

Studies for a Horticultural Building
and Greenhouse.

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Studies for a Horticultural Building and Greenhouse.

- A. Necessity for College to have one.
1. General need of such illustrative laboratories.
 2. Present greenhouse very inadequate; Lack of funds prevented institution from building a better one; very much out of repair.
- B. College should have a large and well arranged Horticultural Building; complete in every respect; Horticulture is very important.
- C. New structure should not be built in a cramped position of old one. should be built where all experiment plots will be near.
- D. Slightly location can be found west of Main Hall near present botanical gardens. Here all the features are favorable, giving south, east and west exposure.
- E. No separate heating plant necessary.
- F. Building should be connected with greenhouse and Palm house
- G. Have adopted form of large square.
- H. Description of structure.

Studies for a Horticultural Building and Greenhouse.

The horticultural course has for its object a method of instruction and practice, as will enable the student to become acquainted with the general principles of plant culture and the application of these principles. The work is planned to give them such knowledge as will help to increase the comforts, beauties and profits of life on the farms. This course has to deal with the principles of Horticulture, Vegetable Gardening, Advanced Horticulture, Floriculture, Industrial Horticulture and several electives.

In view of the fact that we have one of the largest agricultural institutions in the United States, if not the world, and perhaps soon to be the best and most widely known of any of its kind, we are in very great need of a new horticultural building with the necessary greenhouses, so I have decided to write up for "Studies for a Horticultural Building" as my thesis.

I am looking over the various stations reports as collected by the Messrs. True and Clark of the

Agricultural Experiment Station of the various states and territories, I find that we have a very poorly equipped building and greenhouses.

The way things are now we have not the room and accommodations for hardly one-fourth of the students that are required to take horticulture. The buildings for this department consist of a horticultural hall which is only a one story building 32×80 feet with a cellar, having museum, class-room and storage room with two small greenhouses attached, while the building only cost \$4,200 with a total value of equipment and apparatus of only \$18,879. The laboratory contains two offices, a work room and five propagating houses which are very inadequate, also having an insectory. The laboratory was built with a cost of \$5,000.

Our buildings cannot be compared with those of other states. The Iowa and Illinois horticultural buildings are very well equipped, the latter having a building consisting of one hundred thirteen class rooms. Colorado also has very fine and well arranged buildings, the laboratory being built at a cost of \$15,000. and is 52×64 feet, two stories and an attic. The California buildings is a structure 87×170 feet which is built of iron and glass with fine green-

houses costing over \$18000.

The Kansas State Agricultural College is in great need of a new horticultural building and greenhouses in that the one we have at present is very inadequate. We have practically no laboratory at all, we have but one class room, and this with the museum does not amount to as much floor space as a well equipped common school should have for their use. Why is this so? The buildings erected when the college was small are now very inadequate. People are beginning to see that we are in need of more and better methods for giving us the necessary knowledge concerning the best methods for raising and caring for the various flowers, vegetables and fruits at the least expense, with the best result. In order to discover the best methods and always of obtaining these results we must have a large and well equipped building with large class rooms, laboratories, work rooms, libraries and offices, all filled up with the necessary instruments.

These laboratories must have the very best and latest improved apparatus. The class rooms for the students are altogether too small. In a large institution

ion of this kind we are in great need of more room. If we are to give the student the best results from his studies must not have to feel that he has not the proper instruments to do this. Our horticultural building compare with the same buildings of some of the other states are as our carpenter shop, compared with the Sash and door factories of Topeka or Kansas City or Chicago. If we are to maintain the name we have, that we rank among the very first as being one of the largest and best equipped Agricultural College in the world we must have a new horticultural building.

Our present greenhouse would not be fit for a greenhouse in a little country town of four or five hundred inhabitants. In the first place it was inadequate. To begin with it was not properly built.

This was partly due to a lack of funds. People did not seem to think that horticulture would ever be what it is today and that we would have near the number of students at our college that we have at present, and probably that that the present building was very large at that time for a college.

The present greenhouses are very much

out of repair and are unfit for use in such an institution as this, the timbers being rotten and all parts very much decayed, while quite a good deal of the metal parts are very badly rusted, and in fact it would be safe to say that they are about ready to be replaced by new ones; and these new ones should be of the steel kind and with all modern improvements so there will be no thoughts as to their decay. The rusting can be over come by giving them a thorough painting and a new coat of paint every year or so; and it will be found that they are cheapest in the long run, ^{the} first cost is greater than that of one built of wood. Then again the large wooden sash bars are replaced by small iron ones thus obstructing so much light and are ~~not~~ as strong. Some say that the iron bars and other metal parts of houses are affected by heat and cold but this, to a great extent can be overcome by painting with a certain kind of paint which does away with this to a great extent.

It is safe to predict that the present green houses will not last more than three or four years at the outside. If they are repaired they would last but a few years longer, and the repairs would cost more than the value of the buildings at

the smallest cost, and while the cost of repairing would be so great it would be more profitable in the long, run to build new buildings, thus putting the repair money to better use and enabling us to have adequate room and other conveniences.

The College should have a large and modern horticultural building, one that is complete in every respect as regarding the amount of class room, laboratories, work-rooms, offices with the proper museum and libraries, together with modern and up to date instruments to use.

When the new building is erected it should not be built in a cramped position as the old one was, or in a position where the experimental plots are far away as some are at present, or so that the plots cannot be under immediate vision of the buildings, as they are at present.

The plots should represent the various slopes, that are required for the different kinds of fruits and also, that they are the easiest gotten at when the time comes for harvesting the crop. The plots used especially for experiments should be so arranged, that they are the nearest, as they are the ones that are to receive the most attention.

With regard to location, I think the

most favorable position is on the knoll west of the Main Hall, or near where the present botanical gardens are now situated. This knoll presents the various favorable slopes, and also has every good protection. On this ground we have the south-east and southwest slopes for exposure, also at the south part of the field we have a slight north slope, thus presenting a very favorable location for a new building. Another item which seems to be quite in favor, if ever we should have the benefit of a new horticulture building and green houses, is that we will not have to have a separate heating plant as the ground is so situated that there is proper drainage back to the present plant. This is quite an item and will cut down the cost to a noticeable degree as when it comes to putting in new boilers and heating apparatus, it is quite an expense in itself, and as this part we already have, we do not have to let that part stand in the way and the amount of money that would have to be used for that purpose, can be used in making a better equipped building.

Altho the horticultural building could

be separate from the greenhouses, I think it is best to have them connected, also the greenhouses with the palm house, thus making a compact and handsome building where everything is handy, and can be looked after in very much better shape.

The plan I have adopted leaves an open space in the middle, that is of considerable size, which could be constructed into a small basin in which there could be put small aquatic plants where they could be easily studied. By this arrangement, they could easily be protected. The wind and other disturbing elements could not harm them.

I have chosen for a desirable plan the form of a large square with two rows of greenhouses running south from the horticultural building and then a palm house running across the south and parallel to the horticulture building, thus forming, or very nearly so a neat little square, in which may be built a basin, thus improving the space, also the building.

As to the construction and use of greenhouses there is much to say, but I do not think it important enough to take up space here. In the past fifteen or twenty

years not only has there been a marked change in the methods of building green houses but there has been a great increase in their use. This increase has been quite large in the neighborhood of large cities but there has been a greater amount of building in the vicinity of small towns and cities even in the sections remote from settled communities, improved means of transportation making it possible for growers of flowers and fruits to locate where they can secure land and fuel at the lowest expense and from which points the products are often shipped hundreds of miles. As we have an ideal locality and as I said before are in need of a new building, I think we should have one that is thoroughly up to date in every way and am going to give some of my thoughts concerning the same. In some places, greenhouses are profitable for the farmer in that they may use them in connection with his other work tending to them in the part of the year he is not busy with his other work, thus having profitable work the year round.

In many states there have been many very extensive ranges of greenhouses

and horticultrual buildings erected which are used for the production of vegetables and cut flowers during the winter months. As the owners became specialists, they not only find the work remunerative but are also able to occupy the portion of the year which is not required for their other work.

For such purposes a form of house best suited is the even span. This should not be less than twenty feet if it is to be a single house, but if several are to be together they may be narrower in width and of any desired length. If several houses are erected they may be placed side by side with division walls in common, but for most crops the extra expense will be more than repaid by the benefit, that will be derived when the houses are placed far enough apart to prevent shading of one house by its neighbor as well as from light and even ventilation or that can be secured thru the side walls. For roses however the three quarter span roof is generally preferred, while in sections where a slight slope to the south can be secured, a wide side hill house will be found adapted to the growing of vegetables, carnations, violets, etc. and it will in addition be comparatively cheap construction.

While the modern iron frame construction is in many ways desirable and will often in the long run prove more economical, the increased first cost will prevent it from being commonly adopted for the ordinary greenhouse purposes.

The iron frame house may be carried upon a brick foundation or iron posts may be set in the ground to which the side posts can be attached. Iron rafters are placed every six or seven feet and are placed carrying the iron plate holders and a ridge upon which the sash bars rest. With this form of construction much lighter sash bars can be used than in wooden houses as nearly all the strain and weight of the sash is borne by the iron iron posts and rafters. The house will also be much more durable, as the portions that are liable to decay in a wood construction have been replaced by iron, thus making a much more desirable building. If wooden frame houses are used, posts of cedar or cypress should be set at intervals of four to six feet. The height will depend somewhat upon kind of vegetation to be grown and whether there is to be glass side walls or not.

four feet will be ample while in the latter ^{more} four + one half to five will be too much. The walls can be formed of sheeting and a black siding with a double thickness of building paper between. If ventilating sash are to be placed in the side walls there should be a ~~cross~~ sill arranged for them to close upon, various forms of plates may be used, but they should be so arranged that they will provide a firm bearing for the sash bars, and for the running off of the water upon the inside as well as on the outside of the house. In wood framed houses rafters are now seldom used, the usual plan being to depend entirely upon sash bars, which rest upon one or more lines of gas pipe or similar purlins. The usual size of the sash bars is about one and a quarter inches to two and a half, and drip gutters in the sash bars are desirable.

One and sometimes two continuous lines of ventilators at the ridge should be provided and connected with shafting so that a line fifty to one hundred feet in length may be worked with one machine. In houses 20 feet wide a single row of ventilators sash is used; it should vary from twenty four to thirty inches. For most purposes, it is desirable to use glass at least 14 X 18 inches and if roses are to be grown 16 to 24 inches would be much better. In setting the glass

a good grade of putty or mastic is used under the panes. If it is to be lapped it is held in place by means of zinc points or brads. For many purposes, however, beveled glass is preferred, the size generally being 16 x 16. The square form is desirable as it prevents of the turning view between them. When the glass is beveled it is customary to use wooden caps over the sash bar which are screwed down upon the panes. This makes a warm and water tight joint and permits the ready resetting of broken panes. In a three quarter-span house the south wall should be about the same height as the walls of an even span house but the north wall should be about a half higher, in the long span & the south construction is used, but both may be of the same height when the short span to the south, house is used.

The usual height of the ridge is seven feet above the walls except in long span to the south in which the distance from the level of the south wall to the ridge is measured and the ridge is so situated that the sash bars on the south side will be twice as long as those upon the north.

Either raised benches or solid beds may be used, the former being the most commonly employed for flowers and the latter for vegetables. In the construction of these raised benches it is desirable to use either gas pipes

an angle iron for supports, although if constructed of wood they will last a long time when supported upon bricks or cedar blocks. In order to secure proper drainage there should be cracks of one half inch to one inch between the boards used for the bottom of the benches. In some cases tile or slate bottoms are used and with iron frame work will form a very durable bench such as should be used in the new greenhouses. The former practice was to place narrow benches along the center of the houses separated by walks but in order to bring the benches into the more desirable parts of the house the plan of having walks along the side of the house and arranging for three or four beds, from four to five feet in width in the center, with solid beds, a similar arrangement has been followed except that the beds are somewhat wider. Where sub-irrigation is to be used the bottoms of the beds or benches are made practically water tight and are a two lines of drain tile are placed lengthwise of the house. The water is turned in at one end thru a hose and filling the tile makes its way out thru the joints.

In regard to heating need not need to have separate heating plant, but some small device may be used in connection, such as are in heating small ranges of greenhouses.

as the cost iron hot water boiler will prove economical and prove satisfactory being more durable than wrought iron boilers especially the latter be made in the form of box coils from gas pipes. One thing against them is that in screwing them together more or less threads are left exposed and as a result may not last only a few years but with a heavy pipe the durability is much longer.

For our purpose in which are used both hot water and steam, tubular boilers would be very much better and may be employed with very good satisfactory, if when heating the entire shell is filled with tubes. Although the tubes are made of wrought iron they are thicker than those commonly used for boilers coil and the tubes are riveted rather than screwed into the boiler heads, will be quite desirable. A greater saving of pipe may be secured in the amount of pipe by the radiating system being carried under pressure and there is hardly any limit to the size of the plant in which hot water under pressure may be used although many florists prefer, for ranges a size that will make a night fireman desirable. While it will require rather more attention than a hot water system, steam as a resulting method of heating greenhouses

has some advantages.

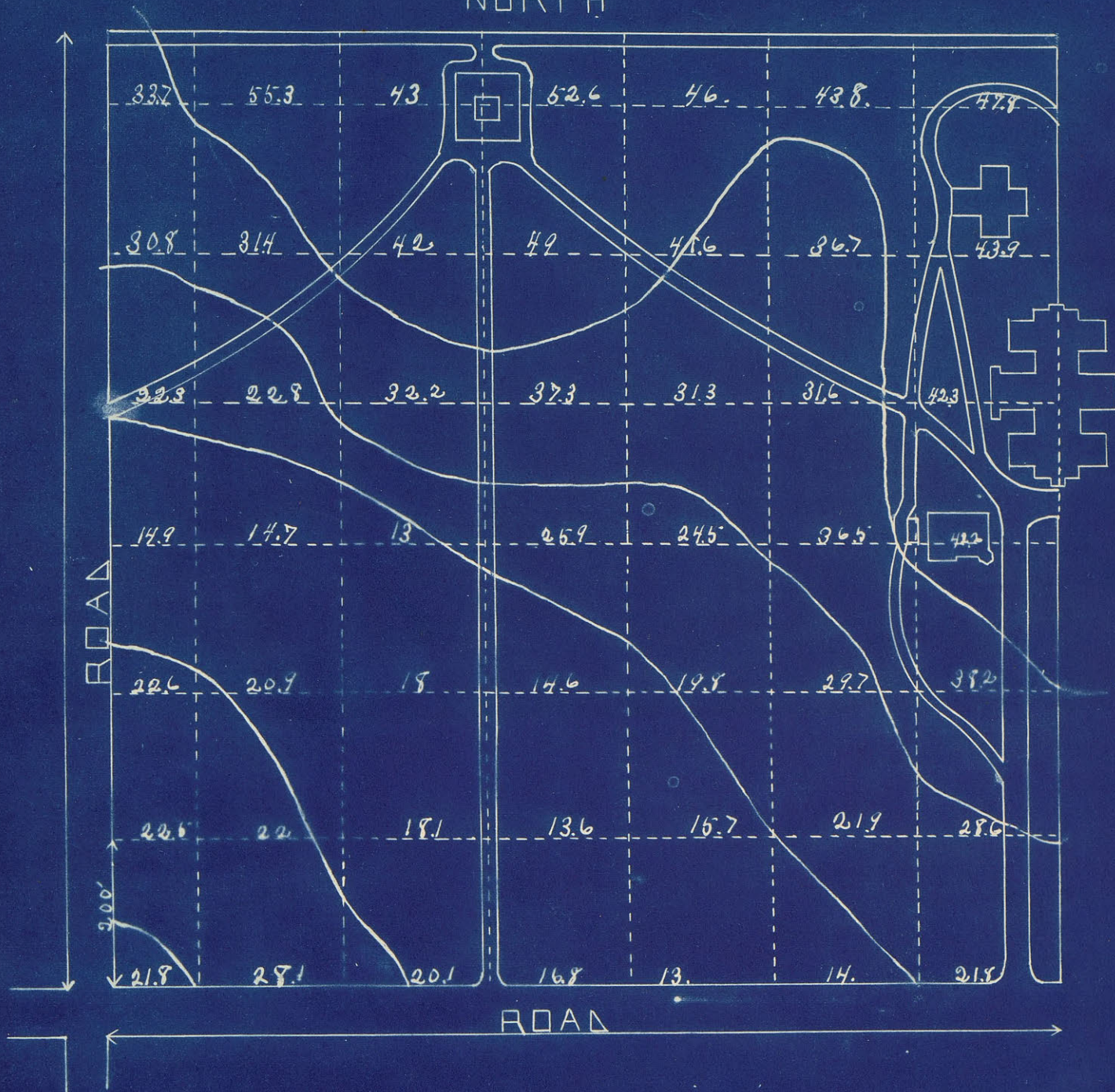
In estimating the amount of radiating surface that will be required, it is customary to estimate that one square foot of pipe will be sufficient for one square foot of glass, if the house is to be carried at 60° with hot water, and that it will answer for four a fire at 50° and 40° respectively are required. With steam heat one foot of radiating surface will be ample for five and one half feet of glass in houses to be heated at 60°, seven and one half if 55° is to be maintained, while only one foot of radiating surface to nine square feet of glass will be required in houses that are to be heated to 40°. The above figures are found substantially correct in sections where the usual winter temperature does not drop below zero, and where the houses are well built and with a comparatively small amount of exposed wall surface. Where the temperature drops much below zero, and where the construction of the house makes it difficult to heat they will need to be slightly modified.

The arrangement of the pipes where steam is used, is quite similar to that in a hot water system the principal difference being that the size of both flow and returned pipes is smaller. The return

pipes need not be larger than one and one quarter inches, and in small houses very good results can be obtained with one inch pipes, while as a rule, a two inch supply pipe will answer for a house 20 x 100 feet, except where high temperature are desired. In the steam system there should be an automatic air valve at the lower end of each of the coils, and for controlling the heat valves are necessary upon both the supply and drip pipes, while in the hot water system only one valve is necessary, although tied will be desirable in case there should be occasion at any time to cut off the coil in order to make repairs upon it. In the steam coils it is also well to have several of the pipes provided with valves in order that one or more of them may be cut off to control the heat as is often the case.

Description of the drawings made to represent some of my ideas concerning a new horticultural building for the college. Drawing number one is a blue print of the grounds, consisting of a forty acre plot of grounds in the south west corner of the grounds. This drawing represents the various buildings that now stand upon the grounds, also chosen location for the new building if we ever have one. The place chosen is at the

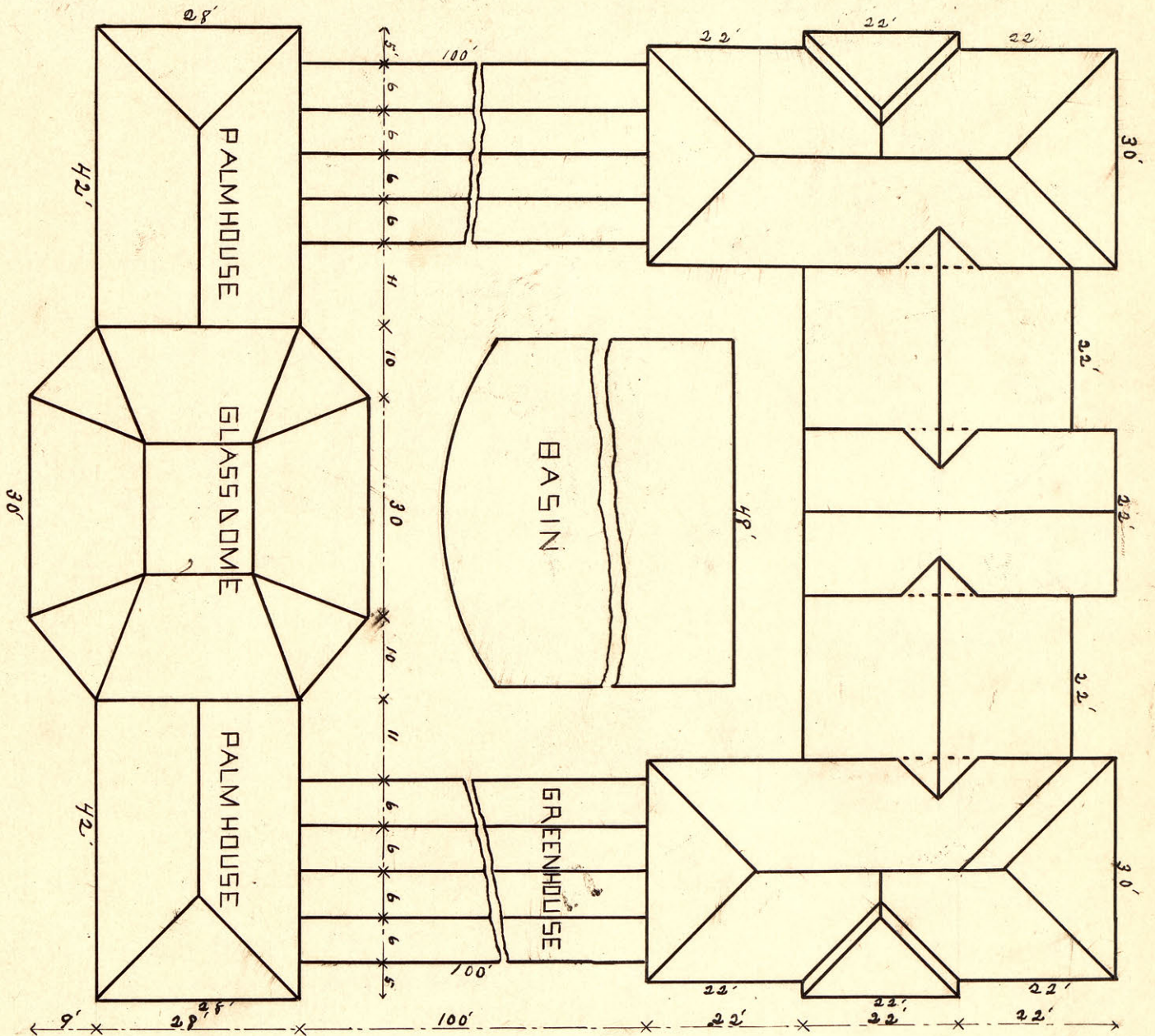
NORTH



PLAN OF THE GROUNDS.

S.W. CORNER $\frac{1}{4}$ Q.

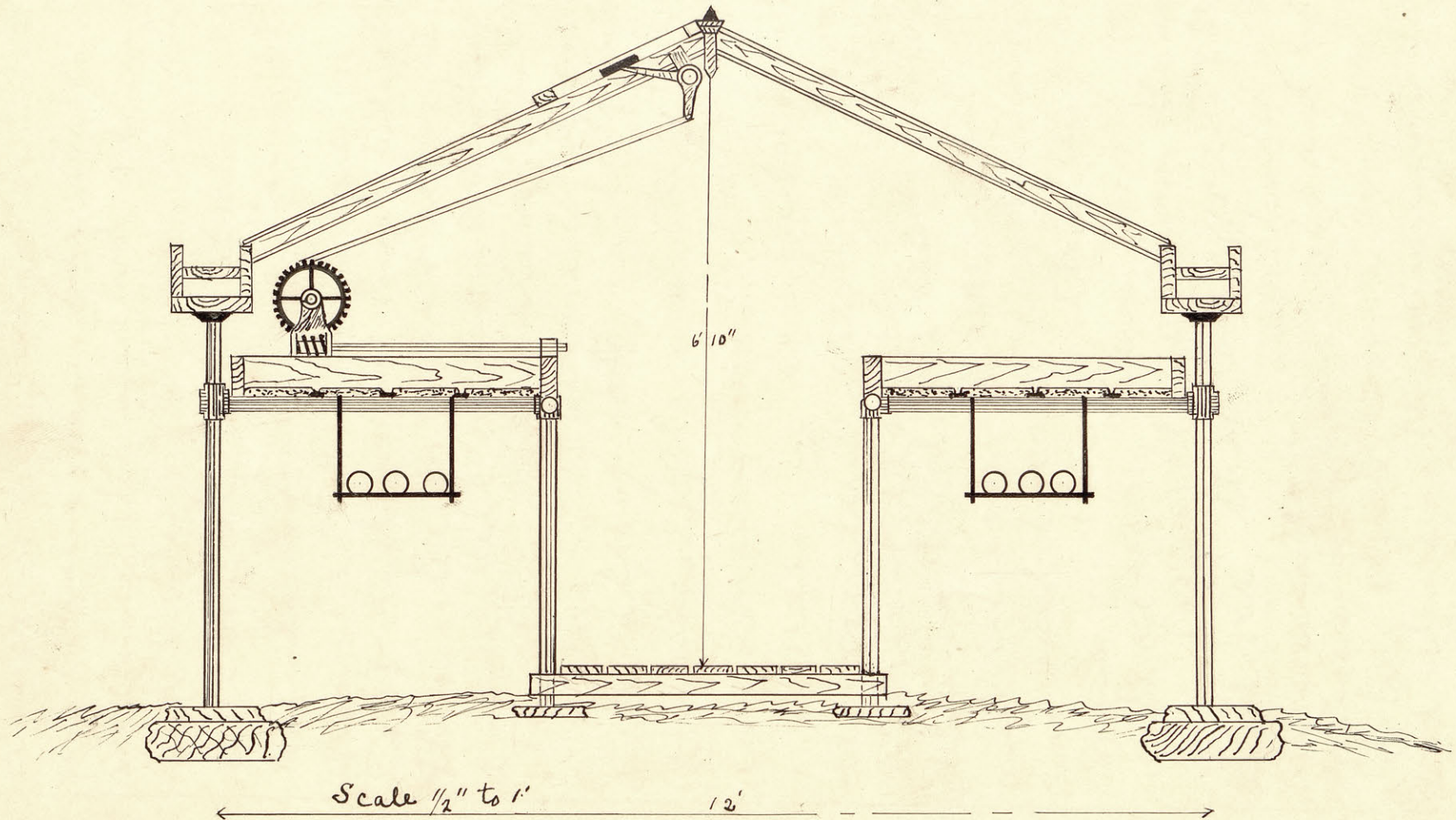
PLAN OF BUILDINGS



north end of the grounds about midway between the road on the west and east line of the forty. It would be just west of the present botanical gardens. This also shows the prospective roads as they may be laid out. One running straight south to the south road, another running from about half way, between the main building and the south road up by the west road of the Domestic Science building north nearly to the gymnasium then across to the new building, another runs from the buildings south west and another comes along the hedge enters at the north side of the buildings. These roads divide the lot into sections, for the various plots to conduct the experiments. Another thing that is shown is the contour lines, thus showing the best locality for the building and various things to be grown.

Drawing number two shows the roof plan of the whole building, with greenhouse and palm house. The part designated, as representing the north shows rough plan of the horticultural building. The east and west wings and center portions are to be two stories high, while the part between them is only to be about eighteen feet high. The building is to be one hundred thirty feet long by sixty six feet wide. Running south from each of the end

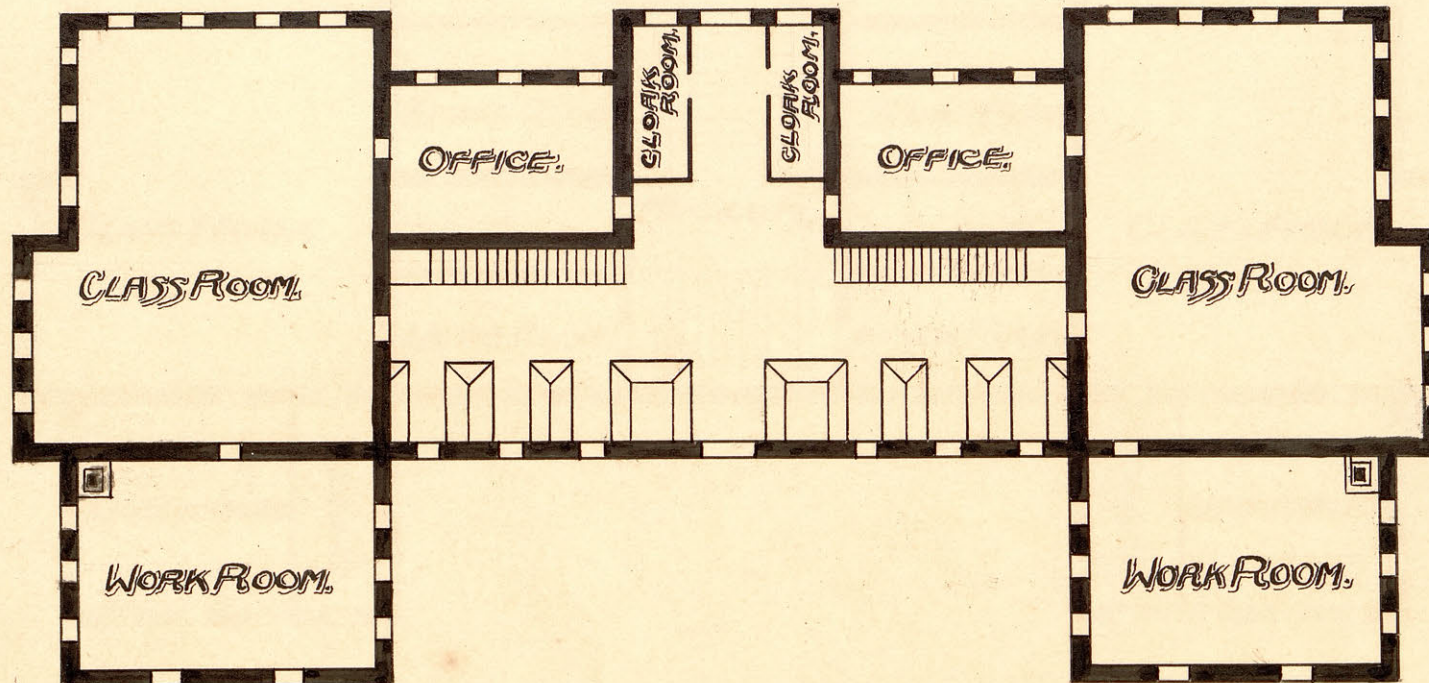
SECTION A GREENHOUSE



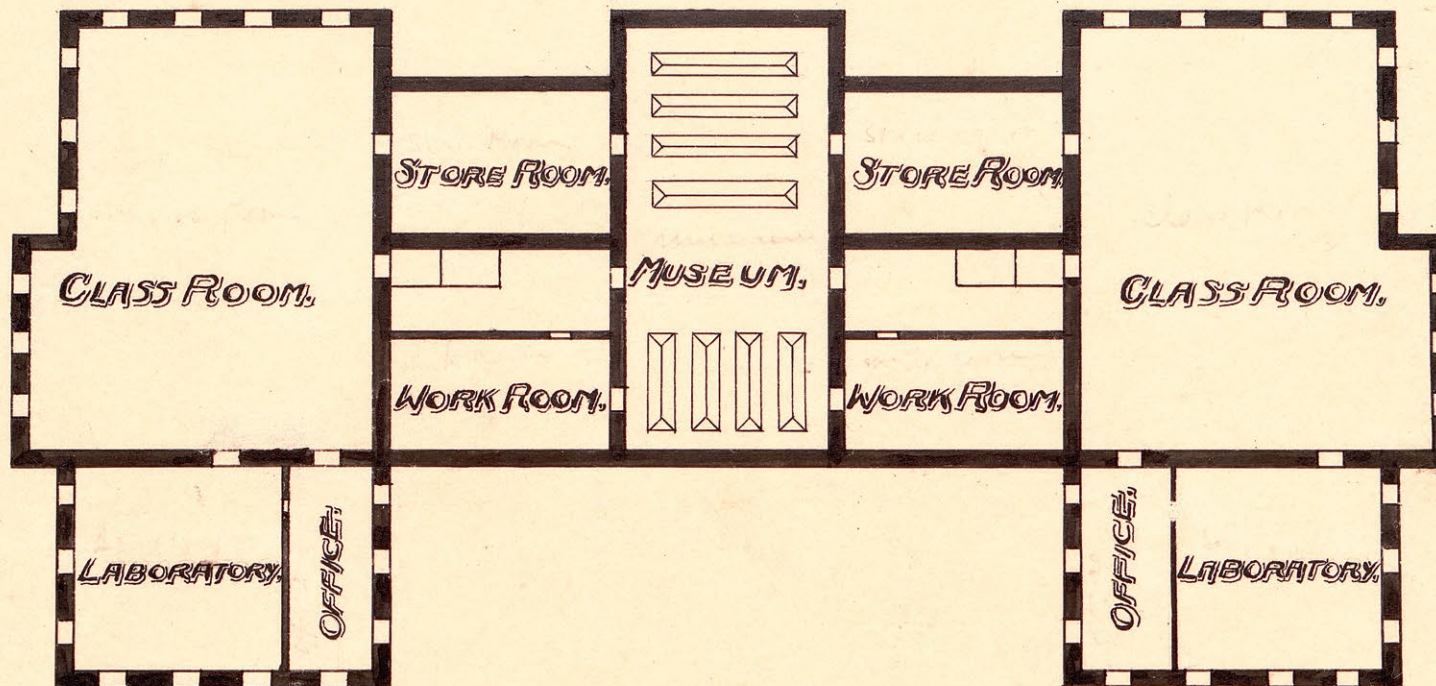
wings are two green houses, which drawing shows number three shows cross section showing the method; raising window benches and heating, watering, methods. These green houses are to be twelve feet wide, by one hundred feet long. Connecting these green houses is a large palm house running east and west twenty eight feet wide. In the center is to be built, a large octagonal dome. All of this is to be built by iron frame structure and of glass. The upper portion of dome is to be built by curved rafters with appropriate railing upon the top. In the vacant place within the building a quite large basin may be built for aquatic plants.

Drawing number four is a plan representing the first floor, showing the different class rooms and windows. Also showing the cloak rooms, stair way, halls, and museum cases. Also shows the windows and doors of the various rooms. The two rooms on the south of the green house are work rooms. Then just north of are two very large class rooms. Leading from these are doors, that take you to the hall where the museum cases are situated, also to the two offices. On your right and left upon entering are two cloak rooms. Just outside the office and between the museum cases which are along the south wall are the stairways which lead up to the second floor.

FIRST FLOOR.



SECOND FLOOR.



20
H. D.

Drawing number five is a plan representing the second floor and various rooms. At the south side, of the east and west wings are the laboratory, and from them is a door leading into the offices. Just north of there are two more large class rooms. On the south side of the hall, of the part that is not to be full two stories are two work rooms. And in the center part that is full two stories are eight large museum cases. And in the north part of the building there are two store rooms. Between the store and work rooms, is the hall leading to the class room. I think this drawing represents an ideal horticultural building which is suited to the needs of the Kansas State Agricultural College and of which we are so greatly in need. The drawings speak very clearly for themselves hence did not go into details very much. The drawings are all drawn to a scale. Thus representing the various parts as they are expected to be. It will probably, be some time before this building is obtained, but nevertheless the college needs are very badly as ever we can see, I have tried to show as best I could, the needs of a new building, also what might be considered an ideal plan for a new building.

Finis