with and accommodate technology systems as they change over time.

The types, quantities and locations of the communications rooms have not been finalized and will be addressed in the next phase of the project.

Telecommunications Rooms (TRs)

Telecommunications Rooms provide a connection point between backbone and horizontal (outlet) cabling, and house equipment for the data network, voice, and other communications systems such as CATV, alarms, security, access control, and building automation systems. Telecommunications Rooms were formerly known as IDF (Intermediate Distribution Frame) and MDF (Main Distribution Frame) rooms.

Typically, three (3) free-standing equipment racks (9-feet high) will reside within a TR (see Figure 5.2.3a next page), centered within the room, with space for one (1) future equipment racks to be installed. However, this configuration may change depending upon the size of the TR, whether the TR is also serving as an EF or ER, and the size and amount of equipment to be installed within it. Each wall of the TR will be covered with 8ft high backboards. Equipment racks within the TR are typically allocated for horizontal (outlet) cabling, backbone cabling, and equipment (see Figure 5.2.3b next page).

Architectural Considerations: The minimum standard size of a Primary TR is 10ft x 14ft with walls to structure. The standard size of a Secondary TR is 10ft x 12ft. TRs should be rectangular or square (i.e. no more than four wall surfaces) and should be absent of columns (i.e. no columns in corners, along walls, or located elsewhere within the space). Although not advisable, depending upon the density of cabling, the amount and type of equipment to be located within, as well as whether or not equipment will be mounted on the walls, a slightly smaller space may be possible. Conversely, a larger space may be required for TRs which are also serving as EFs or ERs, or will otherwise house significant quantities of equipment.

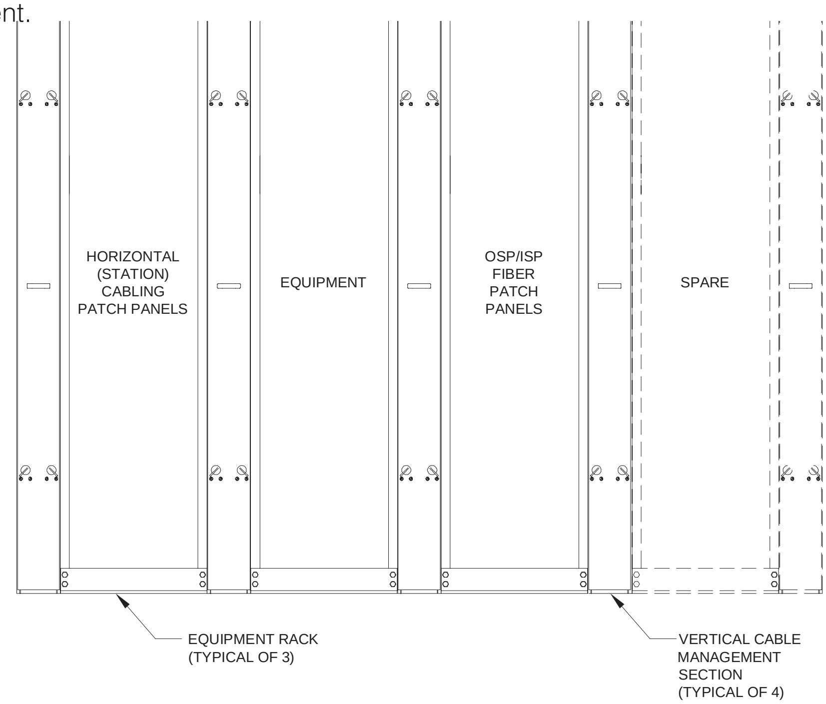


Figure 5.2.3a – Typical Telecommunications Room (TR) Rack Elevation

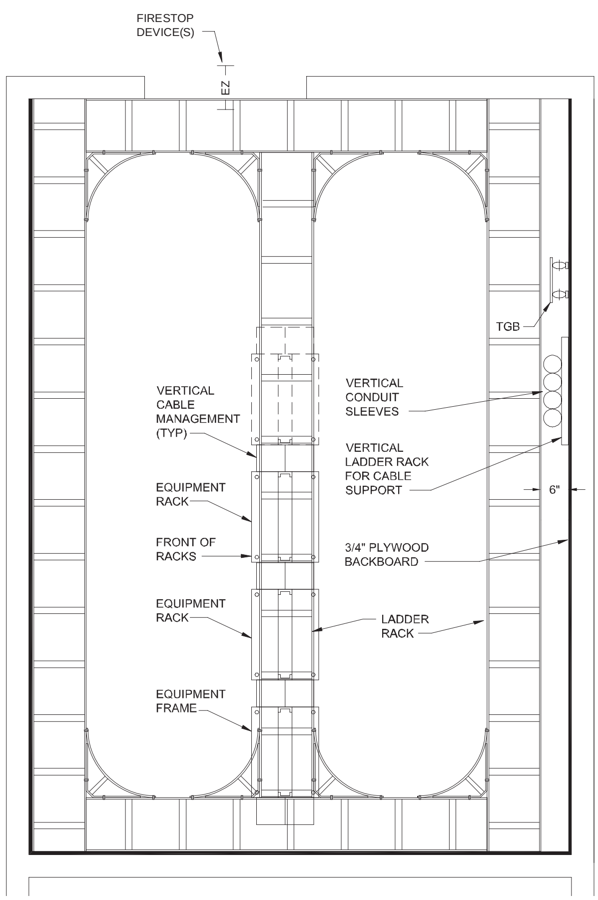


Figure 5.2.3b – Typical Telecommunications Room (TR) Plan

It is preferable to locate TRs in building "core" areas, and in areas more central to the space to be served. Entry into the TRs should be direct from a hallway or a common area – not through another room. Ceiling space within TRs should be left open – false/suspended ceilings are neither required nor desirable. Walls should be to structure. TRs should not be collocated within or otherwise share space with mechanical, electrical, or janitorial spaces, and mechanical ductwork and/or plumbing should not pass through a TR. Ideally, the "long wall" of the TR should not be the same wall as that of an Electrical Room. Doors should swing out of the room (rather than into the room) in order to maximize the use of the space within the room. Fire protection, where required, can be either a wet pipe system or a dry pipe system. If a wet pipe system, wire cages should be installed around sprinkler heads to prevent accidental operation.

In general, a minimum of one Telecommunications Room (TR) will be required on each floor, with each TR serving a radius of (ideally) no more than 180 feet. Within this restriction, a good rule of thumb is to assume one TR per 25,000 square feet, assuming that each TR is generally centered within the area it is to serve. Given this restriction as well as program restrictions which may limit the locations available to place a TR, more than one TR per floor may be required. For multi-floor facilities, TRs should be stacked – this eliminates the costly and difficult to coordinate horizontal raceway which is required between non-stacked TRs, decreases the cost of the backbone cabling system, provides better backbone security, and eases the future maintenance burden on the Owner.

Electrical Considerations: Electrical capacity for a TR shall be sized for the projected load plus future expansion. At a minimum, a TR shall be provided with one or more convenience electrical receptacles for each wall (a minimum of every 6 feet or as required by code, whichever is more stringent), and two dedicated 20A duplex receptacles for each equipment rack. In addition, one or more dedicated 30A receptacles may be required (receptacle types will vary depending upon equipment requirements). Receptacles for the equipment racks will be mounted on unistrut above the racks.

A dedicated electrical service panel will be located within and serve each TR, sized as appropriate to the current and future projected load within the room, but no less than 100A minimum. This panel shall be dedicated for the technology equipment within the room, and shall not be used to power the lights or the convenience receptacles within the room. The panel will preferably be located on the short wall adjacent to the door. If the door is located on a long wall, the service panel should not be located in front of or behind the equipment racks, unless the room is large enough to provide for the clearances required by code.

Provision shall be made for additional circuits and receptacles as necessary for equipment to be mounted on the walls and/or for other equipment to be located within the room. Such equipment could consist of fire alarm panels, door control power supplies, security panels, etc. Provision shall also be made for future electrical capacity within the room. For TRs which are combined with EFs or ERs, additional electrical capacity may be required, depending upon the type and amount of equipment to be housed within the room.

If a building generator and/or building UPS will be provided for the facility, one or more circuits fed from the generator and/or building UPS are to be provided in each TR.

Wall electrical receptacles shall be flush mounted with the backboard – surface mounted electrical receptacles interfere with the mounting of horizontal ladder racking within the room and restrict the surface area available for wall-mounting communications equipment.

Mechanical Considerations: HVAC shall be sized according to the projected load within the room plus future expansion. Positive pressure with a minimum of one air change per hour will be required. Temperature should be maintainable at between 65 and 75 degrees.

Independent environmental control will be required for:

- All TRs which will house equipment with significant power load or heat output potential – such as core routers and switches, Power-over-Ethernet (PoE) switches, computers, and servers.
- All TRs which will house significant quantities of equipment with minor power load or heat output potential – equipment such as non-PoE

switches, door control power supplies, etc.

Independent environmental control will not be required only when the following conditions are met:

- Equipment to be housed within the room will consist only of small quantities of equipment with minor loads or heat output, and any other electronic equipment contained within the room will not add significantly add to the load or heat within the room.
- The room will not be used in the future to house equipment with significant power load or heat output.
- Provisions can be made such that cool, filtered air will be drawn into the room and hot air will be fully exhausted from the room.
- The environment within the room can be maintained at all times within the manufacturer(s) specified environmental operating parameters for optimum operation, for all equipment to be located within the room.
- All equipment to be located within the room is known to not require 24x7 cooling (regular 'building' cooling is not generally 24x7).

Entrance Facility (EF)

The Entrance Facility provides a connection point between the backbone cabling system within the building to backbone and/or Service Provider cabling exterior to the building. Communications conduits from outside the building will be terminated in the EF. The EF may also house Campus and/or other electronic equipment connected to cabling from outside the building.

If the EF is collocated within a TR, additional free-standing equipment racks beyond that specified for the TR may be required. If the EF is separate from the TR, only one or two free-standing equipment racks will be required. Remaining space within the room should be reserved for Campus and/or other equipment connected to cabling from outside the building.

Architectural Considerations: The minimum standard EF size is 10ft x 16ft. If the EF is not collocated within a TR, the EF typically does not need to be larger than a standard TR, and can sometimes be smaller. If collocated within a TR, the size may need to be larger than a normal EF. Other architectural requirements are the same as that specified for Telecommunications Rooms above, with the exception that floor loading requirements for this type of room can be significant and must be planned for.

Electrical and Mechanical Considerations: Electrical and environmental requirements are the same as that specified for Telecommunications Rooms above.

Equipment Room (ER)

The Equipment Room – more commonly known as a Server Room or Data Center – provides a location for housing communications equipment such as servers, storage devices, PBX equipment and head-end equipment for other communications systems.

If the ER is collocated within a TR or EF, additional free-standing equipment racks, 4-post frames, and/or cabinets beyond that specified for the TR or EF may be required.

Architectural, Electrical, and Environmental Considerations: The size of the ER, as well as the electrical and environmental load requirements, will be dependent upon the size and quantity of the equipment to be located within the ER, plus future expansion. Floor loading requirements for this type of room can be significant and must be planned for. Humidity should be maintainable between 30% and 55%.

Communications Infrastructure Considerations: Depending upon the size of the room needed, a communications cabling system within the room may be required. This system is similar in scope and concept to the communications cabling serving the building at large (see Structured Cabling System below), albeit on a much smaller scale. The communications cabling within the room is used for connecting equipment within the room to other equipment in the room.

It is not yet determined if an ER will be required for this project, but if so, the ER will likely be collocated with the EF.

Cabling System

The Cabling System consists of the cabling media upon which most (if not all) common communications signals will be transmitted. The Cabling System will be manufactured by an end-to-end manufacturer (i.e., the same manufacturer manufacturers (or certifies) all cabling (copper and fiber) and the connectors, terminations, and terminating equipment). The contractor installing the system will be required to be a manufacturer-backed and approved installer, able to provide the manufacturer's extended (20-year or 25-year) application, installation and product assurance warranties. The Owner has standardized upon Berk-Tek/Ortronics as the manufacturer for the horizontal copper and Siecor/Corning as the manufacturer for the fiber.

Backbone Cabling: Backbone cabling is used to connect communications rooms to each other within the facility (in a star-topology), and is used in a campus environment to connect facilities together. Backbone cabling for this project will consist of the following:

- Fiber – Fiber backbone cable (single mode and multimode) will be used to distribute digital services. Fiber backbone cable will terminate on patch panels within the communications rooms. The size (fiber counts) of the cables will vary depending upon need. Singlemode fiber with angle-polished connectors will be used for CATV backbone.

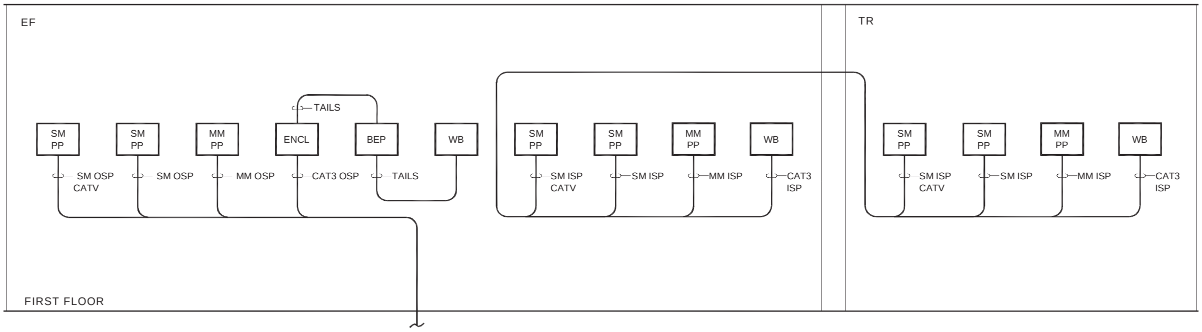
- Multi-Pair Copper – Multi-pair copper backbone cables provide for voice/analog-grade communications. These backbone cables will be terminated on 110-style termination blocks within the TRs and in the EF. The size (pairs) of the cables will vary, depending upon need, but in any case will not be less than 25-pair.

- 4-Pair UTP – The 4-Pair UTP backbone is a minimal system, used for data redundancy. It serves as a backup to the fiber backbone system in those cases where total backbone run lengths are less than 100 meters. The Category rating of the 4-Pair UTP cable will be the same as that specified for the Horizontal Cabling system (see below).

Inside the Building: Inside Plant (ISP) backbone cabling will consist of 24-count multimode and 12-count singlemode fiber, multi-pair copper, and 4-Pair UTP cables described above.

Outside the Building: Outside Plant (OSP) backbone cabling will consist of the multimode and singlemode fiber, and multi-pair copper, cables described above. Fiber cables will be indoor/outdoor rated. Copper cables will be outdoor rated and will transition to indoor rated cables within 50-feet of entry into the building. Building Entrance Protection may be necessary for the copper cables as well.

OSP fiber cable will be 48-count multimode and 96-count singlemode to the Arts Building Room 191, with a redundant 24-count multimode and 48-count singlemode to the North Classroom Building, P1800C (Main Telephone Room). A 100-pair copper cable will also be installed from the Arts Building Room 191 in addition to the copper cable which currently feeds the existing Science Building.



LEGEND

EF	ENTRANCE FACILITY
TR	TELECOMMUNICATIONS ROOM
SMPP	SINGLEMODE PATCH PANEL(S)
MMPP	MULTIMODE PATCH PANEL(S)
ENCL	COPPER SPLICE ENCLOSURE(S)
BEP	BUILDING ENTRANCE PROTECTOR(S)
WB	110-STYLE WIRING BLOCK(S)

Figure 5.2.3c – Typical Backbone Connectivity Diagram

Horizontal Cabling: Horizontal (outlet) Cabling will consist of Category 6 cable from each outlet to the outlet's assigned TR. At this time, all voice cabling will be terminated on 110-style termination blocks on the wall and all data cabling will be terminated on angled patch panels in equipment racks within the TRs. Each CATV cable outlet will consist of Series-6 coax cable. Station cabling will utilize the raceway/pathway system described above. There has been some discussion amongst the various AHEC entities of moving toward a "universal" (no differentiation between voice and data cabling) standard for this project, but at this time no consensus has been reached.

In addition to standard "convenience" outlets located throughout the facility (refer to the rooms and spaces listed at the end of this document for more detail), one two-port outlet will be provided for each wireless access point location, and one one-port outlet will be provided for ceiling mounted projectors. Specialized outlets requiring voice/data support (e.g. Fire Alarm, Elevator, HVAC, wireless access points, etc.) will be coordinated as necessary.

Communications Identification and Administration (Labeling Scheme): An industry standard identification and administration system shall be employed to identify and label communication infrastructure, including passive equipment. Labels shall be unique, machine-generated and permanent. Each component of the communications system (copper and fiber cables, termination hardware, equipment rack/frames/cabinets, etc.) shall have a unique identifying label. The labeling scheme will be coordinated with the Owner during design and prior to installation, and will based upon the Owner's standards (ACTC Standards Manual – Network Construction Standards for Project Managers, Architects, Contractors and Network Professionals).

Pathway System

The communications pathway system consists of conduit, boxes, j-hooks, cable tray, and other raceway required to support communications cabling.

Conduit to Accessible Ceiling Space: The cable pathway serving the communications outlets within the facility will consist primarily of 1-inch (minimum) conduit raceway from the outlet device box to accessible ceiling space, with J-hooks continuing the pathway from the end of the conduit to cable tray, and cable tray continuing the pathway to the Telecommunications Room.

Conduit segments between endpoints/pullboxes will not exceed 100-feet, nor contain more than two 90 degree bends.

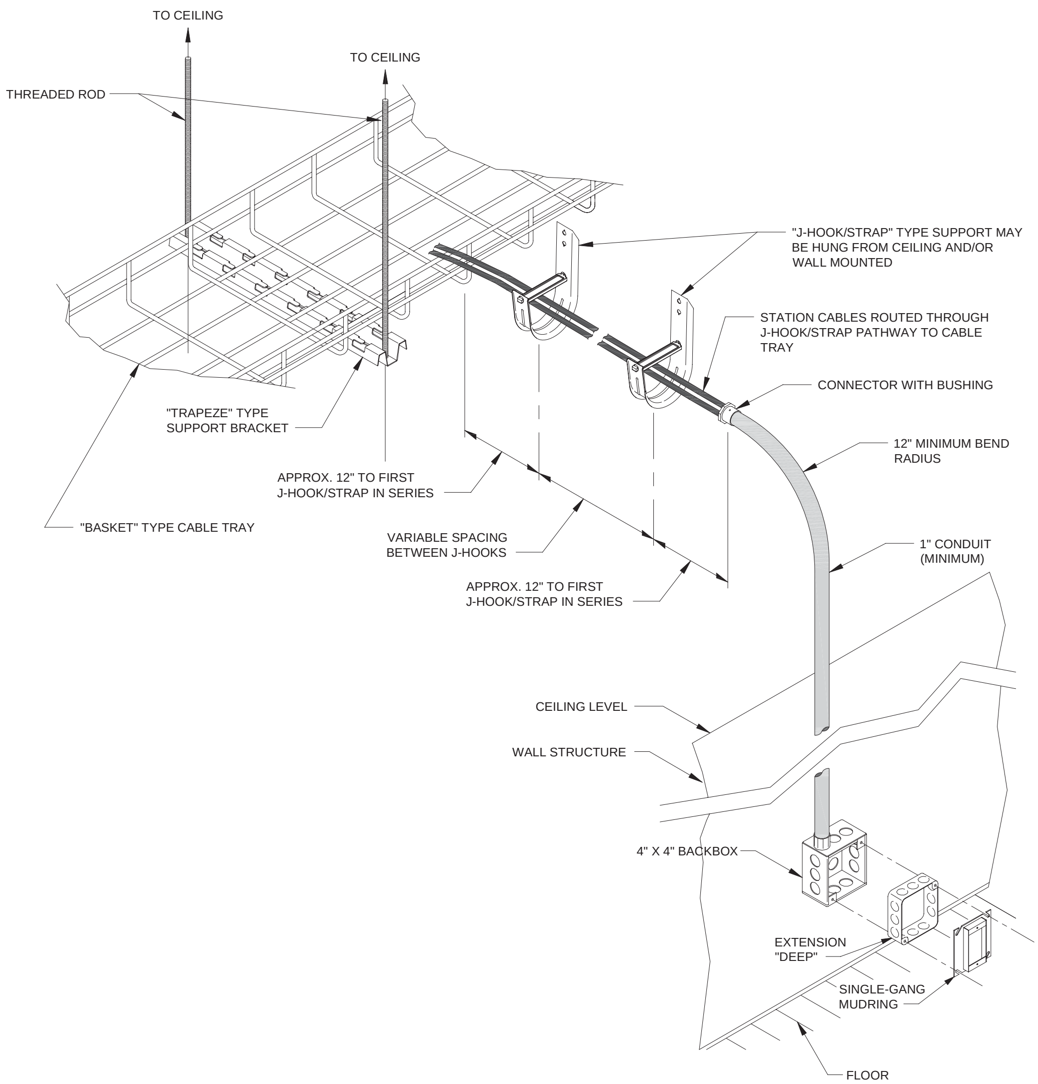


Figure 5.2.3d - Typical Raceway System

Cable Tray: The cable tray system will be the primary raceway serving the communications cabling within the facility. In general, each floor will be equipped with cable tray, and the cable tray will generally be routed in common areas (such as hallways) to facilitate access and maintenance. Cable tray will be "basket-style", which is easier to install and less costly than that of the older "ladder-style" trays of the past.

Where cable tray is required to pass through fire rated barriers, the cable tray will transition to cable pathway firestopping devices through the barrier and back to cable tray on the other side (see the Figure below). The devices will be provided in quantities equal to the volume of the usable volume of the cable tray/conduit which it serves.

Fire Alarm and other "low voltage" systems running on proprietary cabling will not be placed within this cable tray. Such systems will have their own raceway/pathway (which is outside the scope of this narrative) – although, in some cases it is permissible to hang the cabling for these systems beneath the cable tray.

Sleeves: For multi-floor facilities with stacked TRs, a minimum of four 4-inch conduit sleeves will connect the TR to the TR(s) above and/or below. For TRs with a higher concentration of cable, additional sleeves will be required. The EF will be connected to the TRs either through sleeves or through raceway (if the EF is separate from the TR). For the EF the quantity of sleeves and/or raceway is dependent upon the amount of backbone cabling leaving the EF.

If required, one 2-inch conduit will provide a cable path from a TR to the roof for future communications services/equipment (e.g. antenna, etc.).

Cable pathway firestopping devices will be used to provide a code compliant pathway for communications cabling through fire rated barriers.

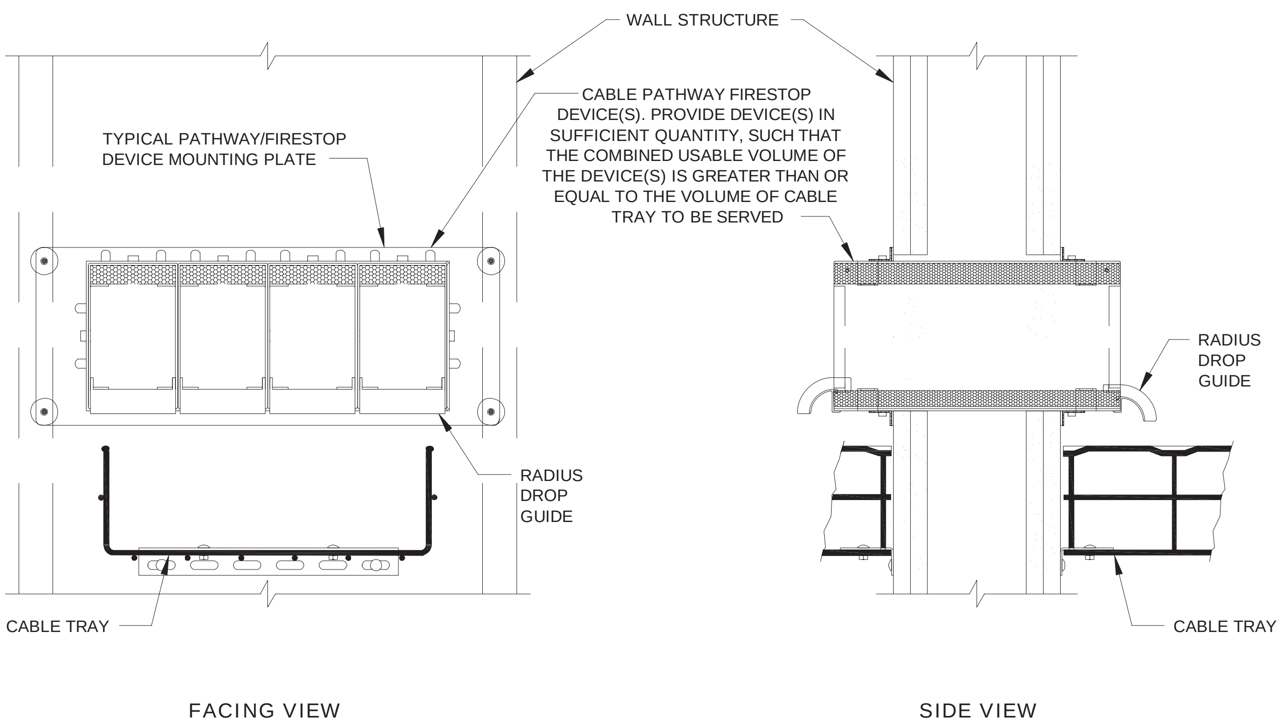


Figure 5.2.3e – Cable Pathway Firestopping Device in a Cable Tray Application

Device Boxes: Outlet devices boxes will be 4-inch x 4-inch, deep-style, with single gang (2-inch x 4-inch) extension rings.

Surface Raceway: Surface raceway (such as Wiremold) will not be used.

Floor Boxes/Poke-Through Devices: The use of floor box and/or poke-through devices will be avoided to the extent possible, but will be provided where no other option is available – these devices will typically share space with power and/or AV. Conduits feeding these devices will be fed underslab (for slab-on-grade installations) or fed from the ceiling space of the floor below.

Outside Plant Ductbank: If required, additional communications conduits from outside the building will be installed and enter the EF to service the existing and new Science facilities. These conduits will be 4-inch conduits (with at least one spare) from an existing communications vault. Underground conduits with potential for damage (dig-ups, shallow depth, below roads, etc.) will be encased in concrete.

Grounding/Bonding System

An industry standard telecommunications grounding system will connect all communications rooms, and the racks and raceway equipment within them, to the building ground. The main communications room will be equipped with a Telecommunications Main Grounding Busbar (TMGB) and the other communications rooms will be equipped with Telecommunications Grounding Busbars (TGBs). The busbars will be interconnected with grounding wire and connected to the building ground.

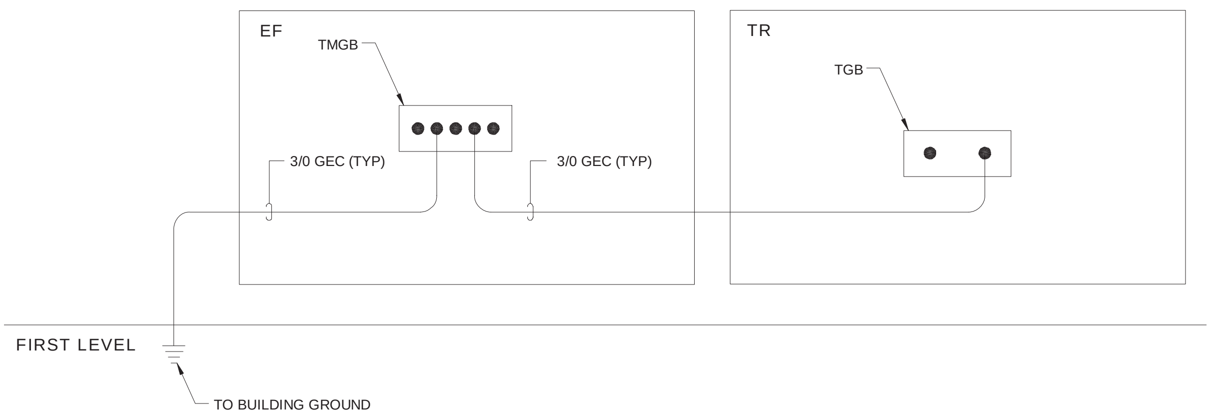


Figure 5.2.3f – Typical Ground/Bonding Riser Diagram

Audiovisual Systems

Audiovisual Systems can include such component systems as Sound Reinforcement, Video Projection, Video Display, Control Systems, and other component systems and equipment. The use of these technologies is very dependent upon the nature of the instruction or presentation, the instructional style of the teacher, training, and ease of use. Different rooms and spaces will require different components with differing degrees of complexity.

Sound Reinforcement System (SRS)

The primary function of the SRS is to distribute a presenter's spoken word to an audience area or to provide sound distribution for a presentation or for video content. The SRS will incorporate ceiling speakers spaced evenly throughout the listening area in order to provide optimal coverage for both speech reinforcement and program material reinforcement. The SRS will utilize a 70 volt transformer ceiling speaker distribution system. The SRS will typically incorporate a volume control, a source selector, and the capability to support multiple audio signal formats. An Assisted Listening System will be incorporated as necessary into the SRS to comply with ADA requirements. The SRS will require an equipment mounting location, power and cable pathway to device locations.

Video Projection System (VPS)

Video projection provides presentation capabilities and reinforcement of video material for a medium to large audience. A VPS consists of a mobile or permanently installed video projector and a projection surface (non-motorized or motorized projection screens, non-reflective white boards, and interactive white boards). A permanently installed VPS will require a ceiling mounted video projector with support hangers (see figure below), a ceiling or wall mounted projection surface (such as a motorized projection screen), an equipment mounting location, power and cable pathway to various device locations.

The placement of installed projectors and the projection surfaces will be coordinated with other room components. Whenever possible, projectors will be placed such that special lenses will not be required. A theft deterrent device will be added to permanently installed projector units. These devices will provide a local audible alarm in the event a projector is removed without authorization.

The VPS will typically incorporate a control switch for a motorized projection screen, a source selector, and the capability to support multiple video formats, such as RGBHV, component, S-video, composite, etc. VPS interfaces will be placed at specific locations within the room to enable source equipment to connect to the VPS. The VPS usually has an integrated Control System to control the multiple devices associated with it.

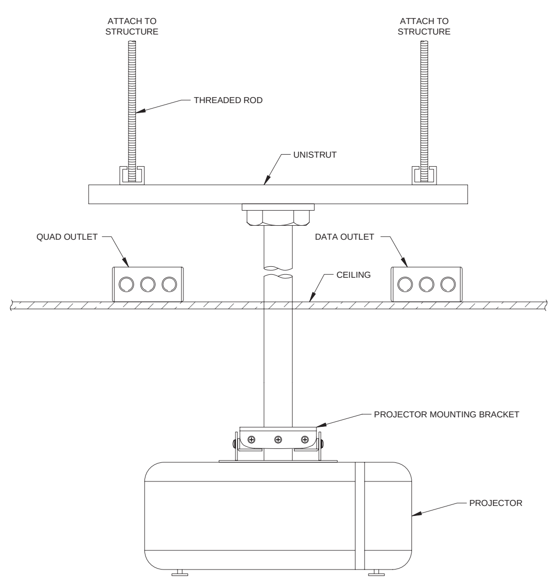


Figure 5.2.3g – Ceiling Mounted Video Projector

Projection Surfaces: Various projection surfaces are available and applicable to varying rooms and spaces:

Non-Motorized Screen: Non-motorized projection screens are typically wall mounted and require manual operation to lower or raise the screen into position.

Motorized Screen: Motorized projection screens are typically recess mounted into the ceiling. They have a remote switch to lower or raise the screen into position. Control of these screens typically integrates into a Control System for automated operation.

Non-Glare Whiteboards: Non-glare whiteboards are increasingly being designed to serve as projection surfaces, in addition to serving as traditional markup surfaces. The use of these white boards promotes ease of use, decreases the technology maintenance burden within the classroom, and provides for a clean and simple aesthetic. However, they are not as bright as a projection screen.

Interactive Whiteboards: Interactive White Boards are equipped with a touch-sensitive display that connects to a computer and a digital projector to show a computer image. The instructor can control computer applications directly from the display, write notes in digital ink and save the work for later use.

Video Display System (VDS)

Video Display Systems provide presentation capabilities and reinforcement of video material to a small audience. A VDS consists of a mobile or permanently installed large format video display device, such as a LCD or Plasma Display. A permanently installed VDS will require a wall mounted video display with structural support, equipment mounting location, power, and cable pathway to various device locations. The placement of installed displays will be coordinated with other room components. The VDS will typically incorporate a source selector and the capability to support multiple video formats, such as RGBHV, component, S-video, composite, etc. The VDS usually has an integrated Control System to control the multiple devices associated with it.

Control Systems (CS)

The Control System enables the user to control equipment such as the AV switcher, the projector, shades (if included in the project), motorized screens, lights, volume levels, source equipment, etc. The CS can range from a fairly simple to a fairly complex piece of equipment, depending upon the functionality desired. The CS will include an equipment mounting location, power, and cable pathway to various device locations. There are two types of Control Systems:

Configurable CS: A Configurable Control System consists of a simplified control interface with hardwired buttons that provide limited functionality for the control of the Audiovisual Systems.

Programmable CS: A Programmable Control System consists of a complex touch screen type interface and control unit that requires extensive software programming. Such a system is usually not easily maintainable by the end user without training.

Video Conferencing Systems (VCS)

Video Conferencing Systems provide conferencing/meeting capabilities via audio, video, and digital means to small audiences separated by great distances. A VCS incorporates a Sound Reinforcement System, a Video Display System, one or more cameras, an audio echo cancellation unit, and a video codec unit. Typically a VCS has an integrated Programmable Control System to control the multiple devices associated with it. A VCS can be mobile or permanently installed.

Mobile VCS: A mobile VCS is housed within a mobile cart that can be move between rooms.

Permanently Installed VCS: A permanently installed VCS is fixed within one room and requires wall mounted video displays with structural supports and an equipment mounting location.

The integration of this equipment within the room is critical: Lighting, equipment placement, the operator control interface, display placement, and the audio system configuration are all crucial to the successful function of a VCS.

Regardless of whether the VCS is mobile or permanently installed, rooms that require VCS functionality must have the communications infrastructure necessary to support it, including cabling, network connectivity, and power.

Distance Learning System (DLS)

DLS capabilities are not planned for this project at this time.

SECURITY SYSTEMS

Access Control System (ACS)

An Access Control System – also known as a "Door Control" System – controls and monitors select doors throughout the facility. It provides for real-time monitoring of entryways, stores entry activity for future retrieval (such as who entered a particular doorway at a given time), and can secure (or open) doors based upon many different variables, such as scheduled building operation (time of day), departmental access verification, or individual access verification.

An ACS is not planned for this project at this time.

Video Surveillance System (VSS)
The primary function of a Video Surveillance System is to monitor events at specified locations using cameras and, if desired, recording those events with video recording/storage devices.

A VSS is not planned for this project at this time.

NETWORKS

Data Network Equipment

The Data Network system will be designed, procured, and installed by the Owner (or a third party under the Owner's direction). The Data Network system will make use of the Communications Infrastructure system described previously in this document – some coordination between the Owner and the Technology Consultant will be desirable in order to ensure that the Communications Infrastructure fully supports the requirements of the Data Network system.

Wireless Network Equipment

The Wireless Network system will be designed, procured, and installed by the Owner (or a third party under the Owner's direction). The Wireless Network system will make use of the Communications Infrastructure system described previously in this document – some coordination between the Owner and the Technology Consultant will be necessary in order to ensure that the Communications Infrastructure fully supports the requirements of the Wireless Network system.

Voice/PBX Equipment

The Voice/PBX system will be designed, procured, and installed by the Owner (or a third party under the Owner's direction). The Voice/PBX system will make use of the Data Network system and the Communications Infrastructure system described previously in this document – some coordination between the Owner and the Technology Consultant will be necessary in order to ensure that the Communications Infrastructure fully supports the requirements of the Voice/PBX system.

TECHNOLOGIES AS APPLIED TO ROOMS AND SPACES

The technology systems and components described previously in this document will be provided for and/or applied to various rooms and spaces within this facility:

Offices

Single occupant offices for each institution will be served with one 4-port outlet which will consist of one port for voice, two ports for data (PC and printer) and one port for fax. Cubicle areas, if present, will each be served with one 4-port outlet. The data network port will be determined by which institution for which the office space is utilized.

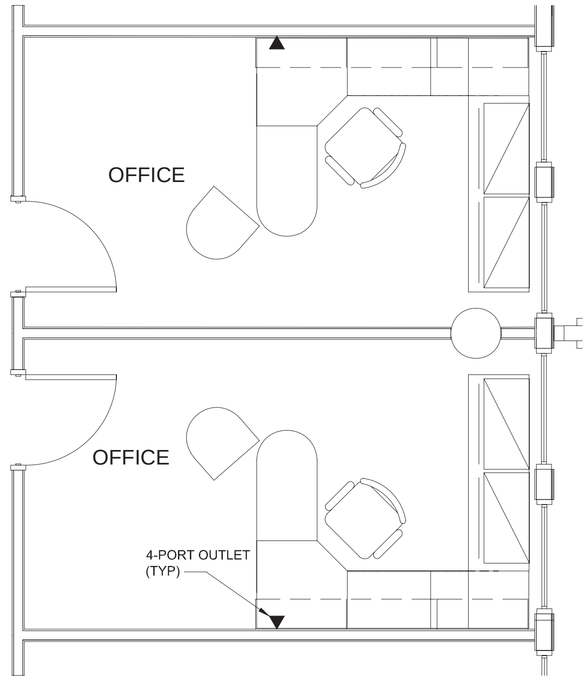


Figure 5.2.3h – Typical Office Outlets

Classrooms

General Classrooms: Classrooms will be served with one CIP outlet. This outlet will be located by the instructor's workstation along with a wall-phone outlet.

AV for general classrooms will include a Video Projection System (with a motorized projection screen), a Sound Reinforcement System (to support the VPS), and a Programmable Control System and various input equipment as required. The AV head-end equipment will be securely mounted within a fixed cabinet outfitted with a rack mounting system.

Lecture Hall: In addition to the above requirements for General Classrooms, a percentage of the fixed seats may be served with one 1-port outlet. Pathway will consist of one or more conduits from a recessed wall mounted access panel stubbed into the furniture, for each row of classroom seating. Conduit size from the furniture to the access panel will vary, depending upon the quantity of communications cables to be routed from each row. Larger conduits (to aggregate the smaller conduits) will exit above the access panel and will terminate in accessible ceiling space.

AV will be the same as that required for General Classrooms above, except the AV systems may be expanded upon to meet special requirements. One such requirement may be the addition of microphone support included as part of the Sound Reinforcement System.

Computer Labs

Computer labs shall have a minimum of one shared (common) data port per workstation location (fed from the wall through the furniture), one CIP outlet and a wall-phone outlet at the instructors' workstation.

AV will be the same as that required for General Classrooms above.

Conference Rooms

Conference Rooms and Group Study Rooms will be served with a minimum of one CIP. This outlet may be on the wall or in a floorbox below the table.

Conference Room AV requirements are expected to vary based upon room types and demands. Some

Conference Rooms may require more extensive AV systems than others, and some Conference Rooms will not need to be equipped with AV systems at all. A typical AV enabled Conference Room will include either a Video Projection System or a Video Display System accompanied by a Sound Reinforcement System. Up to one Conference Room may include a Video Conferencing System.

Laboratories

At a minimum, laboratories will have one CIP outlet and one wall-phone outlet with the room. For those laboratories which will also serve as instructional spaces, a Video Projection System (motorized projection screen), a Sound Reinforcement System (to support the VPS), and a Programmable Control System will be provided.

Dry Labs: In addition to the components listed under "Laboratories" above, these labs will be equipped with 4 to 8 shared (common) data ports per lab table, and/or space for the networking of laboratory computers or instrumental equipment.

Instrumental Labs: In addition to the components listed under "Laboratories" above, these labs will be equipped with 4 to 8 shared (common) data ports per lab table, and/or space for the networking of laboratory computers or instrumental equipment.

Wet Labs – Research: In addition to the components listed under "Laboratories" above, these labs will be equipped with 4 to 8 shared (common) data ports per lab table, and/or space for the networking of laboratory computers or instrumental equipment.

Wet Labs – Teaching: In addition to the components listed under "Laboratories" above, these labs will be equipped with 4 to 8 shared (common) data ports per lab table, and/or space for the networking of laboratory computers or instrumental equipment.

V.2.4 Structural Narrative

The structure proposed for the new building will be structural steel or reinforced concrete. Structural steel framing will likely be 4.5" of normal weight concrete on composite metal deck on composite steel beams and girders. This system achieves a 2 hour fire rating and is generally adequate for vibrations in offices and classrooms caused by people walking. Reinforced Concrete framing will likely be 5" of normal weight concrete on one-way joists or two-way waffle slab. This framing also achieves a 2 hour fire rating. Concrete will use mild reinforcing to increase the flexibility for future renovations.

Live loads will likely be 100 psf not reduced for the slab and floor framing, but reduced for the columns and foundations. Optimum bay sizes in office areas are 30 to 40'. Bay sizes in laboratories will need to be smaller, on the order of 20 to 25', in order to economically achieve the stricter vibration criteria in these spaces. Also, corridors should be placed in a different bay from the laboratories to reduce the vibrations caused by fast walking in the corridors.

Foundations will be drilled piers founded in bedrock to minimize differential settlement with the existing Science Building and to support the significant loads for this multistory building.

Lateral systems will likely be cast-in-place shear walls at the stair and elevator cores supplemented with other shear walls or diagonal bracing where necessary.

V.2.5 Mechanical, Electrical, Plumbing Narrative

EXISTING BUILDING SYSTEM RE-USE CAPABILITIES

Existing Central Chiller Plant Systems

The Central Chiller Plant system appears to be adequate to support the existing building in a Retrofit use scheme. Additional chiller capacity is not available for load additions per conversation with AHEC Facilities Group. The distribution piping is also restricted to the flow presently distributed.

EXISTING CAMPUS HIGH PRESSURE STEAM INFRASTRUCTURE

The present branch piping from the Campus Main is adequately sized to serve a retrofit of the existing Building.

Laboratory Plumbing Systems

1. Acid waste system of multiple vertical risers emanating from underslab "glass" system. This system is routed to an acid neutralization basin preceded by a solids interceptor and then connected to the building sewer. This may be reused for "new labs". The existing acid waste system reuse will need to be confirmed by destructive testing of the piping.
2. Laboratory safety devices of eyewash and shower are existing in the Lab Classroom areas. They are combination shower-eyewash units. A floor drain exists at each location, as required by current Code. Depending on the new usages and layouts, these will be able to be relocated as required. Trap primers to be added to eliminate sewer gas odors.

GENERAL BUILDING PLUMBING SYSTEMS

1. The primary system consists of two (2) restroom groups per floor. These are stacked vertically on all floors. The existing sanitary drainage system may be reused.
2. The roof drain system is internally piped and connects underground to the storm main in the street. The existing storm drainage system may be reused. There are no overflow drains. These will be required when the building is remodeled.
3. The 4-inch domestic water service enters the building in the lower level west mechanical room and has been provided with a new reduced pressure backflow preventor. The existing water service is most likely of adequate capacity and may be reused.
4. Domestic hot water generator is located in the west mechanical room and consists of a storage tank and tube bundle. This system is original to the Building and has exceeded its expected life.

REMODEL OF EXISTING BUILDING HVAC SYSTEMS

1. The existing medium pressure primary air ductwork system may be partially reused. The capacity of the primary air duct system is adequate to support laboratory, classroom or office functions. This assumes that the exterior glazing will be replaced and an upgrade of the perimeter wall and roof insulation condition and thickness. Ductwork will require internal cleaning and all duct joints resealed. Additionally we note that the ductwork has the mechanical room at the North side of the Building, two per floor, as the source of the air delivery. If the Buildings' remodel affects the access to this ductwork on the North side, then the effectiveness

of reusing the ductwork diminishes greatly. Presently, the scheme for the building allows reuse of the mechanical rooms.

2. The existing heating water distribution on the Second and Third Level can be reused. Potentially, the heating water distribution of the First Floor may be reused, but needs to be confirmed by destructive testing of the piping system (i.e. remove a pipe section "coupon" for physical inspection).
3. The existing AHU's will not be reused.
4. Perimeter fin tube radiation will be removed in its entirety. New VAV terminal boxes will include heating coils and will serve as part of the zoning for space temperature and pressure control system heating source.
5. It is the intent of the building reuse to be the office-classroom and "light" Lab functions. We will be using new AHU's located in the same basic locations as presently exists. The Lab functions will be a dedicated unit(s) to allow space pressure control.

Each of the Air Handling Systems will be of the Variable Volume type. We will be investigating the application of "Chilled Beam" systems for the building retrofit for the long-term saving of energy. Total air delivery will be approximately 150,000 CFM (6 AHU's @ 25,000 CFM). This quantity is not based on the Chilled Beam engineering features.

The Air Quality Assurance of this system will be approached by monitoring the CO_2 and other indications by using an integrated "Aircuity" system with the Johnson Control System. The system will optimize the energy requirements and air-side economizer functions.

The use of heating water will be distributed in the building using new variable flow heating pumps. The control valves and sequences will be set up to allow this flow arrangement. High coil temperature differences will be used on the design layout to minimize pipe size and save on pumping energy.

Chilled water in the building will be converted to variable flow also as a "secondary" pumping system. This will primarily serve the AHU coils and "Chilled Beams".

LAB HOOD EXHAUST SYSTEM

This system is being approached as a variable flow system, with heat recovery. The new system coil is a "strobic" type of induction fan system centralized to allow heat recovery. The system will be set up with N+1 redundancy.

This will replace completely the existing Lab exhaust system and makeup air system.

ALTERNATIVES FOR NEW BUILDING HVAC SYSTEMS

Laboratory / Classroom Air Delivery Systems (approx. 198,000 sf)

An important aspect of the new system is to avoid the air re-entrainment of fume hood exhaust into make-up/outdoor intake air. In general the concept will consider fume hood exhaust at the roof of the building configured with equipment that elevates the exhaust air out of the building boundary layer.

In a similar fashion the general exhaust should discharge similarly to the fume hood exhaust. Both of these exhaust streams may be combined into a combined exhaust duct/fan system. The exhaust fans will be designed to elevate the air stream out of the building boundary layer. The exhaust air streams will be provided with some form of heat recovery to allow reduced operating costs for the Life of the Building.

Alternative heat recovery systems that will be reviewed for Life Cycle Costs are: 1) Heat Pipe Coils; 2) Heat Run-A-Round Coils; 3) Heat Wheels. These have individual options, such as evaporative pre-cooling, which will be studied.

Fume Hood Operation is of utmost importance concerning energy efficiency. Whether the fume hoods are constant volume, variable volume or staged On/Off will be most likely determined based on minimum ventilation rates compared to fume hood exhaust rates. Ideally, the hoods being used will be the newest technology "low flow" type. For example, if the laboratory has a large number of hoods, then some form of VAV or staged On/Off may be considered. If the laboratory has a single hood, then constant volume will be considered because the hood exhaust may be equal to the minimum ventilation requirement.

Additionally, we will be investigating the options within these alternatives that would include occupancy "detection" to reduce room air flows and hood exhaust air flows; Off-Hours programming to also reduce air flows. This option would include a timed override function for the users during "Off-Hours".

The basic air handling system will be comprised of some form of a VAV supply system which will respond to building load as well as maintain minimum ventilation rates within the space. These systems will be dedicated systems for laboratory use and classroom use. We believe that these systems should be located with their outside air intakes preferably on an outside wall. The optional separation of outdoor intake and "lab" exhaust could be done by creating an AHU Mechanical Room at grade level or at a significant horizontal separation.

The Air Handling Unit solutions will investigate the use of full air-side economizers; indirect evaporative cooling; direct evaporative cooling; heat recovery "coils"; CO_2 control techniques (such as "Aircuity") for outdoor minimum quantity control.

The total air flow for the Building is anticipated to be 300,000 CFM.

Air filtration will be mindful of current Indoor Air Quality Standards. We anticipate that a 4-inch pleated prefilter (MERV 8) upstream of an 85% extended surface filtration system (MERV 14) will be used in all air handling units.

NEW BUILDING HEATING AND CHILLED WATER SYSTEMS

The heating water systems will use steam-to-heating water exchangers (70% capacity each of two) and central chilled water from the expanded Central Plant.

We propose using a direct HPS to Heating Water Exchanger to optimize operating cost and reduce maintenance, as well as lower first cost.

The steam requirements for the Building are preliminarily estimated to be 7,500-10,000 lb/hr. A separate HPS branch will be routed from the mains on Campus to the Building Mechanical Room. This piping will be a supply pipe only. Condensate does not return to the Xcel System. The piping will be routed through the new Service Corridor.

We will review and determine if heat recovery on the steam system is feasible as the project develops.

The steam will be reduced to building operating pressure for some of the mechanical system uses.

CENTRAL PLANT EXPANSION

To serve the expanded Science Building's 198,000 SF with chilled water, we are planning on expanding the existing Chiller Plant Building. Presently, the two (2) 500 Ton chillers are delivering water to the adjacent three (3) buildings with a constant volume pumping system.

The anticipated load for the new building is 720 Tons.

The expansion of the Plant will include two (2) additional 500 Ton centrifugal chillers. We are exploring alternative types of chillers for efficiency of operation and maintenance simplicity. The chillers will be selected with a maximum of 0.56 kw/Tn and an IPLV of 0.38 max. We will also review the potential of using a Heat Recovery Chiller as a heating source during the low load time of the year. This may offer a further energy savings.

The chilled water pumping system will be an expansion of the existing constant volume primary pumping system. The pumping system will be provided with N+1 backup. To get the chilled water from the Central Plant to the new Building, it will be routed through the proposed service tunnel.

Once the chilled water piping reaches the new building, a secondary set of variable flow pumps will deliver chilled water to the building.

The condenser water for the new chillers will be provided with new cooling towers. Each tower will be sized with 500 Tons of capacity. The cooling towers will be set up as a variable flow condenser water pumping system. And the control system will be set up to reset the condenser water temperature for added chiller efficiency. And the existing plate & frame exchanger will be expanded to maximize the system water-side economizer.

We anticipate the new building expansion to require approximately 2,000 SF.

LABORATORY DESIGN GUIDELINES

HVAC Design Criteria

Laboratory ventilation systems will be designed to be adaptable to changes of research protocols and building operations. The systems must be easily modified so that ventilation can be provided to new sources of hazards as they appear in the laboratory.

Modularity is a key concept to allow adaptable laboratory HVAC system. The HVAC laboratory system should be designed as an assembly of repetitive modules. Each laboratory planning unit will have supply air diffusers, exhaust grilles, supply and exhaust terminal air flow control device, with capability for individual temperature and space pressure control based on each zone. This equipment, ducts, and grilles will be repeatable throughout the building such that all of these components can easily be located.

The laboratory ventilation system shall be flexible, allowing timely and cost effective changes over time without affecting the performance and operation of the building HVAC system. Careful consideration for the future capacity of the HVAC systems and both space and electrical capacity to be considered. Providing capabilities to support additional future fume hoods is part of the flexibility concept.

Note: The operating/comfort conditions for each laboratory space are presented in Detailed Space Requirements sheets.

Ventilation and Supply Air Filtration Requirements

The laboratory space, by nature of the work performed there, must be a relatively clean space in terms of incoming air quality. MERV 8 pre-filters and 85% final filters MERV 14 will be provided on all building air handling units provided conditioned air to the laboratory spaces.

The air flow rate for each laboratory space should result from the following criteria:

- Minimum air changes per hour.
- Laboratory heat gain.
- Exhaust requirements from Fume hoods and other exhaust equipment.

Minimum Air Changes Per Hour

Requirements for ventilation rates for various types of laboratory spaces are defined in Table 1.

Preliminary Heat Gain in Laboratory Spaces

In addition to external heat gain, internal sources of heat often drive the cooling load requirements for laboratory spaces. Occupants, lighting, and equipment are the primary sources of heat gain.

Space Rate	Outside Air		Minimum Air Change Rate
	Minimum	Maximum	AC/ Hr
Laboratory	100%	100%	8
Laboratory Support	100%	100%	8
Office	10%	100%	4
Conference, Lounge	20%	100%	4
Computer server rooms	10%	10%	15
Mechanical Spaces	10%	100%	2

Table 1 - Design Ventilation Rates

Specific heat gain in the laboratory space will be calculated during the Design Development phase. Table 2 provides preliminary typical data for heat gain from laboratory equipment.

Table 2 – Estimated Heat Gain from Laboratory Equipment

Space	BTU/Hr ft^2
Teaching Laboratory	8-10
Research Laboratory	10-20
Laboratory Support	25-50

Exhaust Equipment Requirements

A complete schedule of exhaust equipment will be coordinated during the Design Development phase.

HVAC BASIC SYSTEMS AND CONTROLS

The laboratory HVAC system will be controlled to ensure operational safety, regulatory compliance and satisfy process constraints as well as occupant comfort. A well-controlled system will provide flexibility and minimize the operational cost of the building.

A typical control system should provide the following minimal safety requirements in response to abnormal situations:

- Annunciate the equipment failure to a monitoring center and turn on the existing standby equipment.
- Maintain relative levels of pressurization in the laboratories.
- Stop the air supply to the laboratory, resulting in an increased negative pressurization level in case of fire or smoke detection in the laboratory. The exhaust fans should continue to operate at a level that facilitates a safe evacuation of the building through doors between pressurized spaces. Reducing the level of exhaust to a desired pressurization could be obtained by ramping down the exhaust fans or by activation of bypass dampers on exhaust plenum. Capability of operating doors under fire alarm conditions must be tested and documented as part of the commissioning process.

HVAC control systems will be direct digital control with electronic actuation. Laboratory airflow control can be accomplished by a variety of system types summarized below.

CONSTANT VOLUME - REGULATED

Constant volume - regulated system is the minimum first cost system suitable for the laboratory supply and exhaust air. The constant volume regulators, placed on the supply and exhaust ducts in each laboratory room, must be accurate to ± 10% of design flow and should be pressure independent. They must be specifically designed for laboratory use and have a minimum of five years of installed field operating history. Commercial components are not acceptable.

As a minimum, each fume hood within this system should have a central alarm connection.

The advantage of this system is its simplicity and relatively low cost. The use of constant volume regulators will simplify initial and subsequent air balances of the building. The disadvantages consist of high energy consumption and limited adaptability.

TWO-POSITION CONSTANT VOLUME

The two-position constant volume system provides two levels of operation of laboratory ventilation: one for normal occupancy and the other for unoccupied. Minimum ventilation rates for normal and unoccupied levels of operation are set in each laboratory room. Interlocked, variable speed fans will adjust the air flow to occupied or setback conditions, for both supply and exhaust systems without affecting the fume hood operation.

The system, as a minimum combination of first cost and operating cost, is simple and energy efficient. Energy savings is limited in laboratory buildings with high density of fume hoods, where the minimum airflow rates should continuously satisfy the requirements for safe fume hood operation. Since the mechanical systems should be sized for high peak loads the two-position constant volume approach has no impact on the building capital equipment cost.

VARIABLE AIR VOLUME (VAV)

The variable air volume system controls the supply air and the exhaust flow rates in laboratory spaces to maintain the desired pressurization levels. Each fume hood is controlled to maintain a constant face velocity at any sash opening by varying the hood exhaust air flow. The VAV system provides temperature control according to the thermal conditions in the room and maintains the minimum room ventilation rate at any time. The system is self-balancing and should be integrated into the facility management system. Flexibility and diversity in operation should be applied for sizing the airflow devices.

A higher level of complexity and maintenance and higher capital cost of controls are the disadvantages of variable volume systems. Part of the initial cost of control system is offset by applying system diversity and downsizing the equipment components accordingly.

A considerable amount of energy will be saved by implementing a policy of closing the sashes of fume hoods after operating hours.

HVAC DUCTWORK AND FANS

Supply Air Ductwork

Supply air duct system shall be galvanized steel of minimum 4-inch water gauge pressure class for mains. Branch ducts shall be minimum 2-inch class. Sealing, reinforcing and supporting should be according to SMACNA Standards.

Supply duct lining is not used in laboratory spaces.

Exhaust Air Ductwork

Fume exhaust ducts should be constructed of materials compatible with chemicals to be carried in the air stream. The following materials are available for exhaust ductwork: Galvanized steel, PVC coated galvanized steel, 304 stainless steel, 316 stainless steel, and fiberglass reinforced plastic. Stainless steel Type 316 shall be used for fume hood branches in chemistry areas. The main from organic density area will be stainless steel. Galvanized exhaust ductwork will be used in other areas. Longitudinal sections of exhaust ducts should be continuous seamless tube or continuously welded formed sheet.

Sound absorbing interior lining or other sound absorbing devices will not be used in the exhaust ductwork.

Velocity in fume exhaust duct should range 1,600-2,000 feet per minute.

All fume hood exhaust ductwork shall be under negative pressure.

Exhaust air filtration may be required to reduce the concentrations of contaminants in exhaust discharge.

Balancing and control dampers of the exhaust system shall fail open in event of failure.

Fire dampers shall not be placed in fume exhaust ducts.

Manifolding Exhaust Systems

Exhaust ducts from chemical fume hoods and other special exhaust systems within the same laboratory unit may be combined into an exhaust manifold. A laboratory unit is defined in NFPA 45 and may extend to the area of an entire floor or building. Compatibility of sources, as defined in ANSI/AIHA Z9.5, should be considered in manifolding the fume hood exhaust. A manifold system has the advantage of diluting the effluents inside a combined exhaust system, improving the system flexibility and reducing the initial as well as operating and energy cost.

Exhaust air from each laboratory unit, which may include fume hood and other exhaust systems, shall be separately ducted outside the building, to a mechanical space or shaft.

To further increase fume exhaust dilution, the manifolded fume exhaust systems may be combined into a common laboratory exhaust system, including multiple floor levels.

Exhaust Fans

Fume exhaust fans shall be constructed or coated with materials compatible with chemicals present in the exhausted air. They will be located in a separate room under negative pressure or on the roof in respect to the surrounding spaces and will provide direct access to the outside for fan discharge ducts.

Fume hood exhaust fans of manifolded exhaust systems will have a “N+1” degree of redundancy such that the failure of a single fan does not render the operation of the ventilation system unsafe.

Manifolded fume hood exhaust fans should be provided with standby power.

HVAC BUILDING EXHAUST STACKS AND AIR INTAKE

The fume exhaust stacks must be above the highest point of the building, including mechanical penthouses and roof parapets, to facilitate the removal of hazardous materials and ensure safe dilution levels. The height of the fume exhaust stacks or design of the fan discharge engineering will be carefully determined in conjunction with local codes and regulations. The height of the stacks and their location on the roof are critical to safe building operation and the safety of neighboring sites.

Fume exhaust stacks must be minimum ten feet above the adjacent roof line to avoid exposing the maintenance personnel to the direct upward blast of the fume exhaust.

The discharge velocity from exhaust stacks should be maintained at a minimum of 3,000 feet per minute to counteract any re-intrainment due to varying wind direction or area environmental features. Exhaust stacks should not be located within enclosures or architectural screens. Architectural masking structures may be used as long as the requirements of this section are met and the stack extends at least one diameter above the masking structure.

Recirculation of hazardous fumes from exhaust stacks on the roof to the outside air intakes of building ventilation systems should be prevented. It is recommended that building air intake be located on the lower one-third of the building and high enough above the ground to avoid dust or vehicle exhaust. If located on the roof, air intakes should not be placed near the edges of a wall or roof.

The location of the fume exhaust stacks and the building air intakes should not depend on the prevailing wind directions. More careful risk analysis is desirable to analyze possible cross-contamination as well as the effect of outside wind conditions and surrounding buildings, hills, trees, and other features which cause turbulent flow around the laboratory building. The location and height of the exhaust discharge in relation to the building intakes, the prevailing winds, and the building boundary layer created by the air flow pattern over the building, may need to be studied to minimize any re-entry of exhaust air into this and adjacent buildings. Based on the complexity of the project, the use of specialized techniques such as wind tunnel modeling or numerical simulations may be contracted by the Owner.

HVAC BUILDING MANAGEMENT SYSTEM

The Auraria Science Building will be provided with an expansion of the Johnson Metasys Campus micro-processor based direct digital control building automation/energy management system. This system shall provide energy management controls in all spaces and monitoring of the laboratory controls.

Unsafe levels of operation of the exhaust system should be indicated by local alarms in the rooms affected and should be capable of coupling with a central alarm monitored by building maintenance personnel.

Monitoring of critical parameters of the ventilation system is important for safe operation and effective maintenance and management of the building. HVAC operational parameters of laboratories and other critical spaces, should be recorded, reported, and alarmed.

A high level of control and functionality should be provided by an integrated laboratory and building control system. The monitoring of the complete system should be performed by the centralized facility management system providing graphical displays and analysis tools, centralized alarm reporting, real time status and custom reports, automatic system-wide emergency responses and maximized energy savings.

LABORATORY PIPED SERVICES

Laboratory piped services will be distributed throughout the Auraria Science Building, as required.

The criteria for each service listed below should be considered for these systems:

Industrial Cold Water and Hot Water (IHW, ICW)

An industrial water system will be distributed through each floor of the building. A central reduced pressure backflow prevention device will be provided. Industrial grade water will be provided at laboratory sinks, cupsinks and hoods. All fixtures utilizing industrial water shall have a sign stating "NON-POTABLE WATER".

Potable Cold Water and Hot Water (CW, HW)

A potable water system will be distributed through each floor of the building. A central reduced pressure backflow prevention device will be provided on cold water supply, to protect site mains from backflow from the building. Potable water will be supplied at drench hoses and safety shower/emergency eyewash fixtures. Vacuum breakers shall be provided at each outlet to meet code requirements. In accordance with ANSI Z358.1-1998, delivered flushing water to safety shower/emergency eyewash fixtures shall be tepid; a temperature of 80°F is recommended.

Purified Water (RO, DI)

A Central Purified Water System will be designed to satisfy the present and future laboratory requirements. Initial cost, operating cost, environmental consideration, minimization of chemical use, reliability, and constructability will be considered. Type II CAP or ASTM water resulting from reverse osmosis (RO) and deionization (DI) will meet the requirements of most routine laboratory methods in chemistry as well as in reagent preparation and glassware rinsing. When lower bacterial growth is required the water will be specified as Type II NCCLS. More stringent water purity requirements Type I CAP or ASTM will be provided by local units fed from the central system. The purified water specifications are further detailed in a separate section.

Compressed Air (CA) and Laboratory Compressed Air (LA)

Oil-free instrument grade compressed air (CA) of 100 psig, dried to 2.1 grams of water per pound of dry air (37°F pressure dew-point), will be supplied to the main riser. Floor distribution loops will be 100 psig. Pressure reducing valves at laboratory point of connection above the ceiling, shall provide 15 psig (LA) or other required pressure (CA) at laboratory services.

Laboratory Vacuum System (LV)

Laboratories will be provided with a centralized vacuum system. The system should include duplex vacuum pumps, storage tank(s), controls, and distribution piping providing minimum inch Hg negative pressure at the vacuum service.

Laboratory Vacuum Pump Discharge

The local vacuum pumps should discharge into laboratory exhaust system. The oil ring vacuum pumps should be provided with an oil collector at the lowest end of the vertical pipe. When the discharge from multiple pumps is manifolded, a check valve should be provided on each individual discharge.

Laboratory Gas (LG)

Natural gas will be supplied at low pressure, usually 7-inch of water.

Laboratory Gases (CO_2), (N_2), (O_2), (H_2), (He), (Ar) (If applicable)

Specialty gases will be provided by local gas cylinder stations located in designated spaces. A generic interchangeable piping distribution system may be considered for non-toxic, non-flammable gases.

Laboratory Waste System (LW)

The laboratories will be provided with an acid-resistant drainage system connected to the sanitary sewer outside the building perimeter after dilution levels are achieved. The sinks, cupsinks and piping materials to the floor drops should be of acid resistant materials. Below grade acid-resistant pipes will accommodate minor quantities of acids and solvents in case of an accidental spill. Floor drains will be equipped with automatic trap primers.

The following materials are recommended for piped services:

IHW, ICW, HW, CW, CHWS, CHWR: Copper tube, Type L, with wrought copper fittings and brazed or soldered joints.

LA: Cleaned and capped type L copper-brazed, nitrogen purge.

LV: Copper tube, type L, with solder joints.

Laboratory Vacuum Pump Discharge: Black steel, Copper, PVC or other materials compatible with composition of exhausted chemicals.

RO/DI Water: Unpigmented polypropylene (PP) pipe, valves and fittings with electrofusion joints.

Laboratory Gases: Type L copper pipe, ACR grade, purged and brazed will be the standard material for CO_2, N_2, He, Ar. Stainless steel will be used for H_2 and ultra high purity gases piping.

LG: Black steel with welded and threaded wrought iron fittings as required.

LW, LWV: Laboratory waste and vent: Mechanical joint polypropylene above grade. High silicon iron Duriron/Novacast or Bonstand below grade

Storm and Sanitary Waste: Heavy duty cast iron. No hub.
All piping components subject to sweating, heat loss or freezing will be insulated with appropriate thickness of insulation and fire-retardant jacket. Each laboratory should have easy access to all services and should be isolated to allow any laboratory to be shut down for repair or emergencies without affecting other laboratories. A complete set of laboratory piped services should be stubbed out for each laboratory even though all services may not be initially required in all laboratories. This will increase flexibility and minimize remodel and retrofit costs as laboratory uses change. Each laboratory unit will have separate shut-off valves located in a consistent, accessible manner for emergency shutoff.

BUILDING PLUMBING SYSTEMS

The Plumbing Fixtures will in general be low flow type. Considerations for “ultra-low” flow fixtures are being pursued during the early design phases of the project. We will be reviewing dual-flush level water closets as well as 0.1 gal/flush urinals.

MECHANICAL SYSTEMS OPTION MATRIX

The following matrix is part of the ongoing process to identify and track system and equipment options. The purpose of this process is to review options to allow Optimization of Mechanical Systems along with Cost modeling to test the Budget.

			Advantages	Disadvantages
Topic			**Advantages**	**Disadvantages**
Plumbing				
1.	Ultra Low Flow Urinals - 0.1 gpm (not waterless) - Water savings		Very low wtr consumption; less maintenance than waterless	Higher cost
2.	Low Flow WC's --Water savings, Dual Level flushing		Wtr saving versus standard; low flow(1.1 gpf) on liquids and (1.6gpf) on solid waste	Not as much wtr savings as Ultra-low
3.	Hi-Efficiency Domestic Water Heater			
	a.	No storage - Instantaneous type	Higher efficiency; higher cost than storage	
	b.	HPS (no PRV Station)	Higher efficiency; approx cost wash	
4.	Low Flow Faucets		Wtr savings	
5.	Infrared Actuators		Wtr savings	
6.	Pressure Assisted Low Flow W.C. Fixtures		Smaller pipe sizes; less pressure required; low flow	
HVAC				
7.	Water Meters on Makeup Water		long term water savings; because historical trend data can identify operational issues	
8.	Hi-Efficiency Heating Water Converter			
	a.	Using HPS w/o PRV Station "VACU FLOW"	Highest efficiency; lowest maintenance; cost savings	
9.	Variable Flow Heating Water System; High $\Delta\tau$		Lower pump energy; lower cost; Bldg space savings	
10.	Hi-Efficiency Motors on Pumps (Htg & Clg)		Higher efficiency; low energy; higher cost, Xcel Rebate Prog	Higher Cost
11.	Hi-Efficiency Centrifugal Chillers Low "IPLV"		Higher efficiency; low energy; higher cost, , Xcel Rebate Prog	Higher Cost
12.	Dual Compressor Chillers		Smaller space required versus modular	Possible Added Mech Cost

		Topic	Advantages	Disadvantages
13.	Magnetic Drive Compressors		No contaminate of refrig; lower maintenance, more efficient	Higher Cost
14.	Ice Storage		Off-Peak energy generation saves energy at peak cooling; Xcel rebate program; ; ideal for Central Plant expansion concept;Benefits multiple buildings on campus	Higher Cost
15.	Variable Flow Chilled Water Pumping System - Primary		Higher $\Delta\tau$; smaller pipe size; less cost versus primary – secondary	
16.	AHU's with VFD's		Energy savings versus C.V.	
17.	AHU Fans w/wheels trimmed to match max. performance		Energy efficiency increase	
18.	AHU's with Higher "R" Value Casing		Less energy loss/gain thru casing	Higher Cost
19.	Lower SAT		Higher $\Delta\tau$, less CFM, hp savings	
20.	Variable Flow Air to Labs:			
	a.	Variable Flow Exhaust	Less air means less energy consumed for fan; chilled & heating wtr systems (applies to a–d)	
	b.	Occupied - Unoccupied Control in Classrooms		
	c.	Hood "Occupancy" Sensor		
	d.	Sash Alarms (unoccupied)		
21.	Heat Recovery from Lab/Hood Exhaust System to AHU Makeup:			
	a.	Run-A-Round Cycle	Energy savings	
	b.	Heat Wheel	Energy savings	
	c.	Heat Pipe	Energy savings	
22.	ID Evaporative Cooling & HR on Economizer Cycle			
23.	Direct Evaporative Cooling			
24.	Cooling Towers:			
	a.	SS Basins	Long term maintainability	
	b.	Variable Flow (VFD's)	Energy savings	
	c.	Variable Flow CT Basin or Distribution Nozzles	Energy savings	
25.	Chilled Beam Technology		Energy Savings	Possible added cost
26.	Air-Side Economizer with enhanced Controls by “Aircuity”		Energy savings;Xcel Rebate	

Topic		Advantages	Disadvantages
27.	Low Leak T.C. Dampers	Energy savings	
28.	Direct Drive Motors	No belt drives; higher efficiency	
29.	Systems Commissioning/Tuning Control Loops	More efficient operation	
30.	Meters on Makeup Water	Historic info available for keeping system in tune; wtr savings	
ELECTRICAL			
31.	Daylighting - Lighting Controls	Energy savings	Higher cost
32.	Photovoltaic Panels	Energy savings; Xcel Rebate Prog	
GENERAL			
33.	Building Shell Efficiencies	Thermal break walls; low E-glass; external shading to reduce peak	
34.	Lab Hoods with Lower Face Velocities	Less exhaust/makeup	

ELECTRICAL SERVICE

The New Electrical Service will consist of (2) new XCEL Energy Pad Mounted Primary Transformers with connection cabinets. These (2) new Primary Transformers will feed (2) new 4000A, 480Y/277V, 3PH, 4W Main Services which will supply power to both the new facility and the existing facility. The existing facility will be sub-feed with 3000A from one of the two 4000A services. This will allow for a phased construction where the new building is constructed then the existing building can be remodeled. The existing service feeding the existing building will be removed or relocated to help provide power to the existing Chiller Plant. The new gear will be provided with TVSS (Transient Voltage Surge Protection) and Customer Metering.

A new 500KW (625KVA) EM/Standby Generator will be provided for the entire facility. The Generator will provide backup for Life Safety (EM) loads such as egress lighting, Elevators and other Life Safety Loads required by Code. This will account for about half of the Generator Capacity. The other half of the Generator Capacity will be available for Standby loads dictated by the owner.

SECONDARY ELECTRICAL DISTRIBUTION

Each level will be provided with 277/480V, 3PH, 4W panels that will provide power for lighting and miscellaneous mechanical loads. Each level will also be provided with adequately sized step-down transformers to serve the high 120/208V power requirements for this type of facility. The new electrical distribution equipment will to be provided so it can handle or mitigates the high harmonic currents in modern day buildings. This is accomplished with K type Transformer or Mitigating Transformers and oversized neutrals in feeders and panels. Also, Transient Voltage Surge Suppression (TVSS) will be provided to help protect sensitive electronic equipment.

FIRE ALARM SYSTEM

The new Fire Alarm System will be an addressable, state of the art system which will accommodate the rapidly changing fire system industry. There will be one system for the entire facility.

LIGHTING

The Lighting will consist of new luminaries using linear fluorescent lamps. These lamps will use the newest energy efficient technology, Super T8 Ballasts and Super T8 Lamps. The Lighting will also consist of HID Luminaires, Compact Fluorescent Downlights and LED Exit Signs. A very small amount if any Luminaires will use an incandescent lamp source. The overall building lighting will be controlled by a Central System with a combination of Occupancy Sensors, Daylight Sensors and Manual Switches controlling lighting at the local level.

V.2.6 Civil Engineering Narrative

WATER AND FIRE

The engineer's recommendation is to retain the existing 3-inch domestic service and install a new 4- or 6-inch fire line to sprinkler the existing building. The existing fire hydrants will be adequate for the renovation portion of this project, whether a sprinkler system is added or not. Additionally, a separate domestic water tap could be added specifically for irrigation purposes which would reduce the amount of sewer fees charged for domestic water use. In 2006 dollars, AHEC could save approximately $1,800 annually if it installed a separate water tap for irrigation only.

Construction costs may include 4- or 6-inch DIP for fire line, a tapping sleeve and wet tap, trenching & backfilling, Denver Water tap & review fees, water meter, and miscellaneous fittings, valves, etc. The current 2006 tap fees are $109,450 and $194,025 for 3- and 4-inch taps respectively.

SANITARY SEWER

The Science Building renovation project will not require upgrades to the sanitary sewer system and should retain the existing 4-inch service line.

STORM SEWER

Renovation of the existing Science Building will not require any storm sewer upgrades. If more than 0.5 acres of the site is altered then storm sewers will need to be modified to provide drainage to required storm water detention and water quality features. It is assumed that existing building site disturbance will not exceed 0.5 acres, therefore no storm sewer modifications will be required.

Storm Water Detention and Water Quality

Similarly, renovation of the existing Science Building will not require any storm water detention or water quality upgrades. If more than 0.5 acres of the site is altered then storm water detention and water quality features will be required for the modified site. It is assumed that site disturbance will not exceed 0.5 acres, therefore no storm water detention or water quality features will be required.

NEW SCIENCE BUILDING

WATER AND FIRE

Denver Water will not allow more than one domestic water tap per building. Therefore, if the proposed addition shares a roof line, walls or foundations with the existing building then the old service line must be replaced with a single service for the entire building. A credit will be granted for the old service tap fees. If irrigation is provided for with a separate service then the existing 3-inch tap, meter and service may be adequate for the renovated and addition portions of the building. Conversely, if the new portion of the building is separate from the existing building a new water service will need to be provided for the new building.

The required fire hydrant flows for the renovation and addition to the Science Building, based on the area, number of levels, and construction type, is approximately 8000 GPM without a sprinkler system, or 4000 GPM with a sprinkler system. The Denver Fire Department is requesting four fire hydrants, located on each corner of the project, as well as fire department connections if the building exceeds 3-stories. Fire access lanes, 25-foot wide paved lane(s), must be provided for all sides of the building such that a truck can get to an area not less than 250-feet from any point of the building. The maximum hydrant spacing must not exceed 350-feet. Individually, each hydrant must be able to provide 1500 GPM with a 20 psi residual pressure and combined they must be able to provide the entire required fire flows (4000-8000 GPM) with 20-psi residual pressure. It is anticipated that approximately 2 fire hydrants will need to be reconfigured or added to the system to meet the fire requirements.

Based on the size and location of the new building addition, it is anticipated that a new 3- or 4-inch domestic service and 6-inch fire line will be required to serve the new building addition. Also, the existing fire hydrants may need to be reconfigured or new fire hydrants added to the system to meet Denver Fire Department's criteria. It is unknown at this time whether any water main construction will be required to achieve adequate fire flows and pressures. If so, it would probably consist of upgrading the 6-inch main in Lawrence to a larger diameter and installing a new main on the east side of the site to create a loop around the building site. Fire access lanes will need to be provided on all sides of the new building addition.

Construction costs may include removal of existing 6-inch pipe, 3- or 4-inch copper pipe, 6- and 8-inch DIP, tapping sleeves and wet taps, fire hydrants, fire department connections, standpipes, trenching & backfilling, Denver Water tap & review fees, water meter, and miscellaneous fittings, valves, etc. The current 2006 tap fees are $109,450 and $194,025 for 3- and 4-inch taps respectively.

SANITARY SEWER

The Science Building project will require a new 4- or 6-inch service line for the addition and should retain the existing 4-inch service line. The new Science Building addition will also require an interceptor to separate the solids, and an acid neutralization basin for acid waste lines. Since this service line connection is so close to the beginning upper end of the sewer main, no public sanitary sewer construction is anticipated.

Construction costs may include 8-inch sanitary sewer pipe, 4-inch sanitary sewer pipe for the new service lines, manholes, clean-outs, a sand/oil interceptor, acid neutralization basin(s), trenching & backfilling, and Denver Wastewater tap & review fees. The current 2006 tap fees are based on domestic water tap size and are $93,660 and $169,480 for 3- and 4-inch tap sizes respectively.

STORM SEWER

Based on proposed building addition concept plans, the lateral storm sewers north and east of the existing building may need to be removed and reconfigured to drain the modified site. The new storm sewer system will need to capture site runoff at inlets and convey it to water quality features and detention basin(s) on either/or the north and south sides of the existing building. Then new storm connections will be made between the detention pond(s) and public storm sewers.

Construction costs may include removal or abandonment of old storm sewers and inlets, new 15- or 18-inch RCP storm sewer pipes, inlets, manholes, trenching & backfilling, and Denver Wastewater review and inspection fees.

STORM WATER DETENTION AND WATER QUALITY

Per Denver Wastewater criteria, the entire disturbed project site will need to be brought up to current codes. This means that the site will need to be re-graded such that storm water is captured and conveyed into water quality features and storm water detention ponds. Water quality features may include porous landscape detention areas, grass lined swales or may be incorporated into larger extended detention basins or retention ponds. Based on existing topography there may need to be water quality and detention basins on both the north and south sides of the project site.

Using best available information and proposed project assumptions of total site area of 5.5 acres with approximately 70% imperviousness, a total of approximately 6600 cubic-feet and 30,000 cubic-feet storage will be required for water quality and detention volumes, respectively. For planning purposes, assuming a 1-foot storage depth for water quality will result in 6600 square-feet of water quality area on this site. Similarly, assuming a 3-foot depth for detention will result in nearly 10,000 square-feet of detention area. In extended detention basins, the most common storm water detention ponds, the water quality volume is included in the detention volume so only 10,000 square-feet is required. There are various other detention pond configurations that may be evaluated including underground detention systems in conjunction with above ground water quality features. The optimal design will probably result in a combination of above ground water quality and detention storage as well as some underground storage system. The options will be impacted by site layout, owner preferences and site constraints such as existing storm sewer depths and general topography.

Construction costs may include excavation for water quality features and detention ponds,
filtration basins, under drain systems, erosion protection, underground detention systems, outlet structures, trenching & backfilling, and Denver Wastewater review and inspection fees.

V.3 Project Cost Estimate

The program plan Project Cost Estimate for the renovation of and addition to the Auraria Science Building is an assimilation of best-practices and recent relevant construction project costs, as well as information supplied by Consultant specialists on the Design Team. Specific costs for each spatial type were developed (see Unit Costs, following the Cost Estimate). These costs are applied to each individual space in the Program listing (see Appendix) in order to estimate the overall construction cost.

As a result of the programming process, and utilizing CCHE, CEFPI and other space planning standards a Justified Needs Program was derived (See Appendix VI.5). The estimated cost of this program exceeded the $104,692,040 funding request previously submitted to CCHE by almost $17 million. A Consensus Scenario program plan was developed whereby representatives of all 3 institutions at Auraria agreed to certain cuts to the Program in order to meet the mandated budget figure. The cost concessions are detailed in the "Program Cost Reduction Concepts" table, following the cost estimate. The major cost reductions were:

- Adjust faculty growth projections to apply only to full-time faculty, and to project no growth in adjunct faculty.
- Adjust the prep time associated with each teaching lab section for use in justified space calculations.
- For funded research labs, presume that research funding would pay for the finishing of the research space, and reduce the number of labs by 2.
- Remove the cost of A/V equipment from the project cost.
- Reduce the furniture budget by 75%, requiring re-use of existing furniture or securing of alternate funding.
- Re-use office space in the existing Science building with only minor remodeling (called "light remodel").
- Re-use classroom space in the existing Science building with only light remodel.
- Re-use tiered classroom (Science 119) in the existing Science building with only light remodel.
- Reduce moving costs to accommodate moving major equipment only.
- Defer all landscaping.

The Project Cost Estimate presented herein reflects the Value Engineering efforts of all the participants in the programming process.

Project Budget

Building Area			*357,408*	
(a) New GSF			197,389	
(b) Renovate GSF			160,018	
			Cost/GSF	**Cost Model**
Land Acquisition				
Land Purchase Cost		$	-	$0
Professional Services				
Master Plan/PP		$	2.33	$833,607
Site Surveys, Investigations, Reports		$	0.84	$300,000
Architectural/Engineering/Services		$	26.49	$9,468,363
Code Review/Inspection		$	0.07	$25,000
Construction Management		$	3.92	$1,400,000
Advertisements		$	0.00	$1,000
Other		$	0.49	$176,311
Total Professional Services		*$*	*34.15*	$12,204,281
Construction				
Infrastructure				
(a) Service/Utilities				$875,000
(b) Site Improvements				$0
Structure/Systems/Components				
(a) New GSF		$	332.97	$65,724,785
(b) Renovate GSF		$	104.83	$16,773,936
Other				$0
Total Construction Costs		*$*	*233.27*	*$83,373,722*
Equipment and Furnishings				
Equipment				
(a) A/V Equipment		$	-	$0
(b) Security		$	0.25	$89,352
Furnishings		$	3.75	$1,340,278
Communications				
(a) PBX & Network Equipment		$	5.00	$1,787,038
Total Equip. and Furnishings		*$*	*9.00*	*$3,216,668*
Miscellaneous				
Art in Public Places =1% of Constr.	1%	$	2.33	$833,737
Relocation Costs		$	0.28	$100,000
Other Costs		$	-	$0
Total Misc. Costs		$	2.61	*$933,737*
Sub Total		**$**	**279.03**	**$99,728,408**
Project Contingency				
5% for New	5%	$	9.19	$3,286,239
10% for Renovation	10%	$	4.69	$1,677,394
Total Contingency Requested		*$*	*13.89*	*$4,963,633*
Total Budget				**$104,692,041**

Unit Costs Incorporated into Project Cost Estimate

	Efficiency	62.5%	6.0%	FF&E Escalation		15.0%	Indirect & Markup		62.5%	65.0%	25.0%	of Remodel Unit Cost
Space Type Name	Core & Shell Unit Cost	Tenant Improvements	GC FF&E Unit Cost	MEP Unit Cost	Technology Cabling	15% Indirect Costs & Markup	Total New Unit Cost	Remodel Unit Cost	Backfill Unit Cost	Light Remodel Unit Cost	Remain in place Unit Cost	Remarks
Office	$ 112.00	$ 15.00	$ -	$ 52.00	$ 5.00	$ 27.60	$ 211.60	$ 120.18	$ 51.75	$ 78.11	$ 30.04	
Classroom Flat	$ 112.00	$ 25.00	$ -	$ 70.00	$ 5.00	$ 31.80	$ 243.80	$ 150.08	$ 71.88	$ 97.55	$ 37.52	
Classroom Tiered	$ 112.00	$ 35.00	$ -	$ 70.00	$ 5.00	$ 33.30	$ 255.30	$ 161.58	$ 79.06	$ 105.02	$ 40.39	
Lab Service	$ 112.00	$ 32.50	$ 50.00	$ 111.50	$ 5.00	$ 46.65	$ 357.65	$ 262.78	$ 143.03	$ 170.80	$ 65.69	
Chemistry Teaching Lab	$ 112.00	$ 32.50	$ 60.00	$ 111.50	$ 5.00	$ 48.15	$ 369.15	$ 274.28	$ 150.22	$ 178.28	$ 68.57	
Biology Teaching Lab	$ 112.00	$ 32.50	$ 50.00	$ 111.50	$ 5.00	$ 46.65	$ 357.65	$ 262.78	$ 143.03	$ 170.80	$ 65.69	
Other Teaching Lab	$ 112.00	$ 32.50	$ 37.00	$ 111.50	$ 5.00	$ 44.70	$ 342.70	$ 247.83	$ 133.69	$ 161.09	$ 61.96	
Chemistry Research Lab	$ 112.00	$ 32.50	$ 50.00	$ 111.50	$ 5.00	$ 46.65	$ 357.65	$ 262.78	$ 143.03	$ 170.80	$ 65.69	
Other Research Lab	$ 112.00	$ 32.50	$ 44.00	$ 111.50	$ 5.00	$ 45.75	$ 350.75	$ 255.88	$ 138.72	$ 166.32	$ 63.97	
Shelled Research Lab	$ 112.00	$ -	$ -	$ 83.63	$ 5.00	$ 30.09	$ 230.72	$ 146.19	$ 63.70	$ 95.03	$ 36.55	C&S+75% MEP+no TI,no FF&E
									non C&S new construction cost on ASF only			

CORE & SHELL UNIT COSTS	New Construction	Remodel Construction	Remodel Discount	
Demolition For Remodeling	$ -	$ 15.00	$ (15.00)	
Excavation/Foundations/SOG	$ 11.00	$ -	$ 11.00	
Structural Frame	$ 38.50	$ -	$ 38.50	
Exterior Wall System	$ 43.00	$ 4.00	$ 39.00	
Roofing & Sheetmetal	$ 2.75	$ 2.75	$ -	
Interior Finishes & Specialties	$ 9.00	$ 9.00	$ -	
Elevators	$ 2.75	$ 2.75	$ -	
Site Improvements	$ -	$ -	$ -	Included as separate Budget line item
	$ 107.00	$ 33.50	$ 73.50	

ASSUMPTIONS

- All Costs Are Based On City & County Of Denver Construction Costs
- Assumed Construction Start Date Is 3rd Quarter 2007
- Assumed Construction Completion Time Is Thirty (30) Months
- All Costs Are Escalated To Mid-Point Of Construction
- Indirect Costs & Mark-Up Is Approximately 15% Of Direct Cost
- Indirect Costs & Mark-Up Include The Following:

- Light Remodeling Unit Cost Is 60% Of Remodel Unit Cost
- A/V Equipment included under Owner's Budget
- Technology Cabling included under GC scope of work
- A/V and Telecommunications conduit and backboxes included in Electrical

Space Type Name	HVAC	Plumbing	Fire Protection	HVAC Remodel Discount	HVAC Light Remodel Discount	Electrical Remodel Discount	Electrical Light Remodel Discount
Office	$ 28.50	$ 7.00	$ 3.50	$ 6.00	$ 3.00	$ -	$ 2.00
Classroom Flat	$ 36.50	$ 14.00	$ 3.50	$ 8.00	$ 3.00	$ -	$ 2.00
Classroom Tiered	$ 36.50	$ 14.00	$ 3.50	$ 8.00	$ 3.00	$ -	$ 2.00
Lab Service	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Chemistry Teaching Lab	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Biology Teaching Lab	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Other Teaching Lab	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Chemistry Research Lab	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Other Research Lab	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Shelled Research Lab	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Teaching Lab	$ 52.50	$ 30.00	$ 3.50	$ 9.00	$ 5.00	$ -	$ 3.00
Classroom	$ 36.50	$ 14.00	$ 3.50	$ 8.00	$ 3.00	$ -	$ 2.00

Cost Reduction Strategies Incorporated into Project Cost Estimate

Item Number	Savings Concept	Estimated Savings	Accepted	Rejected	Add Alternate	Remarks	Calculated Savings
PG-1	Reduce Biology & Chemistry faculty office growth to match 30% enrollment growth	$ 1,300,000	$ -	$ -		From 50% to 30% growth equivalent to 15% reduction in space	$ 1,303,320
PG-1a	Provide 50% growth for full-time faculty only and reduce adjunct space to 1-240 per	$ 500,000	$ 500,000	$ -		Growth of faculty offices displaces need for most adjunct space.	$ 754,800
PG-2	1/2 hr prep time only for each Teaching Lab section	$ 4,700,000	$ 4,700,000	$ -		Reduce Teaching Labs by 6. UCDHSC-3, MSCD-2, CCD-1	$ 4,682,657
PG-3	Prep time and recitations accommodated within typical lab utilization standards (80% of 40 hrs)	$ 5,600,000	$ -	$ 5,600,000		Reduce Teaching Labs by 7. Cannot be taken with reduction above.	$ 5,572,568
PG-4	Reduce CCD Biology Teaching Labs to requested rather than justified count	$ 700,000	$ -	$ 700,000		Included in PG-2 or PG-3 above. 1 CCD lab not CH justified when alternate prep time standard applied	$ 705,123
PG-5	Shell all Funded Research Labs under Auraria Shared	$ 1,700,000	$ 1,700,000	$ -	$ 1,700,000	Rely on grant funding or unused contingency to complete labs. **If finished by institution, then reverts to institutional ownership.** Savings reduced to $1.7M from $2.2M based on recalculation with lower initial Funded headcount	$ 1,682,778
PG-5a	Shell only growth justified Funded Research Labs under Auraria Shared	$ 700,000	$ -	$ -	$ -	Shell five out of 14 Funded Research Labs. Not available combined with PG-5	$ 701,751
PG-5b	Add one Funded Research Lab under Auraria Shared	$ (500,000)	$ -	$ (500,000)		No justification or tradeoff.	$ (547,843)
PG-6	Reduce Student Research Lab module by 25%	$ 3,100,000	$ -	$ 3,100,000		Cummulative lab area drops from 1040 to 880 ASF/faculty	$ 3,076,065
PG-7	Reduce Student Research headcount to match 30% enrollment growth	$ 1,300,000	$ -	$ 1,300,000		From 50% to 30% growth equivalent to 15% reduction in space	$ 1,338,497
PG-8	Reduce A/V budget by 50% or $3.15/GSF	$ 1,150,000	$ -	$ -	$ -	Explore alternate funding source or risk availabiilty of contingency. Need to confirm CCD acceptance of 100% deferral. CCD sees higher risk in FF&E deferral scenarios.	$ 1,139,704
PG-8a	Defer full A/V budget	$ 2,300,000	$ 2,300,000	$ -	$ 2,300,000	Explore alternate funding source or risk availabiilty of contingency. Need to confirm CCD acceptance of 100% deferral. CCD sees higher risk in FF&E deferral scenarios.	
PG-9	Reduce furnishings budget by 50% or $7.50/GSF	$ 2,700,000	$ -	$ -	$ -	Maximize reuse of existing. Explore alternate funding source or risk availabiilty of contingency. CCD sees higher risk in FF&E deferral scenarios.	$ 2,713,582
PG-9a	Defer 75% of furnishing budget, but allow for classroom chairs and other essentials	$ 4,100,000	$ 4,100,000	$ -	$ 4,100,000	Reserve 25% for classroom chairs and other essential new furnishings. CCD sees higher risk in FF&E deferral scenarios.	$ 4,070,373
PG-10	10% across the board office space reduction	$ 800,000	$ -	$ 800,000	$ -	May be incompatible with office growth reduction of PG-1 or PG-1a	$ 808,619
PG-11	Reduce standard office size from 120 ASF to 100 ASF	$ 1,400,000	$ -	$ -	$ -	May impact faculty recruitment efforts.	$ 1,426,690
PG-11a	Reduce standard office size from 120 ASF to 110 ASF	$ 700,000	$ -	$ -	$ -	Lose the potential to accommodate guest chairs for student/faculty conference	
PG-12	Reduce Classroom ASF to accommodate current CH + growth	$ 3,600,000	$ -	$ 3,600,000		Roughly 50% reduction from JNP	$ 3,556,872
PG-13	Reduce Classroom ASF to match 2004 Program Plan	$ 2,400,000	$ -	$ 2,400,000		Roughly 35% reduction from JNP	$ 2,425,810
PG-14	Defer all new office space to later phase	$ 11,700,000	$ -	$ 11,700,000	$ -	Potential phasing concept	$ 11,682,626
PG-15	Remodel & Expand UCDHSC Biology in North Classroom Backfill	$ 2,600,000	$ -	$ -	$ -	Limits potential for backfll to provide space of consolidation	$ 2,609,822
PG-16	Light Remodel only to office spaces in existing Science	$ 1,100,000	$ 1,100,000	$ -	$ 1,100,000	Light Remodel space must be distributed equitably between all institutions. Revisit cost model to integrate CCD spaces in new construction.	$ 1,079,406
PG-17	Light Remodel only to existing classroom spaces in Science	$ 2,000,000	$ 2,000,000	$ -	$ 2,000,000	Light Remodel space must be distributed equitably between all institutions. Revisit cost model to integrate CCD spaces in new construction.	$ 1,981,013
PG-18	Light Remodel only to existing Science 119 Classroom	$ 500,000	$ 500,000	$ -	$ 500,000	New lighting critical to successful Light Remodel of existing Science 119.	$ 450,736
PG-19	Share Analytical Chemistry Lab	$ 900,000	$ -	$ 900,000		Currently shared. Maxed out on opening day as shared.	$ 916,804
PG-20	Add MSCD Criminalistics Microscope Teaching Lab	$ (450,000)	$ (450,000)	$ -		Not in original JNP. Institutional priority offset by reduction in justified Funded Research space.	$ (458,402)
PG-21	Add 1 New MSCD Non-major Biology Teaching Lab	$ (900,000)	$ -	$ -		Not in original JNP. These labs could be in less expensive Light Remodel of existing Science.	$ (889,911)
PG-21a	Add 3 MSCD Non-major Biology Teaching Labs as Light Remodel of existing Science	$ (1,350,000)	$ (1,350,000)	$ -	$ (1,350,000)	Limited improvements to existing building. No new lab casework or equipment. No new partitions.	$ (477,063)
PG-22	Provide 1 UCDHSC Anthropology Morphometrics Teaching Lab in lieu of second Anthropology Teaching Lab	$ 100,000	$ -	$ 100,000		Not in original JNP. 2 UCDHSC Antrho labs justified by CH plus growth. Cannot accept with PG-2	$ 96,257
PG-22a	Add UCDHSC Anthropology Morphometrics Teaching Lab	$ (900,000)	$ (900,000)	$ -		Not in original JNP. Institutional priority offset by shelling of justified Funded Research space.	$ 96,257
PG-23	Reduce Funded Research Lab module by 25% for Auraria Shared Space	$ 1,500,000	$ -	$ 1,500,000		Reduce Lab ASF per Faculty from 1040 to 880 ASF	$ 1,541,208
PG-23a	Reduce Shelled Funded Research Lab count from 14 to 12	$ 1,100,000	$ 1,100,000	$ -		Acceptance to be confirmed by MSCD. Remaining Labs to be finished by UCDHSC then no longer shared.	$ 814,985
PG-24	Defer all remodel construction to a later phase	$ 21,000,000	$ -	$ 21,000,000	$ -		$ 20,999,038
PG-25	Defer all backfill construction to a later phase	$ 2,700,000	$ -	$ 2,700,000	$ -	Institutions (except CCD) share cost to finish out. 15,000 ASF impact on classroom space unacceptable.	$ 2,715,029
PG-26	Provide maximum Master Plan flexibility with all new science construction. Only MSCD M&CS & Classrooms remain in remodeled existing Science	$ (11,200,000)	$ -	$ (11,200,000)	$ -	Adds to Project Cost, and unimproved backfill remains in NC, SO, and SI for institutional consolidation	$ (11,200,052)
PG-27	Reduce relocation budget to accommodate major equipment only	$ 300,000	$ 300,000	$ -	$ 300,000	75% reduction. Large equipment includes autoclave, NMR, etc.	
PG-28	Defer all landscaping	$ 875,000	$ 875,000	$ -	$ 875,000	50% of $1.75M Site Development Budget	$ 875,000
PG-29	Delete UCDHSC Math Assistance Lab	$ 200,000	$ -	$ -	$ -	Functions may be accommodated in Math Laboratory in existing Science and JNP	$ 231,752
PG-30	Add back 1 typical Teaching Lab	$ (900,000)	$ -	$ (900,000)	$ -	No justification or tradeoff.	$ (889,911)
PG-31	Delete MSCD Student Research Labs	$ 2,100,000	$ -	$ 2,100,000	$ -	Student research essential to evolving MSCD curriculum.	$ 2,072,044
PG-32	Focus Lab spaces in New Construction with offices and classrooms in Light Remodel of existing Science--components of each institution will be in existing Science	$ -	$ -	$ -	$ -	No cost impact, but all institutions agree to share the impact of Light Remodel construction on programmed spaces. For example, all new Bio & Chem Lab Construction with offices and classrooms in Light Remodel. Further study in Concept Design Phase.	$ 2,072,044
			$ -	$ -	$ -		
	Total Savings	**$ 71,225,000**	**$ 16,475,000**	**$ 44,900,000**	**$ 11,525,000**	Total of line items above.	**$ 71,730,048**

Detailed Construction Cost Estimate

The Program on the following pages lists each individual space, its size, and the number of such spaces to be provided. The *"Scenario per Space"* column indicates whether the space is envisioned in new or remodeled space, or in backfill space (space vacated in other buildings when those program areas move into the Science Building).

		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	University of Colorado at Denver & Health Sciences Center									
	UCDHSC Biology					**27,510**			**44,423**	**$ 13,325,009**
U.B.1.0	Office Space						Light Remodel	$ 78	-	-
U.B.1.1	Chair/Director	160	1	160	3	480	Light Remodel	$ 78	775	60,546
U.B.1.2	Faculty Office	120	1	120	18	2,160	Light Remodel	$ 78	3,488	272,458
U.B.1.3	Adjunct Faculty	60	2	120	1	120	Light Remodel	$ 78	194	15,137
U.B.1.4	Research Assistant Workstation	40	6	240	6	1,440	New	$ 212	2,325	492,035
U.B.1.5	Undergraduate Teaching Assistant	40	6	240	1	240	Light Remodel	$ 78	388	30,273
U.B.1.6	Lab Coordinator	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.B.1.7	Lab Preparator	60	1	60	1	60	Light Remodel	$ 78	97	7,568
U.B.1.8	Program Assistant	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.B.1.9	Academic Advisor	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.B.1.10	Administrative Assistant	120	1	120	2	240	Light Remodel	$ 78	388	30,273
U.B.1.11	Conference	See UCDHSC Shared Spaces below					Light Remodel	$ 78	-	-
U.B.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.B.1.13	Reception	40	4	160	1	160	Light Remodel	$ 78	258	20,182
U.B.1.14	Records	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.B.1.15	Breakroom	See UCDHSC Shared Spaces below					Light Remodel	$ 78	-	-
U.B.1.16	General Office Storage						Light Remodel	$ 78	-	
U.B.1.19	Office Space Reduction			(5,500)	0%	-	Light Remodel	$ 78	-	-
U.B.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
U.B.3.0	Laboratories						New	$ 358	-	-
U.B.3.1	Basic/Non-Major Teaching	53	24	1,260	2	2,520	New	$ 358	4,069	1,455,380
U.B.3.2	General Biology Teaching	53	24	1,260	3	3,780	New	$ 358	6,104	2,183,071
U.B.3.3	Anatomy Teaching	63	20	1,260	1	1,260	New	$ 358	2,035	727,690
U.B.3.4	Physiology Teaching	53	24	1,260	1	1,260	New	$ 358	2,035	727,690
U.B.3.5	Microbiology Teaching	53	24	1,260	1	1,260	New	$ 358	2,035	727,690
U.B.3.6	Molecular/Cellular Teaching	59	16	945	1	945	New	$ 358	1,526	545,768
U.B.4.0	Research Laboratory						New	$ 351	-	-
U.B.4.1	Student Research Lab	175	1	175	43	7,525	New	$ 351	12,151	4,262,084
U.B.5.0	Lab Service						New	$ 358	-	-
U.B.5.1	Prep Room	315	1	315	4	1,260	New	$ 358	2,035	727,690
U.B.5.2	Microbiology Prep	475	1	475	1	475	New	$ 358	767	274,328
U.B.5.3	Molecular Core Facility	600	1	600	1	600	New	$ 358	969	346,519
U.B.5.4	Microbiololgy Equipment Room	165	1	165	1	165	New	$ 358	266	95,293
U.B.5.5	Cold Room	160	1	160	1	160	New	$ 358	258	92,405
U.B.5.6	Greenhouse	See Auraria Shared Space					New	$ 358	-	-
U.B.6.0	Storage	200	1	200	4	800	Remodel	$ 120	1,292	155,247

		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	UCDHSC Chemistry					**20,820**			**33,620**	**$ 10,036,265**
U.C.1.0	Office Space						Light Remodel	$ 78	-	-
U.C.1.1	Chair/Director	160	1	160	1	160	Light Remodel	$ 78	258	20,182
U.C.1.2	Faculty Office	120	1	120	18	2,160	Light Remodel	$ 78	3,488	272,458
U.C.1.3	Adjunct Faculty	60	2	120	1	120	Light Remodel	$ 78	194	15,137
U.C.1.4	Research Assistant Workstation	40	6	240	6	1,440	New	$ 212	2,325	492,035
U.C.1.5	Undergraduate Teaching Assistant	40	6	240	1	240	Light Remodel	$ 78	388	30,273
U.C.1.6	Lab Coordinator	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.C.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.C.1.11	Conference	See UCDHSC Shared Spaces below					Light Remodel	$ 78	-	-
U.C.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.C.1.13	Reception	40	4	160	1	160	Light Remodel	$ 78	258	20,182
U.C.1.14	Records	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.C.1.15	Breakroom	See UCDHSC Shared Spaces below					Light Remodel	$ 78	-	-
U.C.1.16	General Office Storage	120	1	120	1	120	Light Remodel	$ 78	194	15,137
U.C.1.19	Office Space Reduction			(4,880)	0%	-	Light Remodel	$ 78	-	-
U.C.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
U.C.3.0	Laboratories						New	$ 369	-	-
U.C.3.1	General Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,069	1,502,177
U.C.3.2	Organic Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,069	1,502,177
U.C.3.3	Analytical/Inorganic Teaching	70	18	1,260	1	1,260	New	$ 369	2,035	751,089
U.C.3.4	Physical/Instrumental Teaching	118	8	945	1	945	New	$ 369	1,526	563,316
U.C.4.0	Research Laboratory						New	$ 358	-	-
U.C.4.1	Student Research Lab	175	1	175	36	6,300	New	$ 358	10,173	3,638,451
U.C.5.0	Lab Service						New	$ 358	-	-
U.C.5.1	Prep Room	210	1	210	4	840	New	$ 358	1,356	485,127
U.C.5.2	Instrument Room	160	1	160	4	640	New	$ 358	1,033	369,620
U.C.5.3	Balance Room	105	1	105	3	315	New	$ 358	509	181,923
U.C.5.4	Stockroom Satellite	945	1	945	0		New	$ 358	-	-
U.C.6.0	Storage	200	1	200	3	600	Remodel	$ 120	969	116,435
	UCDHSC Anthropology					**3,465**			**5,595**	**$ 669,414**
U.A.1.0	Office Space						Backfill	$ 52	-	
U.A.2.0	Classrooms						Backfill	$ 72	-	
U.A.3.0	Laboratories						Backfill	$ 134	-	-
U.A.3.1	Anthropology Teaching	53	24	1,260	2	2,520	Backfill	$ 134	4,069	544,013
U.A.3.2	Morphometrics Teaching	59	16	945	0	-	Backfill	$ 134	-	-
U.A.5.0	Lab Service						Backfill	$ 143	-	-
U.A.5.1	Prep Room	315	1	315	1	315	Backfill	$ 143	509	72,754
U.A.6.0	Collections	630	1	630	1	630	Backfill	$ 52	1,017	52,646
	UCDHSC Math					**3,060**			**4,941**	**$ 355,154**
U.M.3.0	Laboratories						Backfill	$ 72	-	-
U.M.3.1	Math Laboratory	30	60	1,800	1	1,800	Backfill	$ 72	2,907	208,914
U.M.3.2	Math Assistance Room	53	24	1,260	1	1,260	Backfill	$ 72	2,035	146,240
	UCDHSC Shared Space					**2,815**			**4,546**	**$ 505,424**
U.S.1.0	Office Space						Light Remodel	$ 78	-	-
U.S.1.1	Special Events Conference	See Auraria Shared Spaces below					Light Remodel	$ 78	-	-
U.S.1.2	Conference	25	8	200	2	400	Light Remodel	$ 78	646	50,455
U.S.1.3	Breakroom	80	1	80	2	160	Light Remodel	$ 78	258	20,182
U.S.5.0	Analytical Service Lab	1575	1	1,575	1	1,575	Remain	$ 66	2,543	167,079
U.S.7.0	Interaction/Community						New	$ 244	-	-
U.S.7.1	Departmental Display	50	1	50	7	350	New	$ 244	565	137,791
U.S.7.2	Student Group Study	15	22	330	1	330	New	$ 244	533	129,917
	UCD Math & Other Backfill Space									
						57,670			**93,125**	**$ 24,891,265**

		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	Community College of Denver									
	CCD Biology					**13,120**			**21,186**	**$ 6,251,602**
C.B.1.0	Office Space						Light Remodel	$ 78	-	-
C.B.1.1	Chair/Director	160	1	160	2	320	Light Remodel	$ 78	517	40,364
C.B.1.2	Faculty Office	120	1	120	4	480	Light Remodel	$ 78	775	60,546
C.B.1.3	Adjunct Faculty	60	4	240	4	960	Light Remodel	$ 78	1,550	121,092
C.B.1.10	Administrative Assistant	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.B.1.11	Conference	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.B.1.12	Work/Copy/Print	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.B.1.13	Reception	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.B.1.14	Breakroom	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.B.1.15	General Office Storage	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.B.1.19	Office Space Reduction			(1,760)	0%	-	Light Remodel	$ 78	-	-
C.B.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
C.B.2.1	General Biology Lecture	30	42	1,260	1	1,260	Light Remodel	$ 98	2,035	198,477
C.B.3.0	Laboratories						New	$ 358	-	-
C.B.3.1	General Biology Teaching	53	24	1,260	1	1,260	New	$ 358	2,035	727,690
C.B.3.2	Microbiology Teaching	53	24	1,260	1	1,260	New	$ 358	2,035	727,690
C.B.3.3	Interdisciplinary Teaching	49	32	1,575	2	3,150	New	$ 358	5,087	1,819,226
C.B.3.4	Anatomy & Physiology Teaching	53	24	1,260	2	2,520	New	$ 358	4,069	1,455,380
C.B.4.0	Research Laboratory						New	$ 351	-	
C.B.4.1	Student Research Lab	175	1	175	1	175	New	$ 351	283	99,118
C.B.5.0	Lab Service						New	$ 358	-	-
C.B.5.1	Prep Room	315	1	315	3	945	New	$ 358	1,526	545,768
C.B.5.2	Microbiology Prep	315	1	315	1	315	New	$ 358	509	181,923
C.B.5.3	Instrument Room	315	1	315	1	315	New	$ 358	509	181,923
C.B.5.4	Equipment Room	160	1	160	1	160	New	$ 358	258	92,405
C.B.6.0	Storage	See CCD Shared Spaces below					Remodel	$ 120	-	-
	CCD Chemistry					**3,570**			**5,765**	**$ 1,928,028**
C.C.1.0	Office Space						Light Remodel	$ 78	-	-
C.C.1.1	Chair/Director	160	1	160	1	160	Light Remodel	$ 78	258	20,182
C.C.1.2	Faculty Office	120	1	120	1	120	Light Remodel	$ 78	194	15,137
C.C.1.3	Adjunct Faculty	60	2	120	1	120	Light Remodel	$ 78	194	15,137
C.C.1.10	Administrative Assistant	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.C.1.11	Conference	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.C.1.12	Work/Copy/Print	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.C.1.13	Reception	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.C.1.14	Breakroom	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.C.1.16	General Office Storage	See CCD Shared Spaces below					Light Remodel	$ 78	-	-
C.C.1.19	Office Space Reduction			(400)	0%	-	Light Remodel	$ 78	-	-
C.C.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
C.C.3.0	Laboratories						New	$ 369	-	-
C.C.3.1	General Chemistry Teaching	53	24	1,260	1	1,260	New	$ 369	2,035	751,089
C.C.3.2	Organic Chemistry Teaching	53	24	1,260	1	1,260	New	$ 369	2,035	751,089
C.C.4.0	Research Laboratory						New	$ 358	-	
C.C.4.1	Student Research Lab	175	1	175	1	175	New	$ 358	283	101,068
C.C.5.0	Lab Service						New	$ 358	-	-
C.C.5.1	Prep Room	315	1	315	1	315	New	$ 358	509	181,923
C.C.5.2	Balance Room	160	1	160	1	160	New	$ 358	258	92,405
C.C.6.0	Storage	See CCD Shared Spaces below					Remodel	$ 120	-	-

		Area and Quantity Provided					Cost Model				
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost		Gross Area (GSF)	Estimated Construction Cost
	CCD Shared Spaces					**1,340**				**2,164**	**$ 195,780**
C.S.1.0	Academic Office Suite						Light Remodel	$	78	-	-
C.S.1.1	Adjunct Faculty	Included by departments above				-	Light Remodel	$	78	-	-
C.S.1.2	Science Advisor	120	1	120	1	120	Light Remodel	$	78	194	15,137
C.S.1.3	Lab Coordinator	120	1	120	1	120	Light Remodel	$	78	194	15,137
C.S.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	$	78	194	15,137
C.S.1.11	Conference	25	8	200	1	200	Light Remodel	$	78	323	25,228
C.S.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$	78	194	15,137
C.S.1.13	Reception	40	6	240	1	240	Light Remodel	$	78	388	30,273
C.S.1.14	Records	120	1	120	1	120	Light Remodel	$	78	194	15,137
C.S.1.15	Breakroom	80	1	80	1	80	Light Remodel	$	78	129	10,091
C.S.1.16	General Office Storage	120	1	120	1	120	Light Remodel	$	78	194	15,137
C.S.1.18	Special Events Conference	See Auraria Shared Spaces below					Light Remodel	$	78	-	-
C.S.1.19	Office Space Reduction			(1,240)	0%	-	Light Remodel	$	78	-	-
C.S.1.20	Student Group Study	15	0	-	1	-	New	$	244	-	-
C.S.1.21	Departmental Display	50	1	50	2	100	New	$	244	161	39,369
						18,030				**29,115**	**$ 8,375,410**

		Area and Quantity Provided					Cost Model				
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost		Gross Area (GSF)	Estimated Construction Cost
	Metro State College of Denver										
	MSCD Biology					**30,310**				**48,944**	**$ 14,364,496**
M.B.1.0	Office Space						Light Remodel	$	78	-	-
M.B.1.1	Chair/Director	160	1	160	1	160	Light Remodel	$	78	258	20,182
M.B.1.2	Faculty Office	120	1	120	24	2,880	Light Remodel	$	78	4,651	363,277
M.B.1.3	Adjunct Faculty	60	4	240	1	240	Light Remodel	$	78	388	30,273
M.B.1.4	Lab Coordinator	120	1	120	1	120	Light Remodel	$	78	194	15,137
M.B.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	$	78	194	15,137
M.B.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	$	78	-	-
M.B.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$	78	194	15,137
M.B.1.13	Reception	40	4	160	1	160	Light Remodel	$	78	258	20,182
M.B.1.14	Records	120	1	120	1	120	Light Remodel	$	78	194	15,137
M.B.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	$	78	-	-
M.B.1.16	General Office Storage	120	1	120	1	120	Light Remodel	$	78	194	15,137
M.B.1.19	Office Space Reduction			(4,040)	0%	-	Light Remodel	$	78	-	-
M.B.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$	98	-	-
M.B.2.1	Self Paced Testing Room	25	10	250	1	250	Light Remodel	$	98	404	39,380
M.B.3.0	Laboratories						New	$	358	-	-
M.B.3.1	Non-Major Teaching	53	24	1,260	3	3,780	Light Remodel	$	171	6,104	1,042,574
M.B.3.2	General Biology I & II Teaching	53	24	1,260	3	3,780	New	$	358	6,104	2,183,071
M.B.3.3	Plant Physiology/Taxonomy	53	24	1,260	1	1,260	New	$	358	2,035	727,690
M.B.3.4	Botany Teaching	53	24	1,260	1	1,260	New	$	358	2,035	727,690
M.B.3.5	Ecology Teaching	53	24	1,260	1	1,260	New	$	358	2,035	727,690
M.B.3.6	Anatomy & Physiology Teaching	53	24	1,260	2	2,520	New	$	358	4,069	1,455,380
M.B.3.7	Molecular Biology Teaching	53	24	1,260	1	1,260	New	$	358	2,035	727,690
M.B.3.8	Zoology Teaching	53	24	1,260	2	2,520	New	$	358	4,069	1,455,380
M.B.3.9	Microbiology Teaching	53	24	1,260	2	2,520	New	$	358	4,069	1,455,380
M.B.4.0	Research Laboratory						New	$	351	-	-
M.B.4.1	Student Research Lab	175	1	175	13	2,275	New	$	351	3,674	1,288,537
M.B.5.0	Lab Service						New	$	358	-	-
M.B.5.1	Prep Room	315	1	315	7	2,205	New	$	358	3,561	1,273,458
M.B.5.2	Microbiology Prep	420	1	420	1	420	New	$	358	678	242,563
M.B.5.3	Instrument Room	315	1	315	1	315	New	$	358	509	181,923
M.B.5.4	Equipment Room	315	1	315	1	315	New	$	358	509	181,923
M.B.5.5	Pour Room	105	1	105	1	105	New	$	358	170	60,641
M.B.5.6	Cold Room	105	1	105	1	105	New	$	358	170	60,641
M.B.6.0	Storage	120	1	120	1	120	Remodel	$	120	194	23,287

		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	MSCD Chemistry					**16,230**			**26,208**	**$ 7,967,567**
M.C.1.0	Office Space						Light Remodel	$ 78	-	-
M.C.1.1	Chair/Director	160	1	160	1	160	Light Remodel	$ 78	258	20,182
M.C.1.2	Faculty Office	120	1	120	19	2,280	Light Remodel	$ 78	3,682	287,594
M.C.1.3	Adjunct Faculty	60	4	240	1	240	Light Remodel	$ 78	388	30,273
M.C.1.4	Lab Coordinator	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.C.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.C.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	$ 78	-	-
M.C.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.C.1.13	Reception	40	4	160	1	160	Light Remodel	$ 78	258	20,182
M.C.1.14	Records	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.C.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	$ 78	-	-
M.C.1.16	General Office Storage	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.C.1.19	Office Space Reduction			(3,440)	0%	-	Light Remodel	$ 78	-	-
M.C.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
M.C.3.0	Laboratories						New	$ 369	-	-
M.C.3.1	General Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,069	1,502,177
M.C.3.2	Organic Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,069	1,502,177
M.C.3.3	Analytical Chemistry Teaching	53	24	1,260	1	1,260	New	$ 369	2,035	751,089
M.C.3.4	Physical/Inorganic Chemistry Teachin	79	12	945	1	945	New	$ 369	1,526	563,316
M.C.3.5	Instrumental Analysis Teaching	70	18	1,260	1	1,260	New	$ 369	2,035	751,089
M.C.3.6	Criminalistics Teaching	70	18	1,260	1	1,260	New	$ 369	2,035	751,089
M.C.3.7	Criminalistics Microscope Teaching	53	12	630	1	630	New	$ 369	1,017	375,544
M.C.4.0	Research Laboratory						New	$ 358	-	-
M.C.4.1	Student Research Lab	175	1	175	4	700	New	$ 358	1,130	404,272
M.C.5.0	Lab Service						New	$ 358	-	-
M.C.5.1	Prep Room	210	1	210	4	840	New	$ 358	1,356	485,127
M.C.5.2	Balance Room	105	1	105	2	210	New	$ 358	339	121,282
M.C.5.3	Instrument Room	105	1	105	2	210	New	$ 358	339	121,282
M.C.5.4	Dark Room	315	1	315	1	315	New	$ 358	509	181,923
M.C.6.0	Storage	120	1	120	1	120	Remodel	$ 120	194	23,287
	MSCD Anthropology					**2,720**			**4,392**	**$ 882,236**
M.A.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
M.A.3.0	Laboratories						Remodel	$ 248	-	-
M.A.3.1	Anthropology Teaching	44	36	1,575	1	1,575	Remodel	$ 248	2,543	630,294
M.A.5.0	Lab Service						Remodel	$ 263	-	
M.A.5.1	Prep Room	315	1	315	1	315	Remodel	$ 263	509	133,663
M.A.6.0	Storage						Remodel	$ 120	-	-
M.A.6.1	Collections	630	1	630	1	630	Light Remodel	$ 78	1,017	79,467
M.A.6.2	Storage	200	1	200	1	200	Remodel	$ 120	323	38,812

		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	MSCD Earth Sciences					**13,700**			**22,123**	**$ 3,836,147**
M.G.1.0	Office Space						Light Remodel	$ 78	-	-
M.G.1.1	Chair/Director	160	1	160	1	160	Light Remodel	$ 78	258	20,182
M.G.1.2	Faculty Office	120	1	120	13	1,560	Light Remodel	$ 78	2,519	196,775
M.G.1.3	Adjunct Faculty	60	4	240	3	720	Light Remodel	$ 78	1,163	90,819
M.G.1.5	Student Work Area	40	4	160	0	-	Light Remodel	$ 78	-	-
M.G.1.10	Administrative Assistant	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.G.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	$ 78	-	-
M.G.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.G.1.13	Reception	40	4	160	1	160	Light Remodel	$ 78	258	20,182
M.G.1.14	Records	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.G.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	$ 78	-	-
M.G.1.16	General Office Storage	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.G.1.19	Office Space Reduction			(3,080)	0%	-	Light Remodel	$ 78	-	-
M.G.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
M.G.2.1	GIS Classroom	30	30	900	1	900	Light Remodel	$ 98	1,453	141,769
M.G.2.2	Meteorology Classroom	30	30	900	1	900	Light Remodel	$ 98	1,453	141,769
M.G.3.0	Laboratories						Remodel	$ 248	-	-
M.G.3.1	Geology Teaching	49	32	1,575	2	3,150	Remodel	$ 248	5,087	1,260,589
M.G.3.2	Integrated Natural Science	49	32	1,575	1	1,575	Remodel	$ 248	2,543	630,294
M.G.3.3	GIS Computer Lab	30	30	900	2	1,800	Remodel	$ 150	2,907	436,213
M.G.3.4	Meteorology Computer Lab	30	20	600	1	600	Remodel	$ 150	969	145,404
M.G.5.0	Lab Service						Remodel	$ 263	-	-
M.G.5.1	Prep Room	630	1	630	1	630	Remodel	$ 263	1,017	267,327
M.G.5.2	X-Ray Core	315	1	315	1	315	Remodel	$ 263	509	133,663
M.G.5.3	Rock Collections	315	1	315	1	315	Remodel	$ 263	509	133,663
M.G.5.4	Map Collections	315	1	315	1	315	Remodel	$ 263	509	133,663
M.G.6.0	Storage	120	1	120	1	120	Remodel	$ 120	194	23,287
	MSCD Math and Computer Science					**12,600**			**20,346**	**$ 2,063,867**
M.M.1.0	Office Space						Light Remodel	$ 78	-	-
M.M.1.1	Chair/Director	160	1	160	1	160	Light Remodel	$ 78	258	20,182
M.M.1.2	Faculty Office	120	1	120	37	4,440	Light Remodel	$ 78	7,170	560,052
M.M.1.3	Adjunct Faculty	60	4	240	5	1,200	Light Remodel	$ 78	1,938	151,365
M.M.1.4	Student Work Area	40	4	160	0	-	Light Remodel	$ 78	-	-
M.M.1.5	Systems Administrator	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.M.1.6	Part-Time Staff	40	1	40	1	40	Light Remodel	$ 78	65	5,046
M.M.1.10	Administrative Assistant	120	1	120	3	360	Light Remodel	$ 78	581	45,410
M.M.1.11	Conference	See MSCD Shared Spaces below					Light Remodel	$ 78	-	-
M.M.1.12	Work/Copy/Print	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.M.1.13	Reception	40	4	160	1	160	Light Remodel	$ 78	258	20,182
M.M.1.14	Records	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.M.1.15	Breakroom	See MSCD Shared Spaces below					Light Remodel	$ 78	-	-
M.M.1.16	General Office Storage	120	1	120	1	120	Light Remodel	$ 78	194	15,137
M.M.1.19	Office Space Reduction			(6,840)	0%	-	Light Remodel	$ 78	-	-
M.M.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$ 98	-	-
M.M.2.1	Math Group Learning Classroom	30	12	360	6	2,160	Light Remodel	$ 98	3,488	340,246
M.M.3.0	Laboratories						Remodel	$ 150	-	-
M.M.3.1	Math Education Lab	30	36	1,080	1	1,080	Remodel	$ 150	1,744	261,728
M.M.4.0	Open Laboratories (CS only)						Remodel	$ 150	-	-
M.M.4.1	Mac Lab	30	30	900	1	900	Remodel	$ 150	1,453	218,107
M.M.4.2	Unix Lab	30	30	900	1	900	Remodel	$ 150	1,453	218,107
M.M.6.0	Storage						Remodel	$ 120	-	-
M.M.6.1	Archive Room	120	1	120	1	120	Remodel	$ 120	194	23,287
M.M.6.2	Storage	120	1	120	1	120	Remodel	$ 120	194	23,287
M.M.7.0	Interaction/Community	See MSCD Shared Space below					Remodel	$ 150	-	-
M.M.7.1	Tutoring Lab	40	12	480	1	480	Remodel	$ 150	775	116,323

		Area and Quantity Provided					Cost Model				
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost		Gross Area (GSF)	Estimated Construction Cost
	MSCD Deans' Office					**2,260**				**3,649**	**$ 188,859**
M.D.1.0	Office Space						Backfill	$	52	-	-
M.D.1.1	Dean	240	1	240	2	480	Backfill	$	52	775	40,112
M.D.1.2	Associate Dean	120	1	120	2	240	Backfill	$	52	388	20,056
M.D.1.3	Assistant Dean	120	1	120	2	240	Backfill	$	52	388	20,056
M.D.1.4	Student Work Area	40	2	80	1	80	Backfill	$	52	129	6,685
M.D.1.10	Administrative Assistant	120	1	120	2	240	Backfill	$	52	388	20,056
M.D.1.11	Conference	25	12	300	1	300	Backfill	$	52	484	25,070
M.D.1.12	Work/Copy/Print	120	1	120	1	120	Backfill	$	52	194	10,028
M.D.1.13	Reception	40	6	240	1	240	Backfill	$	52	388	20,056
M.D.1.14	Records	120	1	120	1	120	Backfill	$	52	194	10,028
M.D.1.15	Breakroom	80	1	80	1	80	Backfill	$	52	129	6,685
M.D.1.16	General Office Storage	120	1	120	1	120	Backfill	$	52	194	10,028
M.D.1.17	Office Space Reduction			(2,260)	0%	-	Backfill	$	52	-	-
	MSCD Shared Space					**5,467**				**8,828**	**$ 1,696,456**
M.S.1.0	Office Space						Light Remodel	$	78	-	-
M.S.1.1	Special Events Conference	See Auraria Shared Spaces below					Light Remodel	$	78	-	-
M.S.1.2	Conference	25	8	200	8	1,600	Light Remodel	$	78	2,584	201,820
M.S.1.3	Breakroom	80	1	80	4	320	Light Remodel	$	78	517	40,364
M.S.1.4	Adjunct Faculty	Included by departments above					Light Remodel	$	78	-	-
M.S.2.0	Classrooms	See Auraria Shared Spaces below					Light Remodel	$	98	-	-
M.S.5.0	Lab Service						New	$	358	-	-
M.S.5.1	Scanning Electron Microscope	315	1	315	1	315	New	$	358	509	181,923
M.S.6.0	Storage						Remodel	$	120	-	-
M.S.7.0	Interaction/Community						New	$	244	-	-
M.S.7.1	Departmental Display	50	1	50	11	550	New	$	244	888	216,528
M.S.7.2	Student Group Study	15	59	882	1	882	New	$	244	1,424	347,184
M.S.7.3	Computer Lab	30	60	1,800	1	1,800	New	$	244	2,907	708,637
						83,287				**135,918**	**$ 31,328,419**

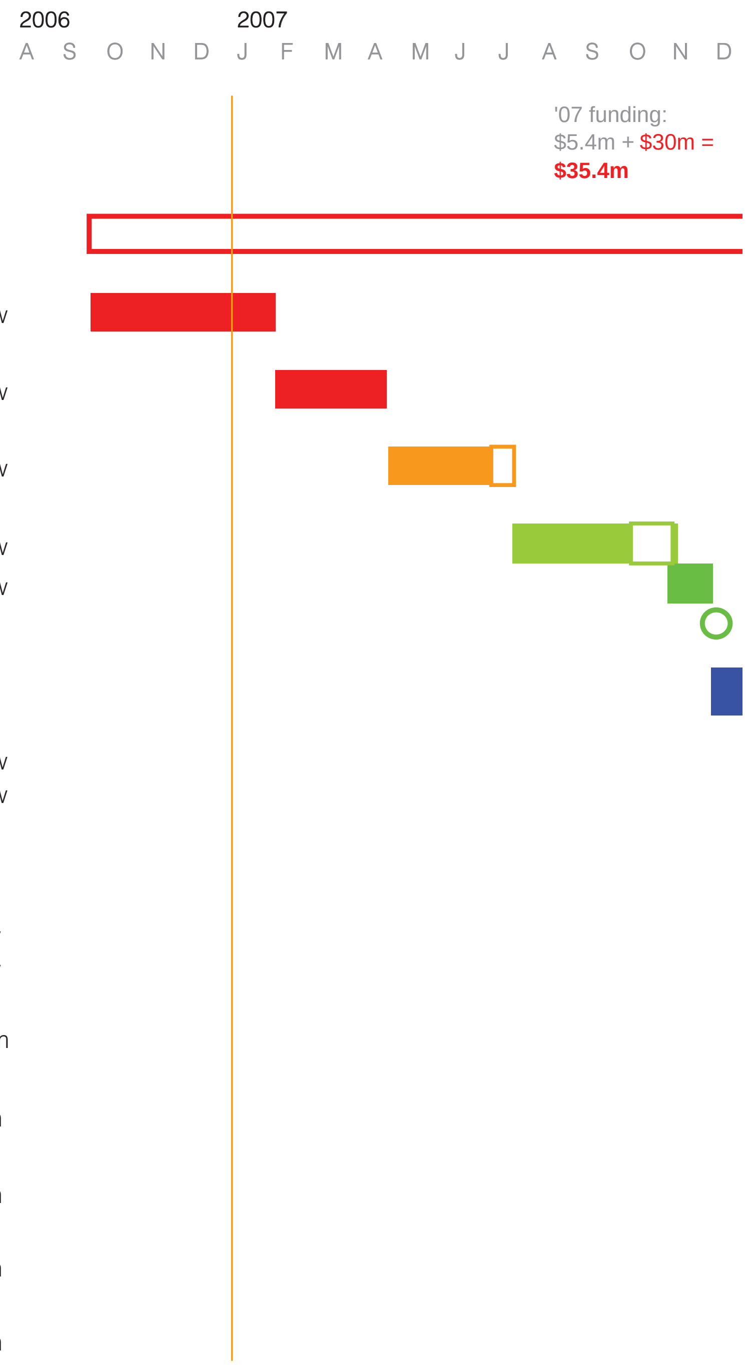
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	Auraria Sciences Shared Space									
	Shared Biology					**2,630**			**4,247**	**$ 1,518,909**
A.B.4.1	Herbarium	630	1	630	1	630	New	$ 358	1,017	363,845
A.B.4.2	Greenhouse	2000	1	2,000	1	2,000	New	$ 358	3,230	1,155,064
	Shared Chemistry					**3,570**			**5,765**	**$ 2,079,338**
A.C.3.0	Laboratories						New	$ 369	-	-
A.C.3.1	Biochemistry Teaching	59	16	945	1	945	New	$ 369	1,526	563,316
A.C.5.0	Lab Service						New	$ 358	-	-
A.C.5.1	Chemistry Stockroom Suite	2205	1	2,205	1	2,205	New	$ 358	3,561	1,273,458
A.C.5.2	Biochemistry Equipment Room	105	1	105	1	105	New	$ 358	170	60,641
A.C.5.3	Prep Room	210	1	210	1	210	New	$ 358	339	121,282
A.C.5.4	Balance Room	105	1	105	1	105	New	$ 358	170	60,641
	Shared Research					**15,886**			**25,653**	**$ 7,231,575**
A.R.4.0	Funded Research Laboratory						New	$ 351	-	-
A.R.4.1	Psychology Research Lab	475	1	475	0	-	New	$ 351	-	-
A.R.4.2	Anthropology Research Lab	630	1	630	0	-	New	$ 351	-	-
A.R.4.3	Chemistry Research Lab	630	1	630	0	-	New	$ 358	-	-
A.R.4.4	Biology Research Lab	630	1	630	0	-	New	$ 351	-	-
A.R.4.5	Shelled Research Lab	790	1	790	12	9,480	New	$ 231	15,308	3,531,905
A.R.5.0	Research Lab Service					-	New	$ 358	-	-
A.R.5.1	Animal Care Suite	2835	1	2,835	1	2,835	New	$ 358	4,578	1,637,303
A.R.5.2	Imaging Room	210	1	210	1	210	New	$ 358	339	121,282
A.R.5.3	Dark Room	210	1	210	1	210	New	$ 358	339	121,282
A.R.5.4	Instrument Room	630	1	630	1	630	New	$ 358	1,017	363,845
A.R.5.5	Plant Growth	158	1	158	2	316	New	$ 358	510	182,500
A.R.5.6	Growth Chamber Room	315	1	315	1	315	New	$ 358	509	181,923
A.R.5.7	Research Greenhouse	630	1	630	2	1,260	New	$ 358	2,035	727,690
A.R.5.8	Equipment Alcove	160	1	160	0	-	New	$ 351	-	-
A.R.5.9	Research Imaging	315	1	315	2	630	New	$ 358	1,017	363,845
	Shared General					**1,235**			**1,994**	**$ 595,331**
A.R.5.1	Instrument Repair	315	1	315	1	315	New	$ 358	509	181,923
A.R.5.2	Machine Shop	315	1	315	1	315	New	$ 358	509	181,923
A.R.5.3	Nitrogen Generator	105	1	105	1	105	New	$ 358	170	60,641
A.R.5.4	Field Equipment Storage	50	1	50	10	500	New	$ 212	807	170,845
	Shared Classrooms					**31,925**			**51,552**	**$ 4,381,259**
A.C.2.0	Classroom						Backfill	$ 72	-	-
A.C.2.1	600 Seat Lecture Hall	13.5	600	8,100	0	-	Backfill	$ 79	-	-
A.C.2.2	300 Seat Lecture Hall	13.5	300	4,050	1	4,050	Light Remodel	$ 105	6,540	686,848
A.C.2.3	180 Seat Tiered Classroom	25	180	4,500	0	-	Backfill	$ 79	-	-
A.C.2.4	100 Seat Tiered Classroom	25	100	2,500	1	2,500	Backfill	$ 79	4,037	319,175
A.C.2.5	50 Seat Classroom	25	**50**	1,250	8	10,000	Light Remodel	$ 98	16,148	1,575,214
A.C.2.5.1	50 Seat Classroom	25	**50**	1,250	0	-	Remodel	$ 150	-	-
A.C.2.5.2	50 Seat Classroom	25	**50**	1,250	12	15,000	Backfill	$ 72	24,222	1,740,952
A.C.2.7	30 Seat Classroom	25	30	750	0	-	Backfill	$ 72	-	-
A.C.2.8	15 Seat Seminar Room	25	15	375	1	375	Light Remodel	$ 98	606	59,071
A.C.2.9	Lecture Prep Room	800	1	800	0	-	Backfill	$ 72	-	-

		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	Shared Building Support					**6,100**			**9,850**	**$ 2,084,315**
A.S.6.1	General Storage	600	1	600	1	600	New	$ 212	969	205,015
A.S.6.2	Loading/Receiving	200	1	200	1	200	New	$ 212	323	68,338
A.S.6.3	Vending	120	1	120	6	720	New	$ 212	1,163	246,017
A.S.6.4	Recycling	80	1	80	6	480	New	$ 212	775	164,012
A.S.6.5	Janitor	80	1	80	6	480	New	$ 212	775	164,012
A.S.6.6	Main Telecom Distribution	120	1	120	6	720	New	$ 212	1,163	246,017
A.S.6.7	Telecom Distribution	80	1	80	18	1,440	New	$ 212	2,325	492,035
A.S.6.8	Shower	80	1	80	2	160	New	$ 212	258	54,671
A.S.6.9	Dock	300	1	300	1	300	New	$ 212	484	102,507
A.S.6.10	Mail	300	1	300	1	300	New	$ 212	484	102,507
A.S.6.11	Hazmat Waste	200	1	200	1	200	New	$ 212	323	68,338
A.S.6.12	Environmental H&S	200	1	200	1	200	New	$ 212	323	68,338
A.S.6.13	Cannister Storage	300	1	300	1	300	New	$ 212	484	102,507
	Shared Interaction/Community				**7%**	**1,000**			**1,615**	**$ 341,691**
A.I.1.0	Special Events Conference	25	40	1,000	1	1,000	New	$ 212	1,615	341,691
A.I.7.0	Interaction/Community						New	$ 244	-	-
A.I.7.1	Departmental Display	50	1	50	0	-	New	$ 244	-	-
A.I.7.2	Student Group Study	Included under Institutional Share			1	-	New	$ 244	-	-
A.I.7.3	Open Computer Lab									
	SHARED SPACE TOTALS					**62,346**			**100,676**	**$ 18,232,417**
					New	122,238		$ 333	197,389	65,724,785
					Remodel	16,150		$ 197	26,079	5,145,967
					Light Remodel	55,085		$ 92	88,951	8,187,336
					Backfill	26,285		$ 77	42,445	3,273,553
					Remain	1,575		$ 66	2,543	167,079
	TOTAL ASSIGNABLE AREA (ASF)					**221,333**	**ASF**			
					Efficiency	**61.9%**	**SF**			
	TOTAL GROSS BUILDING AREA (GSF)					**357,408**	**GSF**	**$ 231**	**357,408**	**$ 82,498,722**

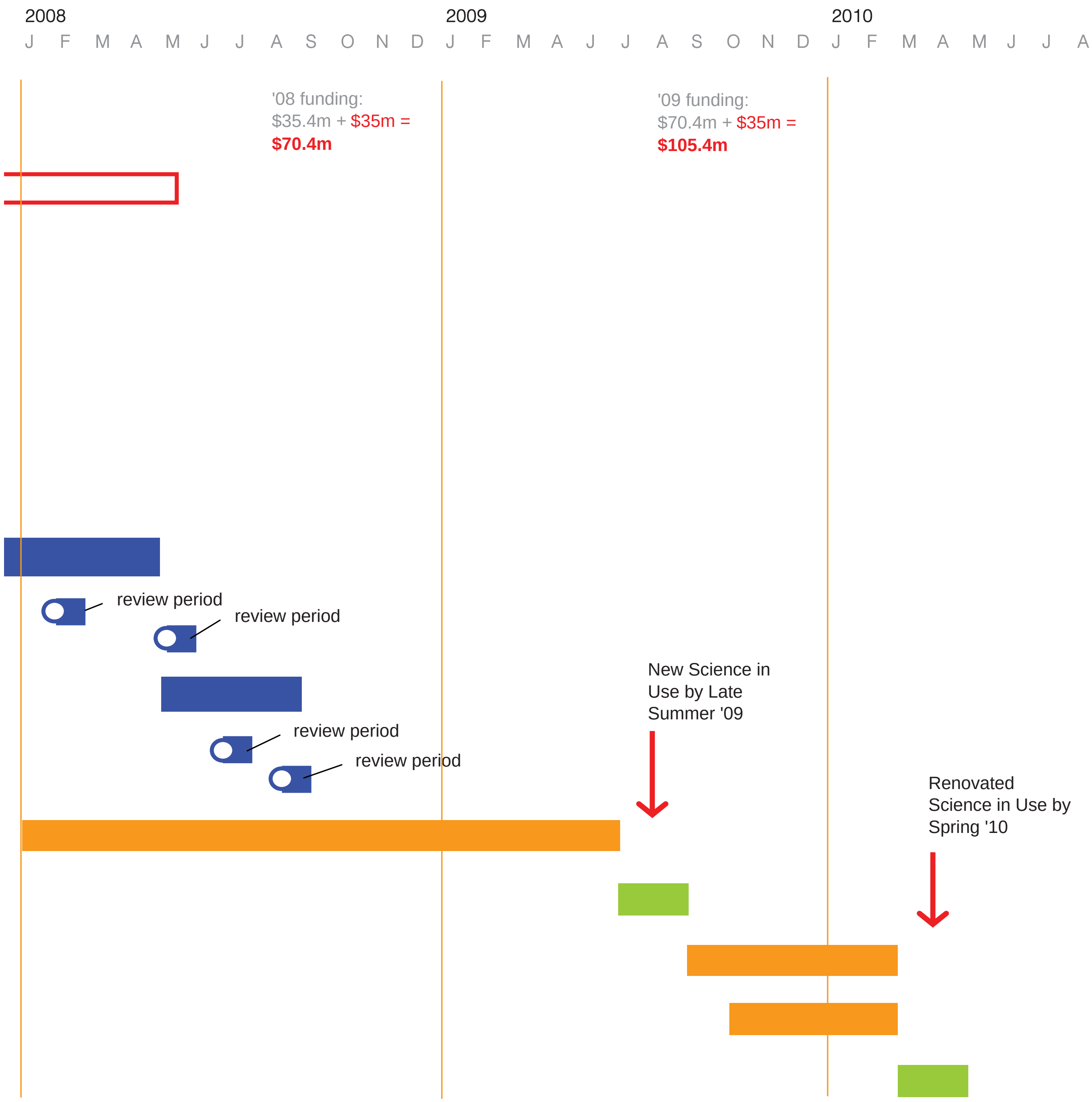
V.4 Project Schedule

The Overview Schedule below, and the Detailed Schedule following represent an anticipated design and construction schedule. The Project will be built by the Construction Manager/General Contractor (CM/GC) process. The CM/GC will be hired during the design phase and will develop the actual construction schedule. It is anticipated that the CM/GC will issue a Guaranteed Maximum Price for the Project at the end of Design Development. Construction may begin at that time by means of a fast track process. The fast track process utilizes bid packs which allow bidding and constructions for certain systems (such as foundations and steel) before the entire building is completely designed and documented.

Design	
Programming	22w
Concept Design (incl. AHEC rev.)	10w
Schematic Design (incl. AHEC rev.)	12w
Design Development (incl. AHEC rev.)	16w
GMP	10w
GMP Delivery	
Construction Documents (new)	
50% Construction Documents (incl. AHEC rev.)	11w
100% Construction Documents (incl. AHEC rev.)	10w
Construction Documents (renov)	
50% Construction Documents (incl. AHEC rev.)	8w
100% Construction Documents (incl. AHEC rev.)	8w
New Construction Phase	18m
Owner Move-in	2m
Renovation Construction Phase	8m
Backfill Construction Phase	5m
Owner Move-in	2m

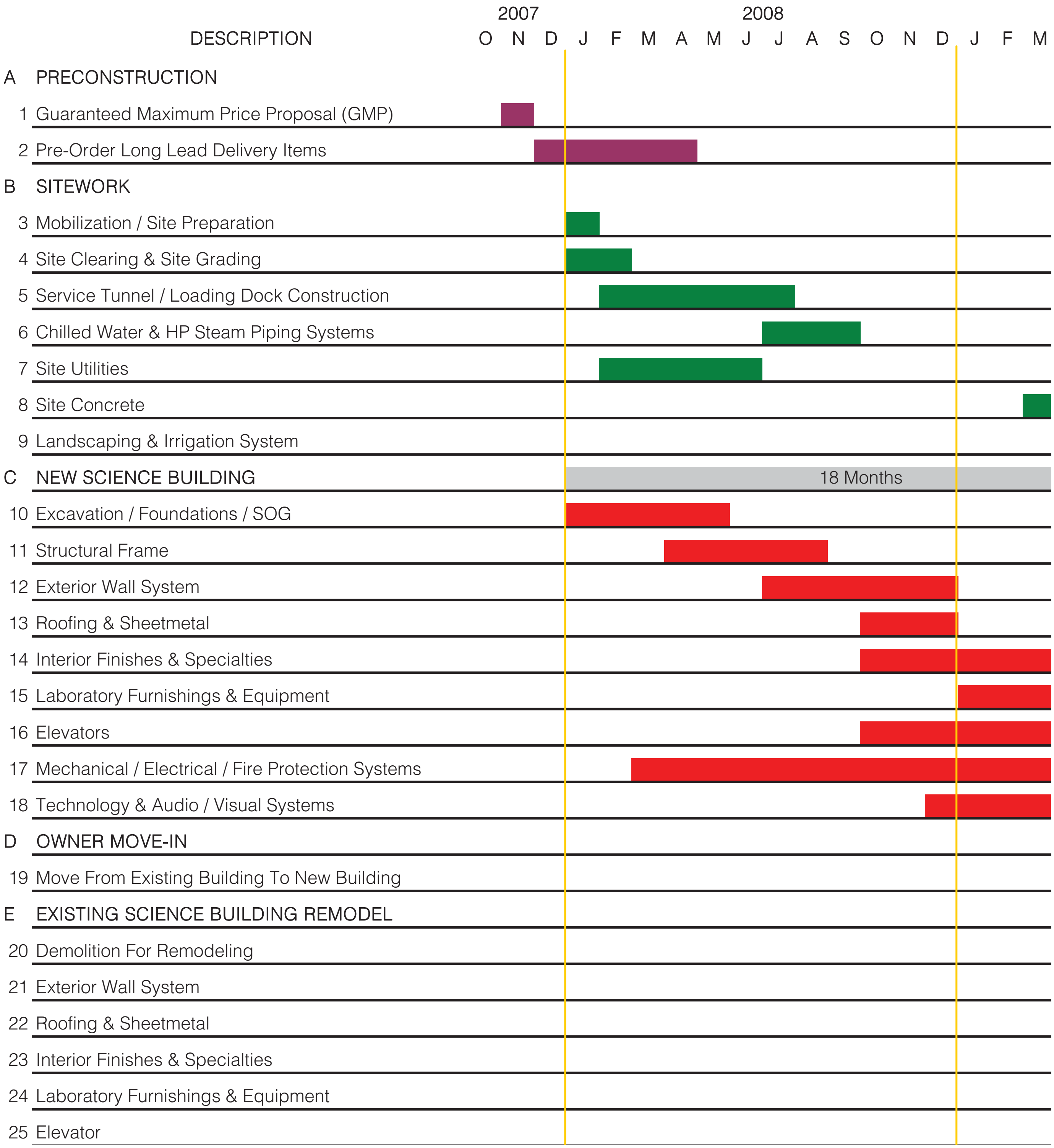


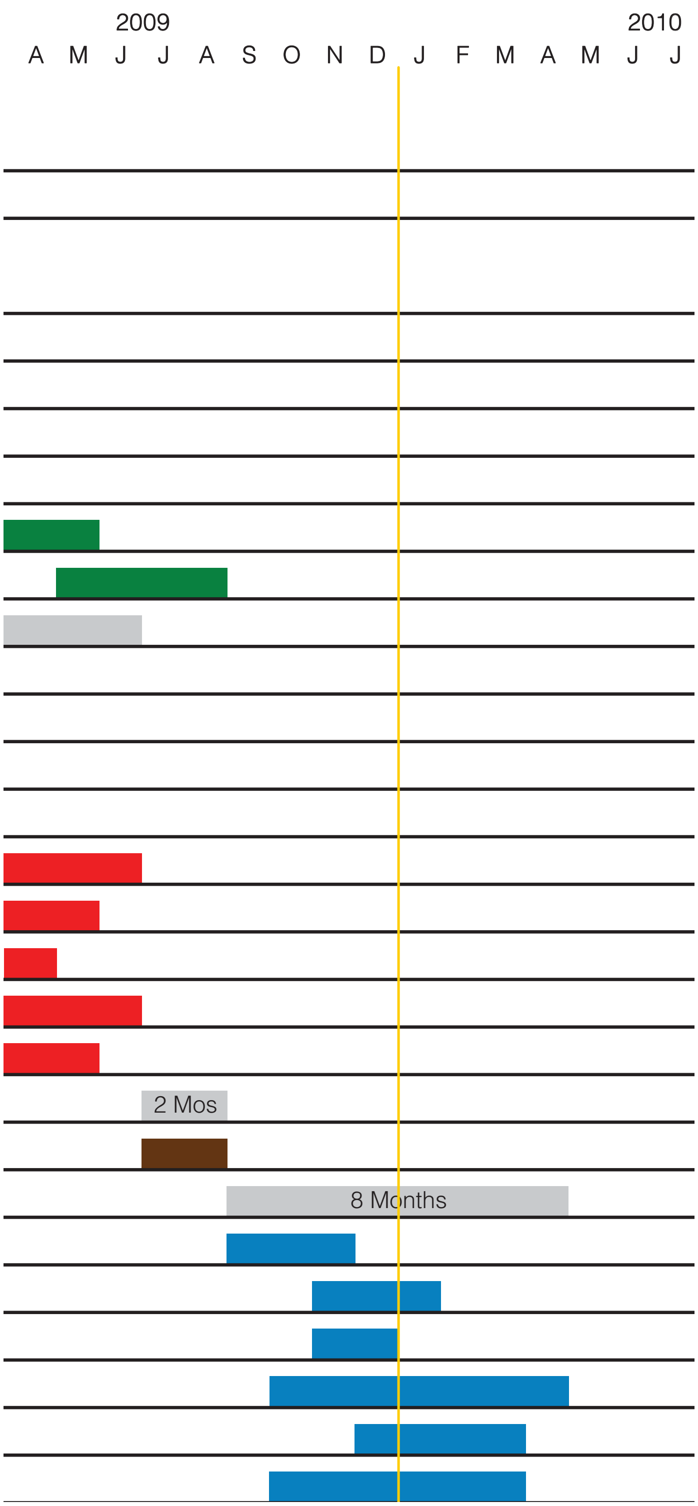
It is presumed that the new building will be built first, then occupants of the existing Science building will move into the new building (sometimes in temporary quarters) while the existing building and the backfill space is renovated. When the renovation is complete, the occupants and program functions can move into their permanent space, whether in new construction or renovation.



V.4.1 Project Schedule (Detailed)

The Detailed Schedule below presents anticipated sequencing and timing of construction activities. The final construction schedule will be developed by the




2009
2010
A M J J A S O N D J F M A M J J
2 Mos
8 Months

V.5 Relation to Master Plan and Other Projects

The Auraria Facilities Master Plan, published in 2000, listed future Capital Construction Projects in a prioritized order. At that time the top two projects were: 1) improvements to the South Classroom Building and 2) Renovation and Addition to the Science Building. Neither project was completed, and, since that time, the Science Building project has become the top priority project. In 2004 a Program Plan was completed for the Science Building Renovation and Addition. That Program Plan was submitted to CCHE for review and CCHE subsequently recommended its funding. The project was not funded at that time. Now, an updated Program Plan for the previously approved project is being submitted.

The Facilities Master Plan of 2000 envisioned additions to the Science Building which directly abutted the existing building. The 2004 Program Plan also envisioned additions (larger than in 2000) which wrapped the existing building. The present Program Plan envisions an addition separate from the existing building yet joined to it.

Currently, a Campus Master Plan is progress. Though not yet finalized and issued, in-progress presentations indicate that the Master Plan will designate the area around the current Science Building as a “science district”. The adjacent North Classroom Building already houses many UCD science labs, thus supporting the notion of a “science district”. The Master Plan recommends construction relating to the sciences to be located in the area between the Science Building, North Classroom Building and Speer Boulevard. This project fits those parameters with the placement of the Science Building Addition.

VI.1 Summary of Existing Spaces

The tables on the following pages list existing science spaces that are currently located in the North Classroom, South Classroom and Science building. The first tables show spaces listed by institution and department. The second table shows a space summary of existing classrooms and laboratories in the North Classroom, South Classroom and Science building.

EXISTING UCDHSC SPACE INVENTORY—North Classroom & Science

	Room Name	ASF	Building	Room Number	Remarks
UCDHSC Biology					
Office					
	Reception	290	NC	3014	
	Faculty Office	121	NC	3014A	
	Faculty Office	189	NC	3014B	
	Faculty Office	121	NC	3014C	
	Faculty Office	121	NC	3014D	
	Faculty Office	148	NC	3014E	
	Faculty Office	112	NC	3014F	
	Reception	237	NC	3016	
	Faculty Office	121	NC	3016B	
	Faculty Office	88	NC	3016C	
	Faculty Office	88	NC	3016D	
	Chair/Director	118	NC	3016E	
	Faculty Office	123	NC	3016F	
	Faculty Office	119	NC	3402	
	Faculty Office	129	NC	3411	
	Faculty Office	90	NC	4019A	
	Faculty Office	86	NC	4019D	
	Lab Coordinator	104	NC	3417	
	Program Assistant	113	NC	3016A	
	Graduate Student Workstation	416	SI	221	For 14 Students
	SUBTOTAL NC	**2,518**			
	SUBTOTAL	**2,934**			
Teaching Lab					
	General Biology Teaching	681	NC	3414	General Biology I and II. Capacity 20; Many sub-biology teaching labs are taught in room.
	Microbiology Teaching	946	NC	3515	Human Anatomy, General Microbiology, Molecular Biology. Capacity 20
	Anatomy & Physiology Teaching	633	NC	3419	Basic Biology I and II, Human Physiology, Plant Science. Capacity 20
	SUBTOTAL NC	**2,260**			
	SUBTOTAL	**2,260**			
Research Lab					
	Biology Research Lab	555	NC	3403	Molecular Biology Research
	Biology Research Lab	77	NC	3403A	Molecular Biology Research
	Biology Research Lab	625	NC	3413	Microbiology Research
	Biology Research Lab	494	NC	2213	research assts; lab works well
	Biology Research Lab	490	NC	3112	Molecular Genetics
	Biology Research Lab	290	NC	3114	Aqua Ecology Research Lab
	Biology Research Lab	73	NC	3114A	Aqua Ecology Research Lab
	Biology Research Lab	99	NC	3404	Aqua Ecology Research Lab
	Biology Research Lab	696	NC	3407	Cellular Biology Research
	Biology Research Lab	118	NC	3410	Forest Ecology Research Lab
	Biology Research Lab	105	NC	3406A	Forest Ecology Research Lab
	Biology Research Lab	31	NC	3406A1	Forest Ecology Research Lab
	Biology Research Lab	32	NC	3406A2	Forest Ecology Research Lab
	Biology Research Lab	426	NC	3513	Physiology Research Lab
	SUBTOTAL NC	**4,111**			
	SUBTOTAL	**4,111**			
Lab Service					
	Prep Room	99	NC	3416	Cadaver Room
	Prep Room	307	NC	3414A/3515A	Biology Teaching Lab Service
	Instrument Room	169	NC	3011	Common Equipment Room
	Dark Room	73	NC	3011A	Dark Room/Sequencing Room
	SUBTOTAL NC	**648**			
	SUBTOTAL ALL	**648**			
	TOTAL BIOLOGY NC	**9,537**			
	TOTAL BIOLOGY	**9,953**			

	Room Name	ASF	Building	Room Number	Remarks
UCDHSC Chemistry					
Office					
	Chair/Director	179	NC	3002C	
	Faculty Office	130	NC	3002A	
	Faculty Office	131	NC	3002B	
	Faculty Office	130	NC	3002D	
	Faculty Office	100	NC	3101	
	Faculty Office	120	NC	3103A	
	Faculty Office	137	NC	3103B	
	Faculty Office	134	NC	3103C	
	Faculty Office	120	NC	3103D	
	Faculty Office	132	NC	3105	
	Faculty Office	128	NC	3107C	
	Faculty Office	173	NC	3215	
	Faculty Office	162	NC	3202	Supposed to be Instrument Room
	Lab Coordinator	115	SI	333B	
	Graduate Student Workstation	243	NC	3204A	Research Assistant Space
	Graduate Student Workstation	219	NC	3205B	Computational Research Assistant Space. Good size room for students; Adjacency to Computation Research Lab is preferred
	Graduate Student Workstation	226	NC	3211/3213	This room should be research lab space
	Undergraduate Teaching Assistant	413	SI	333	
	Reception	168	NC	3002	
	General Office Storage	33	SI	333A	
	SUBTOTAL NC space	**2,632**			
	SUBTOTAL	**3,193**			
Teaching Lab					
	Analytical/Inorganic Teaching	1,127	SI	302	Capacity: 22
	Physical/Instrumental Teaching	653	SI	308	UG Research. Theoretical capacity 12; Realistic cap: 8
	Organic Chemistry Teaching	1,429	SI	330	Theoretical cap: 24; Realistic cap:18
	General Chemistry Teaching	1,128	SI	332	Capacity: 24
	Analytical/Inorganic Teaching	566	SI	306	Shared with MSCD; under Auraria Shared Space. Ex space split 50/50
	Biochemistry Lab		SI	326	Shared with MSCD; under Auraria Shared Space
	SUBTOTAL NC space	**0**			
	SUBTOTAL	**4,903**			

	Room Name	ASF	Building	Room Number	Remarks
Research Lab					
	Chemistry Research Lab	451	NC	3207	Inorganic Research Lab. Good fume hood capacity. There is a capacity for 4 students in the room. There is 229 ASF office space in room.; Two undergraduate students are typical.
	Chemistry Research Lab	461	NC	3204B	Organic Research Lab. Dr, Dyckes' Lab: 6-7 research assistants are typical in combined space
	Chemistry Research Lab	425	NC	3204C	Organic Research Lab. Dr, Dyckes' Lab: 6-7 students/research assistants are typical in combined space
	Chemistry Research Lab	70	NC	3205A	Computation Lab. 1-4 students/research assistants/visiting professors are typical
	Chemistry Research Lab	442	NC	3208B	Biochemistry Research Lab. Space will go to new analytical chemist in the spring 2006 or next fall 2006. 2-3 students/research assts are typical.
	Chemistry Research Lab	51	NC	3209	Unassigned Research Lab. Faculty not assigned to space
	Chemistry Research Lab	465	NC	3209B	Inorganic Research Lab. Xiaotai Wang owns space; 2 UG students are typical--combined with NC 3207.
	Chemistry Research Lab	465	NC	3209C	Unassigned Research Lab. Faculty not assigned to space; but will be assigned to new Department Chair
	Chemistry Research Lab	54	NC	3214	Physical Chemistry Research Lab. Larry Anderson space; Typically has 2-3 students/research assistants.
	Chemistry Research Lab	424	NC	3214B	Physical Chemistry Research Lab. Larry Anderson space; Typically has 2-3 students/research assistants.
	Chemistry Research Lab	464	NC	3214C	Physical Chemistry Research Lab. Larry Anderson space; Typically has 2-3 students/research assistants.
	SUBTOTAL NC space	**3,772**			
	SUBTOTAL ALL	**3,772**			

	Room Name	ASF	Building	Room Number	Remarks
Lab Service					
	Prep Room	174	SI	308A	Advanced Studies Teaching Lab Service
	Prep Room	187	SI	308A1	Advanced Studies Teaching Lab Service
	Prep Room		SI	326A	Teaching Lab Service. Shared with MSCD; under Auraria Shared Space
	Prep Room	139	SI	330A	
	Prep Room	234	SI	332A	
	Prep Room	206	NC	3209A	NMR Room
	Instrument Room	118	NC	3214A	Instrument Room
	Biochemistry Prep	229	NC	3214D	Biochemistry Research Lab Service
	Storage	118	NC	3216	Research Lab Storage
	SUBTOTAL NC space	**671**			
	SUBTOTAL ALL	**1,405**			
	TOTAL CHEMISTRY NC	**7,075**			
	TOTAL CHEMISTRY ALL	**13,273**			
UCDHSC Anthropology					
Teaching Lab					
	Anthropology Teaching	1,236	SI	104	Class Lab with Utilities
	SUBTOTAL	**1,236**			
	TOTAL ANTHROPOLOGY	**1,236**			
UCDHSC Psychology					
Research lab					
	Psychology Research Lab	562	NC	5007	
	Psychology Research Lab	159	NC	5010	Verify space
	SUBTOTAL	**721**			
	TOTAL PSYCHOLOGY	**721**			
UCDHSC Math					
Labortories					
	Math Laboratory	576	SI	130	Computer Teaching Lab with Utilities
	Math Laboratory	575	SI	132	Computer Lab
	Math Laboratory	18	SI	132A	Storage closet
	SUBTOTAL	**1,169**			
	TOTAL MATH	**1,169**			
UCDHSC Shared Spaced					
Research Lab					
	Analytical Service Lab	1,452	NC	3009	Shared across all science disciplines
	SUBTOTAL	**1,452**			
Animal Quarters					
	Animal Care Suite	46	NC	3406	Shared within UCD; Psychology, Biology, etc. Room serves more than Animal Care functions.
	Animal Care Suite	153	NC	3406D	
	Animal Care Suite	94	NC	3406B	
	Animal Care Suite	129	NC	3406C	
	Animal Care Suite	74	NC	3406E	
	Animal Care Suite	80	NC	3406F	
	Animal Care Suite	114	NC	3406G	
	Animal Care Suite	201	NC	3406H	
	SUBTOTAL	**891**			
	TOTAL SHARED	**2,343**			
UCSHSC	**TOTAL NORTH CLASSROOM**	**19,676 ASF**			
UCSHSC	**TOTAL NORTH CLASSROOM/SCIENCE**	**28,695 ASF**		**9,019**	

EXISTING MSCD SPACE INVENTORY—South Classroom & Science

	Room Name	ASF	Builiding	Room Number	Remarks
MSCD Biology					
Office					
	Faculty Office	132	SI	213A	
	Faculty Office	132	SI	213B	
	Faculty Office	132	SI	213C	
	Faculty Office	132	SI	213D	
	Faculty Office	132	SI	213E	
	Faculty Office	154	SI	213F	
	Faculty Office	145	SI	213G	
	Faculty Office	116	SI	213H	
	Faculty Office	116	SI	213J	
	Faculty Office	117	SI	213K	
	Faculty Office	140	SI	216	
	Faculty Office	136	SI	218	
	Faculty Office	116	SI	317A	
	Faculty Office	152	SI	317B	
	Reception	496	SI	213	
	SUBTOTAL	**2348**			
Teaching Lab					
	Ecology Teaching	984	SI	202	Herbarium Lab
	Botany Teaching	983	SI	204	
	Zoology Teaching	1045	SI	205	
	Microbiology Teaching	984	SI	206	
	Molecular Biology Teaching	984	SI	208	
	Human/General Biology Teaching	593	SI	209	No data on existing usage
	Human/General Biology Teaching	983	SI	210	
	Human/General Biology Teaching	633	SI	309	Class lab with Utilities--No data on usage
	Plant Physiology/Taxonomy	1043	SI	311	
	Anatomy & Physiology Teaching	1032	SI	211	
	SUBTOTAL	**9264**			
Lab Service					
	Prep Room	430	SI	204A	Botany
	Prep Room	137	SI	204B	Botany
	Microbiology Prep	995	SI	206A	
	Microbiology Prep	58	SI	206B	
	Microbiology Prep	63	SI	206C	
	Prep Room	284	SI	207	Class Lab Service
	Prep Room	605	SI	211A	
	Prep Room	438	SI	214	Class Lab Service
	SUBTOTAL	**3010**			
	TOTAL BIOLOGY	**14,622**			
MSCD Chemistry					
Office					
	Chair/Director	108	SI	325A	
	Chair/Director	92	SI	325	
	Faculty Office	116	SI	317D	
	Faculty Office	116	SI	319A	
	Faculty Office	152	SI	319C	
	Faculty Office	116	SI	319D	
	Faculty Office	116	SI	321A	
	Faculty Office	152	SI	321B	
	Faculty Office	152	SI	321C	
	Faculty Office	116	SI	321D	
	Faculty Office	108	SI	323A	
	Faculty Office	108	SI	323B	
	Lab Coordinator	127	SI	323C	
	Reception	300	SI	323	
	SUBTOTAL	**1879**			

	Room Name	ASF	Builiding	Room Number	Remarks
Teaching Lab					
	General Chemistry Teaching	1128	SI	304	Capacity: 18
	Biochemistry Teaching		SI	326	Shared with UCD; under Auraria Shared Space Principles of Chemistry. Shared with MSCD; under Auraria Shared Space. Ex space split
	Analytical Chemistry Teaching	565.5	SI	306	50/50
	Criminalistics Microscope Teaching	291	SI	310	
	Physical/Inorganic Chemistry Teaching	687	SI	312	
	Physical/Inorganic Chemistry Teaching	728	SI	312A	
	Criminalistics Teaching	991	SI	314	Criminalistics/Analytical Lab
	Organic Chemistry Teaching	1435	SI	328	
	SUBTOTAL	**5825.5**			
Lab Support					
	Instrument Room	609	SI	315	
	Prep Room	91	SI	314a1	Class Lab Services
	Prep Room	43	SI	314A1	Class Lab Services (Vault)
	Balance Room	135	SI	314B	
	Prep Room	139	SI	314C	PH Room
	Prep Room	66	SI	326A	Class Lab Services
	Prep Room	139	SI	330B	Class Lab Services
	SUBTOTAL	**1222**			
	TOTAL CHEMISTRY	**8,927**			
MSCD Anthropology					
Teaching Lab					
	Anthropology Teaching	1238	SI	108	Used as lecture and lab space.
	SUBTOTAL	**1238**			
Lab Support					
	Prep Room	188	SI	108A	Prep/Storage Room
	SUBTOTAL	**188**			
	TOTAL ANTHROPOLOGY	**1,426**			
MSCD Earth Sciences					
Office					
	Chair/Director	131	SI	231C	
	Faculty Office	761	SI	224	
	Faculty Office	116	SI	227A	
	Faculty Office	152	SI	227B	
	Faculty Office	151	SI	227C	
	Faculty Office	116	SI	227D	
	Faculty Office	108	SI	231B	
	Faculty Office	116	SI	233A	
	Faculty Office	152	SI	233B	
	Faculty Office	152	SI	233C	
	Faculty Office	116	SI	233D	
	Faculty Office	188	SI	114	Also used for map storage
	Reception	213	SI	231	
	Breakroom	92	SI	231A	Office Service (Mail/Kitchen)
	SUBTOTAL	**2564**			
Classroom					
	Meteorology Classroom	926	SI	130	cap:
	SUBTOTAL	**926**			
Teaching Lab					
	Integrated Natural Science	843	SO	211	Capacity: 28
	Geology Teaching	1014	SI	110	Geography/Geology Lab
	SUBTOTAL	**1857**			
Lab Support					
	Prep Room	90	SI	118B	Instrument/Equipment Room
	Prep Room	546	SI	110A	Geography/Geology Prep Room
	Prep Room	186	SI	118A	Class Lab Service
	SUBTOTAL	**822**			

	Room Name	ASF	Builiding	Room Number	Remarks
Computer Lab					
	Meteorology Computer Lab	300	SI	107	Some scheduled classes, remainder of time is open lab for student projects
	GIS Computer Lab	775	SI	118	Some scheduled classes, remainder of time is open lab for student projects
	GIS Computer Lab	631	SI	230	Some scheduled classes, remainder of time is open lab for student projects
	SUBTOTAL	**1706**			
	TOTAL EARTH SCIENCES	**7,875**			
MSCD Math & Computer Sciences					
Office					
	Faculty Office	116	SI	125A	
	Faculty Office	152	SI	125B	
	Faculty Office	152	SI	125C	
	Faculty Office	116	SI	125D	
	Faculty Office	116	SI	127A	
	Faculty Office	151	SI	127B	
	Faculty Office	151	SI	127C	
	Faculty Office	116	SI	127D	
	Faculty Office	116	SI	133A	
	Faculty Office	151	SI	133B	
	Faculty Office	152	SI	133C	
	Faculty Office	116	SI	133D	
	Faculty Office	116	SI	134A	
	Faculty Office	128	SI	134B	
	Faculty Office	128	SI	134C	
	Faculty Office	116	SI	134D	
	Faculty Office	204	SI	135	
	Faculty Office	416	SI	141	
	Faculty Office	164	SI	141B	
	Faculty Office	108	SI	141C	
	Faculty Office	116	SI	223A	
	Faculty Office	151	SI	223B	
	Faculty Office	151	SI	223C	
	Faculty Office	16	SI	223D	
	Faculty Office	116	SI	225A	
	Faculty Office	151	SI	225B	
	Faculty Office	151	SI	225C	
	Faculty Office	116	SI	225D	
	Faculty Office	120	SI	229A	
	Faculty Office	152	SI	317C	
	Faculty Office	152	SI	319B	
	Faculty Office	116	SI	335A	
	Faculty Office	152	SI	335B	
	Faculty Office	152	SI	335C	
	Faculty Office	116	SI	335D	
	Work/Copy/Print	140	SI	141A	Resource Room
	Work/Copy/Print	92	SI	141D	Mail/Supply Room
	Work/Copy/Print	88	SI	141D1	Copy Room
	Work/Copy/Print	184	SI	229	Office Service
	Breakroom	283	SI	226A	Administrative Lounge
	SUBTOTAL	**5700**			

	Room Name	ASF	Builiding	Room Number	Remarks
Classrooms					
	Classrooms	580	SI	136	Class Lab without Utilities
	Classrooms	792	SI	228	Class Lab without Utilities
	Math Group Learning Classroom	188	SI	106	Capacity: 12
	Math Group Learning Classroom	382	SI	116	Capacity: 12
	SUBTOTAL	**1942**			
Labs	Math Education Lab	793	SI	201	Capacity: 36
	Tutoring Lab	268	SI	226	
	SUBTOTAL	**1061**			
Open Labs					
	Mac Lab	650	SI	124C	Capacity: 30
	Unix Lab	433	SI	126	Capacity: 30
	SUBTOTAL	**1083**			
	TOTAL MATH & COMPUTER SCIENCES	**9,786**			
MSCD Dean's Office					
Office					
	Assistant Dean	155	SI	101A	
	Dean	345	SI	101B	
	Associate Dean	164	SI	101C	
	Administrative Assistant	139	SI	101D	
	Reception	456	SI	101	
	Student Work Area	140	SI	101E	
	Conference	217	SI	102A	
	Work/Copy/Print	91	SI	102C	
	General Office Storage	217	SI	102B	
	SUBTOTAL	**1924**			
	TOTAL DEAN'S OFFICE	**1,924**			
MSCD Shared Spaces					
Office					
	Adjunct Faculty	34	SI	224E	
	Adjunct Faculty	34	SI	224F	
	Adjunct Faculty	72	SI	224G	
	Adjunct Faculty	72	SI	224H	
	Storage	38	SI	224A	Office Service
	Storage	38	SI	224B	Office Service
	Storage	38	SI	224C	Office Service
	Storage	38	SI	224D	Office Service
	Storage	34	SI	224J	Office Service
	Conference	761	SI	224	
	SUBTOTAL	**1159**			
Computer Lab					
	Computer Lab	992	SI	124	MSCD IT
	Computer Lab	661	SI	s	MSCD IT
	Student Group Study	133	SI	124B	MSCD IT
	SUBTOTAL	**1786**			
	TOTAL SHARED SPACES	**2,945**			
	MSCD TOTAL	**47,505 ASF**			

EXISTING CCD SPACE INVENTORY—South Classroom

	Room Name	ASF	Builiding Room Number	Remarks
CCD Biology				
Office				
	Chair/Director	219	SO 312F	Science Chair--shared w/all sciences
	Faculty Office	219	SO 312C	
	Reception		SO 306	shared w/all departments
	SUBTOTAL	**438**		
Classroom				
	General Biology Lecture	1,231	SO 209	Classroom/Wet Lab One sink wth casework in room. Primarily used for lectures.
	SUBTOTAL	**1,231**		
Teaching Labs				
	Microbiology Teaching	1,180	SO 235	
	Anatomy & Physiology Teaching	1,180	SO 237	
	Interdisciplinary Teaching	1,326	SO 239	
	SUBTOTAL	**3,686**		
Lab Support				
	Prep Room	493	SO 235A	Class Lab Service
	Prep Room	233	SO 239A	Class Lab Service
	SUBTOTAL	**726**		
	TOTAL BIOLOGY	**6,081**		
CCD Chemistry				
Office				
	Chair/Director	107	SO 312D	Science Chair--shared w/all sciences
	Faculty Office	114	SO 312G	
	Reception		SO 306	shared w/all departments
	SUBTOTAL	**221**		
Teaching Labs				
	General Chemistry Teaching	1,010	SO 247	
	SUBTOTAL	**1,010**		
Lab Support				
	Prep Room	235	SO 247A	Chemistry Lab Prep
	Balance Room	90	SO 247B	Balance Room
	SUBTOTAL	**325**		
	TOTAL CHEMSITRY	**1,556**		
CCD Shared Spaces				
Office				
	Science Advisor	114	SO 312B	
	Adjunct Faculty	219	SO 306F	
	Reception	498	SO 306	Shared with Chemistry/Biology
	SUBTOTAL	**831**		
	TOTAL SHARED SPACES	**831**		
	CCD TOTAL	**8,468 ASF**		

EXISTING SPACE INVENTORY—Science

	Room Name	ASF	Building Room Number	Remarks
Auraria Sciences Shared				
Teaching Lab				
	Biochemistry Teaching	1042	SI 326	Shared MSCD & UCDHSC
	Analytical/Inorganic Teaching	1131	SI 306	Area shared MSCD & UCDHSC
	SUBTOTAL	**2173**		
Lab Support				
	Biochemistry Equipment Room	235	SI 306A	Chemistry Lab Support
	Balance Room	187	SI 306B	Balance Room
	Prep Room	66	SI 326A	Walk-in Cooler
	Chemistry Stockroom Suite	477	SI 331	Central Stockroom Prep
	Chemistry Stockroom Suite	630	SI 331A	Central Stockroom
	Chemistry Stockroom Suite	132	SI 331B	Hazardous Chemical Storage
	Chemistry Stockroom Suite	616	SI 331C	Chemical Storage
	Chemistry Stockroom Suite	188	SI 331D	Hazardous Chemical Storage
	SUBTOTAL	**2531**		
Greenhouse				
	Greenhouse	633	SI 309	Headhouse
	Greenhouse	860	SI 309A	
	Greenhouse	911	SI 309B	
	Greenhouse	962	SI 309C	
	SUBTOTAL	**3366**		
Classrooms				
	Classroom	755	SI 109	
	Classroom	612	SI 111	
	Classroom	567	SI 112	
	Classroom	612	SI 113	
	Classroom	612	SI 115	
	Classroom	3198	SI 119	
	Classroom	416	SI 123	
	Classroom	580	SI 138	
	Classroom	739	SI 203	
	Classroom	664	SI 212	
	Classroom	728	SI 220	
	Classroom	848	SI 222	
	Classroom	792	SI 228	
	Classroom	450	SI 313	
	Classroom	629	SI 327	
	Classroom	629	SI 329	
	SUBTOTAL	**12831**		
Community Areas				
	Interaction/Community	1498	SI 117	Student Lounge
	SUBTOTAL	**1498**		
Support				
	Lecture Prep Room	277	SI 119A	Lecture Hall AV Booth
	Field Equipment Storage	834	SI 121	
	SUBTOTAL	**1111**		
	TOTAL AURARIA SCIENCES SHARED	**23510 ASF**		

EXISTING SCIENCE CLASSROOM AND LAB FACILITIES (by building and room number)

Building:	Room:		Room Use Code:	School:	Department:	Area (ASF)	Room Capacity	ASF per Student Station
Science	103	SI 103	C	MSC	Earth Sciences	926	35	26.5
Science	104	SI 104	L	UCD	Anthropology	1236	20	61.8
Science	106	SI 106	C	MSC	Math & Computer Science	188	10	18.8
Science	107	SI 107	L	MSC	Earth Sciences	300	10	30.0
Science	108	SI 108	L	MSC	SABS (Anthropology)	1238	28	44.2
Science	109	SI 109	C	UCD	Math, Chemistry	755	50	15.1
Science	110	SI 110	L	MSC	Earth Sciences	1014	32	31.7
Science	111	SI 111	C	General - MSC	Math & Computer Science	612	39	15.7
Science	112	SI 112	C	MSC	M&CS, EAS, Biology	612	35	17.5
Science	113	SI 113	C	General - UCD/MSC	most M&CS, Biology/UCD Math, Chemistry	612	40	15.3
Science	115	SI 115	C	General - MSC	Math & Computer Science	612	40	15.3
Science	116	SI 116	C	MSC	Math & Computer Science	382	18	21.2
Science	118	SI 118	L	MSC	Earth Sciences	775	29	26.7
Science	119	SI 119	C	AHEC	Varies	3475	256	13.6
Science	123	SI 123	C	General MSC	Bio/EAS/Educ/M&CS	416	30	13.9
Science	130	SI 130	L	UCD	Math	576	30	19.2
Science	132	SI 132	L	UCD	Math	575	30	19.2
Science	136	SI 136	C	MSC	Math & Computer Science	580	25	23.2
Science	138	SI 138	C	UCD	Math	580	50	11.6
Science	201	SI 201	C	General - MSC	Math & Computer Science. Biololgy	793	36	22.0
Science	202	SI 202	L	MSC	Biology	984	24	41.0
Science	203	SI 203	C	General - MSC	UCD Math, most MSC Biology	739	55	13.4
Science	204	SI 204	L	MSC	Biology	983	24	41.0
Science	205	SI 205	L	MSC	Biology	1045	24	43.5
Science	206	SI 206	L	MSC	Biology	984	24	41.0
Science	208	SI 208	L	MSC	Biology	984	18	54.7
Science	209	SI 209	L	MSC	Biology	593	18	32.9
Science	210	SI 210	L	MSC	Biology	983	24	41.0
Science	211	SI 211	L	MSC	Biology	1032	24	43.0
Science	212	SI 212	C	General - MSC/UCD	MSC Biology, M&CS/UCD Math	664	50	13.3
Science	220	SI 220	C	General - UCD	Chemistry, Math	728	50	14.6
Science	222	SI 222	C	General - MSC/UCD	MSC EAS, Biology/UCD Math	848	60	14.1
Science	228	SI 228	C	MSC	Math & Computer Sciences	792	35	22.6
Science	230	SI 230	L	MSC	Earth Sciences	631	24	26.3
Science	302	SI 302	L	UCD	Chemistry	1127	22	51.2
Science	304	SI 304	L	MSC	Chemistry	1128	18	62.7
Science	306	SI 306	L	MSC/UCD	Chemistry	1131	18	62.8
Science	308	SI 308	L	UCD	Chemistry	653	12	54.4
Science	309	SI 309	L	MSC/UCD	Biology	633	12	52.8
Science	310	SI 310	L	MSC	Chemistry	291	18	16.2
Science	311	SI 311	L	MSC	Biology	1043	18	57.9
Science	312	SI 312	L	MSC	Chemistry	687	12	57.3
Science	312A	SI 312A	L	MSC	Chemistry	687	12	57.3
Science	313	SI 313	C	General - MSC	Chemistry, Earth Sciences	450	25	18.0
Science	314	SI 314	L	MSC	Chemistry	991	18	55.1
Science	326	SI 326	L	MSC	Chemistry	1042	12	86.8
Science	327	SI 327	C	General - MSC/UCD	MSC Chemistry, EAS/UCD Math	629	45	14.0
Science	328	SI 328	L	MSC	Chemistry	1435	18	79.7
Science	329	SI 329	C	General - MSC	Chemistry, Math & Computer Science, EAS	629	50	12.6
Science	330	SI 330	L	UCD	Chemistry	1429	18	79.4
Science	332	SI 332	L	UCD	Chemistry	1128	24	47.0
North	3414	NC 3414	L	UCD	Biology	681	20	34.1
North	3419	NC 3419	L	UCD	Biology	633	20	31.7
North	3515	NC 3515	L	UCD	Biology	946	18	52.6
South	209	SO 209	C	CCD	Biology	1231	49	25.1
South	211	SO 211	L	MSC	Earth Sciences	843	20	42.2
South	235	SO 235	L	CCD	Biology	1180	24	49.2
South	237	SO 237	L	CCD	Biology	1180	24	49.2
South	239	SO 239	L	CCD	Biology	1326	35	37.9
South	247	SO 247	L	CCD	Chemistry	1326	35	37.9

VI.2 Facility Audits, Controlled Maintenance Projects

The following is a summary Facility Audit of the Science Building by Auraria personnel, listing observations by space or area.

Area	Observation
exterior	north entry - patio has deteriorated or missing sealants
exterior	north & east entry - hollow metal storefronts are rusting and damaged at the base
exterior	general - all of the windows in this building leak water and air, are 30 years old, in poor condition, and are an energy drain
exterior	general - brick areas below window mullions are stained; metal window flashing is missing or damaged
exterior	east elevation - tuck pointing missing in areas of patio wall; continuous mortar crack on top of wall; patio wall heavily stained; trip hazard at the top of stairs (east entry)
exterior	minor cracks in patio concrete
exterior	north elevation - ramp handrails are rusting at the base; stem wall concrete has minor and occasional cracks; ramp concrete is cracked in lower portion
exterior	north mechanical towers - paint is very deteriorated on west and south elevations
exterior	west tower basement entry - missing sealants at the foundation and grade concrete; cracked step and landing at the top of stairs
exterior	north elevation - by irrigation cross connects - 3' X 10' area of brick below the first level windows have damaged or missing tuck pointing
exterior	north elevation - ramp - no handrails installed; grade drains across the ramp
exterior	west elevation - minor periodic cracks in foundation wall
exterior	west elevation - ramp and stairs handrails at south end are not ADA compliant and are rusting at the base; ramp concrete is cracked
exterior	south elevation - 1st level corner window (west end) is cracked
exterior	south elevation - brick damage at the foundation
exterior	south elevation - cables installed through brick are not sealed
exterior	building ID signs are not campus standard
roof	general - old style coping metal has modified rubber joint covers and metal strap anchors that are cupped, aged and failing; there are no secondary /overflow drains on roof
roof	old equipment being stored by west tower
roof	paint on towers is very cracked and peeled on the south elevations off the main area of the roof
roof	wind scour at NW corner
roof	wind scour and ridge blister forming in SW corner
roof	greenhouse - widow wet sealant is failing in spots; glazing system is old and a recurring maintenance issue; UV screen is old, worn, and damaged in spots
roof	most roof equipment has peeling or damaged paint; many equipment base covers are sunken and hold water (ex -EF#10)
roof	walk path has loose gravel
roof	weather data collection center on the south elevation has a secure mast sitting on a small piece of modified roofing and could penetrate 4 ply should mast loosen
roof	wind scour SE corner
roof	parapet roof side) sealants missing in brick expansion joints

Area	Observation
roof	small exhaust fan cover damaged
roof	steam valve room - door sign missing; fire extinguishers (2) has outdated inspection dates (1999, 2003);
roof	the "FIORE" drop out sky lights are designed to blow off during any explosion in the chemical rooms below and are allowed to drain from the plastic window through the underside of the aluminum frame work, these have been sealed with rubber caulk and may not allow the explosion release component of the systems (2) to work correctly; one is slightly cracked. These should be replaced immediately.
P000B	missing room number sign; lights out or dim; FACP sign on door is not campus standard
C100B	corridor is dark at 124 entry doors; fire extinguisher cabinet missing cover just outside 125; uncovered j box near i34; trip hazard in floor by 134 entry
C100C	corridor - fire extinguisher cabinet is missing cover near 117; wall patch in the same area unpainted
C100D	corridor - drywall/cove base damage by 138
P100A	extensive drywall damage (4 walls)
P100C	crack in slab on grade; minor penetrations in firewalls are not sealed correctly; floor is not sealed
P100D	custodial - door opens directly onto tempering water valves
P100E	Mechanical - cracks in slab on grade; old chalkboard being stored?
R100B	bathroom - hole in wall
S100A	floor tile damaged, rising & worn
S100B	stairwell - vet separating, delaminated and releasing in spots; cove base is damaged aged and old looking; hollow metal storefronts are rusted at the base
109	classroom - column isolation joint area tile damage; fin tube cover system has metal loose under the register
111	classroom - cove base pulled away from wall; area around white board very stained & dirty
113	classroom - stained ceiling tile; loose cove base
115	classroom - ceiling tile stored in room; dirty walls around white boards
119	classroom - fixed seating is old and parts are not available; acoustics are poor; lighting and controls very poor and antiquated; loud mechanical noise; poor ventilation; media projector cover damaged
121	storage room - this area is used as storage but really is a return air plenum for 119; j box cover missing by exit door
121A	minor cracks in slab on grade; no emergency signs or signs; fire extinguisher has expired inspection date
123	classroom - painted surface is poor; cove base missing in spots, chase cover damaged
124	computer lab - badly stained carpet at the entry
136	Science 18
137	no clear signage for path of travel to elevator equipment room; no room number sign on elevator equipment room; fire extinguisher inspection outdated
138	classroom - pneumatic sensor, thermostat is noisy; 4X6 chalk board is old an has poor working surface; mounting board for AV screen is loose
141	office suite - carpet is old and delaminating in large areas;
141D1	Plastic laminate loose on cabinets; drywall partition from remodel not taped/finished in north east corner
elevator	flooring is delaminated is spots
C200A	corridor - abandoned media installation
P220B	Custodial - door opens directly onto tempering water valves; loose drywall used as fire barrier?

Area	Observation
P220B	Custodial - door opens directly onto tempering water valves; loose drywall used as fire barrier?
P200C	floor penetrations not sealed
P200F	Mechanical - fire extinguisher inspection outdated; drywall damage; pipe insulation damage; chair stored on AHU?
231A	fire extinguisher/door stop inspection date is 1978
C300A	fire extinguisher cabinet cover is cracked
C300D	hollow metal window frames are rusted and very faded (from greenhouse)
P300A	custodial - ground wire & water valve unprotected at floor level
P300B	electrical - access hole for plumbing valve is uncovered
P300D	mechanical - fire extinguisher not mounted correctly; fire wall penetration for newly installed cryo storage not sealed; DI water storage tanks are not secured; stairs leading to the roof access are poorly lit
S300A	stairwell - window sill loose; light out; light lenses broken
S300B	light out; access ladder for the roof hatch is exposed to public and should have a guard on it
306	quantitative analysis - stained ceiling tile
306A	storage - storage cabinets not vented (5)
308	advanced studies lab - poorly lit
309	greenhouse - door lock missing screw; ceramic tile damaged and missing (south); poorly ventilated
309A	greenhouse - fin tube covers fallen off; some standing water; fluorescent tube lighting unprotected
309B	greenhouse - some standing water; fluorescent tube lighting unprotected
309C	greenhouse - fin tube covers fallen off; some standing water; fluorescent tube lighting unprotected
310	instrument lab - stained ceiling tiles; warm
311	plant physiology - extremely noisy, egress door blocked; no 3 way switching; transition missing
311	window sills very dirty; ductwork very dirty where not sealed;
311	no eyewash station (only after market portable)
312A	physical chemistry - fire extinguisher on the floor;
314	criminalistics - fire extinguisher missing at south door; storage rooms missing door signs; poor paint
315	lab - badly stained ceiling tile
323A	office - badly damaged and delaminated carpet - trip hazard
326	bio chemistry lab - stained ceiling tile (south area); missing fire extinguisher (south area)
327	classroom - poor paint condition; fin tube cover piece missing; damaged casework
327	screw installed to hold down AV screen is sticking out away from the wall and could injure someone's leg
328	organic chemistry lab - floor stained; poor ventilation; heavy odor; flammables storage containers not vented; no 3 way switching at corridor doors; poor paint condition
330	organic chemistry lab - floor stained; poor lighting and ventilation; heavy odor; flammables storage containers not vented; no 3 way switching at corridor doors
330	cracked glass in one of the fume hoods
330A	loosely run supply lines for lab equipment; poor lighting
330B	paint in poor condition; hole in east wall; sink access is blocked

Area	Observation
331	due to the nature of the use of this room (chemical storage) the door that opens into the room from the corridor should be installed to open into the corridor (including an alcove), most of the doors in this suite are designed for unrestricted path of travel from the room except for the main entry room? Also no emergency lights installed
331B	explosive chemical storage - door does not latch by itself
331C	storage - windows sills extremely dirty and dusty
331C	chemical storage - flammable cabinets not vented; fluorescent lighting tubes unprotected
331D	explosive chemical storage - door does not latch by itself
332	general chemistry lab - fume hood has broken glass (west end)
332A	unpainted patches; unknown spill on wall; evidence of leak on ceiling deck; poor access to fume hood and sink
333	crack in drywall above window; carpets in very bad condition; media room (330A) access from the office area should be moved to access from the corridor
general	exterior walls have telegraphed the metal studs which indicates poor insulation and no vapor barrier is installed
general	Formica clad doors are damaged on almost all doors in building
general	the corridors and 30% of the labs do not have acoustical ceilings and are loud areas
general	bathroom floor and wall tile in fair to good shape but grout is stained or dirty in most areas (typ)
general	casework, countertops, plumbing fixtures and sinks in all science labs are old, damaged, has ill fitted components, no ADA access; generally does not suit the modern chemistry and sciences curriculum and teaching techniques; inadequate storage in labs/building
general	old air diffusers are poor quality, noisy, and difficult to clean
general	duct work has large amount of dirt and sediment near unsealed joints
general	Building's corridors and larger labs were originally installed with special 220V outlets for maintenance flooring machines. Most were never connected and all have never been used nor are they necessary
general	Building is one of the largest and most utilized buildings on campus but it has no trash collection or maintenance services dock/area. Very big operational/educational resources drain
general	no fire sprinklers, stand pipes or hose cabinets (there are 2 hose cabinets installed on the 3rd floor but there are no valves or connections)
general	building is very well represented with emergency lighting except for the chemical storage rooms (331) and isolated mechanical rooms
general	all 6 p room suites for the 2 towers have emergency (connected to e generator) lighting installed in the secondary rooms but not the first rooms off the corridor
general	many sets (14) of buildings fire egress doors have old style panic hardware
general	There are many offices and suites connected to the corridors with door hold opens installed that do not meet fire code. Among these are rooms: 125, 127, 223, 216, 213, 317, 319, 321,335, 325, 315
general	There are signs on the 3rd level entries from the stairwells to the corridors warning of flammables and chemical use on this level but there are chemicals and flammables used on every level. This along with the old information on the signage used for safety areas in labs should be coordinated
general	emergency showers do not have catch basins in floor (this allows for contaminated water to leak between floors during emergency use and could increase the risk to unaware others, this happened in an acid incident on 2005), are in awkward locations, have irregular and outdated safety signage, are coordinated with other safety aids (fire blankets, mercury clean up kit etc.) in some labs but not in others (very inconsistent); sometimes the fire extinguishers are installed under the emergency showers
general	30X60 ceiling grid system is antiquated, unsafe and is a maintenance drain

Controlled Maintenance Projects

The following is a summary of the major controlled maintenance projects undertaken on the Science Building.

1976 Add emergency generator

1978 Chilled water pump west tower

1986 Miscellaneous roof repairs

1987 Biology room 209 – remodel

1994 Complete roof replacement 4 ply built up roof

1996 Replacement of chillers and cooling towers

1997 Mechanical upgrades, replacement of VAV boxes and new DDC controls

1998 Mechanical remodel

1999 Fire alarm upgrade
Installation of back-flow prevention devices
Acid waste piping – add two new acid neutralizing tanks and replaced all exposed piping elbows
Install new eyewash stations and showers

2000 Computer lab 130 and 132 - remodel

2001 Replace medium voltage building service cable & PMH switch

2002 Science room 104 - remodel

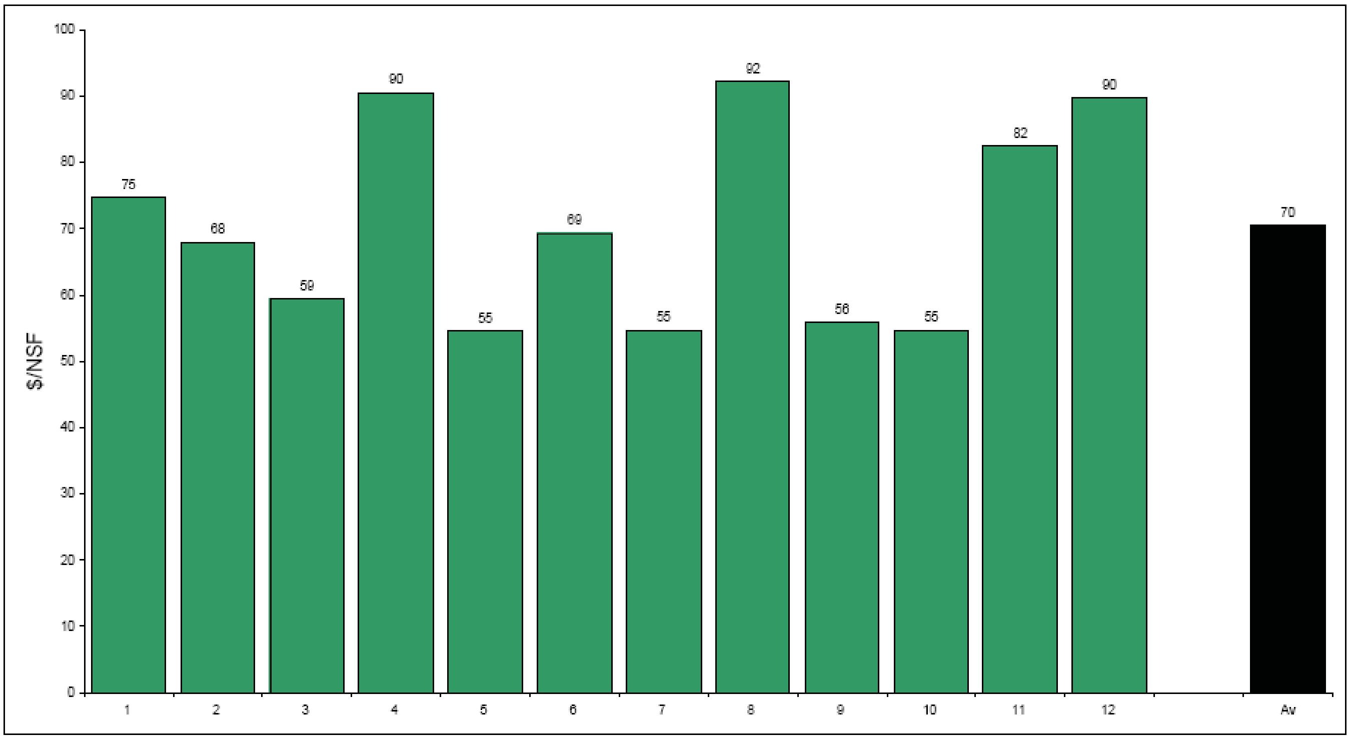
2004 DI water upgrades

2005 Computer lab 124 – remodel
Elevator improvement/ renovation

VI.3 Lab Equipment Cost Comparisons

The following graphs present actual historic costs per square feet of laboratory space for Group I furnishings and equipment, grouped by lab type.
The costs are inflated (as appropriate) to 2006 dollars. All projects listed are for research and teaching labs in new buildings at public institutions.

BIOLOGICAL / LIFE SCIENCES AND ANIMAL FACILITIES

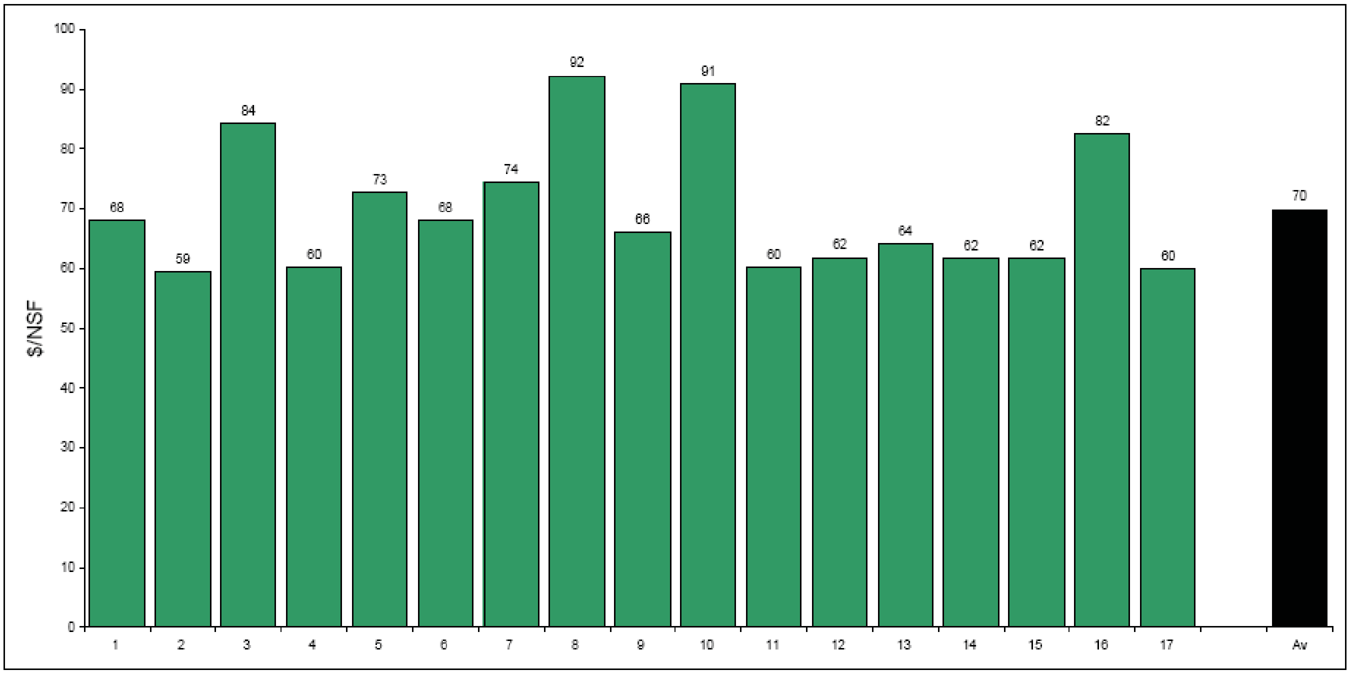


Key:

1 Beadle Center for Science and Technology (University of Nebraska - Lincoln, Nebraska)
2 Biological and Physical Sciences Building (Cameron University - Lawton, Oklahoma)
3 Biotechnology, Sciences and Engineering Building (University of Texas - San Antonio, Texas)
4 Green Earth Sciences Research Building (Stanford University - Stanford, California)
5 Hurst Hall Science Complex (Western State College - Gunnison, Colorado
6 Life Sciences Building South (University of Arizona - Tucson, Arizona)
7 Microbiology and Cell Science Building (University of Florida - Gainesville, Florida)
8 New Science Building (Texas A&M International University - Laredo Texas)
9 Peale Science Center (Hope College - Holland, Michigan)
10 Science Building (Longwood University - Farmville, Virginia
11 Science Building (California State University - Fullerton, California)
12 Sir Alexander Fleming Research Building (Imperial College of Science, Technology and Medicine - London, England)

Av Average

BIOCHEMISTRY / MOLECULAR BIOLOGY AND CHEMISTRY / PHYSICAL SCIENCE

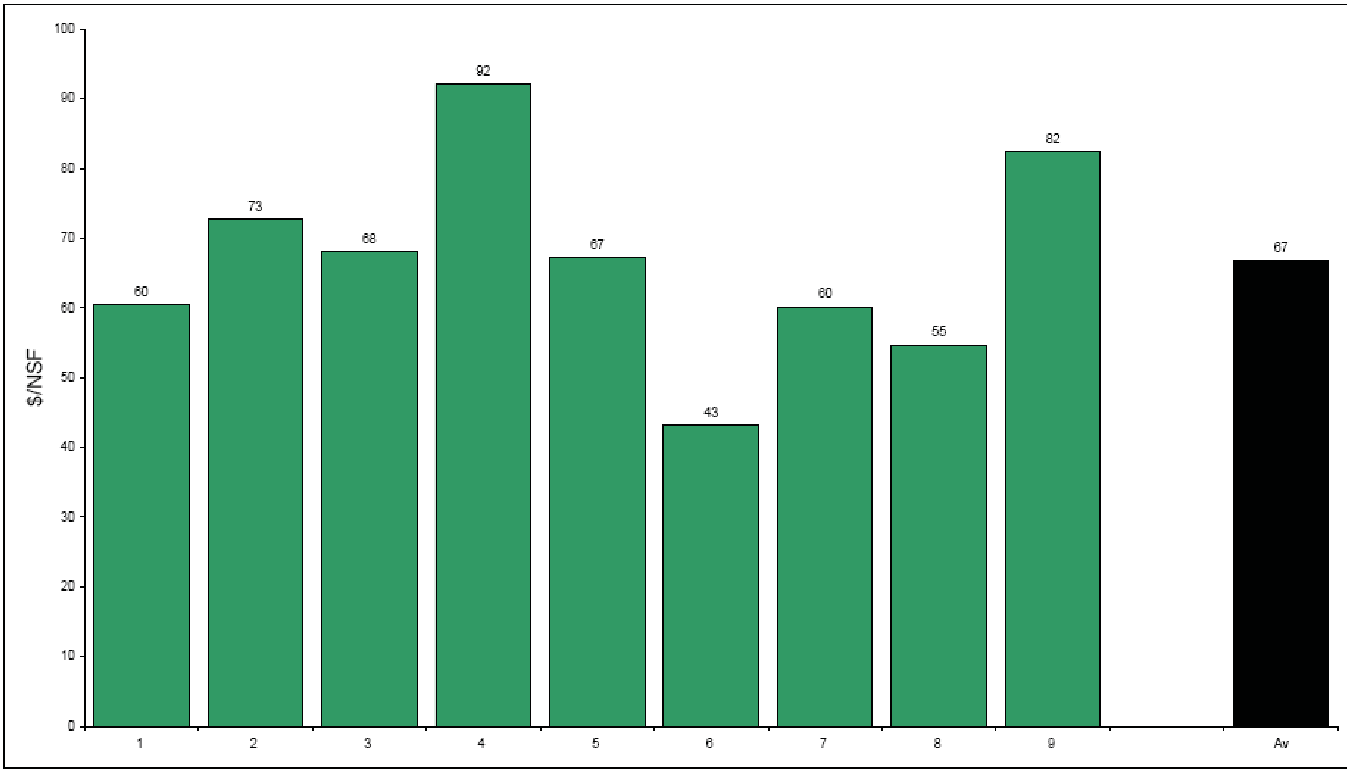


Key:

1 Biological and Physical Sciences Building (Cameron University - Lawton, Oklahoma)
2 Biotechnology, Sciences and Engineering Building (University of Texas - San Antonio, Texas)
3 Chemistry and Biology Teaching Laboratory (University of Arizona - Tucson, Arizona)
4 Glen T. Seaborg Science Complex (Northern Michigan University - Marquette, Michigan)
5 ITS Research and Development Center (Syntex (USA), Inc. - San Jose, California)
6 Kildee/Meats Laboratory (Iowa State University - Ames, iowa)
7 Medical Research Building (Vanderbilt University - Nashville, Tennessee)
8 New Science Building (Texas A&M International University - Laredo Texas)
9 Pharmaceutical Sciences Building (University of California at San Diego - San Diego, California)
10 Ross Hall (University of Northern Colorado - Greeley, Colorado)
11 Science and Math Complex (Cerritos College - Norwalk, California)
12 Science Building (Lander University - Greenwood, South Carolina)
13 Science Center (Juniata College - Huntingdon, Pennsylvania)
14 Science Expansion (University of Virginia's College at Wise - Wise Virginia)
15 Science Laboratory Building (Illinois State University - Normal, Illinois)
16 Science Building (California State University - Fullerton, California)
17 Stanley Quantitative Biosciences and Engineering Facility (University of California, Berkeley - Berkeley, California)

Av Average

EARTH AND GEOLOGICAL SCIENCES

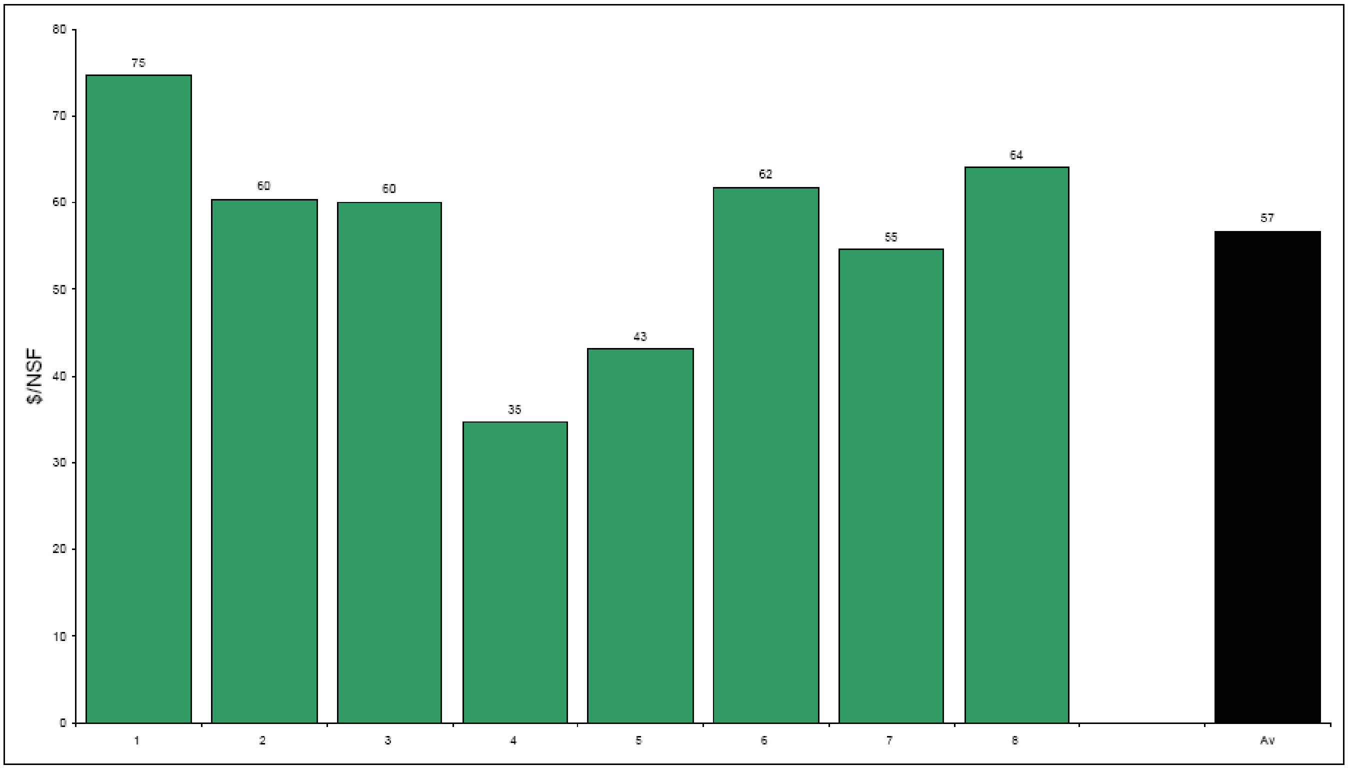


Key:

1 Engineering Building (Boisie State University - Boise, Idaho)
2 ITS Research and Development Center (Syntex (USA), Inc. - San Jose, Californis)
3 Kildee/Meats Laboratory (Iowa State University - Ames, iowa)
4 New Science Building (Texas A&M International University - Laredo Texas)
5 Pharmacy Building (University of Colorado Health Sciences Center - Denver, Colorado)
6 Science and Classroom Building (Eastern Connecticut State University - Willimantic, Connecticut)
7 Science and Math Complex (Cerritos College - Norwalk, California)
8 Science Building (Longwood University - Farmville, Virginia)
9 Science Building (California State University - Fullerton, California)

Av Average

EARTH AND GEOLOGICAL SCIENCES



Key:

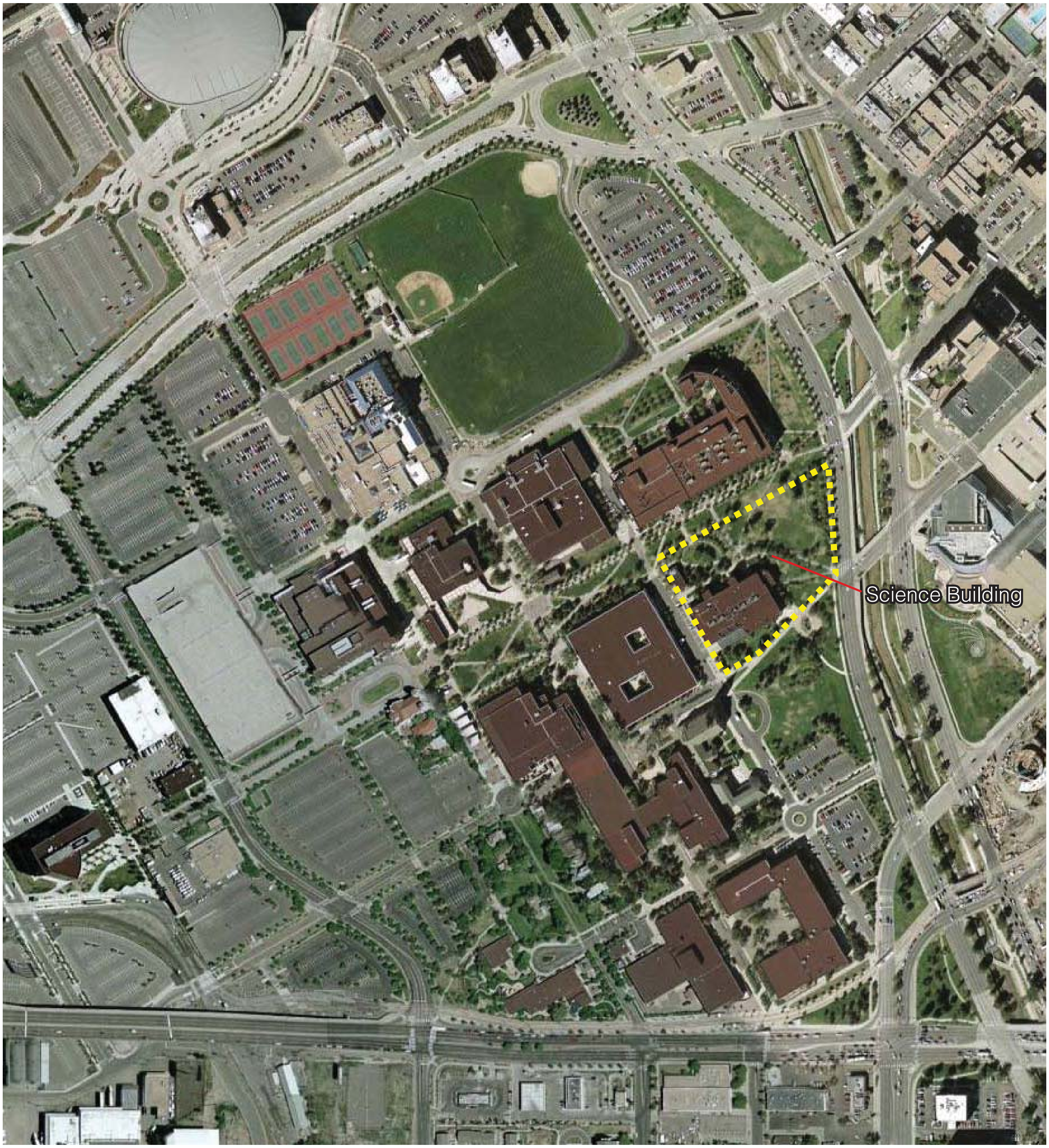
1 Beadle Center for Science and Technology (University of Nebraska - Lincoln, Nebraska)
2 Engineering Building (Boisie State University - Boise, Idaho)
3 Glen T. Seaborg Science Complex (Northern Michigan University - Marquette, Michigan)
4 Hartline Science Center (Bloomsburg University - Bloomsburg, Pennsylvania)
5 Science and Classroom Building (Eastern Connecticut State University - Willimantic, Connecticut)
6 Science Building (Lander University - Greenwood, South Carolina)
7 Science Building (Longwood University - Farmville, Virginia)
8 Science Center (Juniata College - Huntingdon, Pennsylvania)

Av Average

VI.4 Campus Map

Auraria Center for Higher Education
(partial campus map)

VI.4.1 Campus Aerial Photo



VI.5 Justified Needs Program

Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
	University of Colorado at Denver & Health Sciences Center									
	UCDHSC Biology					**29,050**			**46,480**	**$ 15,002,882**
U.B.1.0	Office Space						New	$ 212	-	-
U.B.1.1	Chair/Director	160	1	160	3	480	New	$ 212	768	162,509
U.B.1.2	Faculty Office	120	1	120	18	2,160	New	$ 212	3,456	731,290
U.B.1.3	Adjunct Faculty	60	4	240	1	240	New	$ 212	384	81,254
U.B.1.4	Research Assistant Workstation	40	4	160	10	1,600	New	$ 212	2,560	541,696
U.B.1.5	Undergraduate Teaching Assistant	40	6	240	1	240	New	$ 212	384	81,254
U.B.1.6	Lab Coordinator	120	1	120	1	120	New	$ 212	192	40,627
U.B.1.7	Lab Preparator	60	1	60	1	60	New	$ 212	96	20,314
U.B.1.8	Program Assistant	120	1	120	1	120	New	$ 212	192	40,627
U.B.1.9	Academic Advisor	120	1	120	1	120	New	$ 212	192	40,627
U.B.1.10	Administrative Assistant	120	1	120	2	240	New	$ 212	384	81,254
U.B.1.11	Conference	See UCDHSC Shared Spaces below					New	$ 212	-	-
U.B.1.12	Work/Copy/Print	120	1	120	1	120	New	$ 212	192	40,627
U.B.1.13	Reception	40	4	160	1	160	New	$ 212	256	54,170
U.B.1.14	Records	120	1	120	1	120	New	$ 212	192	40,627
U.B.1.15	Breakroom	See UCDHSC Shared Spaces below					New	$ 212	-	-
U.B.1.16	General Office Storage						New	$ 212	-	-
U.B.1.19	Office Space Reduction			(5,780)	0%	-	New	$ 212	-	-
U.B.2.0	Classrooms	See Auraria Shared Spaces below					New	$ 244	-	-
U.B.3.0	Laboratories						New	$ 358	-	-
U.B.3.1	Basic/Non-Major Teaching	53	24	1,260	2	2,520	New	$ 358	4,032	1,442,045
U.B.3.2	General Biology Teaching	53	24	1,260	4	5,040	New	$ 358	8,064	2,884,090
U.B.3.3	Anatomy Teaching	63	20	1,260	1	1,260	New	$ 358	2,016	721,022
U.B.3.4	Physiology Teaching	53	24	1,260	1	1,260	New	$ 358	2,016	721,022
U.B.3.5	Microbiology Teaching	53	24	1,260	1	1,260	New	$ 358	2,016	721,022
U.B.3.6	Molecular/Cellular Teaching	59	16	945	1	945	New	$ 358	1,512	540,767
U.B.4.0	Research Laboratory						New	$ 351	-	-
U.B.4.1	Student Research Lab	175	1	175	43	7,525	New	$ 351	12,040	4,223,030
U.B.5.0	Lab Service						New	$ 358	-	-
U.B.5.1	Prep Room	315	1	315	4	1,260	New	$ 358	2,016	721,022
U.B.5.2	Microbiology Prep	475	1	475	1	475	New	$ 358	760	271,814
U.B.5.3	Molecular Core Facility	600	1	600	1	600	New	$ 358	960	343,344
U.B.5.4	Microbiololgy Equipment Room	165	1	165	1	165	New	$ 358	264	94,420
U.B.5.5	Cold Room	160	1	160	1	160	New	$ 358	256	91,558
U.B.5.6	Greenhouse	See Auraria Shared Spaces below					New	$ 358	-	-
U.B.6.0	Storage	200	1	200	4	800	New	$ 212	1,280	270,848
	UCDHSC Chemistry					**22,885**			**36,616**	**$ 11,906,208**
U.C.1.0	Office Space						New	$ 212	-	-
U.C.1.1	Chair/Director	160	1	160	1	160	New	$ 212	256	54,170
U.C.1.2	Faculty Office	120	1	120	18	2,160	New	$ 212	3,456	731,290
U.C.1.3	Adjunct Faculty	60	4	240	1	240	New	$ 212	384	81,254
U.C.1.4	Research Assistant Workstation	40	4	160	10	1,600	New	$ 212	2,560	541,696
U.C.1.5	Undergraduate Teaching Assistant	40	6	240	1	240	New	$ 212	384	81,254
U.C.1.6	Lab Coordinator	120	1	120	1	120	New	$ 212	192	40,627
U.C.1.10	Administrative Assistant	120	1	120	1	120	New	$ 212	192	40,627
U.C.1.11	Conference	See UCDHSC Shared Spaces below					New	$ 212	-	-
U.C.1.12	Work/Copy/Print	120	1	120	1	120	New	$ 212	192	40,627
U.C.1.13	Reception	40	4	160	1	160	New	$ 212	256	54,170
U.C.1.14	Records	120	1	120	1	120	New	$ 212	192	40,627
U.C.1.15	Breakroom	See UCDHSC Shared Spaces below					New	$ 212	-	-
U.C.1.16	General Office Storage	120	1	120	1	120	New	$ 212	192	40,627
U.C.1.19	Office Space Reduction			(5,160)	0%	-	New	$ 212	-	-
U.C.2.0	Classrooms	See Auraria Shared Spaces below					New	$ 244	-	-
U.C.3.0	Laboratories						New	$ 369	-	-
U.C.3.1	General Chemistry Teaching	53	24	1,260	3	3,780	New	$ 369	6,048	2,232,619
U.C.3.2	Organic Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,032	1,488,413
U.C.3.3	Analytical/Inorganic Teaching	70	18	1,260	1	1,260	New	$ 369	2,016	744,206
U.C.3.4	Physical/Instrumental Teaching	118	8	945	1	945	New	$ 369	1,512	558,155
U.C.4.0	Research Laboratory						New	$ 358	-	-
U.C.4.1	Student Research Lab	175	1	175	39	6,825	New	$ 358	10,920	3,905,538
U.C.5.0	Lab Service						New	$ 358	-	-
U.C.5.1	Prep Room	210	1	210	4	840	New	$ 358	1,344	480,682
U.C.5.2	Instrument Room	160	1	160	4	640	New	$ 358	1,024	366,234
U.C.5.3	Balance Room	105	1	105	3	315	New	$ 358	504	180,256
U.C.5.4	Stockroom Satellite	945	1	945	0	-	New	$ 358	-	-
U.C.6.0	Storage	200	1	200	3	600	New	$ 212	960	203,136

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	UCDHSC Anthropology					**3,465**			**5,544**	**$ 663,280**
U.A.1.0	Office Space						Backfill	$ 52	-	-
U.A.2.0	Classrooms						Backfill	$ 72	-	-
U.A.3.0	Laboratories						Backfill	$ 134	-	-
U.A.3.1	Anthropology Teaching	53	24	1,260	2	2,520	Backfill	$ 134	4,032	539,028
U.A.3.2	Morphometrics Teaching	59	16	945	0	-	Backfill	$ 134	-	-
U.A.5.0	Lab Service						Backfill	$ 143	-	-
U.A.5.1	Prep Room	315	1	315	1	315	Backfill	$ 143	504	72,088
U.A.6.0	Collections	630	1	630	1	630	Backfill	$ 52	1,008	52,164
	UCDHSC Math					**3,060**			**4,896**	**$ 351,900**
U.M.3.0	Laboratories						Backfill	$ 72	-	-
U.M.3.1	Math Laboratory	30	60	1,800	1	1,800	Backfill	$ 72	2,880	207,000
U.M.3.2	Math Assistance Room	53	24	1,260	1	1,260	Backfill	$ 72	2,016	144,900
	UCDHSC Shared Space					**2,815**			**4,504**	**$ 490,690**
U.S.1.0	Office Space						New	$ 212	-	-
U.S.1.1	Special Events Conference	See Auraria Shared Spaces below					New	$ 212	-	-
U.S.1.2	Conference	25	8	200	2	400	New	$ 212	640	135,424
U.S.1.3	Breakroom	80	1	80	2	160	New	$ 212	256	54,170
U.S.5.0	Analytical Service Lab	1575	1	1,575	1	1,575	Remain	$ 66	2,520	165,548
U.S.7.0	Interaction/Community						New	$ 244	-	-
U.S.7.1	Departmental Display	50	1	50	7	350	Remodel	$ 150	560	84,042
U.S.7.2	Student Group Study	15	22	330	1	330	Light Remodel	$ 98	528	51,506
	UCD Math & Other Backfill Space									
						61,275			**98,040**	**$ 28,414,959**

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	Community College of Denver									
	CCD Biology					**14,380**			**23,008**	**$ 5,415,230**
C.B.1.0	Office Space						Remodel	$ 120	-	-
C.B.1.1	Chair/Director	160	1	160	2	320	Remodel	$ 120	512	61,530
C.B.1.2	Faculty Office	120	1	120	4	480	Remodel	$ 120	768	92,294
C.B.1.3	Adjunct Faculty	60	4	240	4	960	Remodel	$ 120	1,536	184,589
C.B.1.10	Administrative Assistant	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.B.1.11	Conference	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.B.1.12	Work/Copy/Print	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.B.1.13	Reception	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.B.1.14	Breakroom	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.B.1.15	General Office Storage	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.B.1.19	Office Space Reduction			(1,760)	0%	-	Remodel	$ 120	-	-
C.B.2.0	Classrooms	See Auraria Shared Spaces below					Remodel	$ 150	-	-
C.B.2.1	General Biology Lecture	30	42	1,260	1	1,260	Remodel	$ 150	2,016	302,551
C.B.3.0	Laboratories						Remodel	$ 263	-	-
C.B.3.1	General Biology Teaching	53	24	1,260	1	1,260	Remodel	$ 263	2,016	529,754
C.B.3.2	Microbiology Teaching	53	24	1,260	1	1,260	Remodel	$ 263	2,016	529,754
C.B.3.3	Interdisciplinary Teaching	49	32	1,575	1	1,575	Remodel	$ 263	2,520	662,193
C.B.3.4	Anatomy & Physiology Teaching	53	24	1,260	4	5,040	Remodel	$ 263	8,064	2,119,018
C.B.4.0	Research Laboratory						Remodel	$ 256	-	-
C.B.4.1	Student Research Lab	175	1	175	1	175	Remodel	$ 256	280	71,645
C.B.5.0	Lab Service						Remodel	$ 263	-	-
C.B.5.1	Prep Room	315	1	315	4	1,260	Remodel	$ 263	2,016	529,754
C.B.5.2	Microbiology Prep	315	1	315	1	315	Remodel	$ 263	504	132,439
C.B.5.3	Instrument Room	315	1	315	1	315	Remodel	$ 263	504	132,439
C.B.5.4	Equipment Room	160	1	160	1	160	Remodel	$ 263	256	67,270
C.B.6.0	Storage	See CCD Shared Spaces below					Remodel	$ 120	-	-
	CCD Chemistry					**3,570**			**5,712**	**$ 1,456,075**
C.C.1.0	Office Space						Remodel	$ 120	-	-
C.C.1.1	Chair/Director	160	1	160	1	160	Remodel	$ 120	256	30,765
C.C.1.2	Faculty Office	120	1	120	1	120	Remodel	$ 120	192	23,074
C.C.1.3	Adjunct Faculty	60	2	120	1	120	Remodel	$ 120	192	23,074
C.C.1.10	Administrative Assistant	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.C.1.11	Conference	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.C.1.12	Work/Copy/Print	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.C.1.13	Reception	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.C.1.14	Breakroom	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.C.1.16	General Office Storage	See CCD Shared Spaces below					Remodel	$ 120	-	-
C.C.1.19	Office Space Reduction			(400)	0%	-	Remodel	$ 120	-	-
C.C.2.0	Classrooms	See Auraria Shared Spaces below					Remodel	$ 150	-	-
C.C.3.0	Laboratories						Remodel	$ 274	-	-
C.C.3.1	General Chemistry Teaching	53	24	1,260	1	1,260	Remodel	$ 274	2,016	552,938
C.C.3.2	Organic Chemistry Teaching	53	24	1,260	1	1,260	Remodel	$ 274	2,016	552,938
C.C.4.0	Research Laboratory						Remodel	$ 263	-	-
C.C.4.1	Student Research Lab	175	1	175	1	175	Remodel	$ 263	280	73,577
C.C.5.0	Lab Service						Remodel	$ 263	-	-
C.C.5.1	Prep Room	315	1	315	1	315	Remodel	$ 263	504	132,439
C.C.5.2	Balance Room	160	1	160	1	160	Remodel	$ 263	256	67,270
C.C.6.0	Storage	See CCD Shared Spaces below					Remodel	$ 120	-	-
	CCD Shared Spaces					**1,340**			**2,144**	**$ 262,439**
C.S.1.0	Academic Office Suite						Remodel	$ 120	-	-
C.S.1.1	Adjunct Faculty	Included by departments above				-	Remodel	$ 120	-	-
C.S.1.2	Science Advisor	120	1	120	1	120	Remodel	$ 120	192	23,074
C.S.1.3	Lab Coordinator	120	1	120	1	120	Remodel	$ 120	192	23,074
C.S.1.10	Administrative Assistant	120	1	120	1	120	Remodel	$ 120	192	23,074
C.S.1.11	Conference	25	8	200	1	200	Remodel	$ 120	320	38,456
C.S.1.12	Work/Copy/Print	120	1	120	1	120	Remodel	$ 120	192	23,074
C.S.1.13	Reception	40	6	240	1	240	Remodel	$ 120	384	46,147
C.S.1.14	Records	120	1	120	1	120	Remodel	$ 120	192	23,074
C.S.1.15	Breakroom	80	1	80	1	80	Remodel	$ 120	128	15,382
C.S.1.16	General Office Storage	120	1	120	1	120	Remodel	$ 120	192	23,074
C.S.1.18	Special Events Conference	See Auraria Shared Spaces below					Remodel	$ 120	-	-
C.S.1.19	Office Space Reduction			(1,240)	0%	-	Remodel	$ 120	-	-
C.S.1.20	Student Group Study	15	0	-	1	-	Remodel	$ 150	-	-
C.S.1.21	Departmental Display	50	1	50	2	100	Remodel	$ 150	160	24,012
						19,290			**30,864**	**$ 7,133,744**

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	Metro State College of Denver									
	MSCD Biology					**29,290**			**46,864**	**$ 15,662,062**
M.B.1.0	Office Space						New	$ 212	-	-
M.B.1.1	Chair/Director	160	1	160	1	160	New	$ 212	256	54,170
M.B.1.2	Faculty Office	120	1	120	24	2,880	New	$ 212	4,608	975,053
M.B.1.3	Adjunct Faculty	60	4	240	2	480	New	$ 212	768	162,509
M.B.1.4	Lab Coordinator	120	1	120	1	120	New	$ 212	192	40,627
M.B.1.10	Administrative Assistant	120	1	120	1	120	New	$ 212	192	40,627
M.B.1.11	Conference	See MSCD Shared Spaces below					New	$ 212	-	-
M.B.1.12	Work/Copy/Print	120	1	120	1	120	New	$ 212	192	40,627
M.B.1.13	Reception	40	4	160	1	160	New	$ 212	256	54,170
M.B.1.14	Records	120	1	120	1	120	New	$ 212	192	40,627
M.B.1.15	Breakroom	See MSCD Shared Spaces below					New	$ 212	-	-
M.B.1.16	General Office Storage	120	1	120	1	120	New	$ 212	192	40,627
M.B.1.19	Office Space Reduction			(4,280)	0%	-	New	$ 212	-	-
M.B.2.0	Classrooms	See Auraria Shared Spaces below					New	$ 244	-	-
M.B.2.1	Self Paced Testing Room	25	10	250	1	250	New	$ 244	400	97,520
M.B.3.0	Laboratories						New	$ 358	-	-
M.B.3.1	Non-Major Teaching	53	24	1,260	0	-	New	$ 358	-	-
M.B.3.2	General Biology I & II Teaching	53	24	1,260	3	3,780	New	$ 358	6,048	2,163,067
M.B.3.3	Plant Physiology/Taxonomy	53	24	1,260	1	1,260	New	$ 358	2,016	721,022
M.B.3.4	Botany Teaching	53	24	1,260	1	1,260	New	$ 358	2,016	721,022
M.B.3.5	Ecology Teaching	53	24	1,260	2	2,520	New	$ 358	4,032	1,442,045
M.B.3.6	Anatomy & Physiology Teaching	53	24	1,260	3	3,780	New	$ 358	6,048	2,163,067
M.B.3.7	Molecular Biology Teaching	53	24	1,260	1	1,260	New	$ 358	2,016	721,022
M.B.3.8	Zoology Teaching	53	24	1,260	2	2,520	New	$ 358	4,032	1,442,045
M.B.3.9	Microbiology Teaching	53	24	1,260	2	2,520	New	$ 358	4,032	1,442,045
M.B.4.0	Research Laboratory						New	$ 351	-	-
M.B.4.1	Student Research Lab	175	1	175	13	2,275	New	$ 351	3,640	1,276,730
M.B.5.0	Lab Service						New	$ 358	-	-
M.B.5.1	Prep Room	315	1	315	7	2,205	New	$ 358	3,528	1,261,789
M.B.5.2	Microbiology Prep	420	1	420	1	420	New	$ 358	672	240,341
M.B.5.3	Instrument Room	315	1	315	1	315	New	$ 358	504	180,256
M.B.5.4	Equipment Room	315	1	315	1	315	New	$ 358	504	180,256
M.B.5.5	Pour Room	105	1	105	1	105	New	$ 358	168	60,085
M.B.5.6	Cold Room	105	1	105	1	105	New	$ 358	168	60,085
M.B.6.0	Storage	120	1	120	1	120	New	$ 212	192	40,627

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	MSCD Chemistry					**15,840**			**25,344**	**$ 8,355,974**
M.C.1.0	Office Space						New	$ 212	-	-
M.C.1.1	Chair/Director	160	1	160	1	160	New	$ 212	256	54,170
M.C.1.2	Faculty Office	120	1	120	19	2,280	New	$ 212	3,648	771,917
M.C.1.3	Adjunct Faculty	60	4	240	2	480	New	$ 212	768	162,509
M.C.1.4	Lab Coordinator	120	1	120	1	120	New	$ 212	192	40,627
M.C.1.10	Administrative Assistant	120	1	120	1	120	New	$ 212	192	40,627
M.C.1.11	Conference	See MSCD Shared Spaces below					New	$ 212	-	-
M.C.1.12	Work/Copy/Print	120	1	120	1	120	New	$ 212	192	40,627
M.C.1.13	Reception	40	4	160	1	160	New	$ 212	256	54,170
M.C.1.14	Records	120	1	120	1	120	New	$ 212	192	40,627
M.C.1.15	Breakroom	See MSCD Shared Spaces below					New	$ 212	-	-
M.C.1.16	General Office Storage	120	1	120	1	120	New	$ 212	192	40,627
M.C.1.19	Office Space Reduction			(3,680)	0%	-	New	$ 212	-	-
M.C.2.0	Classrooms	See Auraria Shared Spaces below					New	$ 244	-	-
M.C.3.0	Laboratories						New	$ 369	-	-
M.C.3.1	General Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,032	1,488,413
M.C.3.2	Organic Chemistry Teaching	53	24	1,260	2	2,520	New	$ 369	4,032	1,488,413
M.C.3.3	Analytical Chemistry Teaching	53	24	1,260	1	1,260	New	$ 369	2,016	744,206
M.C.3.4	Physical/Inorganic Chemistry Teachir	79	12	945	1	945	New	$ 369	1,512	558,155
M.C.3.5	Instrumental Analysis Teaching	70	18	1,260	1	1,260	New	$ 369	2,016	744,206
M.C.3.6	Criminalistics Teaching	70	18	1,260	1	1,260	New	$ 369	2,016	744,206
M.C.3.7	Criminalistics Microscope Teaching	53	12	630	0	-	New	$ 369	-	-
M.C.4.0	Research Laboratory						New	$ 358	-	-
M.C.4.1	Student Research Lab	175	1	175	4	700	New	$ 358	1,120	400,568
M.C.5.0	Lab Service						New	$ 358	-	-
M.C.5.1	Prep Room	210	1	210	4	840	New	$ 358	1,344	480,682
M.C.5.2	Balance Room	105	1	105	2	210	New	$ 358	336	120,170
M.C.5.3	Instrument Room	105	1	105	2	210	New	$ 358	336	120,170
M.C.5.4	Dark Room	315	1	315	1	315	New	$ 358	504	180,256
M.C.6.0	Storage	120	1	120	1	120	New	$ 212	192	40,627
	MSCD Anthropology					**2,720**			**4,352**	**$ 916,550**
M.A.2.0	Classrooms	See Auraria Shared Spaces below					Remodel	$ 150	-	-
M.A.3.0	Laboratories						Remodel	$ 248	-	-
M.A.3.1	Anthropology Teaching	44	36	1,575	1	1,575	Remodel	$ 248	2,520	624,519
M.A.5.0	Lab Service						Remodel	$ 263	-	-
M.A.5.1	Prep Room	315	1	315	1	315	Remodel	$ 263	504	132,439
M.A.6.0	Storage						Remodel	$ 120	-	-
M.A.6.1	Collections	630	1	630	1	630	Remodel	$ 120	1,008	121,136
M.A.6.2	Storage	200	1	200	1	200	Remodel	$ 120	320	38,456
	MSCD Earth Sciences					**13,700**			**21,920**	**$ 4,159,550**
M.G.1.0	Office Space						Remodel	$ 120	-	-
M.G.1.1	Chair/Director	160	1	160	1	160	Remodel	$ 120	256	30,765
M.G.1.2	Faculty Office	120	1	120	13	1,560	Remodel	$ 120	2,496	299,957
M.G.1.3	Adjunct Faculty	60	4	240	3	720	Remodel	$ 120	1,152	138,442
M.G.1.5	Student Work Area	40	4	160	0	-	Remodel	$ 120	-	-
M.G.1.10	Administrative Assistant	120	1	120	1	120	Remodel	$ 120	192	23,074
M.G.1.11	Conference	See MSCD Shared Spaces below					Remodel	$ 120	-	-
M.G.1.12	Work/Copy/Print	120	1	120	1	120	Remodel	$ 120	192	23,074
M.G.1.13	Reception	40	4	160	1	160	Remodel	$ 120	256	30,765
M.G.1.14	Records	120	1	120	1	120	Remodel	$ 120	192	23,074
M.G.1.15	Breakroom	See MSCD Shared Spaces below					Remodel	$ 120	-	-
M.G.1.16	General Office Storage	120	1	120	1	120	Remodel	$ 120	192	23,074
M.G.1.19	Office Space Reduction			(3,080)	0%	-	Remodel	$ 120	-	-
M.G.2.0	Classrooms	See Auraria Shared Spaces below					Remodel	$ 150	-	-
M.G.2.1	GIS Classroom	30	30	900	1	900	Remodel	$ 150	1,440	216,108
M.G.2.2	Meteorology Classroom	30	30	900	1	900	Remodel	$ 150	1,440	216,108
M.G.3.0	Laboratories						Remodel	$ 248	-	-
M.G.3.1	Geology Teaching	49	32	1,575	2	3,150	Remodel	$ 248	5,040	1,249,038
M.G.3.2	Integrated Natural Science	49	32	1,575	1	1,575	Remodel	$ 248	2,520	624,519
M.G.3.3	GIS Computer Lab	30	30	900	2	1,800	Remodel	$ 150	2,880	432,216
M.G.3.4	Meteorology Computer Lab	30	20	600	1	600	Remodel	$ 150	960	144,072
M.G.5.0	Lab Service						Remodel	$ 263	-	-
M.G.5.1	Prep Room	630	1	630	1	630	Remodel	$ 263	1,008	264,877
M.G.5.2	X-Ray Core	315	1	315	1	315	Remodel	$ 263	504	132,439
M.G.5.3	Rock Collections	315	1	315	1	315	Remodel	$ 263	504	132,439
M.G.5.4	Map Collections	315	1	315	1	315	Remodel	$ 263	504	132,439
M.G.6.0	Storage	120	1	120	1	120	Remodel	$ 120	192	23,074

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	MSCD Math and Computer Science					**12,600**			**20,160**	**$ 2,686,805**
M.M.1.0	Office Space						Remodel	$ 120	-	-
M.M.1.1	Chair/Director	160	1	160	1	160	Remodel	$ 120	256	30,765
M.M.1.2	Faculty Office	120	1	120	37	4,440	Remodel	$ 120	7,104	853,723
M.M.1.3	Adjunct Faculty	60	4	240	5	1,200	Remodel	$ 120	1,920	230,736
M.M.1.4	Student Work Area	40	4	160	0	-	Remodel	$ 120	-	-
M.M.1.5	Systems Administrator	120	1	120	1	120	Remodel	$ 120	192	23,074
M.M.1.6	Part-Time Staff	40	1	40	1	40	Remodel	$ 120	64	7,691
M.M.1.10	Administrative Assistant	120	1	120	3	360	Remodel	$ 120	576	69,221
M.M.1.11	Conference	See MSCD Shared Spaces below					Remodel	$ 120	-	-
M.M.1.12	Work/Copy/Print	120	1	120	1	120	Remodel	$ 120	192	23,074
M.M.1.13	Reception	40	4	160	1	160	Remodel	$ 120	256	30,765
M.M.1.14	Records	120	1	120	1	120	Remodel	$ 120	192	23,074
M.M.1.15	Breakroom	See MSCD Shared Spaces below					Remodel	$ 120	-	-
M.M.1.16	General Office Storage	120	1	120	1	120	Remodel	$ 120	192	23,074
M.M.1.19	Office Space Reduction			(6,840)	0%	-	Remodel	$ 120	-	-
M.M.2.0	Classrooms	See Auraria Shared Spaces below					Remodel	$ 150	-	-
M.M.2.1	Math Group Learning Classroom	30	12	360	6	2,160	Remodel	$ 150	3,456	518,659
M.M.3.0	Laboratories						Remodel	$ 150	-	-
M.M.3.1	Math Education Lab	30	36	1,080	1	1,080	Remodel	$ 150	1,728	259,330
M.M.4.0	Open Laboratories (CS only)						Remodel	$ 150	-	-
M.M.4.1	Mac Lab	30	30	900	1	900	Remodel	$ 150	1,440	216,108
M.M.4.2	Unix Lab	30	30	900	1	900	Remodel	$ 150	1,440	216,108
M.M.6.0	Storage						Remodel	$ 120	-	-
M.M.6.1	Archive Room	120	1	120	1	120	Remodel	$ 120	192	23,074
M.M.6.2	Storage	120	1	120	1	120	Remodel	$ 120	192	23,074
M.M.7.0	Interaction/Community	See MSCD Shared Space below					Remodel	$ 150	-	-
M.M.7.1	Tutoring Lab	40	12	480	1	480	Remodel	$ 150	768	115,258
	MSCD Deans' Office					**2,260**			**3,616**	**$ 187,128**
M.D.1.0	Office Space						Backfill	$ 52	-	-
M.D.1.1	Dean	240	1	240	2	480	Backfill	$ 52	768	39,744
M.D.1.2	Associate Dean	120	1	120	2	240	Backfill	$ 52	384	19,872
M.D.1.3	Assistant Dean	120	1	120	2	240	Backfill	$ 52	384	19,872
M.D.1.4	Student Work Area	40	2	80	1	80	Backfill	$ 52	128	6,624
M.D.1.10	Administrative Assistant	120	1	120	2	240	Backfill	$ 52	384	19,872
M.D.1.11	Conference	25	12	300	1	300	Backfill	$ 52	480	24,840
M.D.1.12	Work/Copy/Print	120	1	120	1	120	Backfill	$ 52	192	9,936
M.D.1.13	Reception	40	6	240	1	240	Backfill	$ 52	384	19,872
M.D.1.14	Records	120	1	120	1	120	Backfill	$ 52	192	9,936
M.D.1.15	Breakroom	80	1	80	1	80	Backfill	$ 52	128	6,624
M.D.1.16	General Office Storage	120	1	120	1	120	Backfill	$ 52	192	9,936
M.D.1.17	Office Space Reduction			(2,260)	0%	-	Backfill	$ 52	-	-
	MSCD Shared Space					**5,467**			**8,747**	**$ 1,277,655**
M.S.1.0	Office Space						Remodel	$ 120	-	-
M.S.1.1	Special Events Conference	See Auraria Shared Spaces below					Remodel	$ 120	-	-
M.S.1.2	Conference	25	8	200	8	1,600	Remodel	$ 120	2,560	307,648
M.S.1.3	Breakroom	80	1	80	4	320	Remodel	$ 120	512	61,530
M.S.1.4	Adjunct Faculty	Included by departments above					Remodel	$ 120	-	-
M.S.2.0	Classrooms	See Auraria Shared Spaces below					Remodel	$ 150	-	-
M.S.5.0	Lab Service						Remodel	$ 263	-	-
M.S.5.1	Scanning Electron Microscope	315	1	315	1	315	Remodel	$ 263	504	132,439
M.S.6.0	Storage						Remodel	$ 120	-	-
M.S.7.0	Interaction/Community						Remodel	$ 150	-	-
M.S.7.1	Departmental Display	50	1	50	11	550	Remodel	$ 150	880	132,066
M.S.7.2	Student Group Study	15	59	882	1	882	Remodel	$ 150	1,411	211,756
M.S.7.3	Computer Lab	30	60	1,800	1	1,800	Remodel	$ 150	2,880	432,216
	MSCD Health Profession / Nursing									
						81,877			**131,003**	**$ 33,245,723**

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	Auraria Sciences Shared Space									
	Shared Biology					**2,630**			**4,208**	**$ 1,504,991**
A.B.4.1	Herbarium	630	1	630	1	630	New	$ 358	1,008	360,511
A.B.4.2	Greenhouse	2000	1	2,000	1	2,000	New	$ 358	3,200	1,144,480
	Shared Chemistry					**3,570**			**5,712**	**$ 2,060,285**
A.C.3.0	Laboratories						New	$ 369	-	-
A.C.3.1	Biochemistry Teaching	59	16	945	1	945	New	$ 369	1,512	558,155
A.C.5.0	Lab Service						New	$ 358	-	-
A.C.5.1	Chemistry Stockroom Suite	2205	1	2,205	1	2,205	New	$ 358	3,528	1,261,789
A.C.5.2	Biochemistry Equipment Room	105	1	105	1	105	New	$ 358	168	60,085
A.C.5.3	Prep Room	210	1	210	1	210	New	$ 358	336	120,170
A.C.5.4	Balance Room	105	1	105	1	105	New	$ 358	168	60,085
	Shared Research					**17,001**			**27,202**	**$ 9,646,459**
A.R.4.0	Funded Research Laboratory						New	$ 351	-	-
A.R.4.1	Psychology Research Lab	475	1	475	3	1,425	New	$ 351	2,280	799,710
A.R.4.2	Anthropology Research Lab	630	1	630	1	630	New	$ 351	1,008	353,556
A.R.4.3	Chemistry Research Lab	630	1	630	5	3,150	New	$ 358	5,040	1,802,556
A.R.4.4	Biology Research Lab	630	1	630	5	3,150	New	$ 351	5,040	1,767,780
A.R.4.5	Shelled Research Lab	630	1	630	0	-	New	$ 231	-	-
A.R.5.0	Research Lab Service					-	New	$ 358	-	-
A.R.5.1	Animal Care Suite	2835	1	2,835	1	2,835	New	$ 358	4,536	1,622,300
A.R.5.2	Imaging Room	210	1	210	1	210	New	$ 358	336	120,170
A.R.5.3	Dark Room	210	1	210	1	210	New	$ 358	336	120,170
A.R.5.4	Instrument Room	630	1	630	1	630	New	$ 358	1,008	360,511
A.R.5.5	Plant Growth	158	1	158	2	316	New	$ 358	506	180,828
A.R.5.6	Growth Chamber Room	315	1	315	1	315	New	$ 358	504	180,256
A.R.5.7	Research Greenhouse	630	1	630	2	1,260	New	$ 358	2,016	721,022
A.R.5.8	Equipment Alcove	160	1	160	14	2,240	New	$ 351	3,584	1,257,088
A.R.5.9	Research Imaging	315	1	315	2	630	New	$ 358	1,008	360,511
	Shared General					**1,235**			**1,976**	**$ 589,876**
A.R.5.1	Instrument Repair	315	1	315	1	315	New	$ 358	504	180,256
A.R.5.2	Machine Shop	315	1	315	1	315	New	$ 358	504	180,256
A.R.5.3	Nitrogen Generator	105	1	105	1	105	New	$ 358	168	60,085
A.R.5.4	Field Equipment Storage	50	1	50	10	500	New	$ 212	800	169,280
	Shared Classrooms					**31,925**			**51,080**	**$ 5,892,301**
A.C.2.0	Classroom						Backfill	$ 72	-	-
A.C.2.1	600 Seat Lecture Hall	13.5	600	8,100	0	-	Backfill	$ 79	-	-
A.C.2.2	300 Seat Lecture Hall	13.5	300	4,050	1	4,050	Remodel	$ 162	6,480	1,047,006
A.C.2.3	180 Seat Tiered Classroom	25	180	4,500	0	-	Backfill	$ 79	-	-
A.C.2.4	100 Seat Tiered Classroom	25	100	2,500	1	2,500	Backfill	$ 79	4,000	316,250
A.C.2.5	50 Seat Classroom	25	**50**	1,250	10	12,500	Remodel	$ 150	20,000	3,001,500
A.C.2.5.1	50 Seat Classroom									
A.C.2.5.2	50 Seat Classroom	25	50	1,250	10	12,500	Backfill	$ 72	20,000	1,437,500
A.C.2.7	30 Seat Classroom	25	30	750	0	-	Backfill	$ 72	-	-
A.C.2.8	15 Seat Seminar Room	25	15	375	1	375	Remodel	$ 150	600	90,045
A.C.2.9	Lecture Prep Room	800	1	800	0	-	Backfill	$ 72	-	-
	Shared Building Support					**6,100**			**9,760**	**$ 1,831,168**
A.S.6.1	General Storage	600	1	600	1	600	New	$ 212	960	203,136
A.S.6.2	Loading/Receiving	200	1	200	1	200	New	$ 212	320	67,712
A.S.6.3	Vending	120	1	120	6	720	New	$ 212	1,152	243,763
A.S.6.4	Recycling	80	1	80	6	480	New	$ 212	768	162,509
A.S.6.5	Janitor	80	1	80	6	480	New	$ 212	768	162,509
A.S.6.6	Main Telecom Distribution	120	1	120	6	720	New	$ 212	1,152	243,763
A.S.6.7	Telecom Distribution	80	1	80	18	1,440	Remodel	$ 120	2,304	276,883
A.S.6.8	Shower	80	1	80	2	160	Remodel	$ 120	256	30,765
A.S.6.9	Dock	300	1	300	1	300	New	$ 212	480	101,568
A.S.6.10	Mail	300	1	300	1	300	New	$ 212	480	101,568
A.S.6.11	Hazmat Waste	200	1	200	1	200	New	$ 212	320	67,712
A.S.6.12	Environmental H&S	200	1	200	1	200	New	$ 212	320	67,712
A.S.6.13	Cannister Storage	300	1	300	1	300	New	$ 212	480	101,568
	Shared Interaction/Community				**7%**	**1,000**			**1,600**	**$ 338,560**
A.I.1.0	Special Events Conference	25	40	1,000	1	1,000	New	$ 212	1,600	338,560
A.I.7.0	Interaction/Community						New	$ 244	-	-
A.I.7.1	Departmental Display	50	1	50	0	-	Remodel	$ 150	-	-
A.I.7.2	Student Group Study	Included under Institutional Shar			1	-	New	$ 244	-	-
A.I.7.3	Open Computer Lab									

		Justified Needs Program								
		Area and Quantity Provided					Cost Model			
Room Number	Space Name	ASF/ Station	Stations/ Room	Room Size	Quantity	Area	Scenario per Space	Unit Cost	Gross Area (GSF)	Estimated Construction Cost
	SHARED SPACE TOTALS					**63,461**			**101,538**	**$ 21,863,641**
					New	127,561		$ 327	204,098	66,780,410
					Remodel	72,652		$ 178	116,243	20,704,545
					Light Remodel	330		$ 98	528	51,506
					Backfill	23,785		$ 78	38,056	2,956,058
					Remain	1,575		$ 66	2,520	165,548
	TOTAL ASSIGNABLE AREA (ASF)					**225,903**	**ASF**			
					Efficiency	**62.5%**	**SF**			
	TOTAL GROSS BUILDING AREA (GSF)					**361,445**	**GSF**	**$ 251**	**361,445**	**$ 90,658,066**

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