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Climate of Iowa Report 2002-1

A Detailed Station History for Selected Historical Climate Network Stations in Iowa, 1893-2002

prepared for the

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by

Harry J. Hillaker
State Climatologist
Iowa Dept. of Agriculture & Land Stewardship
9607 NW Beaver Drive
Johnston, IA 50131

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INTRODUCTION

The purpose of this project is to document the station history of selected Historical Climate Network stations within the state of Iowa. Existing station history information, or metadata, frequently is incomplete or inaccurate. Information regarding station locations, observers, equipment used and types of data recorded are summarized. No data analysis is to be performed as part of this work; however, the general quality and completeness of the historical climate data will be described and quantified. Nevertheless, several gaps remain in our knowledge of the history of many of the HCN stations. However, it is believed that this report will provide the tools necessary to identify the best HCN stations for future study and allow for more accurate assessment of the biases existing in the historical climate data. Finally, while this report is limited to only a very small portion of the national HCN network the findings given should prove useful to anyone interested in the analysis and interpretation of HCN data.

STATION SELECTION

The station selection process was a very simple one. First, this office possesses data only for climate stations within Iowa. There are 23 HCN stations within the state. However, sufficient resources were not available to examine all of these sites. As a result, the 15 stations nearest to Des Moines (the home of the author) were selected for study so as to minimize travel costs and the time necessary to complete field visits of each location. An earlier report (Hillaker, 1985), although by no means a comprehensive summary, provides some additional station history data for other Iowa climate stations during the 1949-1985 period.

ANALYSIS OF HISTORICAL CLIMATE DATA MONTHLY FORMS

The Monthly Report Forms. The first step in this research effort involved an analysis of the original climate data report forms submitted over the years by the National Weather Service (NWS) co-operative observers. Each month the NWS co-op weather observers mail (or these days fax) a single page form detailing their daily weather observations for the prior calendar month. This form has changed names many times over the years and also seen many changes in format that have affected what type of data are routinely reported. In the NWS era the original form was known as "Form 1009". The name was later changed to "Form 1005", "Form E-15" and is currently known as "Form B-91". There are also a few other name variations depending upon what type of equipment is available at each site (for example, those with evaporation pans use a different monthly form).

Time period examined. The original monthly paper report forms are available in most cases only back to January 1893. Earlier data exist but apparently only on microfilm. These older microfilm records are frequently extremely difficult to read and thus were excluded from this study. Additionally, very little of the climate data prior to 1893 has been made available in digital format for use in climate studies. Finally, monthly forms through May 2002 were examined for this study. Thus, this report details the HCN station history from January 1893 through May 2002.

TYPES OF CLIMATE OBSERVATIONS

Over the years the types of weather observations included on the monthly report forms has changed frequently. In this study only the basic observations still routinely made today have been examined. These weather elements are daily maximum and minimum temperature; the 'at observation' temperature; 24-hour precipitation; 24-hour snowfall and the 'at observation' snow depth (the total depth of snow or ice on the ground at the time of the daily precipitation observation).

Daily Maximum and Minimum Air Temperatures. For those unfamiliar with co-operative weather observations the daily maximum and minimum air temperatures are recorded once daily from self-recording instruments. The daily temperature readings are recorded manually and the instruments are also re-set manually to the current temperature to be made ready to register the maximum and minimum temperatures for the next 24-hour period. Hourly temperature readings are not a routine element measured at co-operative weather stations (there are rare occasions when the co-op station was also an "Airways" station where more frequent measurements were made). Among the stations examined in this study Iowa Falls and Mount Ayr briefly were also part of the 'off Airways' network in the late 1930's and early 1940's. Further, the time of day when the once daily max/min temperatures are recorded varies from one station to another, from one year to the next at the same station, and in some cases may even change from month to month (a nightmare for data analysis).

The time of day when the daily weather observations are made is of great importance because it has a profound impact upon the resulting data. Monthly average temperatures; frequency of various temperature thresholds, etc. are all impacted by the time of observation. Unfortunately, it is often difficult to determine the observation time actually in use in any given month. The monthly report form did not include a space to list the observation time until the advent of Form 1005 that first appeared in January 1903 but was not used by all stations until a number of years later. To further complicate matters, to this day not all observers record their observation time on the monthly forms. There are even a few that record the incorrect time (they apparently just keep copying the basic station information from the previous month's form and do not indicate a change in observation time for years after the change was made).

In this report the observation time is assumed to be what has been written on the form. In the absence of any recorded observation time on the form it is assumed to be the same as the last previous month when a time was listed. A synopsis of temperature and precipitation observation times is given in Table 1. Minor month-to-month fluctuations in observation times are not documented here. Thus if just a month or two showed a 6 p.m. observation time in the midst of years of 7 p.m. observations times this change is not noted in Table 1. Similarly, if the observation time listed on the monthly forms fluctuated frequently from month-to-month by an hour or less only the most prevalent time used in noted.

Daylight Savings Time. There have been several time periods when Daylight Savings Time has been used in Iowa. Knowledge of the dates of Daylight Time implementation is required to accurately determine the magnitude of the time of observation bias. A summary of the history of Daylight Time use in Iowa is provided in Appendix 1.

Thrice Daily Temperature Observations.

In addition to daily maximum and minimum air temperatures there are two additional types of temperature measurements that may be found on the co-op monthly forms. The first are thrice daily temperature observations. In the later 19th Century, primarily in the period prior to widespread use of self-registering maximum and minimum thermometers, it was common to record the air temperature at 7 a.m., 2 p.m. and 9 p.m. daily. There are frequent variations on these specific times, particularly in regards to the mid-day reading that was sometimes made as early as noon. Monthly average temperatures, in the time period prior to the use of daily maximum and minimum air temperatures, were computed by taking the sum of these three daily readings, plus adding the 9 p.m. temperature a second time. The average of the four values was considered the daily average temperature ((7 a.m. + 2 p.m. + 9 p.m. + 9 p.m.)/4). Virtually all co-operative stations were using maximum and minimum thermometers by 1903. In most cases the thrice daily readings ended at the same time that the daily maximum and minimum records began. However, there are several stations where both types of readings can be found simultaneously for a few years.

At Observation Temperatures.

The temperature at the time of the daily re-setting of the maximum and minimum thermometers began to be recorded in January 1901 at most locations. This reading was known as the "Set Max" temperature for many years (i.e., the reading of the maximum thermometer after it was re-set). In more recent years this reading is simply called the "At Ob" or "At Observation" temperature. Generally, there are few "Set Max" readings available prior to January 1901 except in those cases where observers were still recording thrice daily readings (the 9 p.m. reading being the equivalent of the "Set Max" although it may have actually been read from a thermometer other than the maximum). Many, but not all, observers also did not record a Set Max reading during the 1903 to 1913 period. However, the Set Max was in universal use after January 1, 1914. The general completeness of daily temperature readings among the Iowa HCN stations can be found in Table 2.

Daily or 24-hour Precipitation.

Once daily readings of rainfall were made at virtually all stations during the period of this study. In the early years this measurement was typically made at the same time as the last daily temperature observation (9 p.m). By the turn of the century when Max/min thermometers were in widespread use 7 p.m. was the more common time for the precipitation measurement. There were occasional times between 1904 and 1924 when 7 a.m. readings were made; although in many of these cases morning readings were only made during the growing season (April 1 to September 30). Finally, beginning in the late 1940's, rainfall reporting to support river flood forecasting activities resulted in a gradual trend towards morning rainfall observations. This trend has continued through the years such that by the 1990's very few co-op sites measure precipitation at any time other than in the morning. Documentation of the precipitation observation time is difficult prior to1949 as there was no place on the monthly report form to enter the precipitation observation time. However, determination of the use of morning observations can often be deduced by careful comparison of the daily precipitation entries with the times of the beginning and ending of precipitation (a very common observation in the early years). The precipitation observation times are also in Table 1 for the HCN stations studied in this report.

<u>Precipitation Measurements With Snow and Sleet</u>.

Measurements of the liquid equivalent of frozen precipitation were not common during the early years of the co-operative weather program. Generally, the precipitation column on the monthly reporting form would simply be left blank on days with snowfall. Or, if any entry was made in the precipitation column, it would be one-tenth of the snowfall amount. This ten-to-one ratio would be published in the official records and these values would also be in today's digital data base. An earlier study, *Climatology of Iowa Series #5* (Waite & Hillaker; 1982, Iowa Dept. of Agriculture, 1982) determined that the actual average snowfall to water ratio in Iowa is 13.3 to 1. Thus, widespread use of the 10 to 1 ratio probably results in a significant 'wet' bias in the earlier portion of Iowa's precipitation time series for the winter season. However, there are a few of the HCN stations that did make actual measurements of winter precipitation from the beginning of the record. Use of the 10 to 1 ratio became less common in the 1920's and is rare in Iowa after 1940 (although there is at least one station still using the ratio today). The general completeness of the daily precipitation measurements among the Iowa HCN stations can be found in Table 2.

<u>Daily or 24-hour Snowfall.</u>

Once daily measurements of the depth of new snowfall accumulation are nearly universal throughout the time period of this study. These measurements nearly always were made at the same time as the daily precipitation measurement (yes, there really are some exceptions to that practice). The general completeness of Iowa HCN daily snowfall measurements can be found in Table 2.

<u>Snow depth or Daily Snow/Ice on Ground</u>.

The measurement of the total depth of snow and/or ice on the ground has been, along with the liquid equivalent of snowfall, the most inconsistently performed of the primary co-op data elements over the years. Knowledge of this element; however, is very important in climate studies because of the major impact that snow cover has upon air temperatures. In the 19th Century total snow depth was recorded on only the 15th day and the last day of each month. There was no column available in the early monthly forms to enter daily snow depth amounts. Furthermore, only about one-half of the observers consistently provided even the mid and end of the month snow depth values. The first monthly forms to include a daily snow depth column appeared in December 1896. However, less than one-half of the HCN stations studied were measuring snow depth on a daily basis by 1912 with three-fourths of the stations including daily measurements by 1934. The most widespread adoption of daily snow depth measurements among the 15 HCN stations studied here came in 1937-1939 with a gradual decline in such measurements since then. The completeness of daily snow depth measurements among Iowa HCN stations can be found in Table 2.

Other Observed Weather Elements.

There are several other weather elements that are sometimes recorded on the co-op station monthly forms that have not been summarized in this report. In the early years of the co-op program (generally up to about 1949) it was expected for all co-op observers to make daily observations of prevailing sky condition (clear, partly cloudy, etc.) and prevailing wind direction (usually using 8 compass points). These sky cover and wind observations were very common until 1949 but only a handful of sites have continued this practice since then. The pre-1949 monthly forms also had spaces for recording dates of 'frost' and 'killing freezes'. A space to note the dates of hail, sleet, thunderstorms and auroras also was present until 1949. Monthly forms in use since 1949 include boxes which can be checked to note the dates of fog, sleet, glaze, thunderstorms, hail and damaging winds. The completeness of these data entries varies considerably from one observer to the next. There are many observers today that never make any of these supplemental observations. One may also find phenological observations, barometric pressure data, lake ice-out dates and just about any imaginable meteorological or astronomical observation at times.

STANDARD HCN STATION EQUIPMENT

Air Temperatures.

Probably the most basic of all climate measurements is that of air temperature. Among the HCN stations most would have begun their existence with a single 'liquid in glass' mercury thermometer. As noted in an earlier section of this report, this thermometer would typically be read at three set times each day. A few observers would also attempt to make observations of maximum and minimum air temperatures by making readings between the three regular observation times. These readings of daily maximum and minimum air temperature are referred to as "eye readings" since they required someone to make frequent visual observations of the non-recording thermometers. However, it is not uncommon to find HCN stations where the daily maximum and minimum temperatures listed on the monthly form are nothing more than the highest and lowest readings among the three regularly scheduled temperature measurements per day.

Maximum Thermometers.

However, self-registering thermometers were available and in widespread (but not universal) use by the beginning of the time period examined in this report. The maximum thermometer essentially is a larger version of the everyday 'fever thermometer' most people are familiar with. This thermometer, usually filled with mercury, automatically registers the highest temperature recorded and retains this reading until it is 'shaken down' to re-set it to the current temperature.

The typical HCN station has this maximum thermometer mounted in a special bracket known as a 'Townsend Support'. This bracket allows the thermometer to be spun quickly to reset it and then has another position that will keep the thermometer in the proper orientation to again measure the temperature. The maximum thermometer will retain the highest temperature reached until someone manually resets it. The usual practice will be to re-set the thermometer once every 24 hours at the same time each day. On some occasions the observer will record the maximum temperature, but forget to re-set the instrument. This presents no problem if the next day becomes warmer than the previous one but will lead to falsely high readings when the opposite is the case. Generally, maximum thermometers have proven to be very reliable over the years and are prone to relatively few failures or loss of calibration.

Minimum Thermometers.

A totally separate thermometer is used to automatically record the minimum temperature. The minimum thermometer is typically an alcohol-filled calibrated glass tube containing a small metal index (a half inch to inch long straight metal pin). This index will retreat with the alcohol column as the temperature decreases but will maintain its position within the alcohol column when the temperature begins to rise. The thermometer automatically registers the lowest temperature attained until it is manually reset. This thermometer is mounted horizontally (or nearly so) within the Townsend Support and is reset by turning it vertically upside-down so that gravity pulls the index back to the top of the alcohol column. Just as with the maximum thermometer it is possible for the observer to record the minimum temperature and then forget to re-set it such that the previous day's minimum temperature will be retained for the next day as well (unless the next day is colder). Traditionally the minimum thermometer has been much more prone to problems than is the maximum thermometer. Vibration (such as by strong winds) can cause the index within the alcohol tube to move. Also, and probably the more common problem, the alcohol column with time is prone to 'separate' such that a portion of the alcohol gradually migrates up the bore of the thermometer. If left unchecked this can result in the minimum temperature reading being too low. Separations of one or two degrees are rather common although there was one case among the HCN stations examined where a 6° separation was documented. However, the better observers would keep a close watch for separations and would rectify them before they could cause noticeable problems with the temperature readings.

Blackening of the Thermometers. When reading through station inspection forms (a section on those later) one will frequently find references to the thermometers being 'blackened'. Both the maximum and minimum thermometers have their temperature scales etched into the glass tube of the thermometer (unlike the typical hardware store variety thermometer where the scale is painted upon a flat plate located behind the glass tube). The etching is done for two reasons. First, it eliminates the possibility that the scale can move (i.e., if the thermometer backing comes loose) and cause the proper calibration to be lost. Second it minimizes problems with the visual perspective of the observer when they read the thermometers since the etched scale is physically much closer to the alcohol column than is the thermometer backing. Why mention all of this? With time the 'paint' within the etch marks wears away which can make it very difficult to accurately determine the temperature. 'Blackening' refers to rubbing a carbon compound across the surface of the thermometer tube so as to fill those etchings with black resin and allow much easier reading of the temperature. Thus, if you find in the station inspection forms that the thermometers have been 'blackened' it is does mean that there was anything wrong with them. This was just an aspect of routine maintenance.

The Thermometer Instrument Shelter.

In order to obtain a representative measure of air temperature it is necessary to place the thermometers in some type of ventilated shelter. The size, color, design and height (distance above the ground) of the shelter can all have a significant impact upon the resulting temperature readings. The NWS has long used the Cotton Region Shelter (CRS) as their standard thermometer shield. These louvered wooden boxes are designed to hold thermometers at a height of about five feet above ground level (such that they are at a level that is easy for most adults to read the thermometers). Although the Cotton Region Shelter is identified as the shelter of choice at least back to 1890 it is not clear when it came into widespread use among the HCN stations in Iowa. The earliest survey of the co-op station instrumentation used in Iowa was conducted around February 1, 1906. At the time of that first survey there were 2 HCN sites using a CRS; 7 using a shelter of a different design and one using no shelter at all (no documentation for the others). All 15 HCN sites examined appeared to be using a CRS by 1932. An excellent description of early temperature observation practices can be found in the U.S. Dept. of Agriculture 1895 report *Instructions for use of Maximum and Minimum Thermometers*.

Electronic Temperature Systems.

In the 1980's it became increasingly difficult to obtain good quality liquid-in-glass thermometers. As a result an electronic temperature system was developed for use in the cooperative network. This system is known as the "Maximum Minimum Temperature System" or "MMTS' for short. The MMTS is composed of a temperature sensor mounted within a prefabricated plastic shelter. The sensor is attached by cable to a readout 'box' which displays the current temperature and stores the maximum and minimum temperature values. Like the old maximum and minimum thermometers the MMTS must be manually re-set daily. Also, the maximum and minimum temperatures are reset individually. Thus it is possible to reset one but forget to reset the other (in real life if the observer forgot to reset the max they probably also would have forgotten to reset the min). A general description of the MMTS can be found in the National Weather Service *Observing Handbook No. 2* (1989).

There are many pros and cons to the MMTS in relation to the old liquid-in-glass (LIG) thermometers. An advantage is that the MMTS can be read and reset remotely; thus the observer does not have to brave the elements to go outside and read them. Another advantage is that the same sensor is recording both the maximum and minimum temperature unlike the LIG's which are two totally separate instruments. The MMTS has also proven to maintain its calibration extremely well over the years. Finally, since it is read remotely there is no need to place the thermometers in a physical location that is easily accessible by the observer. Thus, there is the potential that the exposure of the thermometers can be better in some situations.

However, there are also disadvantages. The biggest one is simply that it is different. It is a different sensor with a different shelter, thus introducing a potential bias in the long-term temperature records. The size of this bias appears to be small; however, its exact magnitude is very difficult to quantify because it varies with the time of year, ground cover and sky condition (among other things). To make the assessment more difficult the MMTS replaced the previous LIG thermometers at nearly all co-op stations thus there are few side-by-side comparisons of the two systems. If that is not bad enough the MMTS typically was not installed until there was a need to move the co-op station. Among the 15 HCN sites examined here, there were only five where the MMTS was placed in the same location as the previous LIG/Cotton Region Shelter. In seven cases the MMTS was installed at an entirely new location with a new observer. In the other three cases the MMTS was installed at a different location on the same property. These changes in microclimate can easily obscure potential biases caused by a change in instrumentation.

Another problem with the MMTS has been its electronic nature. This results in potential new problems not experienced by the LIG's. Early MMTS installations experienced substantial problems with lightning. Modifications to the MMTS have greatly reduced this problem over the years but have not eliminated it.

Additionally, power failures result in a loss of data with the MMTS. Problems with splices in the MMTS cable (leading between the sensor and the display box) sometimes results in spuriously low temperature readings (usually this is a sporadic problem and effects the minimum temperature much more frequently than the maximum temperature). There also have been cases where power surges temporarily interfere with the temperature readings. Fortunately, however, problems with an MMTS being totally out of calibration seem to be very rare. Finally, the need for the cable to connect the MMTS sensor with the readout box can prove very troublesome at some co-op stations where streets, parking lots or other substantial obstacles may make it very difficult to lay cable. In some cases this results in less than ideal exposures being utilized because it is not feasible to lay cable to a more favorable sensor location.

In general; however, I believe that most people would agree that the MMTS provides a more accurate and consistent reading of the true air temperature than do the LIG thermometers (but it is different).

<u>Standard Non-Recording Precipitation Gages</u>.

The NWS standard precipitation gage has long been the "Eight Inch Standard Rain Gage" (SRG). The SRG is a metal cylinder with an eight inch diameter orifice at the top and a capacity of about 20 inches of moisture. Within the eight inch diameter tube is a smaller tube of approximately two inches in diameter. A funnel at the top of the gage minimizes evaporation losses and also directs the precipitation into the inner tube. Owing to its smaller diameter the inner tube effectively magnifies the scale of the gage by a factor of ten so as to make it easy to read the precipitation amount to the nearest one-hundredth of an inch. The larger outer cylinder serves as an overflow for the smaller tube and also prevents loss of precipitation in case the inner tube develops a leak. In winter, the funnel and inner tube are removed and precipitation is caught directly with the 8 inch diameter cylinder. The funnel is removed so as not to interfere with the reception of frozen precipitation. In winter the precipitation in the 8 inch diameter cylinder is poured into the inner tube for measurement (after the precipitation accumulation has been melted if it came in the form of snow or ice). At the time of the initial February 1906 survey of co-op instrumentation (referred to earlier in the temperature section) there were 7 HCN sites already using the SRG. Another 3 sites were using a 3 inch diameter gage. One site was using a 2.5 inch diameter gage while it is not known what the other four were using. It appears that all of the HCN stations were using the SRG by the end of 1927.

Recording Type Precipitation Gages.

There are 5 of the HCN study cities that have also been part of a hydrologic network comprising recording rain gages. These gages record not only the amount of precipitation but also provide a continuous (or nearly so) record of the timing of the precipitation. Documentation of these recording rain gages is generally better than those for the other weather elements. Since these are not routine components of HCN stations the reader is referred to *The Climatology of Iowa Series No 6* (Hillaker, 1984) for more information on these types of gages. The HCN sites with recording rain gages are Iowa Falls, Mount Ayr, Mount Pleasant and Washington. Rockwell City also has a recording rain gage; however, it is not currently co-located with the HCN station.

STATION HISTORY DOCUMENTATION

There are a variety of sources to obtain metadata for the NWS co-op network.

Monthly Data Report Forms.

The first are the monthly data forms. These often provide the best documentation as to the observation times in use and the identity of the observer making the observations. The data forms also obviously provide a record of what types of information were being recorded at any given time. However, they rarely provide information as to the type of instrumentation used in making the weather observations. On rare occasions they do refer to changes in the instrument location. In one instance it was possible to find an address of the station location when such information was not documented anywhere else. Additional information regarding these forms is provided elsewhere in this report.

Station History Forms.

Form 1029-Mis. The earliest station documentation appears in February 1906 in "Form Number 1029-Mis", also known as the "Description of Cooperative Observer's Station and Instruments". This one page, single-sided form was completed by the cooperative observer. It included entries for the type of thermometers, instrument shelter and rain gage in use. There also was a description of the location and exposure of the shelter and rain gage. Other items were the latitude, longitude and elevation of the station (rarely very accurate); the time of observation; and the observer's name and address.

The instrumentation description is usually very detailed and would include the manufacturer, serial number and style of the equipment. The exposure documentation varied considerably from one location to the next but usually provide a fairly good means of determining the likely quality of the station exposure. Unfortunately it is often impossible to determine the actual location of the weather station. The address usually consisted of only the observer's name and the name of their Post Office. Some small towns did not have any form of house numbering until the 1950's and in fact there is one Iowa county that just this year is adopting a 9-1-1 system where rural homes and businesses are uniformly being assigned numbers and street names. It probably is possible to search county property records to pin down some of these locations from knowledge of the observer names and tenures; however, such a task is beyond the scope of this study. Use of the Form 1029-Mis ended in the 1940's.

Unfortunately there are many station moves that were not documented at all, especially during the 1930's and early 1940's.

Report of Substation. The Form 1029 was effectively replaced by the "Report of Substation". Unlike the earlier Form 1029 the newer Substation Reports were completed by NWS personnel, rather than by the observers. These reports have been identified in a variety of forms. First, there was the Form 4303A, then the Form 531-2 and finally the Form B-44. The Substation reports began in the late 1940's and frequently provided sketches of the co-op station layout that would map out houses, trees, streets and other items of interest in the immediate vicinity of the station. These forms also provided driving directions to reach the station. These directions often have been valuable in locating those sites that did not have specific addresses. In the mid 1980's the form was integrated into a computer data base. Unfortunately, this transition resulted in the elimination of the detailed site map. In its place is a very brief numerical description of the azimuth and distance of obstructions near the rain gage. In most cases these exposure descriptions are of almost no value in assessing the overall exposure of the equipment. This is especially true of the temperature equipment as the exposure description is only applicable to the rain gage.

Form 530-1. These are 5 by 7 inch index cards prepared in the mid 1950's that gave a very brief summary of the observer names, tenure, equipment and location of co-op stations. Although the level of detail provided in these cards is minimal they often did provide information on the location (an address) and/or the type of equipment used at co-op stations that can not be found from any other source for the pre-1955 period. The cards were updated through the 1970's but the later data generally duplicated information available elsewhere. The original 530-1 cards are reproduced in the 1956 U.S. Weather Bureau report "Key to Meteorological Records Documentation No 1.1 (Substation History)".

Substation Inspection Forms.

The earliest of this report series appeared in 1917 and provided what were sometimes very detailed descriptions of the co-op stations. In some cases they were practically a miniature station history report in their own right. Unfortunately these reports are very infrequent, averaging maybe one inspection for every 10 or 12 years per station. This initial report was known as Form 4005-Mis, "Inspection of Substation". These reports appear to have been discontinued in the early 1940's.

The next inspection reports, Forms 530-2 and 6055, first appeared in the late 1940's and were discontinued around 1977. These reports are much more frequent (averaging about one per year) and provide a brief description of the type of maintenance performed at each co-op station upon a visit by the NWS personnel. These forms sometimes provide information on station moves that have not been documented elsewhere. They also frequently give the inspector's view as to the skill and level of interest of the co-op observers. At times they give a rather entertaining picture of the challenges involved in maintaining the co-op network.

Other Forms.

Finally, there are 'maintenance cards' that were updated through the 1940's for those co-op sites that had recording rain gages (Universal or Ferguson gages). These cards have no form number but frequently provide rather detailed site descriptions. The old 'Weather Bureau' offices also maintained 'Correspondence' files. These files contain letters and other correspondence between the Weather Bureau office and the co-op observers (although they are not limited to co-op observers). These letters may occasionally contain useful station history information but they were not examined as part of this project (they are organized by date, not by co-op station). One final bit of documentation are invoices filed by the NWS field personnel. These invoices detailed expenditures of money or supplies in the maintenance of the co-op stations (and other duties). Occasionally these would include descriptions of what type of maintenance was performed. These invoices were not examined as part of this project. Generally the invoices and correspondence files cover the period prior to 1950 and probably no longer exist in most states (however, they do exist in Iowa).

FIELDWORK

Once all of the station history information was examined and summarized, the final phase of this project was to go into the field and attempt to pinpoint the locations of all of the current and past weather observing sites of the 15 HCN stations.

Mapping the Daily Routes. Street maps obtained from a commercial CD-ROM were used to approximately locate the current and previous observation sites in each HCN city. These approximate locations were then numbered and keyed to the station history data to facilitate finding the appropriate information while in the field. This effort also allowed for planning the order in which stations were to be visited. I made a mistake in the first two cities not to do this. Even in small towns it is surprising how much time is consumed criss-crossing the town going from one location to the next. Those frequent trips across town also raise the suspicions of the local citizens who wonder what in the world this stranger with 'out-of-county' plates is up to (Iowa has the name of your home county on your car license plate). There is a story to go along with this experience but it will not be detailed here.

Visiting with the Current Co-op Weather Observers. The first stop in most towns was to visit with the current co-op weather observer. These meetings typically would be arranged the day prior to the trip. The purpose of these visits was to see the weather station up close and obtain precise coordinates of all co-op weather equipment. The meeting was also used to discuss the

HCN network and the importance of their observations for the HCN, and for climate data users in general. Any shortcomings they had in their observations would be discussed (very tactfully) and encouragement and techniques for procuring better observations would be provided. There are four cities where the HCN observer is the radio station. At each of those cities I also recorded radio interviews including one 30 minute public affairs program.

There were a few surprises during these visits. At one location, a radio station, the observer was busy with on-air duties so I began the visit by looking over the weather equipment. I found the SRG easily enough and it was in an excellent location. This site also had a Fisher-Porter recording rain gage and it was found to be about 10 feet away from a 25 foot tall tree. At least the tree branches were not quite over the gage. However, I then stood there and tried to find the MMTS. I did not see it when I drove up to the station so I was fairly sure it was not on the other side of the building. After a few frustrating minutes I found the MMTS sticking up in the middle of a large bush, which in turn was adjacent to a four foot high retaining wall and was surrounded by medium sized trees. It would have been difficult to select a worse exposure for the temperature equipment on that property. Arrangements have been made for that equipment to be relocated to a more suitable location.

At another city the primary observer mentioned that some of the substitute observers sometimes have trouble getting accurate temperature readings. While he (the primary observer) is on duty he would periodically check to make sure that the current temperatures looked reasonable. If they did not look good he would jiggle the MMTS cable a little until a more reasonable temperature appeared. He demonstrated this to me and the current temperature fluctuated between 41° and 66°! The culprit was apparently a splice at the point where the MMTS cable goes through the wall to the outside sensor. This explained why I was seeing occasional minimum temperatures from this location that were much too low. This splice is now scheduled to be repaired. Generally it appears that the MMTS temperatures never read too high. If there are power surges, electrical shorts or calibration problems they will invariably read too low.

Fortunately, at many locations the exposure of the instruments was very good and the observers very dedicated to recording good observations. It was not possible to visit with the current observers at Logan and Rockwell City.

Visual Inspection of Past Observation Sites.

All of the prior co-op station locations were visited whenever an accurate address could be determined. These site visits were done from the car in most cases as it was not feasible to make arrangements to go onto each of the properties involved. A Global Positioning System (GPS) unit was used to obtain the latitude and longitude of each location. At most locations a Garmin GPS III Plus was employed that provided coordinates to the nearest one-tenth of a second. At two cities (Belle Plaine and Toledo) a Magellan Model 12001 GPS unit was used that provided only one second precision. Both units also provided elevation data. However, although both units would provide the elevations in one foot units the accuracy of the readings was found to be only about plus or minus 100 feet. These elevation readings were discarded in favor of more precise readings that could be obtained from 1:24,000 scale topographic maps of the U. S. Geological Survey.

At each site the slope and aspect of the ground would be estimated. The distance and direction to the site of the weather equipment would be estimated (if the station history data was sufficient to determine the exact location) so that the 'in car' GPS coordinates could be adjusted to reflect the actual weather station location. A very general synopsis of the station environs would be made so as to provide a rough measure of the probable quality of the station exposure. Finally, the location would be marked as accurately as possible on the street map for later estimation of the station elevation from the topographic maps. A total of 118 co-op station sites were visited. A synopsis of the station location data can be found in Table 3 with maps for each city following in Appendix 3.

CONCLUSION

In this project all readily available NWS documentation regarding co-operative station metadata was examined. The completeness of this documentation is exceptionally poor to non-existent for the period prior to 1906. The quality and quantity of metadata improves substantially by the late 1910's and remains rather good until the late 1930's. However, there is a period of somewhat poorer records in the 1940's and for the first half of the 1950's. The Golden Age of metadata takes place from the mid 1950's through the late 1970's. A gradual decline in quantity of metadata begins in the late 1970's with the demise of the substation inspection reports. Finally, the quality of metadata plummets in the mid 1980's when traditional substation documentation is replaced by a digital station history system. The instrument exposure data provided on the digital Form B-44's was almost totally useless in determining the exposure or location of the MMTS or CRS. Exposure data for the SRG was not much more useful. Generally the exposure data on these recent B-44's was not sufficient to determine where the instruments were located. In order to provide useful metadata the instrument exposure data needs to be much more detailed than has been the common practice. Specific exposure information for the MMTS or CRS also needs to be added. Finally, the addition of latitude and longitude information to the nearest one-tenth of a second for each type of instrument would be very useful.

Documentation of the transition from the CRH to the MMTS is one area in need of specific attention. The conversion to the MMTS took place at the same time that the quality of metadata declined. Thus, interviews with current or recent co-op observers is sometimes the only way to determine how the CRH to MMTS conversion took place. In order to more accurately assess the amount of bias introduced into the long-term temperature trends by conversion to the MMTS we need to be able to identify those co-op sites where the MMTS was installed in the same location as the previous CRH. It is apparent that there are not very many locations where exposure of the temperature equipment was the same with both systems.

Another avenue worth pursuing would be to pin down more precise coordinates for some of the earlier HCN locations. This would allow for a much improved evaluation of the relative degree of urbanization present in those HCN sites for which specific addresses are not available. It would also allow identification of valley bottom or hilltop station locations. Variations in the topographic setting of the co-op stations can have a profound impact on the daily temperature extremes. This might be a project for local historical societies to tackle. We usually know who was the observer and when they were the observer but sometimes do not know where they made their observations.

Finally, the methods utilized in this project could be employed to identify the best co-op station records for use in long-term climate trend research projects. It was readily apparent in this study that some locations currently designated as HCN stations have had a long history of mediocre observations. Some of these sites probably should not be in the HCN while there may be other locations deserving of HCN recognition that currently are not in the network. Unfortunately, many of the data analysis techniques used here require a large amount of tedious manual labor. Thus it is not the sort of project that one would wish to undertake to fill in those rare moments when the usual day-to-day routine can be set aside.

A summarization of the data quality grades listed in Table 2 is given below. The average 'grade' for each of the five data elements examined has been ranked for each of the 15 HCN sites studied. A ranking of '1' indicates the best grade in that category among the 15 stations. A ranking of '15' is the worst average grade in that category.

Station	Temperature	Precipitation	Snowfall	Snow Depth	Monthly Forms	Average
Clarinda	10	1	1	1	7	4.0
Belle Plaine	11	6	2	3	3	5.0
Washington	1	3	14	12	1	6.2
Fairfield	2	8	4	4	14	6.4
Rockwell City	8	5	3	5	12	6.6
Logan	6	4	13	9	2	6.8
Albia	14	2	6	2	11	7.0
Indianola	5	10	7	6	8	7.2
Storm Lake	7	7	5	7	13	7.8
Toledo	4	9	9	13	6	8.2
Algona	15	13	10	10	4	10.4
Mt. Pleasant	9	12	12	11	9	10.6
Iowa Falls	13	15	8	14	5	11.0
Mount Ayr	3	14	15	15	10	11.4
Fort Dodge	12	11	11	8	15	11.4

This ranking reveals 5 HCN stations with composite scores substantially higher than the others (implying less complete data). Thus, those designing a study requiring complete long-term data probably would want to steer clear of these locations. While an evaluation such as this one requires a substantial investment of time it may pay dividends in the form of more efficient use of finite climate research resources. Use of superior data sets, while avoiding those identified as poor ones, should lead to a higher probability of successfully meeting research goals.

Brief comments regarding each of the 15 HCN stations studied can be found in Appendix 2.

TABLE 1

History of Observation Time Changes

This table provides a general history of the Time of Observation for maximum & minimum air temperatures; the Set Maximum or At Observation temperature and for precipitation. All times are given on a 24 hour clock. Multiple times given in the Set Max column are indicative of the time period when thrice daily temperature readings were recorded.

Unless there was documentation found to the contrary it is assumed that the max/min temperature and precipitation observation times were at 9 p.m. at the beginning of the observational record.

There are periods when no observation time can be found in the historical records for many years. In these cases the observation time is assumed to be the same as in the last month for which documentation was found.

Frequent fluctuations in observation time of one hour or less are not indicated.

Refer to the Daylight Savings Time section earlier in this report for information regarding the time periods when Daylight Time was in use. Unless it is indicated otherwise in Table 1 most Iowa stations maintained the use of the same clock hour of observation when the transitions to and from Standard Time were made. In other words, if a station was using a 6 p.m. CST observation time they nearly always used a 6 p.m. CDT observation time.

List of abbreviations used in the table:

Max/min	Time when the max/min thermometers were reset.
Set max	Time when the Set Max or At Observation time was recorded.
Prec.	Time when the precipitation, snowfall and snow depth observations were made.
'na'	Not applicable. No observations of this element were made for the time period in question.
Seas	Seasonal schedule. Generally 7 a.m. from April 1 to Sep 30 and 7 p.m. for the remainder of the year.
SS	Sunset.
Decimal numbers	Indicate readings not made on the hour. For example 17.5 indicates a 5:30 p.m. observation.

TABLE 1. History of Observation Time changes.

HCN station	mo	da	year	max/min	set max	prec.
Albia	3	15	1894	18	na	18
Albia	6	1	1898	19	na	19
Albia	1	1	1901	19	19	19
Albia	4	1	1903	7	na	7
Albia	2	1	1914	7	7	7
Albia	10	1	1918	19	19	19
Albia	4	16	1925	19	19	seas
Albia	1	1	1938	19	19	7
Albia	9	30	1945	20	20	7
Albia	6	28	1951	19	19	7
Albia	6	24	1971	17	17	7
Albia	4	22	1982	18	18	7
Albia	4	12	1985	18	18	6
Albia	8	8	1997	7	7	7
Algona	1	1	1893	na	7.14.21	21
Algona	1	1	1901	19	19	19
Algona	2	5	1901	19	19	19
Algona	6	1	1952	19	19	7
Algona	9	22	1954	18	18	7
Algona	10	1	1960	17	17	7
Algona	6	1	1961	7	7	7
Algona	8	1	1961	17	17	7
Algona	4	1	1964	17	17	6
Algona	7	1	1964	17	17	7
Algona	9	1	1965	18	18	7
Algona	5	1	1966	17	17	7
Algona	2	1	1967	18	18	7
Algona	11	1	1967	17	17	7
Algona	5	1	1969	18	18	7
Algona	12	1	1969	17	17	7
Algona	2	1	1970	18	18	7
Algona	8	1	1971	19	19	7
Algona	4	1	1972	18	18	7
Algona	8	1	1979	19	19	7
Algona	7	1	1980	17	17	7
Algona	6	1	1987	22	22	7
Algona	10	1	1993	18	18	7
Algona	12	1	1993	19	19	7
Algona	3	1	1994	18	18	7
Algona	7	21	1997	7	7	7
Algona	9	10	1998	6	6	7
Belle Plaine	1	1	1893	21	7.14.21	21
Belle Plaine	1	1	1901	21	na	21
Belle Plaine	2	1	1901	21	21	21
Belle Plaine	4	1	1901	21	na	21
Belle Plaine	5	1	1901	7	7	7
Belle Plaine	3	1	1903	7	na	7
Belle Plaine	9	1	1906	19	na	19
Belle Plaine	11	1	1908	18	na	18
Belle Plaine	4	1	1909	19	na	19
Belle Plaine	10	1	1912	19	19	19
Belle Plaine	8	21	1939	18	18	18
Belle Plaine	7	1	1940	19	19	19
Belle Plaine	1	1	1945	18	18	18
Belle Plaine	9	30	1945	19	19	19
Belle Plaine	1	1	1976	18	18	18
Belle Plaine	4	7	1986	22	22	22
Belle Plaine	2	1	1992	23.5	23.5	23.5
Belle Plaine	7	1	1992	7	7	7
Clarinda	1	1	1893	21	7.14.21	21
Clarinda	2	1	1899	21	na	21
Clarinda	4	9	1904	7	na	7
Clarinda	1	1	1914	7	7	7
Clarinda	8	4	1918	20	20	7
Clarinda	9	1	1918	ss	ss	7
Clarinda	3	1	1924	19	19	seas

HCN station	mo	da	year	max/min	set max	prec.
Clarinda	3	1	1939	19	19	7
Clarinda	6	1	1963	18	18	6
Clarinda	8	1	1977	18	18	7
Clarinda	4	1	1988	7	7	7
Clarinda	10	13	1991	8	8	8
Fairfield	1	1	1893	21	7.14.21	21
Fairfield	6	4	1894	19	7.13.19	19
Fairfield	12	5	1901	19	na	19
Fairfield	1	3	1902	19	19	19
Fairfield	5	28	1949	7	7	7
Fairfield	6	1	1950	19	19	7
Fairfield	2	1	1954	17	17	17
Fairfield	11	1	1954	19	19	19
Fairfield	9	1	1955	18	18	7
Fairfield	10	7	1963	24	24	24
Fairfield	4	1	1970	23	23	23
Fairfield	6	1	1977	20	20	20
Fairfield	3	1	1981	18	18	18
Fairfield	10	1	2000	17	17	17
Fort Dodge	12	7	1899	18	na	18
Fort Dodge	1	1	1901	18	18	18
Fort Dodge	4	1	1904	6.5	na	6.5
Fort Dodge	1	1	1914	6.5	6.5	6.5
Fort Dodge	6	1	1919	19	19	7
Fort Dodge	1	1	1920	17	17	17
Fort Dodge	6	1	1920	19	19	seas
Fort Dodge	5	16	1942	19	19	6
Fort Dodge	9	30	1945	20	20	7
Fort Dodge	3	1	1949	19	19	7
Fort Dodge	5	1	1964	20	20	7
Fort Dodge	11	1	1967	19	19	7
Fort Dodge	4	1	1968	20	20	7
Fort Dodge	3	1	1973	20	20	8
Fort Dodge	6	1	1973	7	7	7
Fort Dodge	10	1	1974	6	6	6
Fort Dodge	3	1	1975	7	7	7
Fort Dodge	11	1	1975	6	6	6
Fort Dodge	2	1	1979	17	17	17
Fort Dodge	7	1	1987	24	24	17
Fort Dodge	7	10	1990	7	7	7
Indianola	1	1	1893	ss	na	ss
Indianola	1	1	1901	ss	ss	ss
Indianola	7	1	1904	19	19	19
Indianola	1	26	1921	18.5	18.5	18.5
Indianola	10	1	1943	17.5	17.5	17.5
Indianola	9	30	1945	18	18	18
Indianola	4	29	1965	17	17	17
Indianola	5	1	1982	16	16	16
Indianola	11	1	1982	17	17	17
Indianola	5	1	1983	16	16	16
Indianola	11	10	1983	18	18	7
Indianola	12	3	1987	23	23	6
Indianola	5	13	1988	7	7	7
Indianola	8	1	1988	24	24	7
Indianola	12	2	1990	7	7	7
Indianola	2	5	1991	3.5	3.5	3.5
Indianola	2	21	1991	24	24	24
Indianola	3	7	1991	18	18	5
Indianola	9	1	1993	24	24	7
Indianola	9	1	1994	7	7	7
Iowa Falls	1	1	1893	21	7.14.21	21
Iowa Falls	8	1	1893	21	21	21
Iowa Falls	4	6	1895	21	na	21
Iowa Falls	2	11	1898	21	21	21
Iowa Falls	1	1	1903	21	na	21
Iowa Falls	5	1	1903	7	na	7

HCN station	mo	da	year	max/min	set max	prec.
Iowa Falls	1	1	1914	7	7	7
Iowa Falls	10	1	1918	18.5	18.5	6.5
Iowa Falls	4	16	1925	18.5	18.5	seas
Iowa Falls	12	5	1926	ss	ss	ss
Iowa Falls	5	1	1938	24	24	24
Iowa Falls	6	25	1941	19	19	7
Iowa Falls	2	9	1942	18	18	6
Iowa Falls	9	30	1945	ss	ss	7
Iowa Falls	11	2	1954	17	17	7
Iowa Falls	8	1	1956	19	19	7
Iowa Falls	9	1	1956	17	17	7
Iowa Falls	6	1	1957	18	18	7
Iowa Falls	11	21	1961	19	19	7
Iowa Falls	11	1	1969	18	18	7
Iowa Falls	12	1	1969	18	18	8
Iowa Falls	11	1	1977	18	18	7
Iowa Falls	8	10	1992	7	7	7
Logan	1	1	1893	19	na	19
Logan	1	1	1901	19	19	19
Logan	11	1	1914	18.5	18.5	18.5
Logan	1	1	1919	18	18	18
Logan	5	3	1988	8	8	8
Mount Ayr	1	1	1893	21	21	21
Mount Ayr	5	1	1893	21	na	21
Mount Ayr	9	1	1899	19	na	19
Mount Ayr	1	1	1901	19	19	19
Mount Ayr	11	1	1913	ss	ss	ss
Mount Ayr	3	1	1914	19	19	19
Mount Ayr	10	1	1920	ss	ss	ss
Mount Ayr	3	1	1921	18.5	18.5	18.5
Mount Ayr	7	1	1928	17.5	17.5	17.5
Mount Ayr	9	14	1928	18	18	18
Mount Ayr	5	1	1929	17	17	17
Mount Ayr	5	1	1932	18.5	18.5	18.5
Mount Ayr	9	1	1932	18	18	18
Mount Ayr	12	1	1933	17	17	17
Mount Ayr	12	7	1934	17.5	17.5	17.5
Mount Ayr	12	1	1936	19	19	19
Mount Ayr	5	1	1940	24	24	24
Mount Ayr	1	1	1942	18.5	18.5	18.5
Mount Ayr	9	16	1946	18	18	18
Mount Ayr	5	1	1949	18	18	7
Mount Ayr	7	16	1949	18	18	18
Mount Ayr	6	2	1970	7	7	7
Mount Ayr	9	1	1977	18	18	7
Mount Ayr	3	10	1989	7	7	7
Mount Pleasant	3	1	1894	na	7.14.21	21
Mount Pleasant	5	1	1894	na	8.12.20	20
Mount Pleasant	6	1	1894	na	7.14.21	21
Mount Pleasant	11	1	1894	na	8.12.20	20
Mount Pleasant	2	1	1895	na	8. 20	20
Mount Pleasant	3	1	1895	na	7.14.21	21
Mount Pleasant	10	1	1898	21	na	21
Mount Pleasant	1	1	1901	21	21	21
Mount Pleasant	1	1	1905	18.5	18.5	18.5
Mount Pleasant	11	1	1918	17	17	17
Mount Pleasant	11	1	1924	18	18	18
Mount Pleasant	5	1	1937	17	17	17
Mount Pleasant	2	9	1942	18	18	18
Mount Pleasant	4	1	1942	16	16	16
Mount Pleasant	10	15	1944	19	19	19
Mount Pleasant	9	30	1945	18	18	18
Mount Pleasant	4	6	1970	18	18	7
Mount Pleasant	11	6	1985	24	24	7
Mount Pleasant	6	1	1995	22	22	7
Mount Pleasant	5	1	1997	19	19	7

HCN station	mo	da	year	max/min	set max	prec.
Rockwell City	10	13	1893	na	na	18
Rockwell City	9	1	1894	18	na	18
Rockwell City	1	1	1901	18	18	18
Rockwell City	3	1	1905	19	19	19
Rockwell City	10	17	1916	18	18	18
Rockwell City	4	11	1932	18.5	18.5	18.5
Rockwell City	3	29	1939	19	19	19
Rockwell City	11	1	1939	ss	ss	ss
Rockwell City	3	1	1942	18	18	18
Rockwell City	12	1	1942	18	18	16
Rockwell City	4	1	1943	18	18	18
Rockwell City	11	1	1943	ss	ss	ss
Rockwell City	6	1	1952	19	19	7
Rockwell City	10	14	1961	18	18	7
Rockwell City	1	1	1976	18	18	18
Rockwell City	6	15	1995	7	7	7
Storm Lake	1	1	1893	19	na	19
Storm Lake	1	1	1901	19	19	19
Storm Lake	1	1	1903	17	na	17
Storm Lake	8	8	1903	7	na	7
Storm Lake	10	3	1903	ss	ss	ss
Storm Lake	2	11	1904	7	na	7
Storm Lake	11	1	1906	19	19	19
Storm Lake	3	1	1930	20	20	20
Storm Lake	2	9	1942	19	19	19
Storm Lake	9	30	1945	20	20	20
Storm Lake	6	1	1946	19	19	19
Storm Lake	12	1	1948	16.75	16.75	16.75
Storm Lake	2	4	1950	18	18	18
Storm Lake	4	1	1952	18	18	7
Storm Lake	3	19	1958	7	7	7
Storm Lake	11	1	1974	6	6	6
Storm Lake	7	1	1998	7	7	7
Storm Lake	10	1	1999	10	10	10
Storm Lake	3	1	2000	8	8	8
Storm Lake	7	1	2000	9	9	9
Storm Lake	12	1	2001	8	8	8
Toledo	1	1	1894	na	7.14.21	21
Toledo	9	1	1895	19	na	19
Toledo	1	1	1901	19	19	19
Toledo	9	1	1905	18	18	18
Toledo	10	1	1906	ss	ss	ss
Toledo	3	1	1911	19	19	19
Toledo	10	1	1923	ss	ss	ss
Toledo	6	1	1927	18	18	18
Toledo	12	1	1934	19	19	19
Toledo	5	1	1945	17.5	17.5	17.5
Toledo	9	30	1945	18.5	18.5	18.5
Toledo	4	2	1949	18.5	18.5	7
Toledo	11	1	1959	18	18	7
Toledo	4	22	1964	7	7	7
Toledo	5	24	1994	17	17	7
Toledo	11	1	1997	7	7	7
Washington	1	1	1893	21	8.12.21	21
Washington	2	1	1894	21	7.12.21	21
Washington	11	1	1900	21	na	21
Washington	1	1	1901	21	21	21
Washington	2	1	1901	7	7	7
Washington	5	1	1906	21	21	21
Washington	2	1	1907	21	21	21
Washington	4	1	1917	19	19	19
Washington	10	1	1937	18	18	18
Washington	9	30	1945	19	19	19
Washington	5	1	1949	19	19	7
Washington	10	1	1959	18	18	7
Washington	1	28	1999	7	7	7

TABLE 2

HCN Station Data Quality Grades

This table provides a general indication of the completeness of temperature, precipitation, snow fall and snow depth measurements. This assessment is based upon a subjective evaluation of the original monthly data forms. The quality or precision of the data values has not been evaluated. The grade scale is the familiar four point scale where '0' is flunking (F) and '4' is excellent (A). Again it is emphasized that it is beyond the scope of this report to evaluate the quality of the data. Thus a perfect 4.0 rating implies that complete data exists for the data element in question. However, a perfect 4.0 rating does not imply that the data quality is necessarily excellent as well.

How the ratings were derived:

For temperature "TM", a 4 rating indicates that complete, or nearly complete, daily maximum and minimum temperature data are available *and* that Set Max temperature data also exist. A maximum of only 2 points is assigned if no maximum and minimum temperatures exist (this implies that only the thrice daily readings were observed). One point is deducted if Set Max temperatures do not exist or are incomplete. One point also is deducted if there are notations on the original monthly data forms indicating that the temperature data were unreliable or if there are substantial gaps in the temperature record.

For precipitation "PR", a 4 rating indicates that complete year-round daily precipitation measurements are available. One point is deducted if precipitation measurements are not usually available for snow or ice events. One point also is deducted if it is apparent that the precipitation measurements are somewhat incomplete. An additional point or two can be deducted if the data completeness is particularly acute.

For snowfall "SF", points are deducted for obvious periods of missing data or if snowfall amounts routinely are measured to only the nearest whole inch.

For snow depth "SD", at least one point is awarded if any snow depth measurements are made. Two points are awarded for infrequent readings (perhaps 10% of the time) and three points when readings are available about one-half of the time.

Finally, the "# MO" column gives the number of months for which reasonably complete daily data exist for that year.

TABLE 2. HCN Station Data Quality Grades

ALBIA

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	3	4	4	0	9.5	1948	4	4	4	4	12.0
1894	3	4	4	0	9.0	1949	4	4	4	4	12.0
1895					0.0	1950	4	4	4	4	12.0
1896					0.0	1951	4	4	4	4	12.0
1897	3	4	1	0	2.0	1952	4	3	3	4	12.0
1898	2	4	4	1	10.0	1953	4	3	3	4	12.0
1899	3	3	4	1	12.0	1954	4	4	4	4	12.0
1900	3	3	4	0	12.0	1955	4	4	4	4	12.0
1901	4	3	4	0	12.0	1956	4	4	4	4	12.0
1902	4	3	3	0	12.0	1957	4	4	4	4	12.0
1903	3	3	0	0	12.0	1958	4	4	4	4	12.0
1904	3	4	4	0	12.0	1959	4	4	4	4	12.0
1905	3	4	4	4	12.0	1960	4	4	4	4	12.0
1906	3	4	4	4	12.0	1961	4	4	4	4	12.0
1907	3	4	4	4	12.0	1962	4	4	4	4	12.0
1908	3	4	4	4	12.0	1963	4	4	4	4	12.0
1909	3	4	4	4	12.0	1964	4	4	4	4	12.0
1910	3	4	4	4	12.0	1965	4	4	4	4	12.0
1911	3	4	4	4	12.0	1966	4	4	4	4	12.0
1912	3	4	4	4	12.0	1967	4	4	4	4	12.0
1913	3	4	4	4	12.0	1968	4	4	3	2	12.0
1914	4	4	4	4	12.0	1969	4	4	4	4	12.0
1915	4	4	4	4	12.0	1970	4	4	4	4	12.0
1916	4	4	4	4	12.0	1971	4	4	4	4	12.0
1917	4	4	4	4	12.0	1972	4	4	4	4	12.0
1918	4	4	4	4	12.0	1973	4	4	4	4	12.0
1919	4	4	4	4	12.0	1974	4	4	4	4	12.0
1920	4	4	4	4	12.0	1975	4	4	4	4	12.0
1921	4	4	4	4	12.0	1976	4	4	4	4	12.0
1922	4	4	4	4	12.0	1977	4	4	4	4	12.0
1923	4	4	4	4	12.0	1978	4	4	4	4	12.0
1924	4	4	4	4	12.0	1979	4	4	4	4	12.0
1925	4	4	4	4	12.0	1980	4	4	4	4	12.0
1926	4	4	4	4	12.0	1981	4	4	4	4	11.0
1927	4	4	4	4	12.0	1982	4	4	4	4	8.0
1928	4	4	4	4	12.0	1983	4	4	4	2	12.0
1929	4	4	4	4	12.0	1984	4	4	4	4	7.5
1930	4	4	4	4	12.0	1985	4	4	4	4	8.5
1931	4	4	3	0	12.0	1986	4	4	4	4	12.0
1932	4	4	4	0	12.0	1987	4	4	4	4	12.0
1933	4	4	4	4	12.0	1988	4	4	4	4	12.0
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	4	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	4	4	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	4	12.0
1940	4	4	4	4	12.0	1995	4	4	4	4	12.0
1941	4	4	4	4	12.0	1996	4	4	4	4	12.0
1942	4	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	4	12.0	1998	4	4	4	4	12.0
1944	4	4	4	4	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	4	12.0	2001	4	4	4	4	12.0
1947	4	4	4	4	12.0	avg	3.8	3.9	3.9	3.5	11.5

ALGONA

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	2	3	4	1	12.0	1948	4	4	4	4	12.0
1894	2	3	4	1	12.0	1949	4	4	4	4	12.0
1895	2	3	4	1	12.0	1950	4	4	4	4	12.0
1896	2	3	4	1	12.0	1951	4	4	4	4	12.0
1897	2	3	4	1	12.0	1952	4	4	4	4	12.0
1898	2	3	4	1	12.0	1953	4	4	4	4	12.0
1899	2	3	4	1	12.0	1954	4	4	3	1	12.0
1900	2	3	4	1	12.0	1955	4	4	4	0	12.0
1901	4	3	4	1	12.0	1956	4	3	4	0	11.0
1902	4	3	4	1	12.0	1957	4	3	4	0	12.0
1903	4	3	4	0	12.0	1958	4	4	4	4	9.0
1904	4	4	4	1	12.0	1959	4	3	4	2	12.0
1905	4	4	4	4	12.0	1960	3	4	3	2	12.0
1906	4	4	4	4	12.0	1961	4	3	3	0	12.0
1907	4	4	4	4	12.0	1962	4	4	3	0	12.0
1908	4	4	4	4	12.0	1963	4	4	0	0	12.0
1909	4	4	4	4	12.0	1964	4	4	4	4	12.0
1910	4	4	4	4	12.0	1965	4	3	3	2	12.0
1911	4	4	4	4	12.0	1966	4	3	3	0	12.0
1912	4	4	4	4	12.0	1967	4	4	3	0	12.0
1913	4	4	4	3	12.0	1968	4	3	4	0	12.0
1914	3	4	4	3	12.0	1969	4	3	3	0	12.0
1915	4	4	4	4	12.0	1970	4	3	4	0	12.0
1916	3	3	3	2	12.0	1971	4	4	3	0	12.0
1917	3	3	3	2	12.0	1972	4	4	4	0	12.0
1918	4	4	4	3	12.0	1973	4	4	4	0	12.0
1919	4	3	3	2	12.0	1974	4	4	4	1	12.0
1920	4	4	4	2	12.0	1975	4	3	3	4	12.0
1921	4	4	3	0	12.0	1976	4	4	4	4	11.0
1922	4	3	3	1	12.0	1977	4	3	4	4	12.0
1923	4	4	3	1	12.0	1978	4	3	4	4	12.0
1924	4	3	4	1	12.0	1979	4	4	4	4	12.0
1925	4	3	4	0	12.0	1980	4	4	4	4	12.0
1926	4	3	3	0	12.0	1981	4	3	4	4	12.0
1927	4	4	3	0	12.0	1982	4	4	4	4	12.0
1928	4	3	3	0	12.0	1983	4	3	4	4	12.0
1929	4	3	3	0	12.0	1984	4	3	4	4	12.0
1930	4	4	3	2	11.0	1985	4	4	4	4	12.0
1931	4	4	3	2	12.0	1986	4	4	4	4	12.0
1932	4	4	3	2	12.0	1987	4	3	4	4	12.0
1933	4	4	4	2	12.0	1988	4	4	4	4	12.0
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	3	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	3	4	12.0	1993	4	3	4	4	12.0
1939	4	4	4	4	12.0	1994	4	3	4	4	12.0
1940	4	4	4	4	12.0	1995	4	3	4	4	12.0
1941	4	4	4	4	12.0	1996	4	3	4	3	12.0
1942	4	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	4	12.0	1998	4	4	4	4	12.0
1944	4	4	4	4	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	3	12.0
1946	4	4	4	4	12.0	2001	4	3	4	3	12.0
1947	4	4	4	4	12.0	avg	3.8	3.6	3.7	2.5	11.9

BELLE PLAINE

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	4	3	4	1	12.0	1948	4	4	4	4	12.0
1894	4	3	4	1	12.0	1949	4	4	4	4	12.0
1895	4	4	4	1	12.0	1950	4	4	4	4	12.0
1896	4	3	4	1	12.0	1951	4	4	4	4	12.0
1897	4	4	4	1	12.0	1952	4	4	4	4	12.0
1898	3	3	4	2	12.0	1953	4	4	4	4	12.0
1899	4	3	4	1	11.0	1954	4	4	4	4	12.0
1900	4	3	4	1	10.0	1955	4	4	4	4	12.0
1901	4	3	4	1	12.0	1956	4	4	4	4	12.0
1902	4	3	4	1	12.0	1957	4	4	4	4	12.0
1903	3	3	4	1	12.0	1958	4	4	4	4	12.0
1904	3	3	4	1	12.0	1959	4	4	4	4	12.0
1905	3	3	4	4	12.0	1960	4	4	4	4	12.0
1906	2	3	4	1	12.0	1961	4	4	4	4	12.0
1907	2	3	4	4	12.0	1962	4	4	4	4	12.0
1908	3	3	4	2	12.0	1963	4	4	4	4	12.0
1909	3	3	4	3	12.0	1964	4	4	4	4	12.0
1910	3	4	4	1	12.0	1965	4	4	4	4	12.0
1911	3	4	4	3	12.0	1966	4	4	4	4	12.0
1912	3	4	4	4	12.0	1967	4	4	4	4	12.0
1913	4	4	4	4	12.0	1968	4	4	4	4	12.0
1914	4	4	4	4	12.0	1969	4	4	4	4	12.0
1915	4	4	4	4	12.0	1970	4	4	4	4	12.0
1916	4	4	4	4	12.0	1971	4	4	4	4	12.0
1917	4	4	4	4	12.0	1972	4	4	4	4	12.0
1918	4	4	4	4	12.0	1973	4	4	4	4	12.0
1919	4	4	4	4	12.0	1974	4	4	4	4	12.0
1920	4	4	4	4	12.0	1975	4	4	4	4	12.0
1921	4	4	4	4	12.0	1976	4	4	4	4	12.0
1922	4	4	4	4	12.0	1977	4	4	4	4	12.0
1923	4	4	4	4	12.0	1978	4	4	4	4	12.0
1924	4	4	4	4	12.0	1979	4	4	4	4	12.0
1925	4	4	4	4	12.0	1980	4	4	4	4	12.0
1926	4	4	4	4	12.0	1981	4	4	4	4	12.0
1927	4	4	4	4	12.0	1982	4	4	4	4	12.0
1928	4	4	4	4	12.0	1983	4	4	4	4	12.0
1929	4	4	4	4	12.0	1984	4	4	4	4	12.0
1930	4	4	4	4	12.0	1985	4	4	4	4	12.0
1931	4	4	4	4	12.0	1986	4	4	4	2	12.0
1932	4	4	4	4	12.0	1987	4	3	3	4	11.0
1933	4	4	4	4	12.0	1988	4	4	4	4	12.0
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	4	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	2	12.0
1937	4	4	4	4	12.0	1992	4	3	4	1	12.0
1938	4	4	4	4	12.0	1993	4	3	4	1	12.0
1939	4	4	4	4	12.0	1994	3	3	3	0	12.0
1940	4	4	4	4	12.0	1995	4	3	3	4	12.0
1941	4	4	4	4	12.0	1996	4	4	4	4	12.0
1942	4	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	4	12.0	1998	4	4	4	4	12.0
1944	4	4	4	4	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	4	12.0	2001	4	4	4	4	12.0
1947	4	4	4	4	12.0	avg	3.9	3.8	4.0	3.5	12.0

TABLE 2. HCN Station Data Quality Grades

CLARINDA

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	4	4	4	1	12.0	1948	4	4	4	4	12.0
1894	4	4	4	1	12.0	1949	4	4	4	4	12.0
1895	4	4	4	1	12.0	1950	4	4	4	4	12.0
1896	4	4	4	2	12.0	1951	4	4	4	4	12.0
1897	4	4	4	4	12.0	1952	4	4	4	4	5.0
1898	4	4	4	4	12.0	1953	4	4	4	4	2.0
1899	3	4	4	4	12.0	1954	4	4	4	4	12.0
1900	3	4	4	4	12.0	1955	4	4	4	4	12.0
1901	4	4	4	4	12.0	1956	4	4	4	4	12.0
1902	4	4	4	4	12.0	1957	4	4	4	4	12.0
1903	3	4	4	4	12.0	1958	4	4	4	4	12.0
1904	3	4	4	4	12.0	1959	4	4	4	4	12.0
1905	3	4	4	4	12.0	1960	4	4	4	4	12.0
1906	3	4	4	4	12.0	1961	4	4	4	4	12.0
1907	3	4	4	4	12.0	1962	4	4	4	4	11.0
1908	3	4	4	4	12.0	1963	4	4	4	4	12.0
1909	3	4	4	4	12.0	1964	4	4	4	4	12.0
1910	3	4	4	4	12.0	1965	4	4	4	4	12.0
1911	3	4	4	4	12.0	1966	4	4	4	4	12.0
1912	3	4	4	4	12.0	1967	4	4	4	4	12.0
1913	3	4	4	4	12.0	1968	4	4	4	4	12.0
1914	4	4	4	4	12.0	1969	4	4	4	4	12.0
1915	4	4	4	4	12.0	1970	4	4	4	4	12.0
1916	4	4	4	4	12.0	1971	4	4	4	4	11.0
1917	4	4	4	4	12.0	1972	4	4	4	4	12.0
1918	4	4	4	4	12.0	1973	4	4	4	4	12.0
1919	4	4	4	4	12.0	1974	4	4	4	4	12.0
1920	4	4	4	4	12.0	1975	4	4	4	4	12.0
1921	4	4	4	4	12.0	1976	4	4	4	4	12.0
1922	4	4	4	4	12.0	1977	4	4	4	4	12.0
1923	4	4	4	4	12.0	1978	4	4	3	4	12.0
1924	4	4	4	4	12.0	1979	4	4	4	4	12.0
1925	4	4	4	4	12.0	1980	4	4	4	4	12.0
1926	4	4	4	4	12.0	1981	4	4	4	4	12.0
1927	3	4	4	4	12.0	1982	4	4	4	4	12.0
1928	4	4	4	4	12.0	1983	4	4	4	4	12.0
1929	4	3	3	4	12.0	1984	4	4	4	4	11.0
1930	4	4	4	4	12.0	1985	4	4	4	4	12.0
1931	4	4	4	4	12.0	1986	4	4	4	4	12.0
1932	4	4	4	4	12.0	1987	4	4	4	4	12.0
1933	4	4	4	4	12.0	1988	4	4	4	4	12.0
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	4	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	4	4	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	4	12.0
1940	4	4	4	4	12.0	1995	4	4	4	4	12.0
1941	4	4	4	4	12.0	1996	4	4	4	4	12.0
1942	4	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	4	12.0	1998	4	4	4	4	12.0
1944	4	4	4	4	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	4	12.0	2001	4	4	4	4	12.0
1947	4	4	4	4	12.0	avg	3.9	4.0	4.0	3.9	11.8

FAIRFIELD

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	4	4	4	1	3.0	1948	4	4	4	4	12.0
1894	4	4	4	1	9.0	1949	4	4	4	4	12.0
1895	4	3	4	0	12.0	1950	4	4	4	4	11.0
1896	4	3	4	1	12.0	1951	4	4	4	4	12.0
1897	4	3	4	1	12.0	1952	4	4	4	4	12.0
1898	4	3	3	1	12.0	1953	4	4	4	4	12.0
1899	4	3	3	1	12.0	1954	4	4	4	4	12.0
1900	4	3	3	1	9.0	1955	4	4	4	4	12.0
1901					1.0	1956	4	4	4	4	12.0
1902	4	4	4	1	11.0	1957	4	4	4	4	12.0
1903					0.0	1958	4	4	4	4	12.0
1904					0.0	1959	4	4	4	4	12.0
1905					0.0	1960	4	4	4	4	12.0
1906					0.0	1961	4	4	4	4	12.0
1907					0.0	1962	4	4	4	4	12.0
1908	3	4	4	4	12.0	1963	4	3	4	2	12.0
1909	4	4	4	4	12.0	1964	4	3	3	2	12.0
1910	4	4	4	4	12.0	1965	4	4	4	2	12.0
1911	4	3	4	4	12.0	1966	3	4	4	2	12.0
1912	4	4	4	4	12.0	1967	4	3	4	2	12.0
1913	3	4	4	4	12.0	1968	4	3	4	2	12.0
1914	4	4	4	4	12.0	1969	4	3	4	1	12.0
1915	3	4	4	4	12.0	1970	4	3	4	4	11.0
1916	3	4	4	4	12.0	1971	4	3	4	4	12.0
1917	4	4	4	4	12.0	1972	4	3	4	4	12.0
1918	4	4	4	4	12.0	1973	4	3	4	4	12.0
1919	4	4	4	4	12.0	1974	4	3	4	4	11.0
1920	4	4	4	4	12.0	1975	4	3	4	0	11.0
1921	4	4	4	4	12.0	1976	4	3	4	0	12.0
1922	4	4	4	4	12.0	1977	4	3	4	1	12.0
1923	4	4	4	3	12.0	1978	4	4	4	4	12.0
1924	4	4	4	4	12.0	1979	4	4	4	4	12.0
1925	4	4	4	3	12.0	1980	4	4	4	4	12.0
1926	4	4	4	3	12.0	1981	4	4	4	4	12.0
1927	4	4	4	4	12.0	1982	4	4	4	4	12.0
1928	4	4	4	3	12.0	1983	4	4	3	3	12.0
1929	4	4	4	3	12.0	1984	4	4	3	3	12.0
1930	4	4	4	3	12.0	1985	4	4	3	3	12.0
1931	4	4	4	3	12.0	1986	4	3	3	3	12.0
1932	4	4	4	3	12.0	1987	4	3	4	3	12.0
1933	4	4	4	3	12.0	1988	4	4	3	1	12.0
1934	4	4	4	3	12.0	1989	4	4	4	4	12.0
1935	4	4	4	3	12.0	1990	4	4	3	3	12.0
1936	4	4	4	3	12.0	1991	4	4	4	4	12.0
1937	4	4	4	3	12.0	1992	4	4	4	4	12.0
1938	4	4	4	3	12.0	1993	4	4	4	4	12.0
1939	4	4	4	3	12.0	1994	4	4	4	4	12.0
1940	4	4	4	3	12.0	1995	4	4	4	4	12.0
1941	4	4	4	3	12.0	1996	4	4	4	4	12.0
1942	4	4	4	3	12.0	1997	4	4	4	4	12.0
1943	4	4	4	3	12.0	1998	4	4	4	4	12.0
1944	4	4	4	3	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	4	12.0	2001	4	4	4	4	12.0
1947	4	4	4	4	12.0	avg	4.0	3.8	3.9	3.2	11.2

FORT DODGE

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893					0.0	1948	4	4	4	4	12.0
1894					0.0	1949	4	4	4	4	12.0
1895					0.0	1950	4	4	4	4	12.0
1896					0.0	1951	4	4	4	4	12.0
1897					0.0	1952	4	4	4	4	12.0
1898					0.0	1953	4	4	4	4	12.0
1899					1.0	1954	4	4	4	4	12.0
1900	3	3	4	3	12.0	1955	4	4	4	4	12.0
1901	4	3	4	2	12.0	1956	4	4	4	4	12.0
1902	4	2	4	2	9.0	1957	4	4	4	4	12.0
1903	4	2	4	0	9.5	1958	4	4	4	4	12.0
1904	3	3	3	2	12.0	1959	4	4	4	4	12.0
1905	3	3	3	4	12.0	1960	4	4	4	4	12.0
1906	3	3	3	4	12.0	1961	4	4	4	4	12.0
1907	3	3	3	4	11.0	1962	4	4	4	4	12.0
1908	3	3	3	4	12.0	1963	4	4	4	4	12.0
1909	3	3	3	1	12.0	1964	4	4	4	4	12.0
1910	3	3	3	2	11.5	1965	4	4	4	4	12.0
1911	3	3	3	4	12.0	1966	4	4	4	4	12.0
1912	3	3	3	4	12.0	1967	4	4	4	4	12.0
1913	3	3	3	4	12.0	1968	4	4	4	4	12.0
1914	4	3	3	4	12.0	1969	4	4	4	4	12.0
1915	4	3	3	4	12.0	1970	4	4	4	4	12.0
1916	4	3	3	4	12.0	1971	4	4	4	4	12.0
1917	4	3	3	4	12.0	1972	4	4	4	4	12.0
1918	4	3	3	4	12.0	1973	4	4	3	3	12.0
1919	3	3	3	4	12.0	1974	4	4	4	2	12.0
1920	3	3	4	4	12.0	1975	4	3	4	1	12.0
1921	4	4	4	4	12.0	1976	4	4	4	0	12.0
1922	4	4	4	3	12.0	1977	4	4	4	1	12.0
1923	4	4	4	1	12.0	1978	4	4	3	1	12.0
1924	4	4	4	1	12.0	1979	4	4	3	0	12.0
1925	4	4	4	0	12.0	1980	4	4	3	0	12.0
1926	4	4	4	0	12.0	1981	4	4	3	1	12.0
1927	4	4	4	0	12.0	1982	4	4	3	0	11.0
1928	4	4	4	0	12.0	1983	4	4	4	0	12.0
1929	4	4	4	1	12.0	1984	4	4	4	0	12.0
1930	4	4	4	1	12.0	1985	4	4	4	0	12.0
1931	4	4	4	1	12.0	1986	4	4	4	0	12.0
1932	4	4	4	4	12.0	1987	4	4	4	3	12.0
1933	4	4	4	2	12.0	1988	4	4	4	4	12.0
1934	4	4	4	2	12.0	1989	4	4	4	2	12.0
1935	4	4	4	4	12.0	1990	4	4	3	2	12.0
1936	4	4	3	3	12.0	1991	3	3	3	2	12.0
1937	4	4	4	4	12.0	1992	4	3	3	3	12.0
1938	4	4	4	4	12.0	1993	4	3	3	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	4	12.0
1940	4	4	4	4	12.0	1995	4	4	4	3	12.0
1941	4	4	4	4	12.0	1996	4	4	4	2	12.0
1942	4	4	4	4	12.0	1997	4	4	4	2	12.0
1943	4	4	4	4	12.0	1998	4	4	4	2	12.0
1944	4	4	4	4	12.0	1999	4	4	4	1	12.0
1945	4	4	4	4	12.0	2000	4	3	4	1	12.0
1946	4	4	4	4	12.0	2001	4	4	4	1	12.0
1947	4	4	4	4	12.0	avg	3.9	3.7	3.7	2.8	11.2

TABLE 2. HCN Station Data Quality Grades

INDIANOLA

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	3	4	4	0	10.0	1948	4	4	4	0	12.0
1894	3	4	2	0	12.0	1949	4	4	4	1	12.0
1895	3	4	4	0	10.0	1950	4	4	4	1	12.0
1896	3	4	4	0	12.0	1951	4	4	4	1	12.0
1897	3	4	4	0	12.0	1952	4	4	4	4	12.0
1898	3	4	4	0	12.0	1953	4	4	4	4	12.0
1899	3	4	4	0	12.0	1954	4	4	4	2	12.0
1900	3	4	4	4	12.0	1955	4	4	4	2	12.0
1901	4	4	4	0	12.0	1956	4	4	4	1	12.0
1902	4	3	4	4	12.0	1957	4	4	4	1	12.0
1903	4	3	4	4	12.0	1958	4	4	4	4	12.0
1904	4	3	4	4	12.0	1959	4	4	4	4	12.0
1905	4	4	4	4	12.0	1960	4	4	4	4	12.0
1906	4	3	4	4	12.0	1961	4	4	4	4	12.0
1907	4	3	4	4	12.0	1962	4	4	4	4	12.0
1908	4	4	4	4	12.0	1963	4	4	4	4	12.0
1909	4	3	4	4	12.0	1964	4	4	4	4	12.0
1910	4	3	4	4	12.0	1965	4	4	4	4	12.0
1911	4	4	4	4	12.0	1966	4	3	4	4	12.0
1912	4	4	4	4	12.0	1967	4	4	4	3	11.0
1913	4	3	4	4	12.0	1968	4	4	4	4	12.0
1914	4	3	4	4	12.0	1969	4	4	4	4	12.0
1915	4	4	4	4	12.0	1970	4	4	4	4	12.0
1916	4	3	4	4	12.0	1971	4	4	4	4	12.0
1917	4	3	4	4	12.0	1972	4	4	4	4	12.0
1918	4	3	4	4	12.0	1973	4	4	4	4	12.0
1919	4	3	4	4	12.0	1974	4	4	4	4	12.0
1920	4	3	4	4	8.0	1975	4	4	4	4	12.0
1921	4	3	4	4	11.0	1976	4	4	4	4	12.0
1922	4	3	4	4	12.0	1977	4	4	4	4	12.0
1923	4	3	4	4	12.0	1978	4	4	4	4	12.0
1924	4	3	4	4	12.0	1979	4	4	4	4	12.0
1925	4	3	4	4	12.0	1980	4	4	4	4	12.0
1926	4	3	4	4	12.0	1981	4	4	4	4	12.0
1927	4	3	4	4	12.0	1982	4	4	2	4	12.0
1928	4	3	4	4	12.0	1983	4	4	4	1	9.5
1929	4	3	4	4	12.0	1984	4	4	2	0	12.0
1930	4	3	4	4	12.0	1985	4	4	4	0	12.0
1931	4	4	4	4	12.0	1986	4	3	3	0	12.0
1932	4	4	4	4	12.0	1987	4	3	1	0	8.0
1933	4	4	4	4	12.0	1988	4	2	0	0	7.5
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	4	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	4	4	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	4	12.0
1940	4	4	4	4	12.0	1995	4	4	4	4	12.0
1941	4	4	4	4	12.0	1996	4	4	4	4	12.0
1942	3	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	0	12.0	1998	4	4	4	4	12.0
1944	4	4	4	0	12.0	1999	4	4	4	4	12.0
1945	3	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	0	12.0	2001	4	4	4	4	12.0
1947	4	4	4	0	12.0	avg	3.9	3.7	3.9	3.1	11.8

IOWA FALLS

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	4	3	2	1	11.0	1948	4	3	4	4	12.0
1894	4	4	1	0	12.0	1949	4	3	4	4	12.0
1895	3	3	4	1	12.0	1950	4	3	4	4	12.0
1896	3	3	4	0	12.0	1951	4	3	4	4	12.0
1897	3	3	3	0	12.0	1952	4	3	4	4	12.0
1898	4	3	4	0	12.0	1953	4	3	4	4	12.0
1899	4	3	4	1	12.0	1954	4	3	2	1	11.0
1900	4	3	4	0	12.0	1955	4	3	2	1	12.0
1901	4	3	4	0	12.0	1956	4	4	3	4	12.0
1902	4	3	4	0	12.0	1957	4	4	4	0	12.0
1903	3	3	4	0	12.0	1958	4	3	4	0	12.0
1904	3	3	4	0	12.0	1959	4	3	4	0	12.0
1905	3	3	4	1	12.0	1960	4	4	4	0	12.0
1906	3	3	4	0	12.0	1961	4	4	4	2	12.0
1907	3	3	4	0	12.0	1962	4	3	3	1	12.0
1908	3	3	4	0	12.0	1963	4	4	3	1	12.0
1909	3	3	4	0	12.0	1964	4	4	4	1	12.0
1910	3	3	4	0	12.0	1965	4	3	3	1	12.0
1911	3	3	4	0	12.0	1966	4	4	4	1	12.0
1912	3	3	4	0	12.0	1967	4	4	3	1	12.0
1913	3	3	4	0	12.0	1968	4	4	3	1	12.0
1914	4	3	4	0	12.0	1969	4	4	4	1	12.0
1915	4	3	4	0	12.0	1970	4	4	4	1	12.0
1916	4	3	4	0	12.0	1971	4	4	4	1	12.0
1917	4	3	4	0	12.0	1972	4	4	4	1	12.0
1918	4	3	4	2	12.0	1973	4	4	4	1	12.0
1919	4	3	4	4	12.0	1974	4	4	4	1	12.0
1920	4	3	4	4	12.0	1975	4	4	4	0	12.0
1921	4	3	4	4	12.0	1976	4	4	4	0	12.0
1922	4	3	4	4	12.0	1977	4	4	4	4	12.0
1923	4	3	4	3	12.0	1978	4	4	4	4	12.0
1924	4	3	4	4	12.0	1979	4	4	4	4	12.0
1925	4	3	4	4	12.0	1980	4	4	4	4	11.0
1926	4	3	4	4	12.0	1981	4	4	4	4	11.0
1927	4	3	4	4	12.0	1982	4	4	4	4	12.0
1928	4	3	4	4	12.0	1983	4	4	4	4	12.0
1929	4	3	4	4	12.0	1984	4	4	4	4	4.0
1930	4	3	4	4	12.0	1985	4	4	3	0	8.0
1931	4	3	4	4	12.0	1986	4	4	3	0	12.0
1932	4	3	4	4	12.0	1987	4	4	3	0	12.0
1933	4	3	4	4	12.0	1988	4	4	3	0	11.0
1934	4	3	4	4	12.0	1989	4	4	3	0	12.0
1935	4	3	4	4	12.0	1990	4	3	3	0	12.0
1936	4	3	4	4	12.0	1991	4	3	3	0	12.0
1937	4	3	4	4	12.0	1992	4	4	4	2	12.0
1938	4	3	4	4	12.0	1993	4	4	4	2	12.0
1939	4	3	4	4	12.0	1994	4	4	4	2	12.0
1940	4	3	4	4	12.0	1995	4	4	4	1	12.0
1941	4	3	4	4	12.0	1996	3	4	4	0	12.0
1942	4	3	4	4	12.0	1997	4	4	4	1	12.0
1943	4	3	4	4	12.0	1998	4	4	4	1	12.0
1944	4	3	4	4	12.0	1999	4	4	4	1	12.0
1945	4	3	4	4	12.0	2000	4	4	4	1	12.0
1946	4	3	4	4	12.0	2001	4	4	4	1	12.0
1947	4	3	4	4	12.0	avg	3.9	3.4	3.8	1.9	11.8

LOGAN

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	3	3	4	0	12.0	1948	4	4	4	4	12.0
1894	3	3	4	0	12.0	1949	4	4	4	4	12.0
1895	3	3	4	0	12.0	1950	4	4	4	4	12.0
1896	3	3	4	0	12.0	1951	4	4	4	4	12.0
1897	3	3	4	1	12.0	1952	4	4	4	4	12.0
1898	3	3	4	1	12.0	1953	4	4	4	4	12.0
1899	3	3	4	0	12.0	1954	4	4	4	4	12.0
1900	3	3	4	0	12.0	1955	4	4	4	4	12.0
1901	4	3	4	1	12.0	1956	4	4	4	4	12.0
1902	4	3	4	1	12.0	1957	4	4	4	4	12.0
1903	3	3	4	1	12.0	1958	4	4	4	4	12.0
1904	4	3	4	1	12.0	1959	4	4	4	4	12.0
1905	4	3	4	1	12.0	1960	4	4	4	4	12.0
1906	4	3	4	0	12.0	1961	4	4	4	4	12.0
1907	4	3	4	0	12.0	1962	4	4	4	4	12.0
1908	4	4	2	0	12.0	1963	4	4	4	4	12.0
1909	4	4	0	0	12.0	1964	4	4	4	4	12.0
1910	4	4	1	0	12.0	1965	4	4	4	4	12.0
1911	4	4	1	0	12.0	1966	4	4	2	4	12.0
1912	4	4	0	0	12.0	1967	4	4	4	4	12.0
1913	4	4	1	0	12.0	1968	4	4	4	4	12.0
1914	4	4	1	0	12.0	1969	4	4	4	4	12.0
1915	4	4	1	0	12.0	1970	4	4	4	4	12.0
1916	4	3	0	0	12.0	1971	4	4	4	4	12.0
1917	4	4	2	2	12.0	1972	4	4	4	4	12.0
1918	4	4	4	0	12.0	1973	4	4	4	4	12.0
1919	4	4	4	0	12.0	1974	4	4	4	4	12.0
1920	4	4	4	0	12.0	1975	4	4	4	4	12.0
1921	4	4	4	0	12.0	1976	4	4	4	4	12.0
1922	4	4	4	0	12.0	1977	4	4	4	4	12.0
1923	4	4	4	0	12.0	1978	4	4	4	4	12.0
1924	4	4	4	0	12.0	1979	4	4	4	4	12.0
1925	4	4	4	0	12.0	1980	4	4	4	4	12.0
1926	3	4	4	0	11.5	1981	4	4	4	4	12.0
1927	4	4	1	0	12.0	1982	4	4	4	4	12.0
1928	4	4	0	0	12.0	1983	4	4	4	4	12.0
1929	4	4	1	0	12.0	1984	4	4	4	4	12.0
1930	3	4	1	0	12.0	1985	4	4	4	4	12.0
1931	4	4	0	1	12.0	1986	4	4	4	4	12.0
1932	4	4	0	0	12.0	1987	4	4	4	4	12.0
1933	4	4	1	1	12.0	1988	4	4	4	4	9.0
1934	4	4	2	2	12.0	1989	4	4	4	4	12.0
1935	4	4	2	3	12.0	1990	4	4	4	4	12.0
1936	4	4	4	3	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	4	4	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	4	12.0
1940	4	4	4	4	12.0	1995	4	4	4	4	12.0
1941	4	4	4	4	12.0	1996	4	4	4	4	12.0
1942	4	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	4	12.0	1998	4	4	4	4	12.0
1944	4	4	4	4	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	4	12.0	2001	4	4	4	4	12.0
1947	4	4	4	4	12.0	avg	3.9	3.9	3.4	2.6	12.0

TABLE 2. HCN Station Data Quality Grades

MOUNT AYR

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	3	3	4	0	5.0	1948	4	3	4	1	12.0
1894					0.0	1949	4	3	4	0	12.0
1895	3	2	2	1	10.0	1950	4	4	4	0	12.0
1896	3	4	4	1	12.0	1951	4	4	4	1	12.0
1897	3	4	4	1	12.0	1952	4	3	4	1	12.0
1898	3	4	4	1	12.0	1953	4	3	4	0	12.0
1899	3	4	4	1	12.0	1954	4	3	3	1	12.0
1900	3	4	4	1	12.0	1955	4	3	3	1	12.0
1901	4	4	4	0	12.0	1956	4	3	4	1	10.0
1902	4	4	4	1	12.0	1957	4	3	3	3	8.0
1903	4	4	4	0	12.0	1958	4	3	3	4	12.0
1904	4	4	4	0	12.0	1959	4	3	1	4	12.0
1905	4	4	4	0	12.0	1960	4	4	2	3	12.0
1906	4	4	4	0	12.0	1961	4	4	3	3	11.0
1907	4	4	4	0	12.0	1962	4	4	4	3	12.0
1908	4	4	4	0	12.0	1963	4	4	4	3	12.0
1909	4	4	4	0	12.0	1964	4	4	2	2	11.5
1910	4	4	4	0	12.0	1965	4	4	2	2	11.0
1911	4	4	4	0	12.0	1966	4	4	1	2	12.0
1912	4	4	4	1	12.0	1967	4	4	0	2	10.5
1913	4	3	4	1	12.0	1968	4	4	0	2	9.0
1914	4	3	4	1	12.0	1969	4	4	3	1	7.5
1915	4	3	4	1	12.0	1970	4	3	1	1	12.0
1916	3	3	4	1	12.0	1971	4	3	1	1	12.0
1917	4	3	4	1	12.0	1972	4	3	2	1	12.0
1918	4	3	4	1	12.0	1973	4	3	1	1	12.0
1919	4	3	4	1	12.0	1974	4	4	0	0	12.0
1920	4	4	4	1	12.0	1975	4	4	0	0	11.0
1921	4	4	4	1	12.0	1976	4	4	1	0	5.0
1922	4	4	4	1	12.0	1977	4	4	4	0	12.0
1923	4	4	4	1	12.0	1978	4	4	4	0	11.0
1924	4	4	4	1	12.0	1979	4	4	4	0	12.0
1925	4	4	4	1	12.0	1980	4	4	4	0	12.0
1926	4	4	4	1	12.0	1981	4	4	4	0	12.0
1927	4	4	4	1	12.0	1982	4	4	4	0	12.0
1928	4	4	4	2	12.0	1983	4	3	1	1	8.0
1929	4	4	4	2	12.0	1984	4	3	1	2	12.0
1930	4	4	3	2	12.0	1985	4	3	1	1	12.0
1931	4	4	3	1	12.0	1986	4	3	2	1	12.0
1932	4	4	3	1	12.0	1987	4	3	2	1	12.0
1933	4	4	4	1	12.0	1988	4	3	2	2	12.0
1934	4	3	3	1	12.0	1989	4	3	2	4	12.0
1935	4	4	4	1	12.0	1990	4	3	2	4	12.0
1936	4	4	4	4	12.0	1991	4	3	2	4	12.0
1937	4	4	4	4	12.0	1992	4	3	2	4	12.0
1938	4	4	4	4	12.0	1993	4	3	2	4	12.0
1939	4	4	4	4	12.0	1994	4	3	2	4	12.0
1940	4	4	4	4	12.0	1995	4	3	2	2	12.0
1941	4	4	4	4	12.0	1996	4	3	2	0	12.0
1942	4	4	4	4	12.0	1997	4	3	2	4	12.0
1943	4	4	4	4	12.0	1998	4	3	2	2	12.0
1944	4	4	4	4	12.0	1999	4	3	2	4	12.0
1945	4	4	4	4	12.0	2000	4	3	2	4	12.0
1946	4	3	3	0	12.0	2001	4	3	2	1	12.0
1947	4	3	3	0	12.0	avg	3.9	3.6	3.1	1.5	11.5

MOUNT PLEASANT

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893					0.0	1948	4	4	4	4	12.0
1894	2	3	4	0	8.0	1949	4	4	4	4	12.0
1895	2	4	4	0	12.0	1950	4	4	4	4	12.0
1896	2	3	3	0	12.0	1951	4	4	4	4	12.0
1897	2	3	2	0	12.0	1952	4	4	3	4	10.0
1898	2	3	2	0	12.0	1953					0.0
1899	3	4	2	0	12.0	1954	4	4	3	4	11.0
1900	3	3	2	0	12.0	1955	4	4	3	4	12.0
1901	4	3	1	0	12.0	1956	4	4	4	4	12.0
1902	4	3	4	0	12.0	1957	4	4	4	4	12.0
1903	4	3	4	1	10.0	1958	4	4	4	4	12.0
1904	4	3	4	2	12.0	1959	4	4	4	4	11.0
1905	4	4	4	2	12.0	1960	4	4	4	4	12.0
1906	4	4	4	2	12.0	1961	4	4	4	4	12.0
1907	4	4	4	2	12.0	1962	4	4	4	4	12.0
1908	4	4	4	2	12.0	1963	4	4	2	1	12.0
1909	4	4	4	2	12.0	1964	4	4	0	1	12.0
1910	4	4	4	2	12.0	1965	4	4	0	1	12.0
1911	4	3	4	2	12.0	1966	4	4	0	2	12.0
1912	4	3	4	2	12.0	1967	4	4	2	1	12.0
1913	4	3	4	2	12.0	1968	4	4	0	1	12.0
1914	4	3	4	2	12.0	1969	4	4	3	1	12.0
1915	4	3	4	2	12.0	1970	4	4	4	4	11.0
1916	4	3	4	2	12.0	1971	4	4	4	4	12.0
1917	3	3	4	2	12.0	1972	4	4	4	4	11.0
1918	4	3	3	1	12.0	1973	4	4	4	4	12.0
1919	4	4	2	3	12.0	1974	4	4	4	4	12.0
1920	4	4	4	4	12.0	1975	4	4	4	4	12.0
1921	4	4	4	4	12.0	1976	4	4	4	4	12.0
1922	4	4	4	4	12.0	1977	4	4	4	4	12.0
1923	4	4	4	4	12.0	1978	4	4	4	4	12.0
1924	4	4	4	4	12.0	1979	4	4	4	4	12.0
1925	4	4	4	4	12.0	1980	4	4	4	4	12.0
1926	4	4	4	4	12.0	1981	4	4	4	4	12.0
1927	4	4	4	4	12.0	1982	4	4	4	4	12.0
1928	4	4	4	4	12.0	1983	4	4	4	4	12.0
1929	4	4	4	4	12.0	1984	4	4	4	4	12.0
1930	4	4	4	4	12.0	1985	4	4	3	0	12.0
1931	4	4	4	4	12.0	1986	4	3	3	1	12.0
1932	4	3	4	4	12.0	1987	4	3	3	0	12.0
1933	4	4	4	4	12.0	1988	4	3	3	0	12.0
1934	4	4	4	4	12.0	1989	4	3	3	0	12.0
1935	4	4	4	4	12.0	1990	4	3	3	2	12.0
1936	4	4	4	2	12.0	1991	4	3	3	0	12.0
1937	4	4	4	4	12.0	1992	4	3	3	0	12.0
1938	4	4	4	4	12.0	1993	4	3	3	0	12.0
1939	4	4	4	4	12.0	1994	4	3	3	0	12.0
1940	4	4	4	4	12.0	1995	4	3	3	0	12.0
1941	4	3	4	4	12.0	1996	4	3	3	0	12.0
1942	4	3	3	4	11.5	1997	4	3	3	0	12.0
1943	4	3	4	4	12.0	1998	4	3	3	0	12.0
1944	4	4	4	2	12.0	1999	4	3	3	0	12.0
1945	4	4	4	4	12.0	2000	4	3	3	0	12.0
1946	4	4	4	4	12.0	2001	4	3	3	0	12.0
1947	4	4	4	4	12.0	avg	3.9	3.7	3.5	2.5	11.7

ROCKWELL CITY

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	0	3	1	1	2.5	1948	4	4	4	4	12.0
1894	3	3	2	0	12.0	1949	4	4	4	4	12.0
1895					1.0	1950	4	4	4	4	12.0
1896					0.0	1951	4	4	4	4	12.0
1897	3	3	4	1	11.0	1952	4	4	4	4	12.0
1898	3	3	4	1	12.0	1953	4	4	4	4	12.0
1899	3	4	4	0	12.0	1954	4	4	4	4	12.0
1900	3	3	4	0	12.0	1955	4	4	4	4	12.0
1901	4	3	4	0	12.0	1956	4	4	4	4	12.0
1902	4	3	4	0	12.0	1957	4	4	4	4	12.0
1903	4	3	4	0	12.0	1958	4	4	4	4	12.0
1904	4	3	4	0	12.0	1959	4	4	4	4	12.0
1905	4	3	4	0	12.0	1960	4	4	4	4	12.0
1906	4	3	4	0	11.0	1961	4	4	4	4	12.0
1907	4	3	4	0	12.0	1962	4	4	4	4	12.0
1908	4	3	4	0	12.0	1963	4	4	4	4	12.0
1909	4	3	4	0	12.0	1964	4	4	4	4	12.0
1910	4	3	4	0	12.0	1965	4	4	4	4	12.0
1911	4	3	4	0	12.0	1966	4	4	4	4	12.0
1912	4	3	4	0	12.0	1967	4	4	4	4	12.0
1913	4	3	4	0	12.0	1968	4	4	4	4	12.0
1914	3	4	4	0	12.0	1969	4	4	4	4	12.0
1915	3	4	4	0	12.0	1970	4	4	4	4	12.0
1916	4	4	4	4	12.0	1971	4	4	4	4	12.0
1917	4	4	4	4	12.0	1972	4	4	4	4	10.0
1918	4	4	4	4	12.0	1973	4	4	4	4	12.0
1919	4	4	4	4	11.0	1974	4	4	4	4	12.0
1920	4	4	4	4	12.0	1975	4	4	4	4	12.0
1921	3	4	4	4	9.0	1976	4	4	4	4	12.0
1922	4	4	4	4	8.5	1977	4	4	4	4	12.0
1923	4	4	4	4	12.0	1978	4	4	4	4	12.0
1924	4	4	4	4	9.0	1979	4	4	4	4	12.0
1925	4	4	4	4	9.0	1980	4	4	4	4	12.0
1926	4	4	4	4	11.0	1981	4	4	4	4	12.0
1927	4	4	4	4	10.0	1982	4	4	4	4	12.0
1928	4	4	4	4	11.0	1983	4	4	4	4	12.0
1929	4	4	4	4	8.0	1984	4	4	4	4	12.0
1930	4	3	4	4	10.0	1985	4	4	4	4	12.0
1931	4	4	4	4	12.0	1986	4	4	4	4	12.0
1932	4	4	4	4	11.0	1987	4	4	4	4	12.0
1933	4	4	4	4	12.0	1988	4	4	4	4	12.0
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	4	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	4	4	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	0	12.0
1940	4	4	4	4	12.0	1995	4	4	4	2	12.0
1941	4	4	4	4	12.0	1996	4	4	4	2	12.0
1942	4	4	4	4	12.0	1997	4	4	4	3	12.0
1943	4	4	4	4	12.0	1998	4	4	4	4	12.0
1944	4	4	4	4	12.0	1999	4	4	4	4	12.0
1945	4	4	4	4	12.0	2000	4	4	4	4	12.0
1946	4	4	4	4	12.0	2001	4	4	4	4	12.0
1947	4	4	4	4	12.0	avg	3.9	3.8	4.0	3.2	11.4

TABLE 2. HCN Station Data Quality Grades

STORM LAKE

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	3	4	4	1	12.0	1948	4	4	4	4	12.0
1894					0.0	1949	4	3	4	4	12.0
1895					0.0	1950	4	4	4	4	12.0
1896					0.0	1951	4	4	4	4	12.0
1897					0.0	1952	4	4	4	4	12.0
1898	3	4	4	2	3.0	1953	4	4	4	4	12.0
1899	3	4	4	2	12.0	1954	4	4	4	4	12.0
1900	3	4	4	4	12.0	1955	4	4	4	4	12.0
1901	4	4	4	4	12.0	1956	4	4	4	4	12.0
1902	4	4	4	4	12.0	1957	4	4	4	4	12.0
1903	3	3	3	3	12.0	1958	4	4	4	4	12.0
1904	3	3	4	3	12.0	1959	4	4	4	4	12.0
1905	3	3	4	4	12.0	1960	4	4	4	4	12.0
1906	3	3	3	2	8.0	1961	4	4	4	4	12.0
1907	4	3	3	1	11.0	1962	4	4	4	4	12.0
1908	4	4	4	1	11.0	1963	4	4	4	4	12.0
1909	4	4	4	1	12.0	1964	4	4	4	4	12.0
1910	4	3	3	1	12.0	1965	4	4	4	4	12.0
1911	4	3	3	0	12.0	1966	4	4	4	4	12.0
1912	4	4	4	4	12.0	1967	4	4	4	4	12.0
1913	4	4	4	3	12.0	1968	4	4	4	4	12.0
1914	4	4	4	0	12.0	1969	4	4	4	4	12.0
1915	4	4	4	0	12.0	1970	4	4	4	4	12.0
1916	4	4	4	0	12.0	1971	4	4	4	4	12.0
1917	4	4	4	0	12.0	1972	4	4	4	4	12.0
1918	4	4	4	1	12.0	1973	4	4	4	4	12.0
1919	4	4	4	1	12.0	1974	4	4	4	4	12.0
1920	4	4	4	1	12.0	1975	4	4	4	4	12.0
1921	4	4	4	0	12.0	1976	4	4	4	4	12.0
1922	4	4	4	0	12.0	1977	4	4	4	4	12.0
1923	4	4	4	0	12.0	1978	4	4	4	4	12.0
1924	4	4	4	0	12.0	1979	4	4	4	4	12.0
1925	4	4	4	0	12.0	1980	4	4	4	4	12.0
1926	4	4	4	0	12.0	1981	4	4	4	4	12.0
1927	4	4	4	0	12.0	1982	4	4	4	4	12.0
1928	4	4	4	0	12.0	1983	4	4	4	4	12.0
1929	4	4	4	1	12.0	1984	4	4	4	4	12.0
1930	4	4	4	4	12.0	1985	4	4	4	4	12.0
1931	4	4	4	3	12.0	1986	4	4	4	4	12.0
1932	4	4	4	4	12.0	1987	4	4	4	4	12.0
1933	4	4	4	3	12.0	1988	4	4	4	4	12.0
1934	4	4	4	4	12.0	1989	4	4	4	4	12.0
1935	4	4	4	4	12.0	1990	4	4	4	4	12.0
1936	4	4	4	4	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	3	4	2	12.0
1939	4	4	4	4	12.0	1994	4	3	4	3	12.0
1940	4	4	4	4	12.0	1995	4	3	4	0	12.0
1941	4	4	4	4	12.0	1996	4	3	4	0	12.0
1942	4	3	4	3	12.0	1997	4	3	4	0	12.0
1943	4	3	4	2	12.0	1998	4	2	3	0	12.0
1944	4	3	3	3	12.0	1999	3	3	3	1	12.0
1945	4	4	4	4	12.0	2000	3	3	3	0	12.0
1946	4	4	4	4	12.0	2001	3	2	2	0	12.0
1947	4	4	4	4	12.0	avg	3.9	3.8	3.9	2.8	11.4

TOLEDO

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893					0.0	1948	4	4	4	1	12.0
1894	2	3	3	1	12.0	1949	4	4	4	1	12.0
1895	2	3	4	0	12.0	1950	4	4	4	1	12.0
1896	3	3	4	0	12.0	1951	4	4	4	1	12.0
1897	3	3	3	1	12.0	1952	4	4	4	1	12.0
1898	3	3	3	0	12.0	1953	4	4	4	1	12.0
1899	3	3	0	0	12.0	1954	4	4	4	1	12.0
1900	3	3	2	1	12.0	1955	4	4	4	1	12.0
1901	4	2	0	0	12.0	1956	4	4	4	1	12.0
1902	4	3	4	1	6.0	1957	4	4	4	1	12.0
1903	4	4	4	1	12.0	1958	4	4	4	1	12.0
1904	4	4	4	0	12.0	1959	4	3	2	2	12.0
1905	4	4	3	0	12.0	1960	4	3	3	2	12.0
1906	4	3	4	0	12.0	1961	4	3	1	2	12.0
1907	4	3	4	0	12.0	1962	4	3	3	2	12.0
1908	4	3	4	0	12.0	1963	4	3	3	2	12.0
1909	4	3	4	0	12.0	1964	4	3	3	2	12.0
1910	4	3	4	0	12.0	1965	4	4	4	3	12.0
1911	4	3	4	0	12.0	1966	4	4	4	4	12.0
1912	4	3	4	0	12.0	1967	4	4	4	4	12.0
1913	4	3	4	0	12.0	1968	4	4	4	4	12.0
1914	4	3	4	0	12.0	1969	4	4	4	4	12.0
1915	4	4	4	0	12.0	1970	4	4	4	4	12.0
1916	4	3	4	1	12.0	1971	4	4	4	4	12.0
1917	4	4	4	0	12.0	1972	4	4	4	4	12.0
1918	4	4	4	2	12.0	1973	4	4	4	4	12.0
1919	4	4	4	0	12.0	1974	4	4	4	4	12.0
1920	4	4	4	1	12.0	1975	4	4	4	4	12.0
1921	4	4	4	0	12.0	1976	4	4	4	4	12.0
1922	4	4	4	0	12.0	1977	4	4	4	4	12.0
1923	4	4	4	1	12.0	1978	4	3	4	4	12.0
1924	4	4	4	1	12.0	1979	4	4	4	4	12.0
1925	4	4	4	0	12.0	1980	4	4	4	4	12.0
1926	4	4	4	1	12.0	1981	4	4	4	4	12.0
1927	4	4	4	1	12.0	1982	4	4	4	4	12.0
1928	4	4	4	1	12.0	1983	4	4	4	4	12.0
1929	4	4	4	1	12.0	1984	4	4	4	4	12.0
1930	4	4	4	1	12.0	1985	4	4	4	4	12.0
1931	4	4	4	3	12.0	1986	4	4	4	3	12.0
1932	4	4	4	3	12.0	1987	4	4	4	4	12.0
1933	4	4	4	3	12.0	1988	4	4	4	4	12.0
1934	4	4	4	3	12.0	1989	4	4	4	4	12.0
1935	4	4	4	3	12.0	1990	4	4	4	3	12.0
1936	4	4	4	3	12.0	1991	4	4	4	4	12.0
1937	4	4	4	3	12.0	1992	4	4	4	4	12.0
1938	4	4	4	3	12.0	1993	4	4	4	4	12.0
1939	4	4	4	3	12.0	1994	4	4	4	4	12.0
1940	4	4	4	2	12.0	1995	4	4	4	4	12.0
1941	4	4	4	2	12.0	1996	4	4	4	4	12.0
1942	4	4	4	1	12.0	1997	4	4	4	4	12.0
1943	4	4	4	1	12.0	1998	4	4	4	4	12.0
1944	4	4	4	1	12.0	1999	4	3	4	4	12.0
1945	4	4	4	1	12.0	2000	4	4	4	4	12.0
1946	4	4	4	1	12.0	2001	4	4	4	4	12.0
1947	4	4	4	1	12.0	avg	3.9	3.7	3.8	2.0	11.8

WASHINGTON

YR	TM	PR	SF	SD	#MO	YR	TM	PR	SF	SD	#MO
1893	4	4	3	0	12.0	1948	4	4	4	4	12.0
1894	4	4	3	0	12.0	1949	4	4	4	4	12.0
1895	4	3	3	0	12.0	1950	4	4	4	4	12.0
1896	4	3	3	0	12.0	1951	4	4	4	4	12.0
1897	4	4	3	0	12.0	1952	4	4	4	4	12.0
1898	3	4	0	0	12.0	1953	4	4	4	4	12.0
1899	3	4	0	0	12.0	1954	4	4	4	4	12.0
1900	3	4	1	0	12.0	1955	4	4	4	4	12.0
1901	3	4	1	0	12.0	1956	4	4	4	4	12.0
1902	3	4	1	0	12.0	1957	4	4	4	4	12.0
1903	4	4	1	0	12.0	1958	4	4	4	4	12.0
1904	4	4	1	0	12.0	1959	4	4	4	4	12.0
1905	4	4	1	0	12.0	1960	4	4	4	4	12.0
1906	4	4	1	0	12.0	1961	4	4	4	4	12.0
1907	4	4	1	0	12.0	1962	4	4	4	4	12.0
1908	4	4	1	0	12.0	1963	4	4	4	4	12.0
1909	4	4	1	0	12.0	1964	4	4	4	4	12.0
1910	4	4	1	0	12.0	1965	4	4	4	4	12.0
1911	4	4	0	0	12.0	1966	4	4	4	4	12.0
1912	4	4	2	0	12.0	1967	4	3	3	4	12.0
1913	4	4	1	0	12.0	1968	4	4	3	4	12.0
1914	4	4	1	0	11.0	1969	4	4	4	4	12.0
1915	4	4	1	0	12.0	1970	4	4	4	4	12.0
1916	4	4	4	0	12.0	1971	4	4	4	4	12.0
1917	4	4	4	1	12.0	1972	4	4	4	4	12.0
1918	4	4	4	1	12.0	1973	4	4	4	4	12.0
1919	4	4	4	1	12.0	1974	4	4	4	4	12.0
1920	4	4	4	1	12.0	1975	4	4	4	4	11.0
1921	4	4	4	1	12.0	1976	4	4	4	4	12.0
1922	4	4	2	1	12.0	1977	4	4	4	4	12.0
1923	4	4	4	1	12.0	1978	4	4	4	4	12.0
1924	4	3	3	0	12.0	1979	4	4	4	4	12.0
1925	4	3	3	0	12.0	1980	4	4	4	4	12.0
1926	4	3	3	0	12.0	1981	4	4	4	4	12.0
1927	4	3	3	0	12.0	1982	4	4	4	4	12.0
1928	4	3	3	0	12.0	1983	4	4	4	4	12.0
1929	4	3	3	0	12.0	1984	4	4	4	4	12.0
1930	4	3	3	0	12.0	1985	4	4	4	4	12.0
1931	4	4	4	0	12.0	1986	4	4	4	4	12.0
1932	4	4	4	0	12.0	1987	4	4	4	4	12.0
1933	4	4	4	0	12.0	1988	4	4	4	4	12.0
1934	4	4	4	0	12.0	1989	4	4	4	4	12.0
1935	4	4	4	0	12.0	1990	4	4	4	4	12.0
1936	4	4	4	1	12.0	1991	4	4	4	4	12.0
1937	4	4	4	4	12.0	1992	4	4	4	4	12.0
1938	4	4	4	4	12.0	1993	4	4	4	4	12.0
1939	4	4	4	4	12.0	1994	4	4	4	4	12.0
1940	4	4	4	3	12.0	1995	4	4	4	4	12.0
1941	4	4	4	4	12.0	1996	4	4	4	4	12.0
1942	4	4	4	4	12.0	1997	4	4	4	4	12.0
1943	4	4	4	4	12.0	1998	4	4	4	2	12.0
1944	4	4	4	4	12.0	1999	4	4	4	0	12.0
1945	4	4	4	4	12.0	2000	4	4	4	1	12.0
1946	4	4	4	4	12.0	2001	4	4	4	1	12.0
1947	4	4	4	4	12.0	avg	4.0	3.9	3.3	2.3	12.0

TABLE 3

HCN Station History Summary

This table provides information on the observer names, addresses and the equipment location, type and exposure.

'map'	This number refers to the station location on the city maps in the Appendix.
Begin & End Dates	A ? in these column indicates that the actual date of the change is unknown. If the year is accompanied by a question mark this indicates the mid point of the time period when the change should have occurred.
Address:	bl = number of city blocks; P. O. = Post Office; 'old' indicates the previous or 'old location'
Elev.	The elevation of the precipitation gage in feet above mean sea level. These numbers were derived from USGS 1:24, 000 scale topographic maps. In no cases were the elevations provided in the station history files used unless they happened to coincide with the topo map data (not a common occurrence).
Elev. Qual.	Estimated precision of the station elevation value on a scale of 1 (least precise) to 5 (most precise) where 1 = accurate to plus or minus 150 ft; 2 = plus or minus 75 ft.; 3 = plus or minus 50 ft.; 4 = plus or minus 25 ft; and 5 = accurate to within plus or minus 10 feet.
'srg'	Standard Rain Gage.
'lat/lon	Latitude and longitude are provided in degrees, minutes and seconds on the basis on GPS data.
'lat/lon qual'	Estimated precision of the latitude and longitude data. Uncertainty is the result of lack of specific knowledge as to the location of the station rather than any doubt as to the absolute precision of specific GPS readings. Once again a 1 to 5 scale is used. 1 = an estimated accuracy of plus or minus 3000 feet; 2 = plus or minus 1000 ft.; 3 = plus or minus 300 ft.; 4 = plus or minus 100 ft. and 5 = an estimated precision of plus or minus 30 ft. NOTE: In some cases the relative position of the temperature and rainfall equipment is known (i.e. the rain gage was located ten feet east of the temperature shelter), yet the specific location of the station is unknown, the lat/lon may be expressed in tenths of a second as an indication of the relative positions of the equipment to each other and is not intended to imply that the absolute coordinates are known with certainty.
"srg expo"	Quality of the exposure of the rain gage on a scale of 1 (terrible) to 5 (excellent).
"type prec gage"	The type of precipitation gage in use. SRG = NWS 8" Standard Rain Gage. 3" is a 3" diameter rain gage and 2.5" reflects use of a 2.5 inch diameter rain gage.
"temp"	Temperature Equipment.
"temp expo"	Quality of the exposure of the thermometers using the same scale as for precipitation (see 'srg expo'above).
"type mx/mn"	The type of temperature equipment used. 'lig' indicates a 'liquid in glass' max & min thermometer. 'mmts' is an electronic maximum/minimum temperature system. A '?' usually implies use of some type of non-recording thermometer.
"shelter"	Type of thermometer shelter in use. 'crh'= standard Cotton Region Shelter. 'near S' indicates a shelter that is very similar to a CRH. 'non S' indicates a shelter that greatly differs from a CRH.

TABLE 3. HCN Station History Summary

map	HCN Station	Begin Date Mo	Begin Date Da	Begin Date Yr	End Date Mo	End Date Da	End Date Yr	Observer	Address	Elev	Elev Qual	srg lat deg	srg lat min	srg lat sec	srg lon deg	srg lon min	srg lon sec	srg lat/lon qual	srg expo	type prec gage	temp lat deg	temp lat min	temp lat sec	temp lon deg	temp lon min	temp lon sec	temp lat/lon qual	temp expo	type mx/mn	shelter
	Albia	3	15	1894	2	28	1898	Cal Koontz	unknown	965	4	41	1	38	92	48	24	1	?	?	41	1	38	92	48	24	1	?	lig	?
	Albia	6	1	1898	11	20	1901	R. Moore	unknown	965	4	41	1	38	92	48	24	1	?	?	41	1	38	92	48	24	1	?	lig	?
	Albia	11	21	1901	11	20	1905	E. R. Reeve	Hiteman Road	950	3	41	1	59	92	48	47	2	5	srg	41	1	59	92	48	47	2	2	lig	non S
	Albia	11	21	1905	9	30	1913	J. I. Chenowith	Hiteman Road	950	3	41	1	59	92	48	47	2	5	srg	41	1	59	92	48	47	2	2	lig	non S
	Albia	10	1	1913	1	1	1914	F. H. Holmes	Hiteman Road	950	3	41	1	59	92	48	47	2	5	srg	41	1	59	92	48	47	2	2	lig	non S
4	Albia	1	1	1914	11	27	1919	F. H. Holmes	330 North D St.	962	5	41	1	52.2	92	48	46.1	5	4	srg	41	1	52.1	92	48	46.1	5	5	lig	crh
5	Albia	11	28	1919	9	30	1921	F. H. Holmes	203 D Avenue East	952	5	41	1	54.0	92	48	20.3	5	4	srg	41	1	54.1	92	48	20.3	5	4	lig	crh
6	Albia	10	1	1921	6	27	1930	O. E. McBride	114 A Avenue West	963	5	41	1	40.2	92	48	37.3	5	3	srg	41	1	40.2	92	48	37.3	5	3	lig	crh
8	Albia	6	28	1930	4	11	1933	J. M. Stevenson	212 4th Ave. West	935	5	41	1	21.3	92	48	40.1	5	5	srg	41	1	21.3	92	48	40.1	5	5	lig	crh
7	Albia	4	12	1933	4	1	1934	S. L. Gasaway	219 4th Ave. West	944	5	41	1	23.7	92	48	41.2	5	4	srg	41	1	23.7	92	48	41.5	5	4	lig	crh
9	Albia	4	2	1934	8	28	1938	O. E. McBride	303 A Avenue West	963	5	41	1	42.5	92	48	44.1	5	3	srg	41	1	42.5	92	48	44.1	5	3	lig	crh
10	Albia	8	29	1938	6	27	1951	Arthur L. Freed	407 North 8th St.	950	5	41	1	55.2	92	47	56.6	4	5	srg	41	1	55.2	92	47	56.6	4	5	lig	crh
11	Albia	6	28	1951	7	7	1963	George Seibert	203 2nd Ave. West	962	5	41	1	32.5	92	48	38.3	5	2	srg	41	1	32.5	92	48	38.2	5	2	lig	crh
12	Albia 4 SE	7	8	1963	10	26	1965	George Seibert	665th Ave.	966	5	40	58	9.4	92	46	57.7	5	5	srg	40	58	9.4	92	46	57.8	5	5	lig	crh
13	Albia	10	27	1965	6	28	1970	George Seibert	121 Benton Ave. East	966	5	41	1	39.4	92	48	21.0	5	4	srg	41	1	39.4	92	48	21.9	5	3	lig	crh
13	Albia	6	29	1970	6	23	1971	George Seibert	121 Benton Ave. East	966	5	41	1	39.4	92	48	21.8	5	3	srg	41	1	39.4	92	48	21.9	5	3	lig	crh
14	Albia	6	24	1971	11	30	1981	Edward Steinbach	512 North 3rd St.	953	5	41	1	58.1	92	48	14.4	5	5	srg	41	1	58.1	92	48	14.4	4	5	lig	crh
15	Albia	4	22	1982	7	23	1984	James I. Hunt	424 4th Ave. East	951	5	41	1	21.5	92	48	8.7	5	3	srg	41	1	21.5	92	48	8.7	4	3	lig	crh
16	Albia 3 NNE	4	12	1985				Ross R. Rekemeyer	1661 664th Ave.	890	5	41	3	55.4	92	47	12.5	5	4	srg	41	3	55.5	92	47	12.5	5	4	mmts	mmts
	Algona	1	1	1893	12	31	1903	C. D. Pettibone	unknown	1200	2	43	4	8	94	13	57	1	?	?	43	4	8	94	13	57	1	?	?	?
2	Algona	1	1	1904	1	31	1916	F. T. Seeley, M.D.	605 E. McGregor St.	1204	5	43	4	1.8	94	13	49.2	4	4	srg	43	4	1.8	94	13	49.2	4	1	lig	non S
3	Algona	2	1	1916	?	?	1929	W. E. Laird	123 W. Nebraska St.	1201	5	43	4	5.1	94	14	20.4	5	2	srg	43	4	5.1	94	14	20.4	5	1	lig	non S
3	Algona	?	?	1929	5	24	1930	W. E. Laird	123 W. Nebraska St.	1201	5	43	4	5.2	94	14	20.4	5	2	srg	43	4	5.1	94	14	20.4	5	2	lig	crh
4	Algona	6	1	1930	9	22	1941	Leon M. Merritt	403 E. McGregor St.	1208	5	43	4	2.1	94	13	56.8	5	2	srg	43	4	1.6	94	13	57.0	5	3	lig	crh
5	Algona	9	23	1941	9	21	1954	Harry Nolte	1219 E. State St.	1197	5	43	4	8.4	94	13	19.1	5	4	srg	43	4	8.5	94	13	18.9	5	4	lig	crh
6	Algona 2 NW	9	22	1954	4	7	1958	Stewart P. Albright	Algona Airport	1212	5	43	4	50.8	94	16	23.4	4	5	srg	43	4	50.8	94	16	23.4	4	5	lig	crh
6	Algona 2 NW	4	8	1958	7	22	1959	Wayne Johnson	Algona Airport	1212	5	43	4	50.8	94	16	23.4	4	5	srg	43	4	50.8	94	16	23.4	4	5	lig	crh
7	Algona 3 W	7	23	1959	?	?	1975	Radio KLGA		1228	5	43	4	6.8	94	18	19.0	5	4	srg	43	4	6.6	94	18	19.2	5	4	lig	crh
7	Algona 3 W	?	?	1975	5	21	1985	Radio KLGA		1230	5	43	4	5.8	94	18	19.6	5	5	srg	43	4	6.6	94	18	19.2	5	4	lig	crh
7	Algona 3 W	5	21	1985				Radio KLGA		1230	5	43	4	5.8	94	18	19.6	5	5	srg	43	4	6.6	94	18	19.2	5	4	mmts	mmts
	Belle Plaine	1	1	1893	9	30	1895	H. W. Vandike	unknown	835	2	41	53	52	92	16	41	1	?	?	41	53	52	92	16	41	1	?	?	?
1	Belle Plaine	10	1	1895	9	30	1912	S. P. Vandike	1507 9th Ave.	854	5	41	53	59	92	16	28	5	?	?	41	53	59	92	16	28	5	?	?	?
2	Belle Plaine	10	1	1912	?	?	1928?	O. C. Burrows	510 16th St.	846	5	41	54	3	92	16	48	5	4	srg	41	54	3	92	16	48.1	5	4	lig	crh
2	Belle Plaine	?	?	1928?	8	20	1939	O. C. Burrows	510 16th St.	847	5	41	54	3.3	92	16	48.2	5	4	srg	41	54	3.2	92	16	48.2	5	4	lig	crh
3	Belle Plaine	8	21	1939	9	23	1940	R.O. Burrows	911 15th St.	840	5	41	53	57	92	16	25	5	2	srg	41	53	56.6	92	16	24.5	5	2	lig	crh
4	Belle Plaine	9	24	1940	12	31	1944	R.O. Burrows	802 19th St.	890	5	41	54	12.2	92	16	33.7	5	3	srg	41	54	12.1	92	16	33.6	5	3	lig	crh
5	Belle Plaine	1	1	1945	8	25	1976	Walter C. Rabe	1709 9th Ave	854	5	41	54	8	92	16	27	5	4	srg	41	54	8	92	16	27.3	5	3	lig	crh
6	Belle Plaine	8	26	1976	4	6	1986	James C. Pech	603 7th Ave.	791	5	41	53	20.8	92	16	39	5	4	srg	41	53	21	92	16	39	5	3	lig	crh
7	Belle Plaine	4	7	1986	6	30	1992	Funk Seed Internation	8th St.	790	5	41	53	28	92	17	2	3	5	srg	41	53	28	92	17	2	3	?	mmts	mmts
8	Belle Plaine	7	1	1992	9	25	1995	Russell L. Key	1310 7th Ave.	841	5	41	53	53	92	16	44	5	4	srg	41	53	53	92	16	43.9	5	4	mmts	mmts
6	Belle Plaine	9	26	1995				James C. Pech	603 7th Ave.	792	5	41	53	22	92	16	40	5	4	srg	41	53	22	92	16	40	5	4	mmts	mmts
1	Clarinda	1	1	1893	2	29	1924	A. S. Van Sandt	203 W. Washington	1050	5	40	44	22.2	95	2	22.1	5	3	srg	40	44	22.2	95	2	22.1	5	3	lig	crh
2	Clarinda	3	1	1924	12	16	1937	H. C. Hawley	unknown	1042	3	40	43	39	95	2	22	2	5	srg	40	43	39	95	2	22	2	5	lig	crh
3	Clarinda	12	17	1937	10	17	1943	Forrest E. Allison	Clarinda Water Works	1004	5	40	44	20.0	95	1	14.3	5	5	srg	40	44	20.0	95	1	14.5	5	5	lig	crh
3	Clarinda	10	18	1943	5	31	1955	Walter L. Weakland	Clarinda Water Works	1004	5	40	44	20.0	95	1	14.3	5	5	srg	40	44	20.0	95	1	14.5	5	5	lig	crh
3	Clarinda	6	1	1955	5	2	1963	Wayne D. Fuller	Clarinda Water Works	1004	5	40	44	20.0	95	1	14.3	5	5	srg	40	44	20.0	95	1	14.5	5	5	lig	crh
4	Clarinda	5	3	1963	11	1	1965	Harold L. Davis	221 N. 19th St.	1075	5	40	44	24.8	95	2	30.9	5	3	srg	40	44	24.7	95	2	30.8	5	2	lig	crh
4	Clarinda	11	2	1965	8	29	1976	Harold L. Davis	221 N. 19th St.	1074	5	40	44	24.8	95	2	30.6	5	3	srg	40	44	24.7	95	2	30.5	5	2	lig	crh
5	Clarinda	8	30	1976	1	25	1984	Harold L. Davis	515 W. State St.	1114	5	40	44	33.7	95	2	31.2	5	4	srg	40	44	33.7	95	2	31.1	5	3	lig	crh
6	Clarinda	1	26	1984	9	30	1985	Harold L. Davis	302 S. 15th St.	1032	5	40	44	8.4	95	2	9.5	5	3	srg	40	44	8.5	95	2	9.5	5	3	lig	crh
7	Clarinda	10	1	1985	5	11	1986	Harold L. Davis	522 W. Main St.	1081	5	40	44	17.1	95	2	40.4	5	2	srg	40	44	17.1	95	2	40.4	5	2	mmts	mmts
8	Clarinda	5	12	1986	3	29	1988	Harold L. Davis	901 N. 16th St.	1020	5	40	44	45.6	95	2	15.1	5	3	srg	40	44	45.6	95	2	15.1	5	3	mmts	mmts
9	Clarinda	3	30	1988	5	9	1996	Robert S. Lydick	611 W. State St.	1120	5	40	44	33.2	95	2	44.3	5	3	srg	40	44	33.2	95	2	44.4	5	3	mmts	mmts
10	Clarinda	5	10	1996	2	13	1997	Robert S. Lydick	700 E. Chestnut St.	1016	5	40	44	25.5	95	1	48.0	5	3	srg	40	44	25.4	95	1	48.0	5	3	mmts	mmts
11	Clarinda	2	14	1997				Harry Ridnour	Waste Water Treatment Plant	975	5	40	43	28.3	95	1	8.8	5	5	srg	40	43	28.7	95	1	7.5	5	5	mmts	mmts

TABLE 3. HCN Station History Summary

map	HCN Station	Begin Date Mo	Da	Yr	End Date Mo	Da	Yr	Observer	Address	Elev	Elev Qual	srg lat deg	srg lat min	srg lat sec	srg lon deg	srg lon min	srg lon sec	srg lat/lon qual	srg expo	type prec gage	temp lat deg	temp lat min	temp lat sec	temp lon deg	temp lon min	temp lon sec	temp lat/lon qual	temp expo	type mx/mn	shelter
1	Fairfield	1	1	1893	2	28	1894	J. Fred Clarke	706 N. 3rd St.?	740	4	41	0	54	91	57	58.9	2	2	?	41	0	54	91	57	58.9	2	1	?	?
1	Fairfield	6	4	1894	9	30	1900	C. J. Fulton	706 N. 3rd St.?	740	4	41	0	54	91	57	58.9	2	2	?	41	0	54	91	57	58.9	2	1	?	?
1	Fairfield	12	5	1901	6	14	1902	William W. Mendenhall	706 N. 3rd St.?	740	4	41	0	54	91	57	58.9	2	2	?	41	0	54	91	57	58.9	2	1	?	?
1	Fairfield	6	15	1902	11	30	1902	J. C. Blackford	706 N. 3rd St.?	740	4	41	0	54	91	57	58.9	2	2	?	41	0	54	91	57	58.9	2	1	?	?
1	Fairfield	1	1	1908	1	19	1947	R. Monroe McKenzie	706 N. 3rd St.?	740	4	41	0	54	91	57	58.9	2	2	srg	41	0	54	91	57	58.9	2	1	lig	crh
1	Fairfield	1	20	1947	7	21	1955	Paul B. Selz	706 N. 3rd St.?	740	4	41	0	54	91	57	58.9	2	2	srg	41	0	54	91	57	58.9	2	1	lig	crh
2	Fairfield	7	22	1955	7	6	1956	Frederick P. Ford	701 N. 3rd St.	763	5	41	0	50.5	91	57	57.7	5	3	srg	41	0	50.5	91	57	57.7	5	2	lig	crh
3	Fairfield	7	7	1956	10	6	1963	Frederick P. Ford	302 W. Stone St.	769	5	41	0	48.9	91	58	0.4	5	4	srg	41	0	48.9	91	58	0.2	5	3	lig	crh
4	Fairfield	10	7	1963	3	15	1977	City Water Works	City Water Works	742	5	41	1	6.5	91	57	17.9	5	5	srg	41	1	6.2	91	57	17.8	5	3	lig	crh
4	Fairfield	3	16	1977	8	28	1985	City Water Works	City Water Works	746	5	41	1	5.0	91	57	16.6	5	4	srg	41	1	5.0	91	57	16.5	5	3	lig	crh
4	Fairfield	8	29	1985				City Water Works	City Water Works	746	5	41	1	5.0	91	57	16.6	5	4	mmts	41	1	4.7	91	57	14.8	5	3	mmts	mmts
	Fort Dodge	12	7	1899	9	30	1902	W. A. Turpin	Tobin College?	1080	1	42	30	14	94	11	32	1	?	?	42	30	14	94	11	32	1	?	?	?
	Fort Dodge	1	3	1903	2	28	1903	O. F. Beu	Tobin College?	1080	1	42	30	14	94	11	32	1	?	?	42	30	14	94	11	32	1	?	?	?
	Fort Dodge	5	1	1903	6	30	1903	W. E. Humphrey	Tobin College?	1080	1	42	30	14	94	11	32	1	?	?	42	30	14	94	11	32	1	?	?	?
	Fort Dodge	7	1	1903	9	11	1903	Stephens	Tobin College?	1080	1	42	30	14	94	11	32	1	?	?	42	30	14	94	11	32	1	?	?	?
	Fort Dodge	9	17	1903	5	30	1919	John F. Monk	Tobin College	1080	1	42	30	14	94	11	32	1	3	srg	42	30	14	94	11	32	1	3	lig	crh
3	Fort Dodge	5	31	1919	10	31	1920	Isadore Haugh	221 N. 13th St.	1117	5	42	30	31.8	94	10	50.4	5	3	srg	42	30	31.8	94	10	50.4	5	2	lig	crh
4	Fort Dodge	11	5	1920	4	30	1922	Fred Heman	631 11th Ave. North	1093	5	42	30	56.7	94	11	37.5	5	3	srg	42	30	56.7	94	11	37.5	5	2	lig	crh
5	Fort Dodge	5	8	1922	5	15	1942	Emma Sampson	628 11th Ave. North	1096	5	42	30	59.5	94	11	38.0	5	3	srg	42	30	59.5	94	11	38.0	5	2	lig	crh
6	Fort Dodge	5	16	1942	3	31	1973	Fred F. Kratosky	1826 8th Ave. North	1111	5	42	30	50.7	94	10	21.6	5	3	srg	42	30	50.9	94	10	21.7	5	4	lig	crh
7	Fort Dodge	4	1	1973	10	24	1985	Radio KWMT	540 A Street	1131	5	42	29	42.5	94	12	27.3	5	4	srg	42	29	42.4	94	12	27.2	5	3	lig	crh
7	Fort Dodge	10	25	1985				Radio KWMT	540 A Street	1131	5	42	29	42.5	94	12	27.3	5	4	srg	42	29	42.4	94	12	27.2	5	3	mmts	mmts
1	Indianola	1	1	1893	8?	31?	1903?	John L. Tilton	Simpson College	970	4	41	21	54	93	33	50	3	5	?	41	21	54	93	33	50	3	5	lig	near S
2	Indianola	9?	1?	1903?	8	31	1920	John L. Tilton	west edge of town	955	2	41	21	47	93	35	4	1	3	srg	41	21	54	93	33	35.3	1	3	lig	near S
3	Indianola	1	26	1921	9	30	1943	Seth F. Shenton	711 W. 3rd Ave.	964	5	41	21	25.5	93	34	13.4	5	3	srg	41	21	25.5	93	34	13.4	5	3	lig	crh
5	Indianola	10	1	1943	11	6	1958	Francis I. Moats	1000 N. Howard St.	952	5	41	22	11.1	93	33	39.0	5	4	srg	41	22	11.4	93	33	38.7	5	4	lig	crh
6	Indianola	11	7	1958	6	5	1961	Donald H. Sherwood	412 W. Lincoln Ave.	950	5	41	22	24.8	93	33	59.0	5	4	srg	41	22	24.8	93	33	59.0	5	4	lig	crh
7	Indianola	6	6	1961	4	28	1965	Clarence L. Heskett	814 E. Franklin Ave.	958	5	41	22	0.5	93	33	4.9	5	4	srg	41	22	0.5	93	33	5.1	5	4	lig	crh
8	Indianola 2 SSW	4	29	1965	1	31	1975	Charles E. Blake	Water Works	819	5	41	20	24.6	93	34	32.1	5	5	srg	41	20	24.6	93	34	31.8	5	5	lig	crh
8	Indianola 2 SSW	2	1	1975	8	31	1983	Karl W. Bachof	Water Works	819	5	41	20	24.6	93	34	32.1	5	5	srg	41	20	24.6	93	34	31.8	5	5	lig	crh
9	Indianola	11	10	1983	3	31	1987	Thomas A. Curtis	1215 E. Girard St.	942	5	41	22	0.0	93	32	41.0	5	3	srg	41	22	0.0	93	32	41.0	5	3	lig	crh
9	Indianola	4	1	1987	7	31	1987	Sarah Curtis	1215 E. Girard St.	942	5	41	22	0.0	93	32	41.0	5	3	srg	41	22	0.0	93	32	41.0	5	3	mmts	mmts
10	Indianola	12	3	1987	12	31	1987	Radio KXLQ	2104 W. 2nd Ave.	971	5	41	21	24.2	93	35	21.5	5	5	srg	41	21	24.2	93	35	21.6	5	5	mmts	mmts
11	Indianola	5	13	1988				David Winston Sayre	413 W. 5th Ave.	940	5	41	21	18.1	93	33	58.1	5	3	srg	41	21	17.1	93	33	57.9	5	2	mmts	mmts
1	Iowa Falls	1	1	1893	12	4	1926	J. B. Parmelee	2 mi.E of Iowa Falls	1114	3	42	31	18	93	13	28	2	5	3"	42	31	18	93	13	28	2	1	lig	non S
2	Iowa Falls	12	5	1926	11?	1?	1930	Charles H. Gilbert	1 mi.N of Iowa Falls	1143	5	42	32	14.3	93	15	45.3	4	3	srg	42	32	14.3	93	15	45.3	4	4	lig	crh
2	Iowa Falls	11?	1?	1930	2	3	1938	Charles H. Gilbert	1 mi.N of Iowa Falls	1143	5	42	32	13.3	93	15	45.5	4	3	srg	42	32	14.3	93	15	45.3	4	4	lig	crh
2	Iowa Falls	2	4	1938	6?	1?	1938	Charles H. Gilbert	1 mi.N of Iowa Falls	1143	5	42	32	13.3	93	15	45.5	4	3	srg	42	32	14.3	93	15	45.3	4	4	lig	crh
2	Iowa Falls	6?	1?	1938	10	8	1954	Charles H. Gilbert	1 mi.N of Iowa Falls	1143	5	42	32	14.3	93	15	47.5	4	5	srg	42	32	14.3	93	15	45.3	4	4	lig	crh
3	Iowa Falls	11	2	1954	5	20	1957	John W. Skidmore	Ellsworth College	1128	5	42	31	37.2	93	15	59.9	5	5	srg	42	31	37.1	93	15	45.3	5	5	lig	crh
4	Iowa Falls	5	21	1957	6	12	1957	Guy W. Burton	Water Works	1090	5	42	31	38.3	93	15	43.8	5	5	srg	42	31	38.3	93	15	43.8	5	5	lig	crh
5	Iowa Falls	6	13	1957	11	20	1961	Carl Hamilton	403 Jason	1100	5	42	31	18.9	93	16	27.1	5	4	srg	42	31	18.9	93	16	27.1	5	4	lig	crh
6	Iowa Falls 1 W	11	21	1961	10	12	1969	Emerson R. Calkins	U. S. Highway 20 west	1088	5	42	31	2.4	93	18	23.3	5	3	srg	42	31	2.3	93	18	23.3	5	3	lig	crh
7	Iowa Falls 1 E	10	13	1969	9	8	1974	Russell J. Hensing	County Road D-15 east	1114	5	42	31	17.8	93	13	28.2	5	5	srg	42	31	17.8	93	13	28.8	5	5	lig	crh
7	Iowa Falls	9	9	1974	10	12	1977	Russell J. Hensing	County Road D-15 east	1114	5	42	31	17.8	93	13	28.2	5	5	srg	42	31	17.8	93	13	28.8	5	5	lig	crh
8	Iowa Falls	10	13	1977	7	31	1984	Donald M. Hey	1016 River St.	1125	5	42	31	35.1	93	16	2.7	5	3	srg	42	31	35.1	93	16	2.4	5	2	lig	crh
9	Iowa Falls	5	1	1985	8	9	1992	Mark Hamilton	115 Foster Blvd.	1090	5	42	31	3.3	93	16	10.2	5	3	srg	42	31	3.3	93	16	10.2	5	3	mmts	mmts
10	Iowa Falls	8	10	1992	3	1	1996	Francis I. Janssen	Water Pollution Control Plant	1044	5	42	31	7.2	93	15	13.0	5	4	srg	42	31	7.3	93	15	12.9	5	4	mmts	mmts
10	Iowa Falls	3	2	1996	6	27	1996	Francis I. Janssen	Water Pollution Control Plant	1051	5	42	31	8.2	93	15	12.6	5	3	srg										
10	Iowa Falls	6	28	1996				Francis I. Janssen	Water Pollution Control Plant	1051	5	42	31	8.2	93	15	12.6	5	3	srg	42	31	8.1	93	15	12.5	5	3	mmts	mmts
	Logan	1	1	1893	10	31	1904	Millicent B. Stern	?	1096	1	41	38	40	95	47	22	2	?	?	41	38	40	95	47	22	2	?	?	?
	Logan	11	1	1904	7	31	1914	Glenn H. Stern	3rd St.	1094	5	41	38	50	95	47	11	2	3	3"	41	38	50	95	47	11	2	1	lig	non S
	Logan	8	1	1914	10	31	1918	Ted Stern	3rd St.	1094	5	41	38	50	95	47	11	2	3	3"	41	38	50	95	47	11	2	1	lig	non S
	Logan	11	1	1918	5	5	1927	Mary Jean Stern	3rd St.	1094	5	41	38	50	95	47	11	2	3	3"	41	38	50	95	47	11	2	1	lig	non S
3	Logan	5	6	1927	5	3	1955	Amy Ann Stern	402 W. 7th St.	1190	5	41	38	35.3	95	47	41.7	5	3	srg	41	38	35.3	95	47	41.8	5	2	lig	crh
3	Logan	5	4	1955	11	4	1960	Amy Ann Stern	402 W. 7th St.	1191	5	41	38	35.3	95	47	42.6	5	3	srg	41	38	35.3	95	47	41.8	5	2	lig	crh
4	Logan	11	5	1960	3	29	1966	M. C. Minshall	110 S. Elm Ave.	1115	5	41	38	32.2	95	47	36.4	5	3	srg	41	38	33.4	95	47	36.4	5	2	lig	crh
5	Logan	3	30	1966	5	8	1967	Louis E. Allstot	County Jail	1094	5	41	38	33.7	95	47	24.0	5	3	srg	41	38	33.7	95	47	24.2	5	2	lig	crh
6	Logan	5	9	1967	7	22	1973	Howard A. Holben	315 2nd Ave.	1102	5	41	38	46.2	95	47	22.2	5	3	srg	41	38	46.1	95	47	22.2	5	3	lig	crh
6	Logan	7	23	1973	1	31	1988	Howard A. Holben	315 2nd Ave.	1101	5	41	38	45.3	95	47	22.1	5	2	srg	41	38	45.3	95	47	22.2	5	2	lig	crh
7	Logan	5	2	1988	2	28	2002	Robert Salter	Water Pollution Control Plant	1030	5	41	38	17	95	47	16	5	4	srg	41	38	17	95	47	16	5	4	mmts	mmts
7	Logan	3	1	2002				Scott Muxfeldt	Water Pollution Control Plant	1030	5	41	38	17	95	47	16	5	4	srg	41	38	17	95	47	16	5	4	mmts	mmts

TABLE 3. HCN Station History Summary

map	HCN Station	Begin Date Mo	Begin Date Da	Begin Date Yr	End Date Mo	End Date Da	End Date Yr	Observer	Address	Elev	Elev Qual	srg lat deg	srg lat min	srg lat sec	srg lon deg	srg lon min	srg lon sec	srg lat/lon qual	srg expo	type prec gage	temp lat deg	temp lat min	temp lat sec	temp lon deg	temp lon min	temp lon sec	temp lat/lon qual	temp expo	type mx/mn	shelter
	Mount Ayr	1	1	1893	12	31	1893	William Shriver	?										?	?								?	?	?
	Mount Ayr	3	1	1895	7	31	1895	H. C. Beard	?	1230	1	40	42	52	94	14	21	1	?	?	40	42	52	94	14	21	1	?	?	?
	Mount Ayr	8	1	1895	2	28	1897	J. W. Beard	?	1230	1	40	42	52	94	14	21	1	?	?	40	42	52	94	14	21	1	?	?	?
	Mount Ayr	3	1	1897	6	16	1912	A. F. Beard	in town	1230	1	40	42	52	94	14	21	1	4	srg	40	42	52	94	14	21	1	1	lig	non S
3	Mount Ayr	6	17	1912	11	15	1926	Alex Maxwell	half mile NE of previous	1220	4	40	42	53	94	13	48	4	4	srg	40	42	53	94	13	48	4	3	lig	crh
4	Mount Ayr	11	15	1926	4	22	1927	Owen Hamersly	Lot 60, 2 bl N, 5 bl W of old	1238	4	40	43	0	94	14	5	4	4	srg	40	43	0	94	14	5	4	3	lig	crh
3	Mount Ayr	4	23	1927	6	30	1928	Alex Maxwell	8 blocks E of P. O.	1220	4	40	42	53	94	13	48	4	4	srg	40	42	53	94	13	48	4	3	lig	crh
3	Mount Ayr	7	1	1928	8	31	1928	S. E. Hollen	same	1220	4	40	42	53	94	13	48	4	4	srg	40	42	53	94	13	48	4	3	lig	crh
5	Mount Ayr	9	1	1928	4	30	1933	E. O. Gleason	2 bl S & 1.5 bl W of old; 6 bl E & 2 bl S of P.O	1225	4	40	42	46	94	13	54	4	4	srg	40	42	46	94	13	54	4	3	lig	crh
	Mount Ayr	5	1	1933	11	30	1934	E. O. Gleason	1 mi W of P.O.; 1.5 mi W of old	1180	1	40	42	53	94	15	8	1	4	srg	40	42	53	94	15	8	1	3	lig	crh
7	Mount Ayr	12	1	1934	?	?	1935?	Irene Rhoades Hood	48' SW of P.O. (funeral home)	1232	5	40	42	52.9	94	14	23.4	4	4	srg	40	42	52.9	94	14	23.4	4	3	lig	crh
8	Mount Ayr	?	?	1935?	2?	8?	1938	Irene Rhoades Hood	0.75 mi NW of P. O.	1205	2	40	43	15	94	14	28	2	3	srg	40	43	15	94	14	28	2	3	lig	crh
8	Mount Ayr	2?	8?	1938	9	17	1946	Irene Rhoades Hood	100' S & 50' W of old.	1205	2	40	43	14	94	14	28.5	2	4	srg	40	43	14	94	14	28.5	2	4	lig	crh
9	Mount Ayr 2 NNE	9	18	1946	7	28	1969	Howard L. Cornelison	Highway 344	1164	5	40	44	23.1	94	13	56.2	5	4	srg	40	44	23.0	94	13	56.2	5	3	lig	crh
10	Mount Ayr	7	29	1969	6	1	1970	Jack R. Terry	102 Shellway Dr.	1223	5	40	42	50.3	94	14	40.1	5	4	srg	40	42	50.4	94	14	40.2	5	3	lig	crh
11	Mount Ayr	6	2	1970	9	9	1975	Barton D. French	207 S. West St.	1201	5	40	42	46.5	94	14	37.3	5	4	srg	40	42	46.1	94	14	36.8	5	4	lig	crh
11	Mount Ayr	9	10	1975	8	31	1977	Barton D. French	207 S. West St.	1202	5	40	42	46.8	94	14	36.6	5	4	srg	40	42	46.8	94	14	36.8	5	4	lig	crh
12	Mount Ayr	9	1	1977	4	30	1983	Rodney G. Stark	603 Cindy Dr.	1190	5	40	42	43.5	94	14	37.0	5	4	srg	40	42	43.4	94	14	37.1	5	4	lig	crh
13	Mount Ayr 5 SW	9	1	1983	4	23	1986	Kurt L. Randles		1187	5	40	39	13.4	94	17	33.5	5	4	srg	40	39	13.4	94	17	33.5	5	3	lig	crh
14	Mount Ayr 4 SW	4	24	1986				Kurt L. Randles	1928 County Rd. J43	1135	5	40	40	57.9	94	17	41.9	5	2	srg	40	40	58.0	94	17	41.7	5	2	mmts	mmts
1	Mount Pleasant	3	1	1894	8	31	1898	Max E. Witte, M.D.	Iowa Mental Hospital	720	4	40	57	15	91	32	11	3	4	srg	40	57	15	91	32	11	3	4	lig	crh
1	Mount Pleasant	9	1	1898	1	31	1904	Frank T. Stevens, M.D	Iowa Mental Hospital	720	4	40	57	15	91	32	11	3	4	srg	40	57	15	91	32	11	3	4	lig	crh
2	Mount Pleasant	2	1	1904	?	?	1911?	J. W. Edwards	206 N. Jefferson St.	728	5	40	58	5.8	91	33	15.8	5	3	srg	40	58	6.0	91	33	14.8	5	1	lig	none
2	Mount Pleasant	?	?	1911?	9	5	1918	J. W. Edwards	206 N. Jefferson St.	728	5	40	58	5.8	91	33	15.8	5	3	srg	40	58	6.0	91	33	14.8	5	2	lig	crh
3	Mount Pleasant	9	6	1918	3	31	1937	John H. Jericho	302 N. Main St.	728	5	40	58	8.4	91	33	9.3	5	2	srg	40	58	8.4	91	33	9.4	5	2	lig	crh
1	Mount Pleasant	4	1	1937	8	31	1941	Lewis Peterson	Iowa Mental Hospital	720	4	40	57	15	91	32	11	3	4	srg	40	57	15	91	32	11	3	4	lig	crh
1	Mount Pleasant	9	1	1941	10	15	1944	Robert E. Jones	Iowa Mental Hospital	720	4	40	57	15	91	32	11	3	4	srg	40	57	15	91	32	11	3	4	lig	crh
4	Mount Pleasant	10	16	1944	6	27	1948	Arthur M. Patterson	401 Broadway	720	5	40	58	12.3	91	33	16.8	5	3	srg	40	58	12.3	91	33	16.6	5	3	lig	crh
4	Mount Pleasant	6	28	1948	11	16	1948	Arthur M. Patterson	401 Broadway	720	5	40	58	12.3	91	33	16.8	5	3	srg	40	58	12.3	91	33	16.6	5	3	lig	crh
5	Mount Pleasant	11	17	1948	9	10	1963	Arthur M. Patterson	807 S. Main St.	709	5	40	57	27.6	91	33	17.1	5	3	srg	40	57	27.6	91	33	16.7	5	2	lig	crh
6	Mount Pleasant	9	11	1963	5	21	1964	Gilbert S. Cantwell	604 W. Henry St.	697	5	40	58	8.7	91	33	37.3	5	3	srg	40	58	8.7	91	33	37.4	5	3	lig	crh
6	Mount Pleasant	5	22	1964	4	6	1970	Gilbert S. Cantwell	604 W. Henry St.	696	5	40	58	8.7	91	33	37.7	5	3	srg	40	58	8.7	91	33	37.8	5	3	lig	crh
7	Mount Pleasant	4	7	1970	7	25	1972	Leo Turley	1.3 mi. SSE of P. O.	711	5	40	56	47.2	91	33	28.8	5	4	srg	40	56	47.1	91	33	28.1	5	4	lig	crh
7	Mount Pleasant	7	26	1972	11	5	1985	Leo Turley	1.3 mi. SSE of P. O.	711	5	40	56	47.2	91	33	28.8	5	4	srg	40	56	47.1	91	33	28.1	5	4	lig	crh
8	Mount Pleasant 1 SSW	11	6	1985				John Kuhens	Radio KILJ	700	5	40	56	55.9	91	33	55.8	5	5	srg	40	56	56.8	91	33	55.9	5	1	mmts	mmts
	Rockwell City	10	13	1893	8	31	1894	G. B. Rigg	?	1230	4	42	23	45	94	38	3	1	?	?	42	23	45	94	38	3	1	?	none	none
	Rockwell City	9	1	1894	4	30	1898	G. B. Rigg	?	1230	4	42	23	45	94	38	3	1	?	?	42	23	45	94	38	3	1		?	?
	Rockwell City	5	1	1898	10	16	1916	C. M. Randall	?	1230	4	42	23	45	94	38	3	1	?	?	42	23	45	94	38	3	1		?	?
3	Rockwell City	10	17	1916	3	31	1932	A. W. McIsaac	628 Pleasant St.	1228	5	42	23	54.0	94	38	15.2	5	4	srg	42	23	54.0	94	38	15.2	5	3	lig	crh
4	Rockwell City	4	11	1932	6	8	1937	E. H. Boicourt	317 Richmond St.	1219	5	42	23	35.0	94	37	56.1	5	3	srg	42	23	35.3	94	37	56.3	5	3	lig	crh
4	Rockwell City	6	9	1937	2	4	1938	E. H. Boicourt	317 Richmond St.	1220	5	42	23	35.2	94	37	56.1	5	4	srg	42	23	35.3	94	37	56.3	5	3	lig	crh
4	Rockwell City	2	5	1938	3	28	1939	E. H. Boicourt	317 Richmond St.	1220	5	42	23	35.2	94	37	56.1	5	4	srg	42	23	35.3	94	37	56.3	5	3	lig	crh
5	Rockwell City	3	29	1939	4	29	1946	F. C. Beitelspacher	110 E. Lake St.	1219	5	42	23	50.7	94	37	46.7	5	3	srg	42	23	50.8	94	37	46.7	5	2	lig	crh
5	Rockwell City	4	30	1946	10	3	1961	F. C. Beitelspacher	110 E. Lake St.	1216	5	42	23	50.7	94	37	46.4	5	3	srg	42	23	50.6	94	37	46.4	5	2	lig	crh
6	Rockwell City	10	4	1961	7	16	1968	Edward A. Ludwig	419 Richmond	1230	5	42	23	35.5	94	38	3.1	5	3	srg	42	23	35.5	94	38	2.9	5	2	lig	crh
6	Rockwell City	7	17	1968	9	9	1986	Edward A. Ludwig	419 Richmond	1230	5	42	23	35.5	94	38	3.1	5	3	srg	42	23	35.5	94	38	2.9	5	2	lig	crh
6	Rockwell City	9	10	1986	6	7	1994	Edward A. Ludwig	419 Richmond	1230	5	42	23	35.5	94	38	3.1	5	3	srg	42	23	35.5	94	38	2.9	5	2	mmts	mmts
7	Rockwell City	6	8	1994	6	14	1995	Phil R. Heinlen	409 Richmond	1230	5	42	23	35.5	94	38	2.1	5	3	srg	42	23	35.8	94	38	2.0	5	2	mmts	mmts
8	Rockwell City	6	15	1995				Janet K. Lindstrom	117 E. Lake St.	1224	5	42	23	48.7	94	37	45.0	5	4	srg	42	23	48.2	94	37	45.2	5	3	mmts	mmts

TABLE 3. HCN Station History Summary

map	HCN Station	Begin Date Mo	Da	Yr	End Date Mo	Da	Yr	Observer	Address	Elev	Elev Qual	srg lat deg	srg lat min	srg lat sec	srg lon deg	srg lon min	srg lon sec	srg lat/lon qual	srg expo	type prec gage	temp lat deg	temp lat min	temp lat sec	temp lon deg	temp lon min	temp lon sec	temp lat/lon qual	temp expo	type mx/mn	shelter
1	Storm Lake	1	1	1893	12	31	1893	A. J. Bond	From Form 530-1	1431	5	42	38	35	95	11	33	5	?	?	42	38	35	95	11	33	5	?	?	?
	Storm Lake	10	14	1898	8	5	1902	M. L. Fuller	?	1430	3	42	38	35	95	12	14	1	?	?	42	38	35	95	12	14	1	?	?	?
	Storm Lake	8	6	1902	11	30	1903	L. E. Burdick	?	1430	3	42	38	35	95	12	14	1	?	?	42	38	35	95	12	14	1	?	?	?
3	Storm Lake	12	1	1903	5	31	1906	C. E. Burdick	602 Otsego St.	1428	5	42	38	40.5	95	12	24.2	5	4	3"	42	38	40.5	95	12	24.2	5	3	lig	non S
	Storm Lake	11	1	1906	7	12	1908	Ralph H. Carr	at College?	1430	3	42	38	40	95	12	31	1	?	?	42	38	40	95	12	31	1	?	lig	?
	Storm Lake	7	13	1908	8	31	1910	S. B. Fracker	at College?	1430	3	42	38	40	95	12	31	1	?	?	42	38	40	95	12	31	1	?	lig	?
	Storm Lake	9	1	1910	5	31	1913	numerous	at College?	1430	3	42	38	40	95	12	31	1	?	?	42	38	40	95	12	31	1	?	lig	?
5	Storm Lake	6	1	1913	11	30	1928	George H. Fracker	420 Geneseo St.	1427	5	42	38	29.8	95	12	14.0	5	3	srg	42	38	29.8	95	12	14.0	5	3	lig	?
6	Storm Lake	12	1	1928	2	28	1930	L. B. Florey	410 Geneseo St.	1427	5	42	38	28.4	95	12	14.0	5	3	srg	42	38	28.4	95	12	14.0	5	3	lig	crh
7	Storm Lake	3	1	1930	11	30	1935	Russel M. Edwards	0.5 mi W of P. O.. 450' from lake	1422	4	42	38	28	95	12	39	2	3	srg	42	38	28.5	95	12	39	2	3	lig	crh
8	Storm Lake	12	1	1935	8	20	1941	Russel M. Edwards	1600' E of old site:750' from lake	1422	4	42	38	22.4	95	12	14	2	3	srg	42	38	22	95	12	14	2	3	lig	crh
9	Storm Lake	8	21	1941	11	30	1948	Paul Vance	DeKalb Seed Plant	1415	3	42	38	2	95	10	50	2	4	srg	42	38	2	95	10	50	2	4	lig	crh
10	Storm Lake 2 E	12	1	1948	?	?	1956?	Radio KAYL	Highway 71 East	1428	5	42	38	4.6	95	10	10.1	5	4	srg	42	38	4.7	95	10	10.4	5	4	lig	crh
10	Storm Lake 2 E	?	?	1956?	10	13	1986	Radio KAYL	Highway 71 East	1428	5	42	38	4.2	95	10	10.1	5	4	srg	42	38	4.3	95	10	10.4	5	4	lig	crh
10	Storm Lake 2 E	10	14	1986				Radio KAYL	Highway 71 East	1428	5	42	38	4.2	95	10	10.1	5	4	srg	42	38	4.4	95	10	10.2	5	4	mmts	mmts
	Toledo	1	1	1894	6	30	1899	Charles Mason	?	880	3	41	59	53	92	34	36	2	?	?	41	59	53	92	34	36	2	?	?	?
	Toledo	7	1	1899	8	31	1902	Lulu G. Bookwalter	?	910	2	41	59	42	92	34	27	1	?	?	41	59	42	92	34	27	1	?	?	?
	Toledo	9	1	1902	9	1	1906	Herbert Paul Giger	?	910	2	41	59	42	92	34	27	1	?	?	41	59	42	92	34	27	1	?	?	?
3	Toledo	9	2	1906	5	31	1927	I. F. Giger	4 bl N; 1 bl W of 408 E.So St.	894	4	41	59	53	92	34	28	3	3	srg	41	59	53	92	34	28	3	3	lig	crh
3	Toledo	6	1	1927	5?	1?	1928?	Herbert Paul Giger	4 bl N; 1 bl W of 408 E.So St.	894	4	41	59	53	92	34	28	3	3	srg	41	59	53	92	34	28	3	3	lig	crh
4	Toledo	5?	1?	1928?	10	13	1959	Herbert Paul Giger	408 E. South St.	920	5	41	59	37	92	34	23	5	3	srg	41	59	37	92	34	23	5	3	lig	crh
5	Toledo	10	14	1959	4	21	1964	Donald L. Anderson	610 E. High St.	902	5	41	59	43	92	34	15	5	4	srg	41	59	43	92	34	15	5	4	lig	crh
6	Toledo	4	22	1964	4	11	1984	Charles L. Patterson	Pioneer Hybrid Seed Co.	862	5	41	59	41	92	34	13	5	5	srg	41	59	41	92	34	13	5	5	lig	crh
6	Toledo	4	12	1984	9	30	1986	Charles L. Patterson	Pioneer Hybrid Seed Co.	862	5	41	59	30	92	34	58	5	5	srg	41	59	30	92	34	58	5	5	mmts	mmts
6	Toledo	10	1	1986	5	23	1994	Jeannene Rank	Pioneer Hybrid Seed Co.	862	5	41	59	30	92	34	58	5	5	srg	41	59	30	92	34	58	5	5	mmts	mmts
7	Toledo	5	24	1994	4	26	1999	Robert Buresh	207 N. Wilson	885	5	41	59	52	92	34	15	5	4	srg	41	59	52	92	34	15	5	4	mmts	mmts
8	Toledo 3 N	4	27	1999	7	31	2000	Thomas M. Cooper	2805 N. Highway 63	940	5	42	2	8	92	34	49	5	4	srg	42	2	8	92	34	50	5	4	mmts	mmts
8	Toledo 3 N	8	1	2000				Randy M. Cooper	2805 N. Highway 63	940	5	42	2	8	92	34	49	5	4	srg	42	2	8	92	34	50	5	4	mmts	mmts
1	Washington	1	1	1893	?	?	1914	William A. Cook	315 W. Main St.	756	5	41	17	57.1	91	41	42.7	5	2	2.5"	41	17	57.1	91	41	42.7	5	3	lig	non S
1	Washington	?	?	1914	9	8	1924	William A. Cook	315 W. Main St.	756	5	41	17	57.1	91	41	42.7	5	2	srg	41	17	57.1	91	41	42.7	5	3	lig	non S
2	Washington	9	9	1924	?	?	1932	D. D. Sherman	220 W. Jefferson	748	5	41	17	51.6	91	41	38.2	5	3	srg	41	17	51.6	91	41	38.2	5	2	lig	non S
2	Washington	?	?	1932	3	31	1937	D. D. Sherman	220 W. Jefferson	748	5	41	17	51.6	91	41	38.2	5	3	srg	41	17	51.6	91	41	38.2	5	2	lig	crh
3	Washington	4	1	1937	2	14	1938	Harvey Preston Wolf	331 E. Polk St.	752	5	41	17	17.8	91	41	17.2	5	3	srg	41	17	17.8	91	41	17.3	5	3	lig	crh
3	Washington	2	15	1938	?	?	1941?	Harvey Preston Wolf	331 E. Polk St.	752	5	41	17	17.8	91	41	16.7	5	3	srg	41	17	17.8	91	41	17.3	5	3	lig	crh
3	Washington	?	?	1941?	7	15	1942	Harvey Preston Wolf	331 E. Polk St.	752	5	41	17	17.8	91	41	16.7	5	3	srg	41	17	17.8	91	41	17.3	5	3	lig	crh
4	Washington	7	16	1942	10	31	1967	Clarence M. Logan	703 S. 3rd Ave.	753	5	41	17	37.2	91	41	23.9	5	3	srg	41	17	37.0	91	41	23.8	5	3	lig	crh
4	Washington	11	1	1967	4	10	1978	Robert H. Logan	703 S. 3rd Ave.	753	5	41	17	37.2	91	41	23.9	5	3	srg	41	17	37.0	91	41	23.8	5	3	lig	crh
4	Washington	4	11	1978	10	28	1986	Robert H. Logan	703 S. 3rd Ave.	753	5	41	17	37.2	91	41	23.9	5	3	srg	41	17	37.0	91	41	23.8	5	3	lig	crh
4	Washington	10	29	1986	9	14	1993	Robert H. Logan	703 S. 3rd Ave.	753	5	41	17	37.2	91	41	23.9	5	3	srg	41	17	37.0	91	41	23.8	5	3	mmts	mmts
5	Washington	9	15	1993	1	26	1999	Janice A. Newhouse	302 E. Jefferson St.	752	5	41	17	51.9	91	41	21.1	5	2	srg	41	17	51.7	91	41	21.1	5	2	mmts	mmts
6	Washington	1	28	1999				Waste Water Treatment	Waste Water Treatment Plant	690	5	41	16	57.9	91	42	24.5	5	5	srg	41	16	57.7	91	42	24.2	5	4	mmts	mmts

APPENDIX 1

Daylight Savings Time Adoption in Iowa

The implementation of so-called 'Daylight Savings Time' is of importance to the analysis of historical temperature trends in that it can potentially impact the magnitude of the time of observation bias in temperature records. A brief synopsis of the time periods of Daylight Savings Time use follows.

Summer Time.

The first uniform implementation of Daylight Savings Time came with the advent of the involvement of the United States in World War I. "Summer Time", as it was called then, was adopted beginning at 12 a.m. March 31, 1918 when clocks were advanced one hour. The return to Standard Time in the fall of 1918 apparently came on October 27, although this date could not be confirmed by any remarks in the Iowa climate record books. Summer Time was again observed from March 31, 1919 until October 26, 1919 when the state returned to Standard Time. It appears from the climate records that the Iowa weather observers kept the same 'clock' hour of observation during the transition between Standard and Summer Time. Thus, a 7 p.m. CST observer would continue their weather observations at 7 p.m. Summer Time (equivalent to 6 p.m. CST).

War Time.

The United States entry into World War II resulted in a return to Daylight Savings Time on February 9, 1942 when clocks were advanced one hour. During this time period the change was referred to as "War Time". War Time was used year-round until it ended at 2 a.m. September 30, 1945. Unlike the Summer Time experience virtually all Iowa weather observers continued to make their observation at the same 'solar time'. Thus, for example, observers previously using 7 p.m. CST observations began to use 8 p.m. War Time observations. However, at the end of the war the observation time practice was not uniform at all. Some observers went back to the previous CST observation time (such as 8 p.m. WT to 7 p.m. CST). Others kept the same hour of observation (8 p.m. WT to 8 p.m. CST). Still others went on to use entirely different observation times (always earlier in the evening).

Local Option Daylight Time.

Documentation of this practice is difficult to find. However, in the late 1950's into the early 1960's some Iowa communities adopted Daylight Savings Time on a local option basis. Among the Iowa HCN stations examined only Washington noted use of Daylight Time during this period (May ?, 1960 to Aug 28, 1960 and May 28, 1961 to Aug 27, 1961). At Washington the observer continued to use the same 'clock time' during the summer (6 p.m. CST to 6 p.m. CDT).

Statewide Daylight Time.

Iowa adopted Daylight Savings Time statewide in 1964 and 1965. In 1964 it began on April 26 and ended on September 6. In 1965 it began on May 30 and ended on September 7. In both years all of the Iowa HCN stations examined appeared to maintain the same 'clock time' during this period.

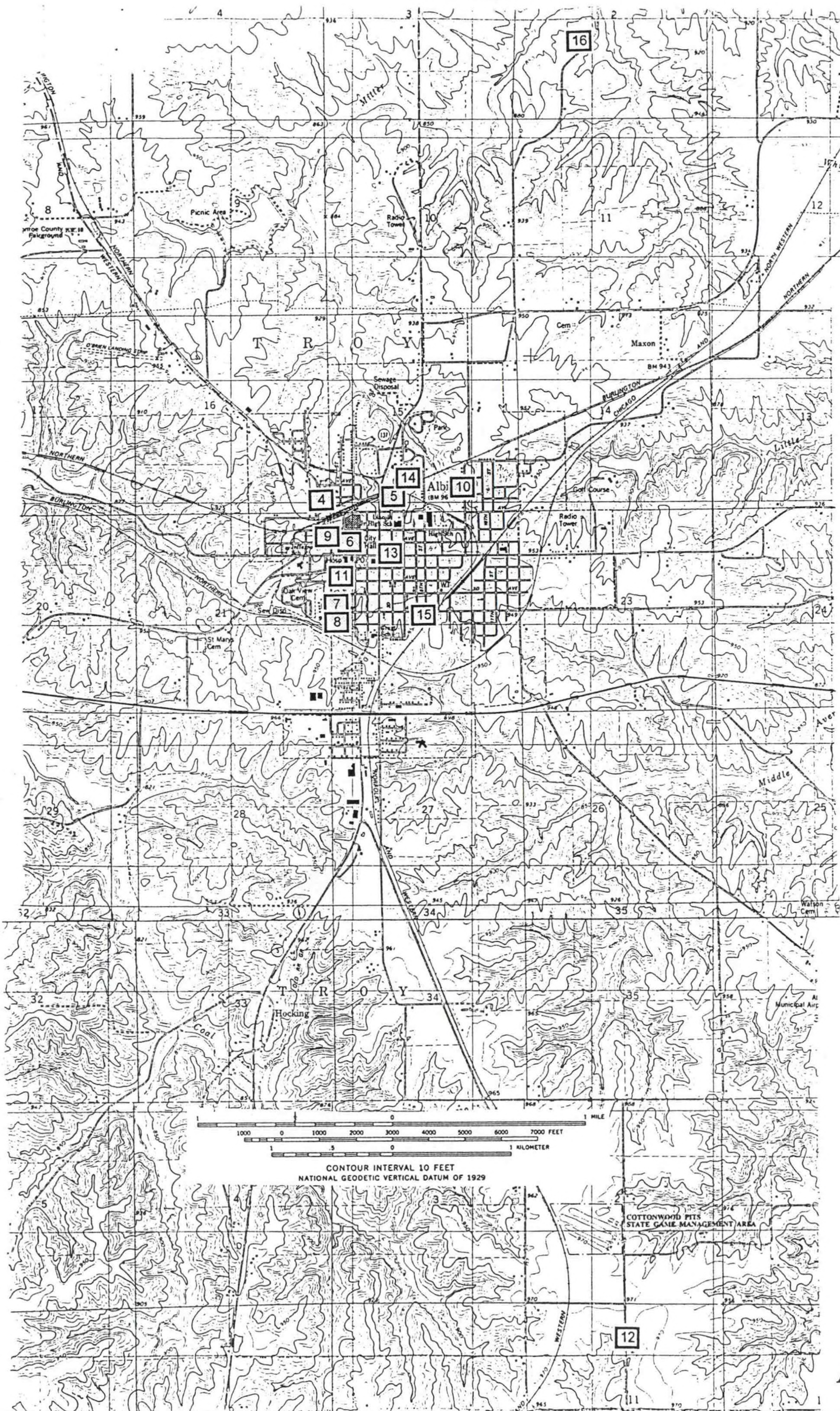
National Uniform Time Act

In 1966 the Uniform Time Act implemented Daylight Savings Time nationwide with the provision that some states or parts of states (for those in multiple time zones) could opt out of the use of Daylight Time. Iowa has always observed Daylight Savings Time since the Act was adopted. Beginning in 1966 and continuing through 1986 Daylight Time began at 2:00 a.m. on the last Sunday of April and ended at 2 a.m. on the last Sunday of October. The practice was changed in 1987 to begin Daylight Time on the first Sunday of April. An exception to this observational practice came during the Energy Crisis of the 1970's. In 1974 Daylight Time began on January 6 and ended at the usual time on the last Sunday of October. Then in 1975 Daylight Time began on February 23 and again ended on the last Sunday of October. Throughout the life of the Uniform Time Act it appears that all of the Iowa HCN stations examined as part of this project kept their observations on the same 'clock time'. However, it is known that a few Iowa stations (Columbus Junction and Clinton #1, for example) have maintained observance of the same 'sun time' for at least a portion of the 'modern' Daylight Time era.

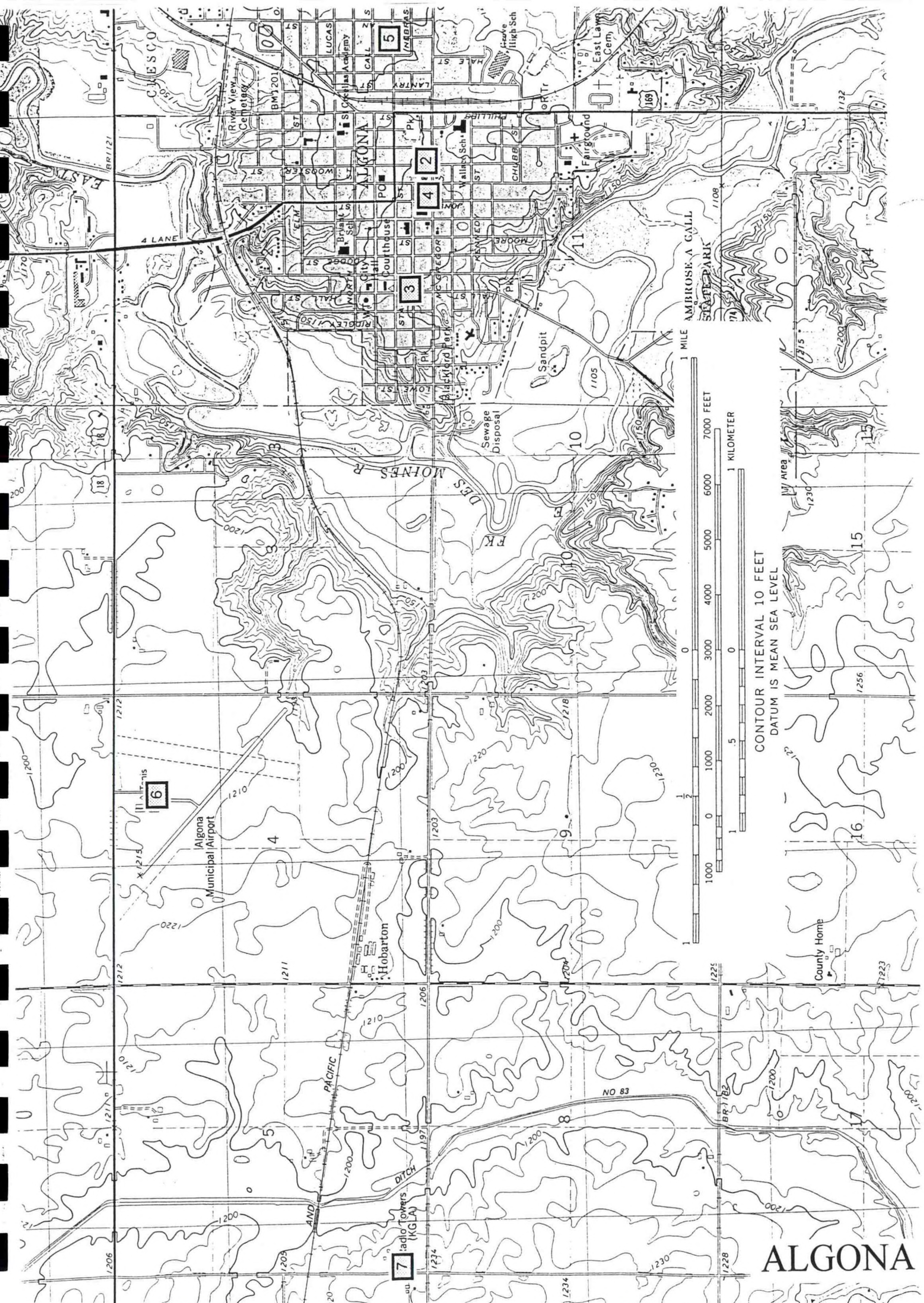
APPENDIX 2

City maps of HCN Locations

The numbers on these maps correspond to those given in the left most column of Table 3

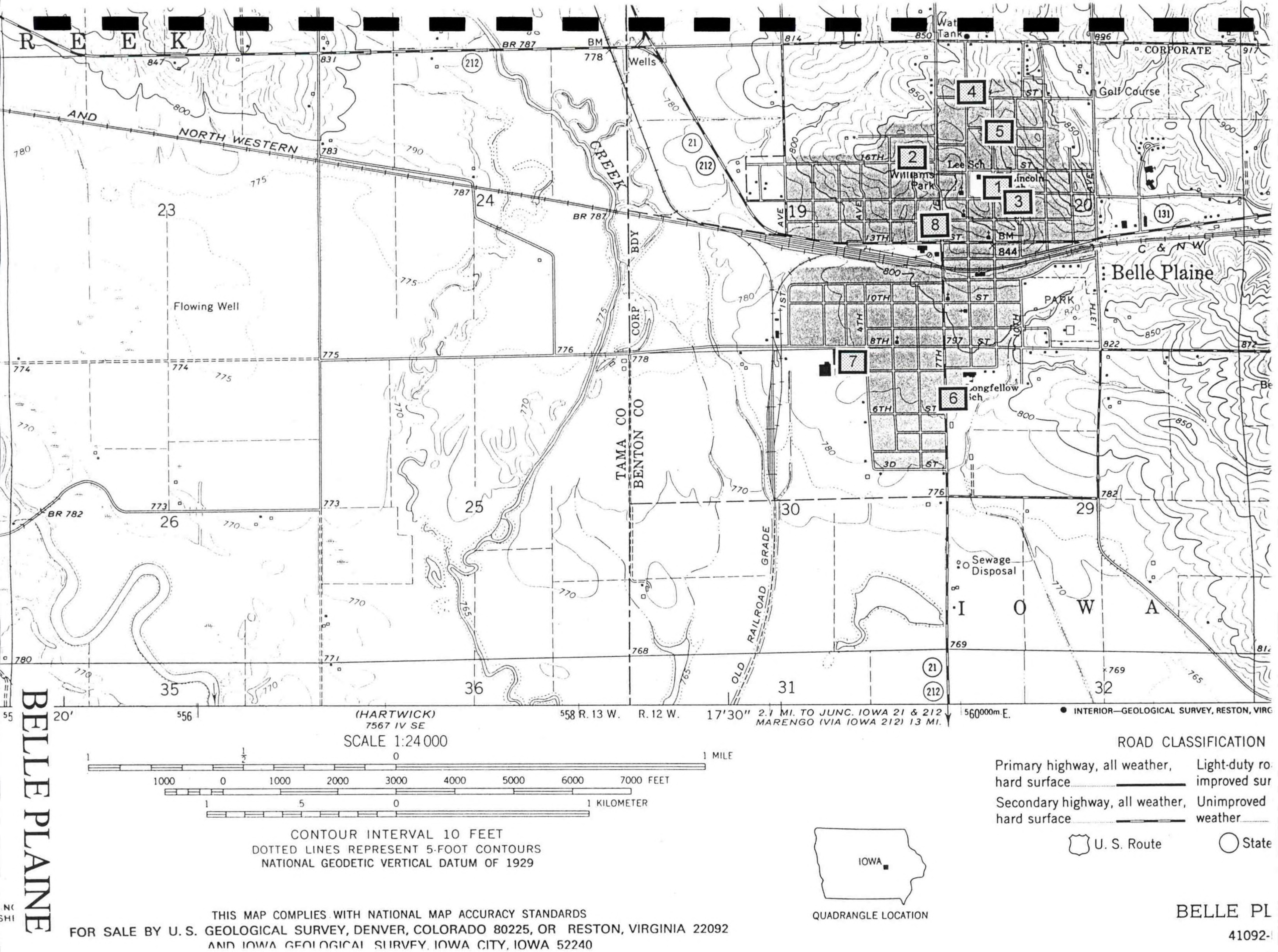

16
Picnic Area
Fairground
Radio Tower
T R O Y
Cem
Maxon
BM 943
Sewage Disposal
Park
BURLINGTON
CHICAGO
NORTHERN
NORTH WESTERN
Little
14
5
10
4
9
6
13
11
7
8
15
City Hall
High Sch
Golf Course
Radio Tower
Oak View Cem
Sew Disp
St Marys Cem
Middle
Watson Cem
T R O Y
Hocking
Coal
Municipal Airp
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
COTTONWOOD PITS
STATE GAME MANAGEMENT AREA
12

ALBIA



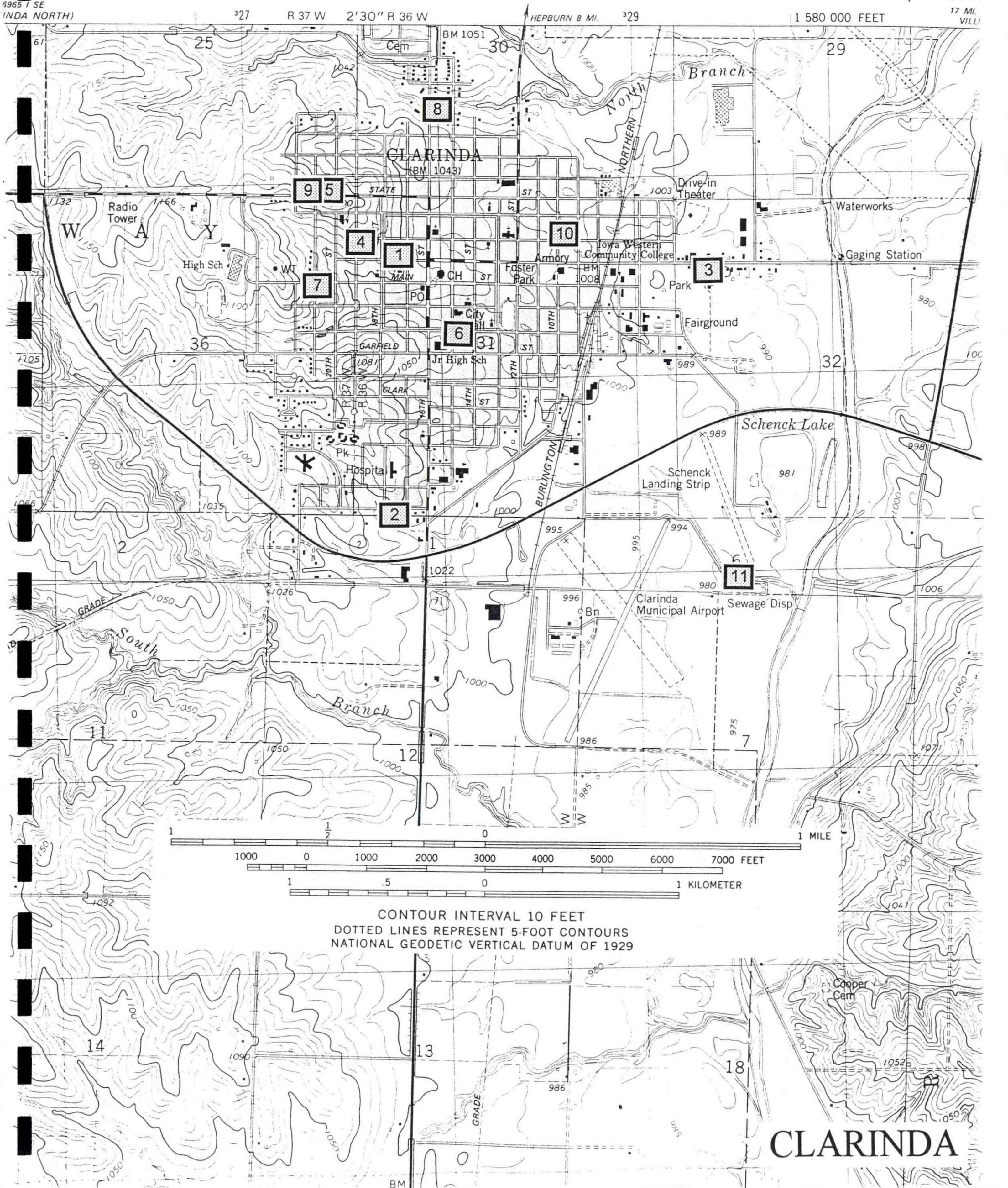
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
1 MILE
7000 FEET
1 KILOMETER
ALGONA
Courthouse
City Hall
PO
Bryant Sch
Wallace Sch
St Cecilias Academy
River View Cemetery
East Lawn Cem
Fairground
AMBROSE A CALL STATE PARK
Sandpit
Sewage Disposal
DES MOINES R
Algona Municipal Airport
Hobarton
County Home
Radio Towers (KGLA)
4 LANE
NO 83
PACIFIC
DITCH
2
3
4
5
6
7

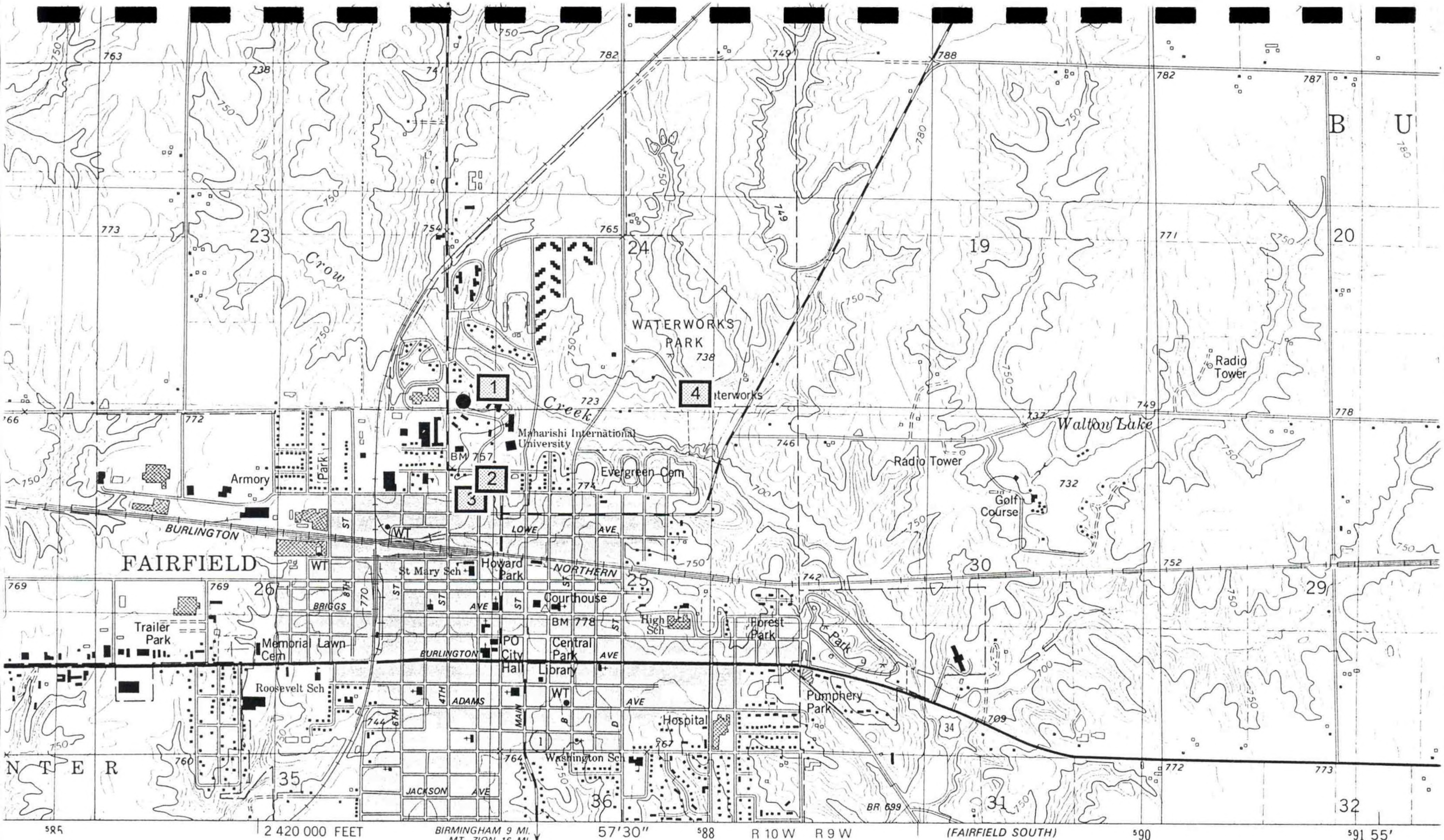
ALGONA



BELLE PLAINE

CLARINDA SOUTH QUADR
IOWA–PAGE CO.
7.5 MINUTE SERIES (TOPOGR





585 | 2 420 000 FEET | BIRMINGHAM 9 MI. MT. ZION 16 MI. | 57'30" | 588 | R 10 W R 9 W | (FAIRFIELD SOUTH) 7665 IV NW | 590 | 591 55'

FAIRFIELD

and ... shed by the Geological Survey
NOS
amr ... nethods from aerial photographs
neck ... 6. Map edited 1980
)-foo ... icks: Iowa coordinate
amb ... ormal conic)
Trai ... Mercator grid, zone 15
Dat
ted ... American Datum 1983
nes ... s north and
wn by dashed corner ticks

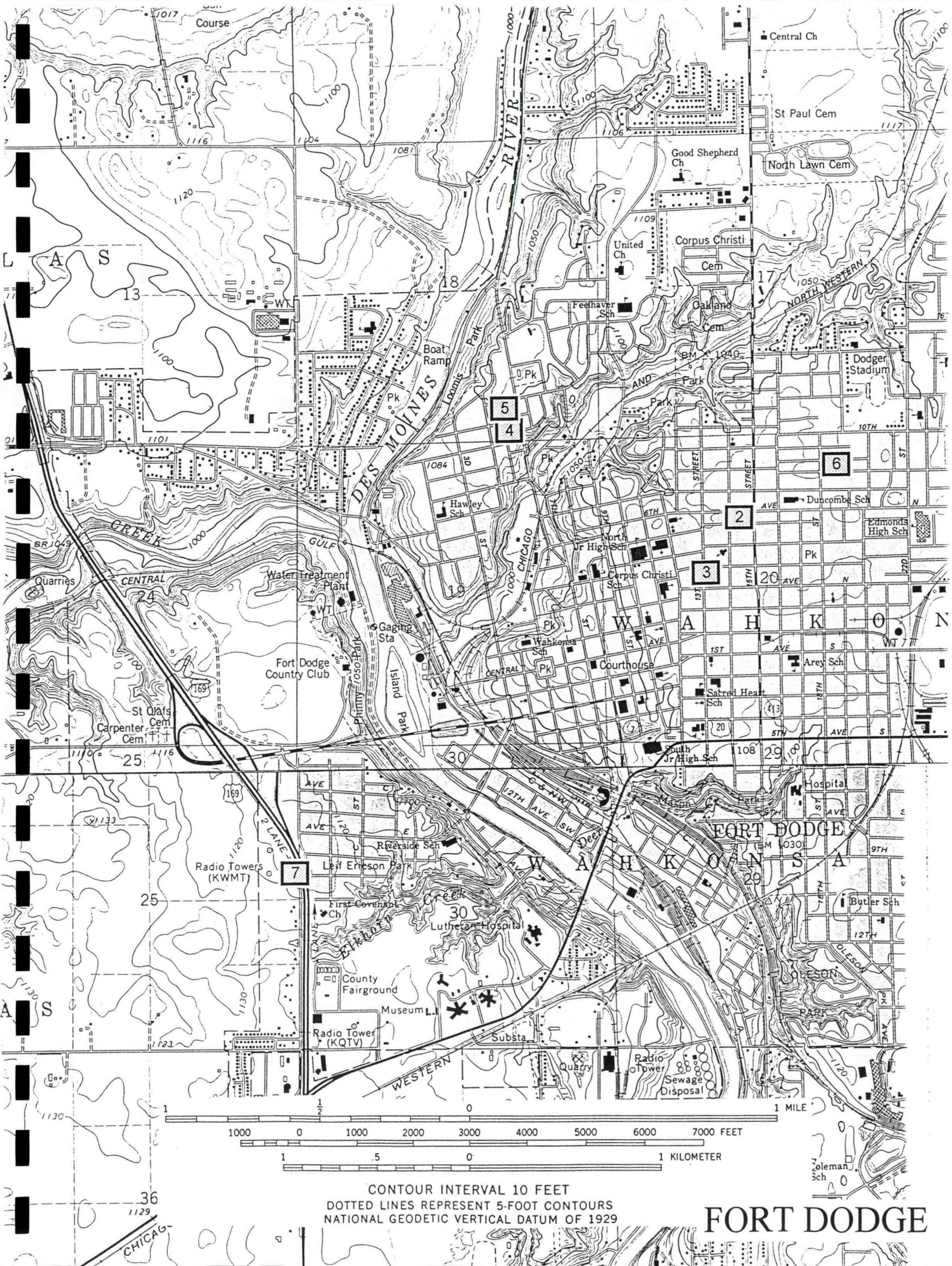
GN MN
0°42' 12 MILS
4½° 80 MILS
UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 ½ 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

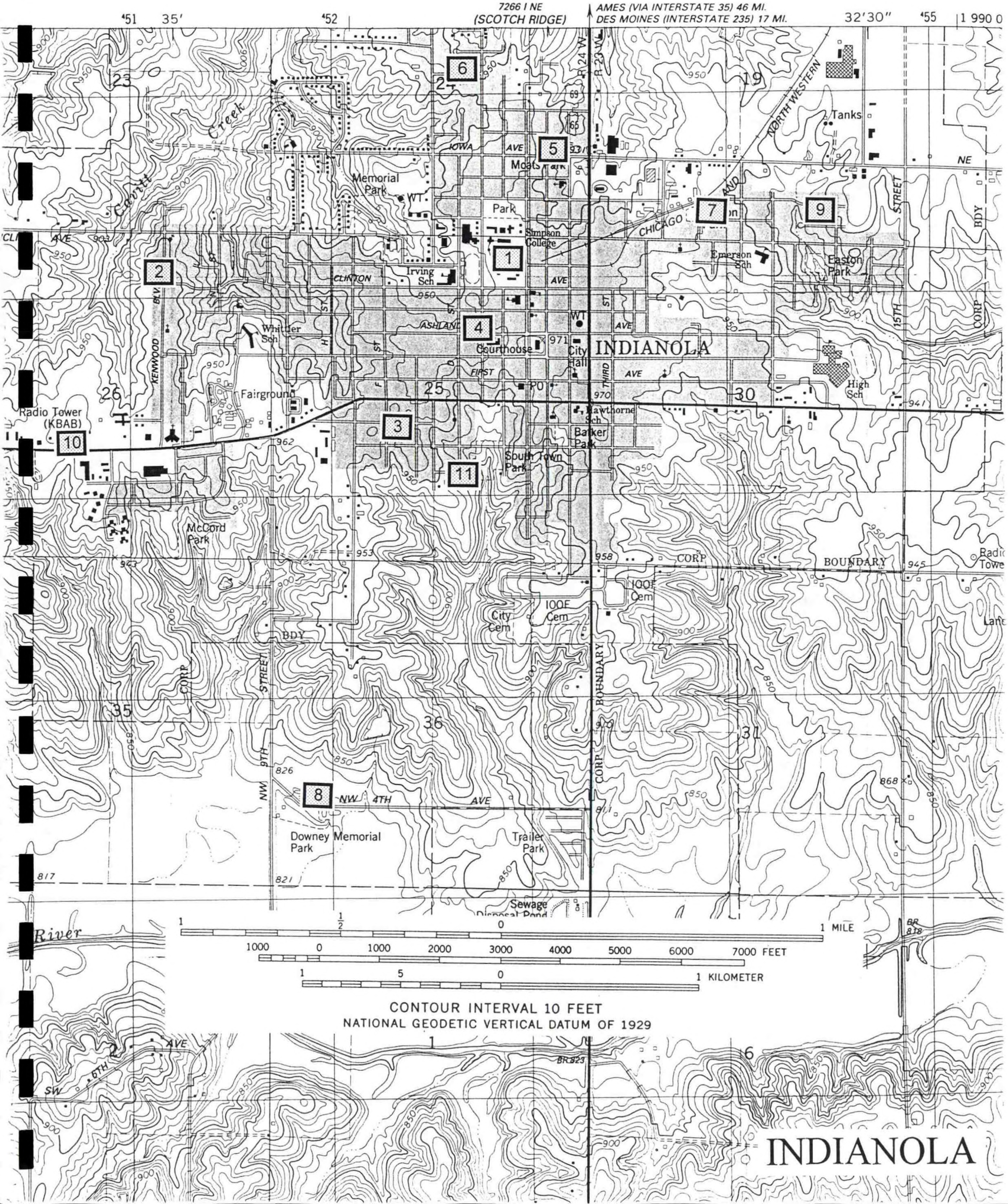
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

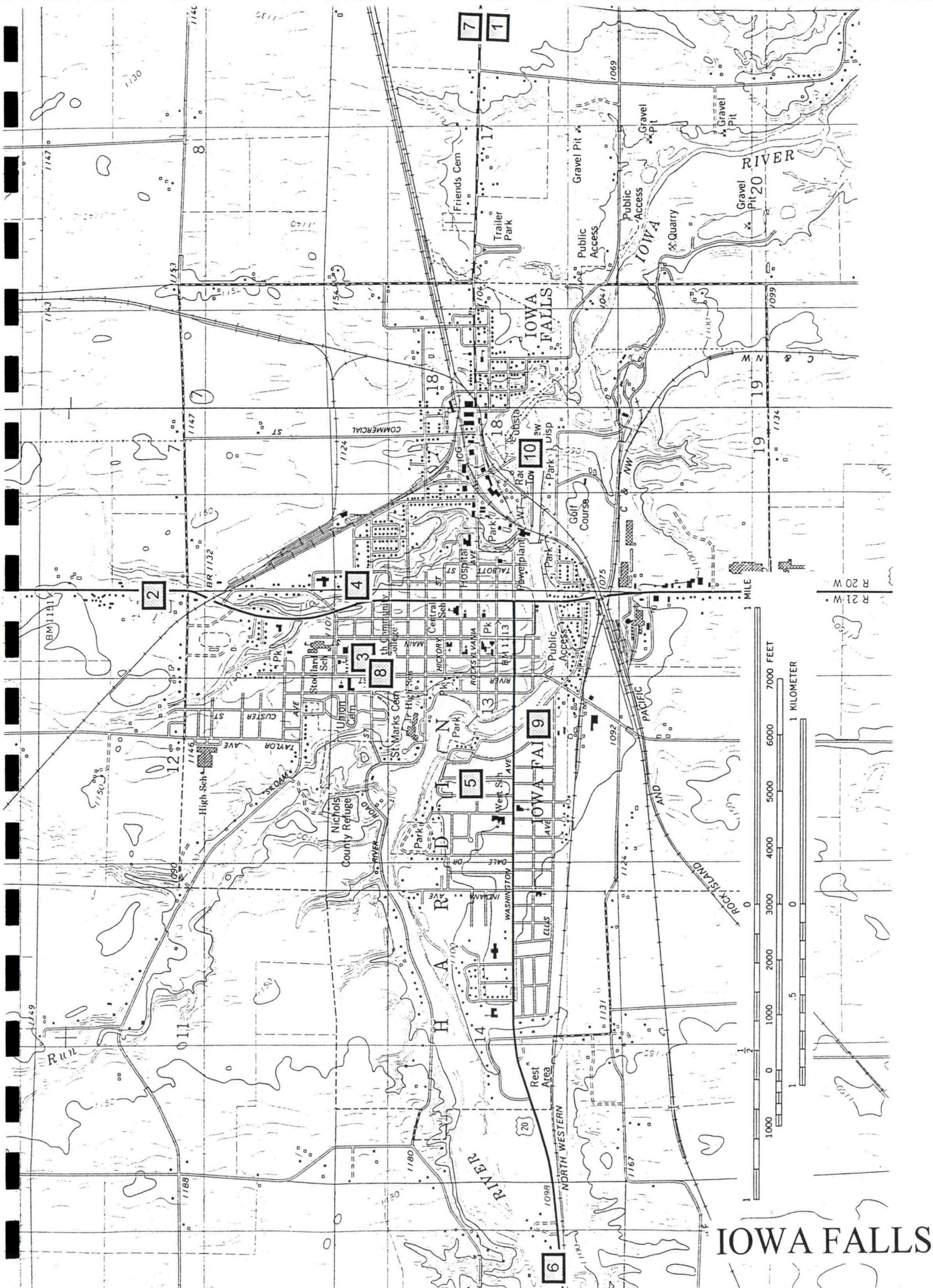


Course
Central Ch
St Paul Cem
North Lawn Cem
Good Shepherd Ch
RIVER
DES MOINES
United Ch
Corpus Christi Cem
Oakland Cem
Feelhaver Sch
Boat Ramp
Loomis Park
Dodger Stadium
NORTH WESTERN
Hawley Sch
Duncombe Sch
Edmonds High Sch
North Jr High Sch
Corpus Christi Sch
GULF
CREEK
CENTRAL
Quarries
Water Treatment Plant
Gaging Sta
Fort Dodge Country Club
Island Park
Wahkonsa Sch
Courthouse
Arey Sch
Sacred Heart Sch
South Jr High Sch
St Olafs Cem
Carpenter Cem
Hospital
Mason Park
FORT DODGE
Riverside Sch
Leif Erickson Park
Radio Towers (KWMT)
First Covenant Ch
Elkhorn Creek
Lutheran Hospital
Butler Sch
County Fairground
Museum
Radio Tower (KQTV)
Substa
Quarry
Radio Tower
Sewage Disposal
OLESON PARK
WESTERN
CHICAGO
Coleman Sch
W A H K O N
W A H K O N S A
2
3
4
5
6
7
1 ½ 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FORT DODGE

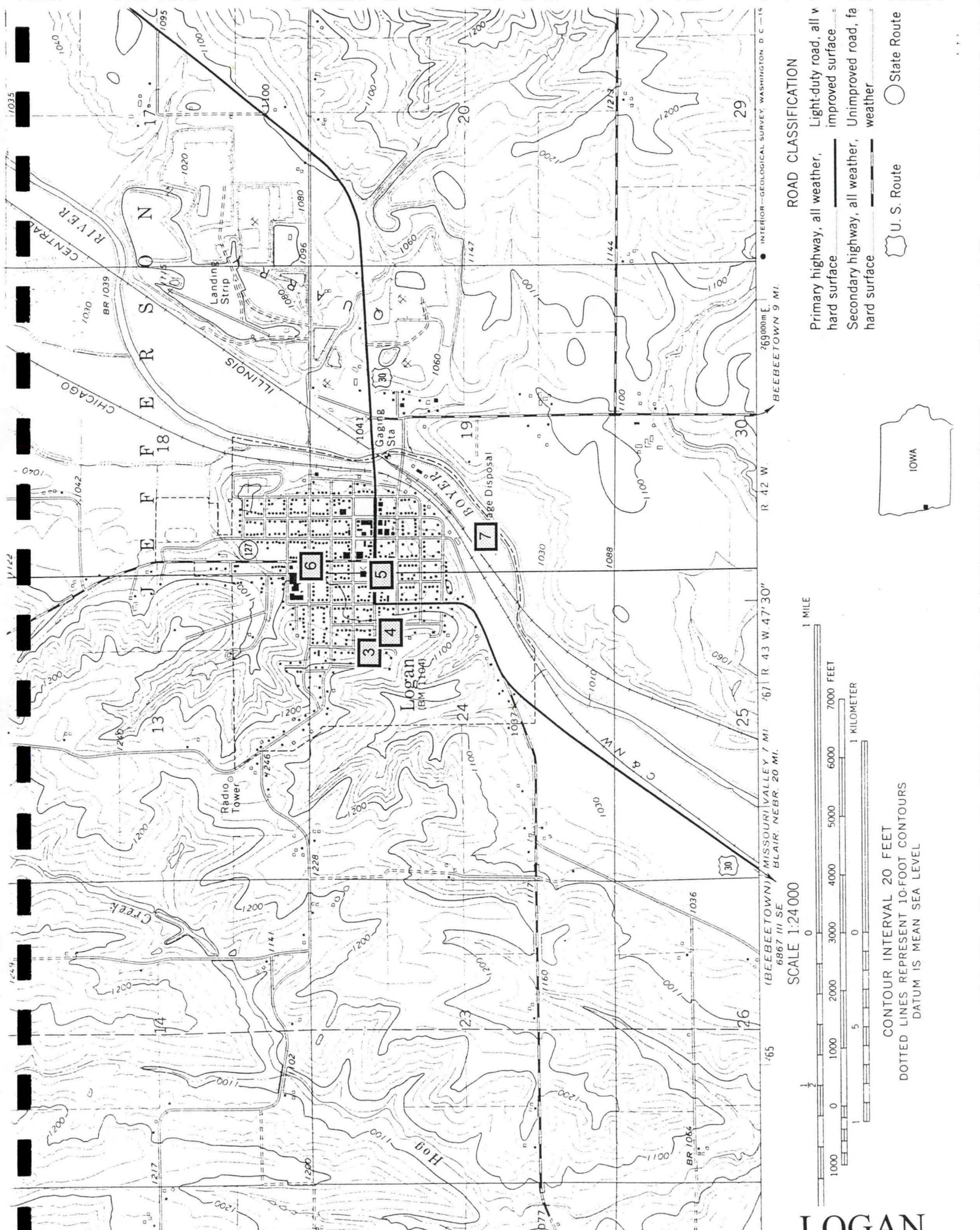

7266 I NE
(SCOTCH RIDGE)
AMES (VIA INTERSTATE 35) 46 MI.
DES MOINES (INTERSTATE 235) 17 MI.
32'30"
1
2
3
4
5
6
7
8
9
10
11
INDIANOLA
Memorial Park
Moats Park
Park
Simpson College
Irving Sch
Whittier Sch
Courthouse
City Hall
PO
Emerson Sch
Easton Park
Tanks
High Sch
Fairground
Radio Tower (KBAB)
Hawthorne Sch
Barker Park
South Town Park
McCord Park
City Cem
IOOF Cem
Downey Memorial Park
Trailer Park
Sewage Disposal Pond
CLINTON AVE
ASHLAND AVE
FIRST AVE
IOWA AVE
CHICAGO AND NORTH WESTERN
KENWOOD BLV.
THIRD ST
15TH STREET
NW 9TH STREET
NW 4TH AVE
SW 6TH AVE
CORP BOUNDARY
River
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

INDIANOLA

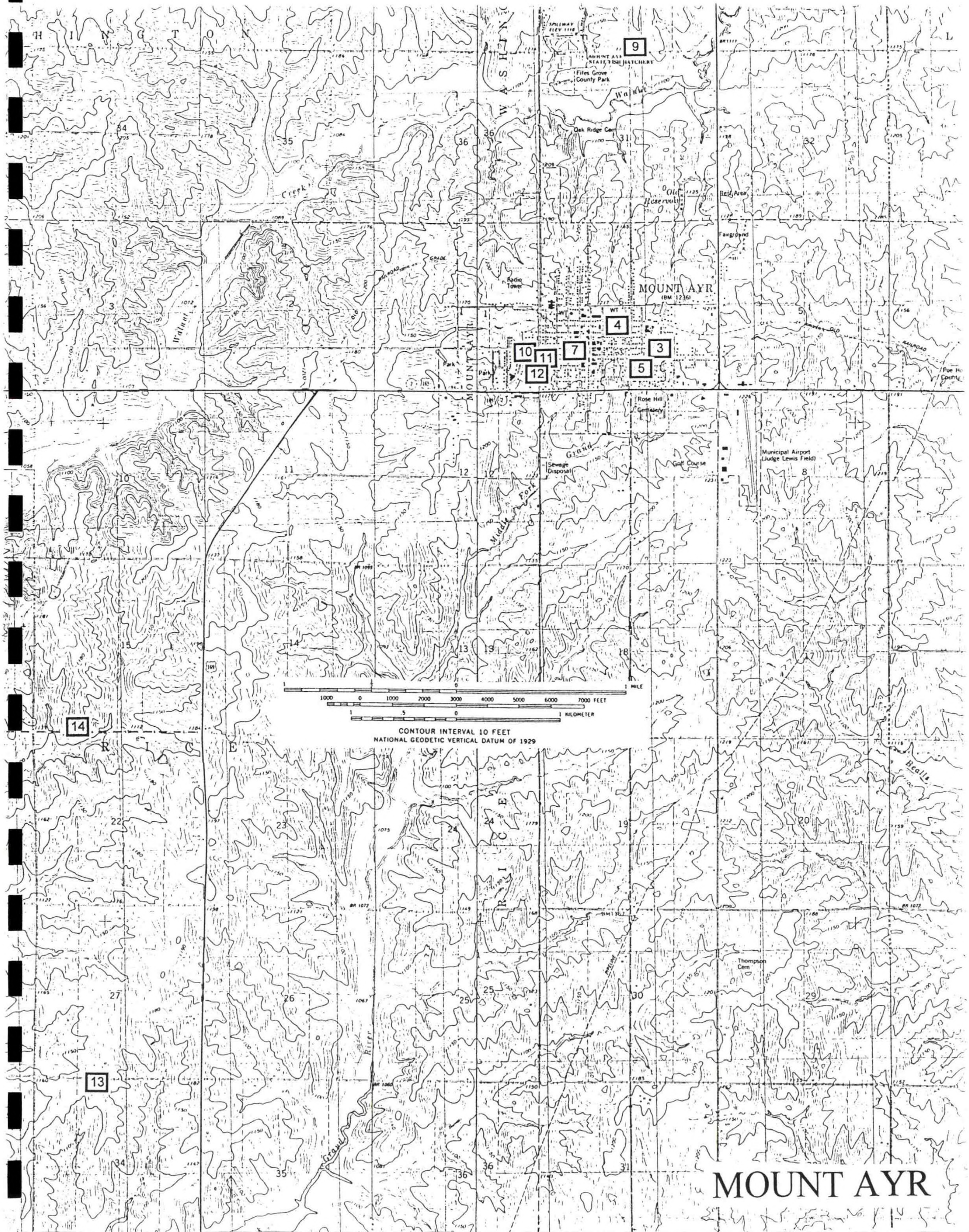


IOWA RIVER
IOWA FALLS
Friends Cem
Trailer Park
Public Access
Gravel Pit
Quarry
Golf Course
Park
Hospital
Central Sch
Stoddard Sch
St Marks Cem
Union Cem
High Sch
Nichols County Refuge
West Sch
Rest Area
Powerplant
COMMERCIAL ST
CUSTER ST
TAYLOR AVE
HICKORY ST
MAIN
ROCKSYLVANIA
RIVER
TALBOTT
WASHINGTON AVE
INDIANA AVE
DALE DR
ELLIS
NORTH WESTERN
ROCK ISLAND AND PACIFIC
C & NW
ICG
Run
R 20 W
R 21 W
1 MILE
7000 FEET
1 KILOMETER

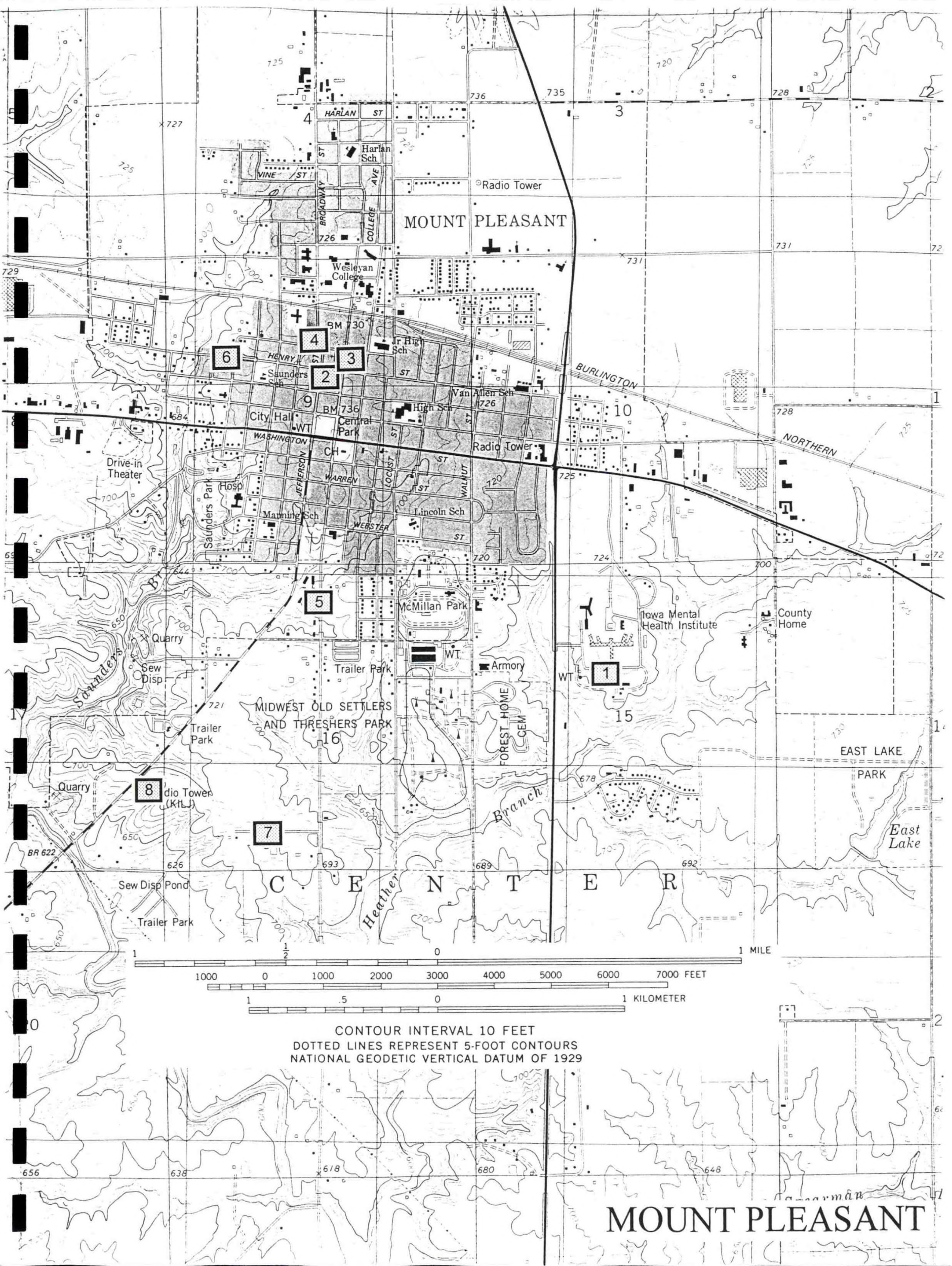
IOWA FALLS


ROAD CLASSIFICATION
Primary highway, all weather, hard surface
Light-duty road, all weather, improved surface
Secondary highway, all weather, hard surface
Unimproved road, fair or dry weather
U. S. Route
State Route
IOWA
SCALE 1:24 000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
(BEEBEETOWN)
6867 III SE
MISSOURI VALLEY 7 MI.
BLAIR, NEBR. 20 MI.
BEEBEETOWN 9 MI.
R. 43 W.
R. 42 W.
47'30"
INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.
JEFFERSON
CHICAGO
CENTRAL
ILLINOIS
RIVER
BOYER
C & NW
Logan
(BM 1104)
Landing Strip
Gaging Sta
Radio Tower
Hog
Creek
3
4
5
6
7

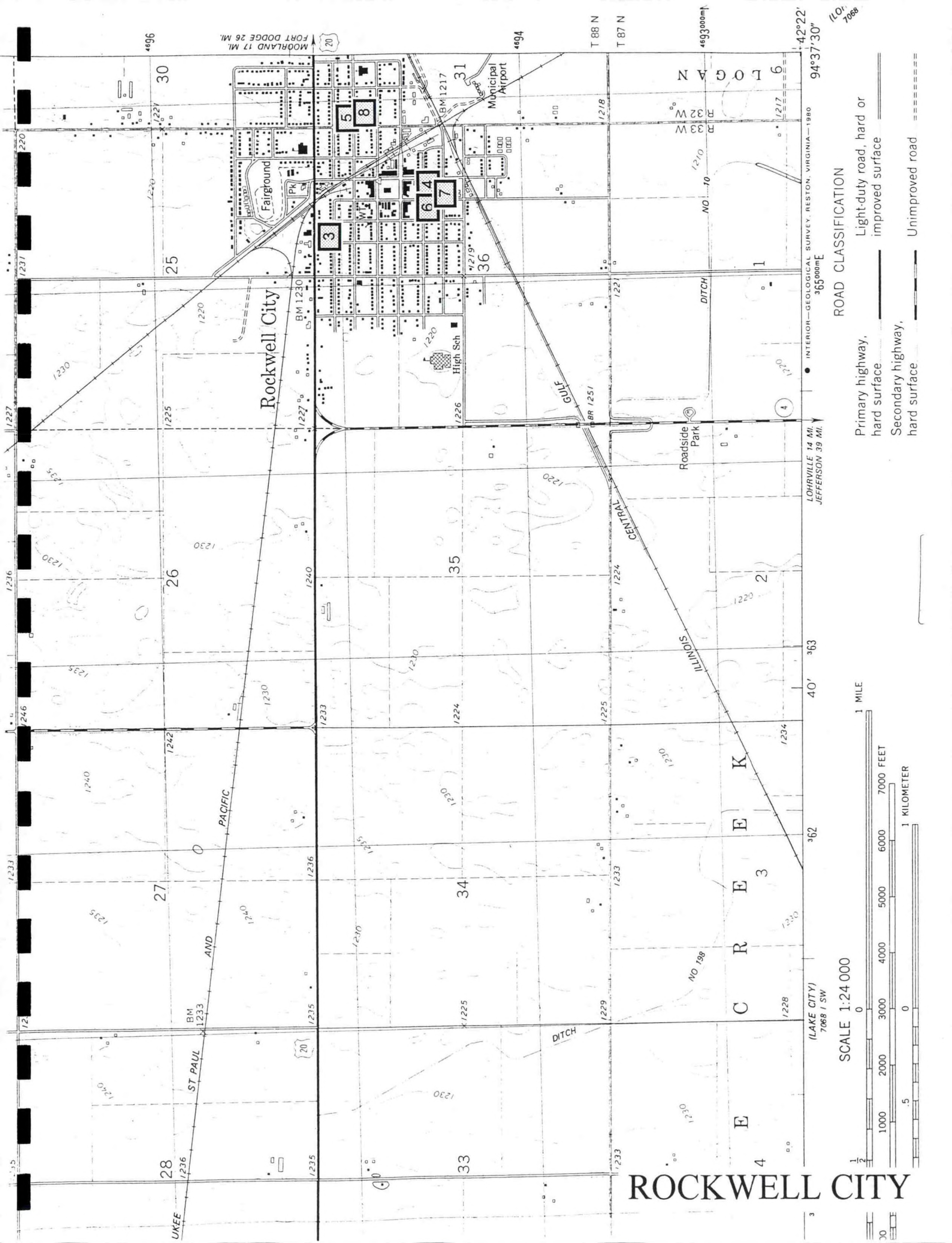
LOGAN


9
Fifes Grove County Park
Walnut
Oak Ridge Cem
Old Reservoir
Rest Area
Fairground
Radio Tower
MOUNT AYR
4
3
5
7
10
11
12
Park
Rose Hill Cemetery
Grand
Sewage Disposal
Golf Course
Municipal Airport (Judge Lewis Field)
Middle Fork
Creek
Walnut
RICE
14
13
Beails
Thompson Cem
River
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER

MOUNT AYR



MOUNT PLEASANT
HARLAN ST
Harlan Sch
VINE ST
BROADWAY
COLLEGE
AVE
Radio Tower
Wesleyan College
BM 730
Jr High Sch
HENRY
Saunders Sch
BM 736
City Hall
WT
Central Park
High Sch
Van Allen Sch
BURLINGTON
NORTHERN
WASHINGTON
CH
Radio Tower
Drive-in Theater
Hosp
Saunders Park
JEFFERSON
WARREN
LOCUST
WALNUT
Manning Sch
Lincoln Sch
WEBSTER
ST
McMillan Park
Iowa Mental Health Institute
County Home
Quarry
Sew Disp
Trailer Park
Armory
MIDWEST OLD SETTLERS AND THRESHERS PARK
FOREST HOME CEM
Saunders Br
Trailer Park
Quarry
dio Tower (KILJ)
Branch
EAST LAKE PARK
East Lake
BR 622
Sew Disp Pond
Trailer Park
C E N T E R
Heather
1
2
3
4
5
6
7
8
9
10
15
16
1 ½ 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
MOUNT PLEASANT



ROCKWELL CITY

ǀ³17 ǀ³18 1°2'30" ǀ³20 (LAKESIDE) 6969 II SW ǀ³21 ǀ³22 10' 1.3 MI. TO JUNC

STORM LAKE

...the Geological Survey

...rom aerial photographs
...edited 1979

...a coordinate
...nic)
...grid ticks,
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...mark buildings are shown

...boundaries of
...n this map

...selected fence and field lines where
...graphs. This information is unchecked

UTM GRID AND 1979 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

GN 1°29' 26 MILS — MN 6½° 116 MILS

SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

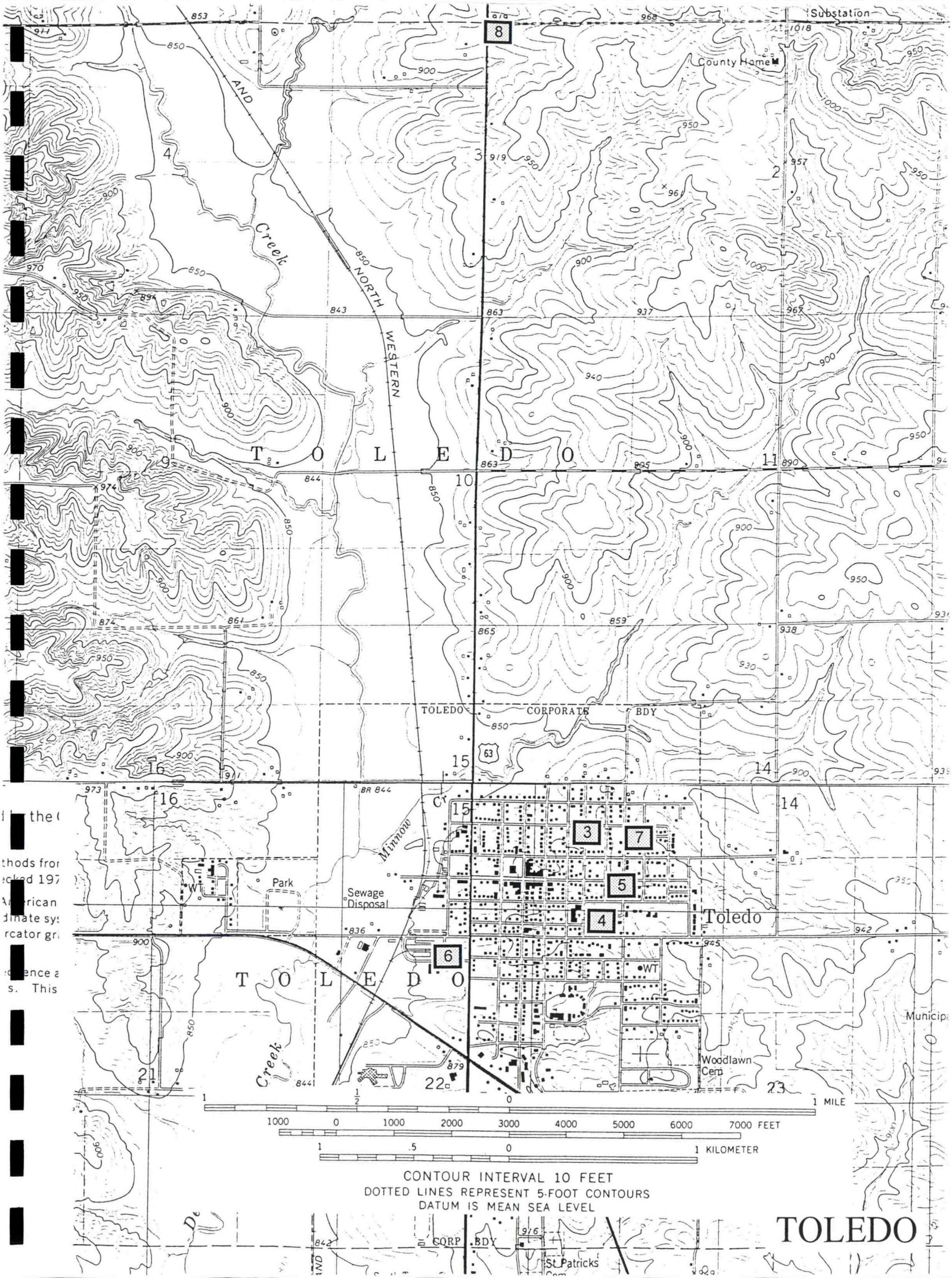
1 .5 0 1 KILOMETER

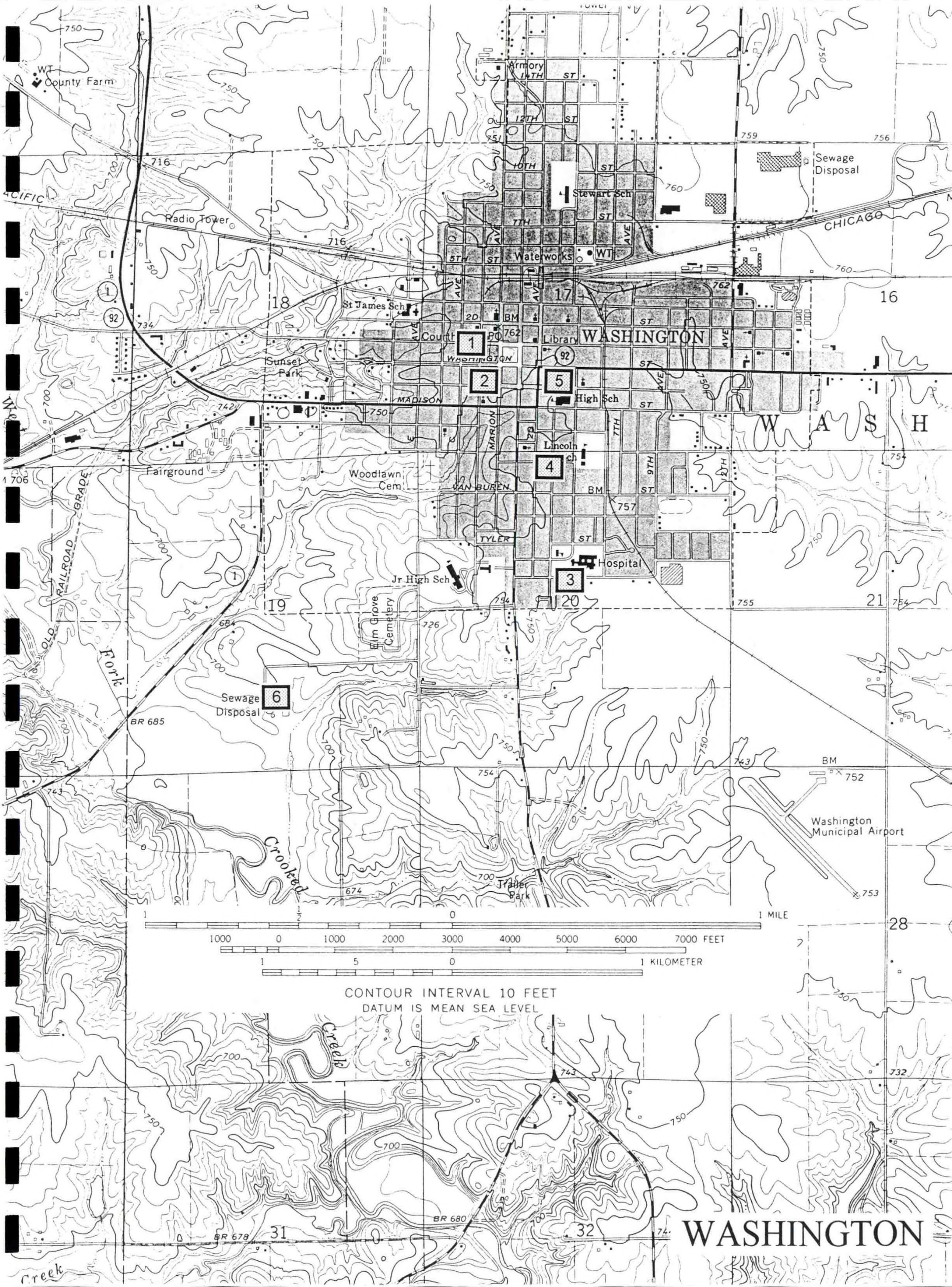
CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
AND BY THE IOWA GEOLOGICAL SURVEY, IOWA CITY, IOWA 52240
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

IOWA

QUADRANGLE L...


Substation
County Home
NORTH WESTERN
Creek
T O L E D O
TOLEDO CORPORATE BDY
63
Minnow Cr
Park
Sewage Disposal
WT
Toledo
Woodlawn Cem
St Patricks
CORP BDY
8
3
7
5
4
6
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
TOLEDO


County Farm
Armory
14TH ST
12TH ST
10TH ST
Stewart Sch
Sewage Disposal
Radio Tower
7TH ST
CHICAGO
5TH ST
Waterworks
WT
St James Sch
2D
BM
Courth
PO
762
Library
WASHINGTON
Sunset Park
MADISON
High Sch
WASH
Lincoln Sch
Fairground
Woodlawn Cem
VAN BUREN
TYLER ST
Hospital
Jr High Sch
Elm Grove Cemetery
RAILROAD GRADE
OLD
Fork
Sewage Disposal
BR 685
Crooked
Creek
Washington Municipal Airport
Trailer Park
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
BR 680
BR 678
1
2
3
4
5
6
WASHINGTON

APPENDIX 3

Additional HCN Station Notes

Albia. This station has the distinction of having been moved most often. The instrumentation has been moved at least 16 times. In Albia most home lots are rather small thus the instrument exposure was frequently less than ideal owing to the close proximity of houses. Albia is located on high ground. Metadata is nonexistent until 1905 with the exact location of the weather station unavailable until 1913. The station was located in rural locations (both times on hill crests) from 1963-65 and from 1985 to the present.

The first documentation of the station location in February 1906 notes that the instrument shelter was built of 'house shutters' with dimensions of 3.0 x 2.5 x 1.5 feet. The floor of the shelter was only two feet above ground.

An interesting weather event was noted on November 11, 1911. On this date the temperature was 72° at 9 a.m.; a blizzard hit at 10:30 a.m. and the temperature fell to 5° by 9 p.m. that evening.

Algona. Station location unknown until 1904. The area is fairly level except where the river has cut a narrow valley. As far as is known the weather station has always been located in the relatively level 'upland' areas. It was located within the city until 1954 and in a rural location since then. Among the relatively few observers over the years only the records of Nolte (1941-1954) were consistently outstanding.

The first description of the instrument shelter in February 1906 was that of a 30 x 30 x 10 inch "box" mounted on the north side of a wood shed. Although the station was moved it appears that this same shelter remained in use when inspected in November 1928. At that time it was painted green and was mounted on the north side of a garage. It was noted that the circulation of the air was practically shut off within the shelter. A standard CRS was ordered and apparently installed shortly after this inspection.

Belle Plaine. The first detailed description of the instrumentation and exposure was made in 1914 with all standard Weather Bureau equipment in place at that time. It is not clear if the records of H.W. and S.P. Vandike were made at the same location. This station has had several excellent observers (Burrows, Rabe, Pech) with only one brief period of poor quality records (1992-95).

It appears that this station was located within the town until 1976. The town is generally built on a broad south facing hill slope. The 1976-1986 and 1995-present sites (same observer on same property) are on nearly level ground on the very edge of town and is essentially a rural location. The 1986-1992 site also is on the edge of town but it was not possible to determine the exact location of the station (within a large seed processing complex). These latter two sites are also of much lower elevation than all of the other Belle Plaine station locations.

Some very interesting remarks are made on the monthly report forms during the 1890's. A description of an 'exploding meteor' is provided on March 27, 1894. On July 28, 1894 (a very severe drought year) a fire destroyed the entire business district of the town. Finally, on May 28, 1899 the observer measured a hailstone of 8.5 inches circumference 25 minutes after it fell.

Clarinda. The data quality appears to be very good for most of the period of record at this station. Several gaps in the record appear in the early 1950's. There have been relatively few observers at this station over the years. However, one observer (Harold Davis) moved three times in only three years. The city of Clarinda is built upon the east slope of a hill. A. S. Van Sandt was the weather observer until 1924. However, there are two addresses given for his location (203 and 1707 W. Washington). It is suspected that both addresses were actually on the same city block (a house numbering change?). The exact location of the second observer (Hawley) could not be determined. However, it is clear that the Hawley residence was on the extreme south edge of town with open farm fields adjacent to the station. The Water Works (1937-1963) was located on the extreme east edge of the city and is near the edge of the river flood plain. The instrumentation at the Water Works; however, was located atop a large eight foot high mound, thus perhaps reducing the expected effect of cold air drainage. Finally, the current location (since 1997) is totally rural and is strongly affected by cold air drainage in its valley bottom location. Also, the station was briefly located (1986-1988) on a north facing slope near a creek bottom within the north portion of town.

Fairfield. The documentation for this station is very poor until 1955. It appears that the station was associated with Parson's College until 1963. However, just where the instruments were located for the period prior to 1955 is not clear. At least a portion of this time it was located on the college campus but it possibly could have been moved several times. The quality of the records is fairly poor until 1947 with numerous changes in observer and small gaps in the record. The first instrumentation documentation was made in January 1914 and noted that the floor of the CRH was only 30 inches above the ground. This condition was noted again in December 1926 with the comment that it was to be raised to standard height in the spring of 1927. It appears that this non-standard exposure was frequently very shaded as well as on a northeast-facing slope. The college campus is on the north edge of the city with the overall topography sloping generally to the north-northeast. The station was located just south of campus in the 1955-1963 period on small residential lots with fairly poor exposures. Finally, the station was moved to the current rural Water Works location in 1963. However, the weather equipment at the Water Works has been in close proximity to fairly expansive buildings.

The weather observation form notes the occurrence of an earthquake at this location at 4 a.m. October 31, 1895.

Fort Dodge. Fort Dodge is by far the most populous of the 15 HCN cities examined in this study. The city is located on fairly level ground that is deeply dissected by the Des Moines River and several creeks. It appears that the weather station was associated with Tobin College until 1919. There are numerous observers during this early period and the records are not particularly stellar. The only address given (on Form 531-1) is for a residence although other documents clearly indicate that the station was on the college campus. The monthly form notes that the instruments and shelter were destroyed by fire on March 4, 1910. The quality of the records improves after 1919 with excellent data during the tenure of Kratosky (1942-1973). There have been numerous changes in observation times and completeness of data during the tenure of the current observer (Radio KWMT).

The May 1977 form notes that two tornadoes struck Fort Dodge on May 4, 1977 causing 9 to 12 million dollars damage with 1 fatality and 30 injuries. Hail up to baseball size was observed.

Indianola. Indianola is built upon the crest of a hill. The station was associated with Simpson College until 1920. The weather equipment was at an unknown location on the college campus until at least 1903. On the date of the first station description (1906) it was located at the observer's residence on the far west edge of town (specific address unknown). As was the case with most college weather stations there were many different observers over the years with frequent small gaps in the record. The station was again moved in 1921 to the home of the town's newspaper editor. There is a reference on a 1924 station inspection form that the station had been moved 7 blocks northeast of its previous location some time since 1921 (but no address given). However, another inspection form in 1942 gives the original 1921 address. Perhaps the station had been moved to the newspaper office at some point and then back to the residence? The Indianola weather station has been in or very near the city except for the period from 1965 to 1983 when it was at the Water Works. The Water Works location is rural and is in the valley bottom about 140 feet lower than the city. The current weather station location is on the extreme south edge of town with open fields immediately adjacent to the south of the station. The MMTS is located on a steep south-facing slope but is shaded by a tree during the afternoon hours.

Iowa Falls. This city is located on fairly level terrain that is bisected by the Iowa River. The exact location of the first observer (Parmelee) could not be determined but appears to be very close to that of Hensing (1969-1977). The station was in a rural location until 1954 and was again rural from 1963 to1977. The 1963-1969 location was nearly in the Iowa River flood plain. The Iowa Falls station has suffered from very poor records of snowfall water equivalent and snow depth for much of its history.

Logan. This is the smallest town among the HCN stations examined. Logan is situated on a an east-facing hill slope with the 1927-1966 locations on a rather steep east facing slope on the higher west edge of town. The Stern family has the distinction of having been the weather observer for 100 years (1860-1960). However, the quality of the Stern's observations are rather poor by modern standards until the 1940's. It is not clear where the weather station was located in the early years of the record but appears to have been in town since at least 1904 (if not always). Holben (1967-1988) kept excellent records but the exposure was poor (trees and houses nearby). The station has been at the Sewage Treatment Plant since 1988 that is in a rural location in the valley bottom.

Mount Ayr. Mount Ayr probably is one of the poorest documented of the HCN stations examined. It was not possible to precisely locate any of the weather station locations until 1946 with the exception of one move in 1936 to a site that apparently was soon moved to another undocumented location at an unknown date. It is clear that the weather station was in a rural location for the 1946-1969 period and for the 1983 to present period. The quality of the weather observations at Mount Ayr has been poor for most of its history. This, combined with its poor station history data, probably would make it the poorest of the HCN sites examined in this study.

Mount Pleasant. This station was at the Iowa State Mental Hospital until 1904 and again was at that location from 1937 to 1944. The hospital is in a rural location but is comprised of numerous large buildings. It was not possible to determine the exact location of the weather station (probably more than one location) within the hospital campus. The station was definitely in an urban setting from 1904 to 1948 and again from 1963 to 1970. The station was in a 'nearly' rural location from 1948 to 1963 at a large house on a large lot. The station has been totally rural since 1970. However, the exposure of the MMTS has been extremely poor at its current location. The best quality records exist during the 1970 to 1985 period. The first station description in 1906 indicates that the thermometers were mounted on the north side of a house and that there was no shelter. A station inspection in March 1917 shows that there was a CRS by this time but it is not known when it was installed.

Rockwell City. The early station history for this city is almost non existent. The very first detailed station description does not appear until January 1927. The overall quality of the weather data is fairly poor until 1932 and, with but a few exceptions, is good since that time. Rockwell City is located on nearly level ground and the weather station has been located within the city since at least 1916. This city easily has the most uniform topography of any of the HCN cities examined.

Storm Lake. The station history data associated with this city is very poor. The WB Form 530-1 included detailed coordinates for the first Storm Lake location. These coordinates, unlike many of the early ones, do actually match up with a location within the city. The station appears to have been associated with Buena Vista College from 1906 to 1930 with the exact location of the instruments unknown for the 1906 to 1913 period. No street address is given for the next observer (Russel Edwards, 1930 to 1941) who is known to have moved about December 1935. However, the distance and direction of the Edward's locations from previous and subsequent observers is very inconsistent. This means that there may be an unknown third Edwards home or that at least one of his residences is incorrectly described. To further complicate things there is no address given for the next observer (De Kalb Seed) and the seed plant apparently no longer exists. The quality of the Storm Lake observations have been only fair for much of its tenure and has been extremely poor since 1993. It is believed that the lake influences temperatures in the city during periods of south winds.

A severe thunderstorm toppled the KAYL radio tower on August 8, 1969 and destroyed the instrument shelter. The weather equipment since 1948 has been at the KAYL transmitter which is in a rural location east of town.

<u>Toledo</u>. A precise street address for the weather station is not available until 1928. The Toledo station was located within the city until 1964 except that there is a brief period from 1899 to 1903 when its location is unknown. Toledo has relatively large house lots and wide streets, thus the exposures of most of the weather stations is probably better than what would be found in most small Iowa towns. The weather station was at the Pioneer Seed Plant from 1964 to 1994 that is on the extreme west edge of town and is at a lower elevation than the city. The Pioneer site was far enough from buildings that it would have been nearly rural in character. The station was moved back into town from 1994 to 1999 and has been at a rural hilltop location since 1999.

<u>Washington</u>. This is perhaps the best documented HCN among those studied (mainly thanks to there being the same observer for a very long time during the beginning of this record). An inspection made in November 1926 notes that the instrument shelter is similar to a CRS but is larger in all dimensions. It was also painted dark green. The observer was asked to paint it white and to lower it about one foot to make it easier to read the thermometers. Considerable shading by trees apparently kept the dark green shelter color from affecting temperatures very much. Earlier descriptions did not indicate anything different about the shelter, thus it is not clear how long it was of non-standard design and color. With one exception (1937-1942) this station was always well within the borders of the city. During the 1937-1942 period it was at a nursery on the south edge of town. However, it appears that this site was well shaded by trees and probably was still 'urban' in character. Excellent observations were made from 1942 to 1999; however, the 1993 to 1999 site was very sheltered. Since 1999 the station has been at a rural location and about 60 feet lower in elevation than the city (but still about 20 to 30 feet above the valley bottom).

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