Guide to Conducting a

WELLHEAD CONTAMINANT SOURCE INVENTORY

IOWA DEPARTMENT OF NATURAL RESOURCES
Lyle W. Asell, Interim Director
January 2001

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WELLHEAD CONTAMINANT SOURCE INVENTORY

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So You've Decided to Create a Wellhead Protection Plan!

Congratulations! When you chose to enter the Wellhead Protection Plan program you took a major step toward protection of the water supply for the citizens of your community. A well formulated plan will help you to protect your water supply for many years to come, helping you avoid interruptions in water supply service and costly remediation of contamination. The Iowa Wellhead Protection Plan document contains in-depth background information, discussion of federal government requirements, incentive information, and a detailed discussion of all phases of the Wellhead Protection Plan process. If you have not already done so, it is recommended that you obtain a copy of the Iowa Wellhead Protection Plan from the Iowa Department of Natural Resources.

The purpose of this document is to assist you in setting up the initial phases of your Wellhead Protection Plan, and to help you complete the inventory of potential contaminant sources that may pose a threat to your drinking water supply. The recommended procedures will be presented, and we will walk through an example for a fictitious Iowa community.

Perhaps the most important aspect of your Wellhead Protection Plan is properly conducting the wellhead inventory. This inventory involves the following five steps:

- ✓ Assemble the source inventory team.
- ✓ Assemble existing information sources, including base maps, databases, and potential contaminant source lists.
- ✓ Conduct the field survey.
- ✓ Assess relative risk and set priorities.
- ✓ Conduct the interview survey.

The inventory itself is designed to be completed in three phases:

1. An initial field survey in which land uses or activities that may be potential sources of contamination are identified;
2. A site prioritization phase in which the relative risk that each site might pose is assessed;

3. An interview inventory in which detailed data concerning the potential contaminants are obtained at each site identified during the field survey.

At this point the process may seem a bit overwhelming, but the procedures presented in this document have been developed to assist you and to make the task ahead as efficient and effective as possible. Rest assured that you are not the first to tackle this task. Other Iowa communities have completed wellhead protection plans, and experience indicates that the results justify the commitment.

*Remember, this is **your** plan.* The procedures suggested here are intended to help you develop the inventory portion of your plan. They are based on past successful plan developments, but they may not be the most effective procedures in every instance. If you find that they don't work out in your case, you can modify the procedures so that they better fit your particular situation. If you do modify these procedures, please keep in mind that monitoring waivers can be affected by the methods you use. If you are seeking monitoring waivers, your plan must meet all requirements set forth in the Iowa Wellhead Protection Plan. This publication deals only with the inventory aspect of wellhead protection. To find out more about monitoring waivers see the Iowa Wellhead Protection Plan or contact the Iowa Department of Natural Resources.

Where Do We Begin?

The idea behind wellhead protection is to define an area around your well or wellfield where a contaminant spill might reach your water supply, identify all potential contaminant sources in that area, and manage the area to prevent those contaminants from getting into the ground water. This is explained in detail in the Iowa Wellhead Protection Plan. In many instances the hardest part of the entire process is defining the wellhead protection area. This is because the geological parameters can be difficult to establish. Previously, each community was on their own when delineating their wellhead protection area. **GOOD NEWS! Now, because of federal source water protection legislation, the Iowa Department of Natural Resources, Geological Survey Bureau (IDNR-GSB), will delineate the wellhead protection area for you!**

Iowa wellhead protection areas are being delineated over the next three years and are being completed on a regional basis. You should contact the IDNR-GSB to find out the status and expected completion date of your wellhead protection area delineation. Additionally, IDNR-GSB will provide you with information from their databases about existing wells and known contamination sources within the wellhead protection area. The data you will receive from IDNR-GSB will be discussed in more detail, and an example of what you can expect to receive will be provided in the procedures section.

The delineation received from the IDNR-GSB will be general, and in some situations a refinement of the wellhead protection area might be needed or desirable. Such a refinement will need to be contracted out. Typically city water supply officials have knowledge of firms and organizations that can perform these services.

How Do We Start The Inventory?

The first step of the inventory process is to assemble the Source Inventory Team. This is an extremely important step, since these are the members of your community who will do the actual work of planning and implementing the source inventory. These volunteers will search the Wellhead Protection Area, identifying potential contaminant sources. There are a couple of reasons why it is important that all citizens of your community have an opportunity to participate in the inventory process. First, the Wellhead Protection Plan can only be successful if it is supported by the citizens of your community. Allowing them the opportunity to participate helps build that support. Secondly, nobody knows a community better than the members of that community. There is a wealth of information about your town and its history to be obtained from your neighbors. Tapping into this source of information will make the inventory process much easier.

The size of the inventory team you assemble will depend largely upon the size of your wellhead protection area and the number of contaminant sources in that area. Small towns with no industry, for example, may have a smaller team than a larger, more diverse town. The number of team members is entirely up you, but we recommend that, regardless of the size, the team represent all

interests of the community. Each group within your town will bring a unique perspective to the team, and team diversity will lead to a better plan. There are many groups in your town that do community service projects, and it is likely that others will help if the opportunity presents itself. Some of the people you could include are listed below. This list is not comprehensive and is provided only to give you an idea of the kind of resources that are out there. You should keep in mind that everybody in your town willing to participate is important.

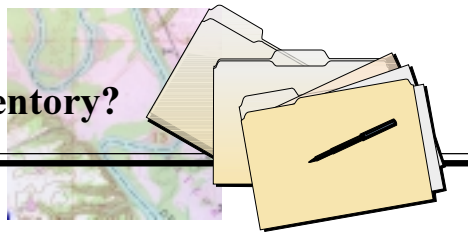
- 4-H
- American Legion
- Boy Scouts/Girl Scouts of America
- Businesses and the Chamber of Commerce
- Church Groups
- College Fraternities and Sororities
- Elected Officials
- Emergency Responders (Fire department members, police, etc.)
- Farmers
- Future Farmers of America
- High School Clubs and Organizations
- Jaycees
- Land Developers
- Local Government Agencies (Health, Planning, Natural Resources, etc.)
- Local Water Suppliers
- Local Well Drillers
- Retired Citizens Organizations
- Shriners, Masons, Lions, Elks, and Similar Groups
- Teachers
- Other Interested Citizens

As you can see, there are more potential team members than you might at first realize. In addition to being able to do some of the work involved, many of these people can provide special expertise that can be a valuable asset in the inventory process. For example, firefighters have special training with hazardous materials; medical professionals have experience with

biohazardous waste; hydrologists and drillers have knowledge of how the groundwater system works; long-time residents will know of historical aspects of the town (locations of former gas stations where underground storage tanks might exist, or old coal-gas plants, etc.) that may not appear on maps. All of these people should be encouraged to participate.

No team is complete without a leader, and the Source Inventory Team is no exception. A project leader is needed who can keep the team organized and on track. A local official or community leader who has already gained community support and respect might be a good choice for this role. Possible candidates for this position are the city mayor, city manager, water superintendent, councilperson, or a local businessperson.

What Do We Need To Complete the Inventory?

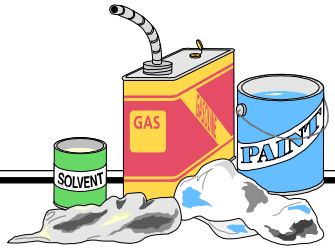


Before the inventory team can complete their task, you must assemble the resources they will need to accomplish the mission. You don't send your baseball team onto the field without balls, bats, and gloves. Likewise you don't send your inventory team into the field without maps, forms, and all available data. The team's objective is to identify all contaminant sources and to be able to locate them within the protection area. They can best accomplish this by entering the locations of the contaminants on a base map of your protection area. There are a number of maps available, and you will be able to use any combination of maps you deem necessary to develop your base map. After delineation of your wellhead protection area is complete, the IDNR-GSB will provide you with a computer-generated map showing the boundary of the Wellhead Protection Area, as well as locations of known wells and potential contamination sources within that area. City and county plat and zoning maps are available, many of which have been digitized by the county and have associated aerial photographs that can be very useful. Topographic maps are also available from the IDNR-GSB in Iowa City at (319) 335-1575. These maps provide very useful information that should be incorporated into the base map, but their scale might be too small to serve as the primary base map. You should be able to identify specific locations on your base map. You may need two different scale maps for some wellhead protection areas, as you will see in our example.

In addition to the maps, all available information pertaining to known potential contaminant sources within the wellhead protection area should be collected. Local, county, state, and federal government offices often have information concerning facility operations which could provide data on historical or current potential contaminant sources. These data can sometimes be found in documents such as construction permits, real estate title searches, telephone directories, aerial photographs, discharge permit records, environmental spill files, environmental impact studies, city or county assessor files, zoning records, business licenses, maps and plats, disposal permits, emergency plans, Natural Resources Conservation Service and Farm Service Agency records, and other historical records. Most of these records are readily available and can help describe and locate possible contaminant sources. The sanitary survey for public water supply facilities conducted by the IDNR may help in identification of potential problems. As part of federal source water protection requirements, the IDNR will provide data from a number of these lists to each public water supply. The accuracy of these records varies, so it is important that they be used only as a starting point. Verification of the data by the source inventory team is essential. A list of contaminant source databases and the responsible agency for each can be found in Appendix D of the Iowa Wellhead Protection Plan. Locations of all known potential contaminants should be entered onto the base map before the inventory process begins. The base map will be the major source of information for known potential contaminants that the inventory team will have available to them during the inventory process.

You will also need to have available as much information on your water supply wells as possible. Detailed construction logs, water quality history, and copies of the sanitary survey conducted by IDNR will prove useful in later steps.

What Are We Looking For?



A good question. Before you embark on your inventory, you need to know the kind of things that are considered potential contamination sources and the land uses that they might be associated with. Table 1 lists potential sources of groundwater contamination, and defines the categories based on the type of operation that may produce the contaminants.

Table 1. Potential contaminant sources.

Agricultural
- Agricultural drainage wells
- Animal burial areas
- Animal feedlots
- Animal research facilities
- Chemical application (e.g., pesticides fungicides, and fertilizers)
- Chemical storage areas
- Grain storage
- Irrigation
- Manure spreading and pits
- Tank loading and rinsing areas

Commercial
- Agricultural chemical dealers
- Airports
- Auto: repair, machinery, service shops
- Boat yards / marinas
- Car washes
- Cemeteries / funeral services
- Construction areas
- Dry-cleaning establishments
- Educational institutions (e.g., labs, lawns, and chemical storage areas)
- Fuel pipelines
- Gas stations
- Golf courses (chemical applications and storage)
- Grain storage (fumigation)
- Degreasing operations
- Hardware stores
- Jewelry and metal plating
- Junk yards
- Laundromats
- Lumber yards
- Material transport (trucks and railroads)
- Medical facilities
- Paint shops
- Photography establishments
- Printing / copy shops
- Railroad tracks and maintenance yards
- Stormwater drains and retention basins
- Road deicing operations (road salt)
- Road maintenance depots
- Storage tanks and pipes (above and below ground)

Industrial
- Asphalt plants
- Chemical manufacturing, warehousing, and distribution activities
- Construction activities
- Degreasing operations
- Electrical and electronic products and manufacturing
- Electroplating and metal fabrication
- Foundries
- Former manufactured gas plants
- Lagoons, pits, holding ponds
- Machine and metalworking shops
- Manufacturing and distribution sites for cleaning supplies
- Mining (surface and underground), mine drainage, and waste piles
- Petroleum products production, storage and distribution centers
- Pipelines (e.g. oil, gas, coal, and slurry)
- Radioactive materials production, distribution, and storage
- Storage tanks (above and below ground)
- Toxic and hazardous spills
- Wells, operating and abandoned (e.g., oil, gas, water supply, injection, monitoring, and exploration)
- Wood preserving facilities

Residential
- Cesspools
- Fuel storage sites
- Furniture and wood strippers and refinishers
- Hazardous products (cleaners, paint, oil)
- Lawns (chemical application)
- Septic systems
- Sewer lines
- Stormwater drains and retention basins
- Swimming pools (e.g., chlorine)
- Water softeners

Waste Management
- Fire training facilities
- Hazardous waste management units (e.g., landfills, land treatment areas, surface impoundments, waste piles incinerators, treatment tanks)
- Leaky sewers
- Municipal incinerators
- Municipal landfills
- Municipal wastewater and sewer lines
- Open burning sites
- Recycling and waste-reduction facilities

Modified from US-EPA 1989, Wellhead Protection Programs: Tools for Local Governments. EPA 440/6-89-002.

The identification of potential pathways that the contaminants can take to enter the groundwater system is another very important step. Certain structures can act as conduits that accelerate contaminant entry into the groundwater. Examples of pathways include:

- Wells
- Borings
- Stormwater Drainage Pipes
- Floor Drains

Of particular concern are improperly abandoned wells, as they can provide direct access to aquifers. During the field inventory, any structure that might act as a pathway for contaminants should be identified. This information is essential to developing proper management strategies for the wellhead protection area.

How Do We Conduct the Field Survey?

The team is now assembled, the maps and data have been collected, and you have a good idea of what you are looking for. It's now time to go out and see what's there. The purpose of this step is to identify high-risk land uses and activities within the wellhead protection area, confirm the location and type of potential contaminant sources that were previously identified on the base map, identify additional potential contaminant sources, and identify all potential pathways for contaminants to enter the aquifer. The source inventory team should have available to them the base map and copies of the field survey form (Appendix A, page A-2).

This step can be done by the entire source inventory team. The members of the team all bring different expertise to the inventory process. You will want to develop a strategy to take advantage of this diversity. For example, persons with historical information about certain sections of a community might be assigned to those areas. Members of the business community might be better utilized in areas zoned for business purposes. Persons in the agricultural sector might be

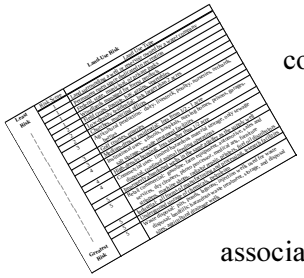
better at identifying risks in that setting than would some other people. You should design your inventory to take advantage of the diverse background of your source inventory team and maximize the available resources.

The intent of the field survey is not to get all of the details about the potential contaminants. It's designed to provide enough information to make informed decisions about what sites need to be revisited and assessed to gather more detailed information. To do this, the field survey forms (page A-2) should be filled out as completely as possible. A unique identifier should be assigned to each site, the location of that site identified on the field survey form and the base map; owner name, if known; description of the site including a sketch map; and any unusual conditions that can be easily observed (for example: leaking barrels, bare soil, oil spills, etc.). A separate field survey form should be filled out for each site that is identified as a potential contaminant source or pathway. Not all information asked for on the field survey form will be immediately known, but the form should be filled out as completely as possible with what information is available. These forms will be used to prioritize the sites for the interview phase of the inventory. Properly completed field survey forms make the prioritization process easier and more effective. The team leader should emphasize this to members of the team to avoid problems later in the process.

What Do We Do With These Field Survey Forms?

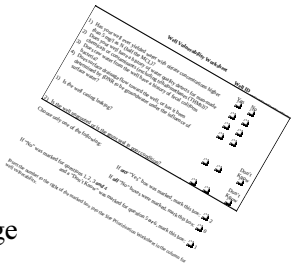
- ✓ Complete field survey forms (page A-2)
- ✓ Assessment
  - ⇨ Land-use risk (page A-3)
  - ⇨ Well vulnerability (page A-4)
  - ⇨ Aquifer vulnerability (page A-5)
  - ⇨ Site prioritization (page A-6)
  - ⇨ Rank the sites (page A-7)
- ✓ Interview inventory (page A-8)

You've now completed your field survey. At this point you will be faced with a pile of completed field survey forms. There is a wealth of information on these forms, but if they are not processed



correctly they are of no value. We recommend that you use the completed field survey forms to assess the risk each site poses to your groundwater and to prioritize the sites from highest risk to lowest. The rank that a site receives should be based on a combination of several factors, including the potential risk associated with the land use, how close the site is to your well or well field, and the vulnerability of your wells and aquifer. The prioritization process should be designed as a lead-in to the next stage of the inventory process, the interview inventory, at which time more detailed information will be obtained.

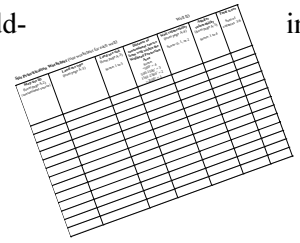
Worksheets are provided that can assist you in the prioritization process. Factors that need to be determined are land-use risk, well vulnerability, and aquifer vulnerability. Appendix A, pages A-3 through A-5 are used to determine scores for each of these factors.



The table on page A-3 shows categorized land-use risk scores. The land use identified for each site in the field survey should be located in this table. Page A-4 is a worksheet that can be used to assess well vulnerability. It is designed to make the well assessment easier by providing yes or no questions pertaining to the well. Similarly, page A-5 will help assess the vulnerability of the aquifer from which you draw your groundwater.

The scores from this table (A-3) and these worksheets (A-4 and A-5) can then be entered into the appropriate column of the table on page A-6 to calculate a risk score for each site relative to each well and/or aquifer type. A separate copy of page A-6 should be used for each public water supply well. For example, if you have three wells, you will calculate the risk score that each site poses to each well. When the scores from figures pages A-3 through A-5 have been entered into the table on page A-6, the score for distance of the site from the well can be entered in column 4 and the final score can be calculated by adding up columns 3 through 6. This final score represents the risk each contaminant source site poses to the well.

Finally, the scores for each site can be entered into the table on page A-7. This table simply consolidates the scores from all copies of page A-6, so that a final total score can be obtained by adding up the risk a site poses to all of your wells combined. At this point the task might seem a bit overwhelming. There are a lot



of forms and worksheets to deal with. *Hang in there.* This description may be a bit confusing, but the example presented in this document will illustrate how easy the process really is.

These tables and worksheets are intended to help you prioritize contaminant source risk, but the final determination of vulnerability and priority is your own judgement. Nobody knows your situation better than you. If you feel that the forms are producing misleading results, you can assign priorities that you feel better represent your particular circumstances.

It's your water, they're your wells, and it's your plan.

We have the Rankings. What's Next?

You are now approaching the end of the potential contaminant source inventory process. Before you can correctly manage the contaminant source sites, you must know exactly what the threats are at each site. You need to verify what contaminants are present, in what quantity, how they are used and handled, and what precautions are being taken to prevent them from entering the groundwater. The interview inventory should be conducted by wellhead protection team members who are aware of the overall wellhead protection plan and know what information is needed to accomplish the goals of the plan. For example, you might choose to have the city manager, water superintendent, and/or the leader of the source inventory team perform the interviews. The interview inventory form used during the interview process should record more in-depth information than that gathered during the field survey. In Appendix A, page A-8 is a worksheet designed for this purpose. You may not need to do an interview at every site if you feel you have a good idea of the contaminants present and the precautions taken for these materials.

The interviews are designed to gather information. You should be tactful during interviews, as you don't want to antagonize the people whom you need to support the plan. Even if there are potential problems at a site, make sure the interview does not become a confrontation. This is a good opportunity to promote and educate the community about wellhead protection, particularly those located within the wellhead protection area. The management aspects of the wellhead protection plan are designed to help find ways that are beneficial and acceptable to everyone involved.

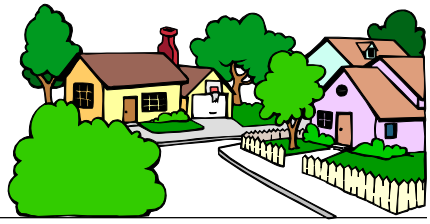
The field survey forms contain the site identification number, location and owner name and address. Using this information, the owner and/or operator of each site should be located and interviewed. It is recommended that an appointment be made for this purpose, as these people are likely to be busy and may be unreceptive to a drop-in visit. The information obtained during this interview inventory should include:

- ✓ A list of potential contaminants on site and whether Material Safety Data Sheets exist for those contaminants.
- ✓ Approximate quantities of each potential contaminant.
- ✓ The exact location of each potential contaminant, including a sketch of the site layout and location of the contaminants.
- ✓ The steps currently being taken to minimize the hazard posed by the potential contaminants.

Page A-8 has room for one contaminant per site. If a site has multiple contaminants, multiple forms will be required for that site.

When the interview inventory has been conducted for each site, the potential contaminant source inventory process is complete. The interview information will be used to formulate the management strategy for the wellhead protection plan, so it is vital that the information obtained be as accurate as possible. This publication does not deal with the management portion of the wellhead protection plan. For details on development of management plans, see Chapter 5 of the Iowa Wellhead Protection Plan or contact the IDNR.

It is important that the information gathered during the potential contaminant source inventory be updated regularly. The frequency of updates will depend largely on the growth rate within the wellhead protection area. The longest interval between updates should be no more than ten years. IDNR will notify public water supplies of new permitted activities within the wellhead protection area. It is up to you to update your plan accordingly.



While we have tried to make the directions above as easy to follow as possible, there may be some confusion about how exactly to proceed. To solve this problem, we will present here a small example of how to conduct the inventory. This example will by no means address all situations that you might encounter. It is intended to illustrate how to go through the five steps discussed previously and how to fill out the various worksheets that are provided to assist you in completing the contaminant source inventory.

This example is for a small fictitious Iowa community that we will call Goodwater. Goodwater sits along the Cooldrink River. Goodwater gets most of its drinking water from an alluvial aquifer associated with the Cooldrink River. This is a shallow aquifer that can be recharged quickly through surface water infiltration. Because of this, it is particularly vulnerable to contamination and can become contaminated fairly quickly.

Goodwater also has one well drawing water from the Jordan aquifer. The Jordan aquifer is much deeper and recharges much slower than the alluvial aquifer because of impermeable material located between the aquifer and the land surface. The Jordan aquifer is not as susceptible to contamination but can become contaminated quickly if contaminants have a pathway such as an improperly abandoned well.

The city leaders of Goodwater have been reading about groundwater protection and have decided that a wellhead protection plan is a good idea. They have created a community wellhead protection team, headed by the mayor, and consisting of the city manager, water supply manager, a chamber of commerce member, a city council member, the school superintendent, and a retired city employee. The committee decided that it was time to form the source inventory team. To accomplish this, they held a public meeting, aired live over the local access cable channel, and invited the local newspaper to cover the event. During this meeting they discussed what wellhead protection is, what the advantages were, and why they felt that it was the right thing for Goodwater. They invited all interested persons to contact them about volunteering to assist in

developing the plan and to attend the next wellhead protection team meeting to discuss any concerns that they might have about the plan.

The second meeting was well attended, and the committee did its best to answer the questions and concerns of those attending. Following the meeting, the committee continued to solicit volunteers from the community. In the meantime, they contacted the Iowa Department of Natural Resources, informing them of the decision to create a wellhead protection plan for Goodwater, and asking for help. The IDNR responded by sending the committee maps of the Goodwater wellhead protection area and information about known contaminant sources and wells in the area. The maps (Appendix B, pages B-1 and B-2) provide a number of items:

1. **The boundary of the wellhead protection area defined by a 10-year time of travel.** Contamination taking place within the area shown on the map (pages B-1 and B-2) could be expected to show up in the well water in 10 years or less.

2. **The delineation of a secondary wellhead protection zone.** This larger zone indicates the area where contamination might reach the aquifer through transport by surface water (page B-1). This is especially important for alluvial aquifers such as the one Goodwater uses. It is unreasonable to expect to be able to manage such a large area, but the fact that contaminants can enter from an outside source is important to note. Education of persons in this area would be especially important. In reality, this area could encompass the entire basin of the Cooldrink River. An area that large would be impossible to handle, so the secondary wellhead protection zone shown on B-1 is provided to help identify the area that could pose a more immediate threat should surface water contamination occur. There should be a mechanism in place for alerting city water officials of any spills into the Cooldrink River or tributaries located within the secondary wellhead protection zone.

3. **The locations of known public and private wells in and around Goodwater, for which there is data, and locations where water withdrawal permits have been issued. This is not all wells, only those wells in the IDNR databases.**

Please note that water withdrawal permits are not exact locations. They are shown in the center of a section, indicating that they should be located somewhere in that section.

4. **The location of natural features such as rivers, streams, ponds, lakes, and topography.**

5. **The locations of man-made features such as roads, highways, and railroads.** Additionally, some land use features might be included, such as an airport or a golf course.

6. **A geographic grid based on the Public Land Survey System, showing the township, range, and sections located in and around Goodwater.** As you can see, the map provided is a regional map probably not suitable for locating actual contaminant sources in the wellhead protection zone. A more detailed map is needed for this purpose. The detailed map shown (see page B-2) will not be provided by IDNR, but might be similar to one developed by the wellhead protection team. It is provided here only as an example.

7. **The location of potential contaminant sources within the wellhead protection area that are contained in the IDNR-GSB database.** These include hazardous waste generators, wastewater treatment plants, underground storage tanks, and livestock lagoons. Other information will be provided as it is developed.

Along with the map, IDNR provided the wellhead protection committee with information about wells in the Geological Survey Bureau database, data on permitted private wells, permitted water withdrawal wells and public water supply wells (Appendix B, pages B-3 through B-24). This data identifies the wells shown on the map, who owns them, approximately where they are located, and some characteristics about the wells, when known.

For instance, well number 75010 (page B-3) shows location, depth and elevation of the well, date drilled, and a geologic formation log. This geologic information was developed by survey geologists who examined the drill cuttings from the well. The date drilled may be important in determining if this well poses a threat. Older wells may not have been constructed to today's standards. It is not known if this well is in use or abandoned.

Well permit number 111 (page B-8) identifies a private well and shows location, estimated depth, and use of the well. Also shown is information on other existing wells on the property location, uses and status of the wells. For instance, permit 111 shows that in addition to the permitted well there are two other wells that are inactive. Part of the management plan might provide assistance for well plugging if needed.

Water withdrawal permits (page B-10) show the location of all facilities permitted to withdraw more than 25,000 gallons per day from surface or groundwater. These wells pump at a high rate and may affect the groundwater flow system in the area.

Public water supply wells include information on both municipal and other public supplies. More extensive information is available on municipal wells. Pages B-11 through B-23 show typical information for the city of Goodwater. Information on a public water supply (page B-24) outside of the immediate city limits is also provided. Other public supplies are often subdivisions, trailer courts, rural restaurants or bars, recreational facilities, or larger industrial operations.

IDNR also supplied information about contaminant sources shown on the map. This information is shown in Appendix B, pages B-25 through B-28, and includes data for hazardous waste generators, underground storage tanks, sanitary treatment plants, and agricultural waste storage facilities. The databases this information is drawn from are under development and more information will probably be available when these forms are mailed to each public water supplier.

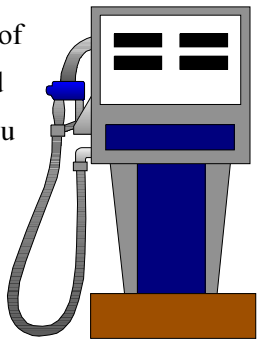
The committee collected the names of all people who indicated that they would be willing to participate in the inventory process, and grouped them by background, identifying special skills or knowledge that would be useful in different situations. The committee then split the volun-

teers into groups, and each group was assigned approximately equal portions of the work load. Each group was assigned an area to be surveyed after evaluating the skills and knowledge of the group members.

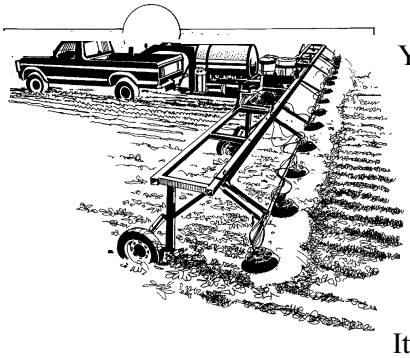
The committee recognized the need to assign unique ID numbers to each site. To accomplish this, each group was assigned a letter designator, so that site IDs could be easily related to a particular group. Each site ID consists of the group letter and a number, assigned sequentially (e.g., A50, A51, A53; B65, B66, B67, etc.). This is just one of many possible systems that you can use. For example, you could use the surveyor's initials and a number (e.g., CAT-1, EN-1, etc.). Regardless of what method you use, it is very important that each site be assigned a site ID that will never be duplicated. The base maps, background information, and all necessary forms were distributed to each group along with instructions on how to conduct the field survey and fill out the forms. The groups then began the field survey portion of the contaminant source inventory. At this time, the survey was just done for the area within the 10-year time-of-travel zone.

Each of the groups surveyed their assigned areas, identifying all activities that could pose a threat to the groundwater system. For each location that was identified, a field survey form (page A-2) was filled out. All information was filled in as completely as possible, making sure that the entries were legible, and a sketch map of each location was drawn on the back of each form. For the purposes of this guide, five sites will be used as illustrations. The number of forms you will create will probably be much larger. The completed forms for this example are presented in Appendix C, pages C-1 through C-12. Note that for each form, a list of any potential contaminants could be easily viewed is included in the description. The sketch map on the back of each form is important for finding these potential contaminants later during the interview phase of the inventory.

Reviewing the field survey forms shows that the inventory team collected a lot of valuable information. In this example, the Goodwater Fast Stop (pages C-9 and C-10) is a convenience store. Looking at the DNR map (pages B-1 and B-2) you will see an underground gasoline storage tank at the Fast Stop's location. This tells you that there is data supplied by DNR about an underground storage tank at that site. That data is shown on page B-26 (reg. #9876545) and



indicates the status and any known leak information for this tank. Note, however, that all sites are not listed in the IDNR data. For example, there is no information listed for the Goodwater Cement Company.



You should take note of the farm (site W12, page C-5) in this example. Chemicals applied to the corn field (site map, page C-6) can be washed by rainfall runoff into the adjacent creek or can enter the groundwater system through infiltration. The creek runs past some of Goodwater's wells and also feeds the Cooldrink River, which flows past other wells. In Iowa, agricultural chemicals have been found in well water. It is important to identify sites like this one because they pose a threat to shallow groundwater and require special management consideration. Examples include those where row crops are planted, livestock production is taking place, or extensive application of fertilizer/pesticides to lawns is practiced.

When all field survey forms were completed and submitted, and the locations were updated or added to the "master" base map (page C-13), the role of the field survey team members was complete. The rest of the process was completed by members of the wellhead protection committee. The next step for the committee was to prioritize the sites located by the field survey to determine which were the greatest threat to the drinking water supply. Recall that this is a two-step process. To do this they began by filling out a Site Prioritization Worksheet for each of the five public water supply wells on the map (pages C-21 through C-25). First, they entered each of the map site IDs into column 1 of the form for each well. Then using the table on page A-3, they determined the land-use type and the associated risk score for each site and entered these into columns 2 and 3 of the form. Note that these values do not change, so the same information was entered into the forms for each well.

Next, using the base map, they determined the distance that each site was from each of the wells. The risk score for distance from the well (from the header for column 4) was entered in column 4 of the Site Prioritization Worksheet for each site. The idea behind this column is that if a spill occurs close to a well, it poses a greater threat than one that occurs further away. Therefore, the closer a site is to a well, the higher the score.

A Well Vulnerability Worksheet (pages C-14 through C-18) was completed for each of the five public water supply wells shown on the map. The resulting scores were entered into column 5 of the Site Prioritization Worksheets (pages C-21 through C-25). The committee then filled out Aquifer Vulnerability Worksheets (pages C-19 and C-20) for the two aquifers being used, and entered those scores into the Site Prioritization Worksheets (pages C-21 through C-25) in column 6. If there are questions about the vulnerability of a well or an aquifer, you can call the IDNR-GSB at (319) 335-1575. The Site Prioritization Worksheets (pages C-21 through C-25) were then completed by adding up columns 3 through 6 for each site, and entering the sum in column 7.

The final step was to summarize the risk posed by each site and determine the priority for further investigation. The scores from each site were summarized on the Site Prioritization Summary form (page C-26) and rankings assigned. To do this the well Id for each well was entered in the boxes provided across the top of the form and the Map Site Id for each potential contaminant source was entered in the column provided on the left side of the form. Then the scores were transferred from the Site Prioritization Worksheets and the total for each site for all wells was entered in column 7. Rankings were assigned and entered in column 8.

In the Goodwater example, the car dealership (S7) received the highest risk score due to its proximity to two of the town's wells. The next highest scores were received by sites N12 and J2. These were the Goodwater Fast Stop and the Goodwater Agrochemical Co., respectively. A possible chemical spill at the agrochemical plant a few years ago had been noted on the field survey form, although no details were given by the survey team. Further research by the well-head protection committee confirmed that a spill had occurred six years previously. With this additional information the committee decided that although the car dealership was nearer to two wells, the agrochemical plant might pose a greater risk to the water supply. For this reason, they adjusted the rankings so that site J2 was assigned the highest priority followed by S7 and then N12. Remember, the prioritization worksheets (pages A-6 and A-7) are used to provide an estimate of each site's relative threat. However, the relative threat is open to interpretation and may be revised based on local knowledge, as this example shows.

The committee was then ready for the final step of the contaminant source inventory process. They called the owners of each of the sites and scheduled a meeting time with each of them to

discuss their particular circumstances. Because the development of the wellhead protection plan and the inventory process had been well advertised and discussed, none of the owners were caught off guard by the request. Each was cooperative with the committee members conducting the interviews and supported the wellhead protection plan.
For the purposes of this example we will show completed interview inventory forms for only one of the sites. These are shown on pages C-27 through C-30. These are for the Goodwater Cement Company plant, and include information on the hydraulic fluid, diesel fuel, and oils and other fluids used by the owners for maintenance and operation of the machinery used by the facility. Note the sketch map on page C-28. This map shows in more detail the location and quantity of the contaminants on the property.

When all of the site interviews were done, the contaminant source inventory was complete. Using the information obtained by the inventory, the committee then started development of a management plan. Management plan procedures are not discussed in this document. For information on management plans you should see the Iowa Wellhead Protection Plan or contact the IDNR.

Final Notes

There are a couple of things you should note in the example presented here. As previously stated, site W12 is a farm located within the wellhead protection area. This site is considered to be a non-point source of potential contaminants. That is, chemicals coming from the field are spread over an area and can't be isolated to a single point such as a drain pipe. That makes management of this site much more difficult. Because they require special management considerations, it is important that **all** non-point sources be identified during the potential contaminant source inventory.

Second, although they are located outside the wellhead protection area, there are some sites located within the larger source water protection area that should be noted. In this example there is an airport north of Goodwater and a livestock lagoon in section 11 northwest of town. Neither of these sites are within the wellhead protection area, but they could pose a threat to Goodwater's

groundwater if contaminants enter the surface water system. Because of this, the committee should identify these sites and attempt to educate the owners/operators of these facilities about the dangers they could pose to the groundwater and what they can do to prevent contamination. When you are developing your plan you should keep circumstances like this in mind and take appropriate action if your situation so warrants.

That's all there is to it.

We hope this guide will provide you with the tools you need to complete the contaminant source inventory phase of your wellhead protection plan.

Good luck, and if you have any questions, please contact the Iowa Department of Natural Resources, Geological Survey Bureau at (319) 335-1575.

APPENDIX A — Blank Forms and Worksheets

Forms and Worksheets

Appendix A consists of blank field survey, assessment, and interview inventory forms. They are for your use. Please photocopy as many or as few of each form as you need to conduct your own inventory of potential contaminant sources. For example, you need, at a minimum, **one Field Survey Form (page A-2) for every site visited.**

Your team may choose to only make a few copies of the **Land-Use Risk form (page A-3).** However, you should make **one copy of the Well Vulnerability Worksheet (page A-4) for each well.**

Likewise, you should use **one Aquifer Vulnerability Worksheet (page A-5) for each aquifer supplying your wells.**

Depending on the number of sites identified during the field survey, **one copy of the Site Prioritization Worksheet (page A-6) is needed for each well.** Again, depending on the number of sites and number of wells in your community, you may only need a few of the **Site Prioritization Summary (page A-7) forms.**

Finally, you will need **one copy of the Interview Inventory Form (Page A-8) for each potential contaminant identified during the on-site inventory.**

This is your guide, use it as you see fit. We have designed it so the forms may be easily photocopied without removing them from the book. We recommend that the guide be kept intact for reference purposes.

For additional information about wellhead protection and other water resources-related topics or for copies of this guide in Portable Document Format® (.pdf), see GSB's website (in the *Publications* catagory) at www.igsb.uiowa.edu.

Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: _____ Time: _____

Map site ID: _____ County: _____

Name of person conducting survey: _____

Business or occupant's name: _____ Phone: _____

Owner's name: _____ Phone: _____

Site address or location: _____

City: _____ State: _____ Zip code: _____

Location (describe): _____
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

_____ 1/4, of the _____ 1/4, of the _____ 1/4, of the _____ 1/4, of Section _____ ,

Township _____ N, Range _____ W or E

Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

_____

_____

_____

_____

Conditions: _____
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.

Land-Use Risk

Least Risk ▲	Risk Score	Land Use Type
	1	Land surrounding a well or reservoir owned by a water company
	1	Permanent open space dedicated to recreation
	1	Federal, state, municipal, or private parks
	1	Woodlands managed for forest products
	2	Field crops: pasture, hay, grains, vegetables
	2	Low-density residential: lots larger than 2 acres
	2	Churches, municipal offices
	3	Agricultural production: dairy, livestock, poultry, nurseries, orchards, berries
	3	Golf courses, quarries
	3	Medium-density residential: lots from 1/2 - 1 acre
	4	Institutional uses: schools, hospitals, nursing homes, prisons, garages, salt storage, sewage treatment facilities
	4	High-density housing: lots smaller than 1/2 acre
	4	Commercial uses: limited hazardous material storage, only sewage disposal, confined animal feeding operations
	5	Improperly abandoned wells in the same aquifer as the supply well
	5	Retail commercial: gasoline, farm equipment, automotive, sales and services, dry cleaners, photo processor, medical arts, furniture strippers, machine shops, radiator repair, printers, fuel oil distributors
	5	Industrial: all forms of manufacturing and processing, research facilities
▼	5	Underground storage of chemicals, petroleum
Greatest Risk	5	Waste disposal: pits, ponds, lagoons; injection wells used for waste disposal; landfills; hazardous waste treatment, storage, and disposal sites; agricultural drainage wells

Source: U.S. Environmental Protection Agency, 1989, A Local Planning Process for Ground Water Protection, Office of Drinking Water, Washington, D.C.

Well Vulnerability Worksheet

Well ID: _____

	Yes	No	Don't know
1) Has your well ever yielded water with nitrate concentrations higher than 5 mg/l as N (half the MCL)?	☐	☐	
2) Does your well have a history of water quality detects for man-made chemicals or contaminants (excluding trihalomethanes (THMs))?	☐	☐	
3) Does raw water from the well have a history of fecal coliform bacteria?	☐	☐	
4) Does surface drainage flow toward the well, or has it been determined by IDNR to be groundwater under the influence of surface water?	☐	☐	
5) Is the well casing leaking?	☐	☐	☐
6) Is the well ungrouted or is the grout seal in poor condition?	☐	☐	☐

Summary:
To determine the well vulnerability, choose only one of the following:

		Score
If any "Yes" box was marked, mark this box	☐	2
If all "No" boxes were marked, mark this box:	☐	0
If "No" was marked for questions 1, 2, 3 and 4 and a "Don't Know" was marked for question 5 or 6, mark this box:	☐	1

Transfer the resulting score to the column for well vulnerability on the Site Prioritization Worksheet (p. A-6).

Aquifer Vulnerability Worksheet

Complete one Aquifer vulnerability worksheet for each aquifer.

Aquifer name: _____

(Hydrogeologic name: refer to well records)

What is the thickness of the confining materials, such as glacial till or shale, above the aquifer in the wellhead protection area?

	Score	
<25 ft.	4	☐
25 - 50 ft.	3	☐
50 - 100 ft.	2	☐
>100 ft,	1	☐

Insert the score corresponding to the marked box into the aquifer vulnerability column o Site Prioritization Worksheet (p. A-6).

Site Prioritization Worksheet

(complete as needed for each well)

Well ID: _____

Map site ID (from page A-2) (contaminant source)	**Land-use type** (from page A-3)	**Land-use risk score** (from page A-3) Score: 1 to 5	**Distance of contaminant source from well** Score: <500' = 4 500-1500' = 3 1501-2500' = 2 >2500' = 1	**Well vulnerability** (from page A-4) Score: 0, 1, or 2	**Aquifer vulnerability** (from page A-5) Score: 1 to 4	**Total score** Sum of columns 3-6
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Site Prioritization Summary

Map site ID	Well(s)					Total for all wells	Rank order
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Instructions:

1) Insert Map site ID in column (1) and well ids in spaces provided across the top of the form.
2) Enter scores from column 7 on the Site Prioritization Worksheet (p. A-6) for each site in columns (2) through (6). Use one column for each well.
3) Add forms as needed to complete all sites and/or wells. Bring totals forward from previous sheets.
4) Sum the transferred scores and enter in column (7). Enter the rank order in column (8).

Wellhead Protection Contaminant Source Inventory: Interview Inventory Form

Use additional sheets as needed for each potential contaminant on the site.

Map site ID: _____
(from field survey form)

Interviewee: _____

Description and location of potential contaminant material:

Volume or quantity of material on site:

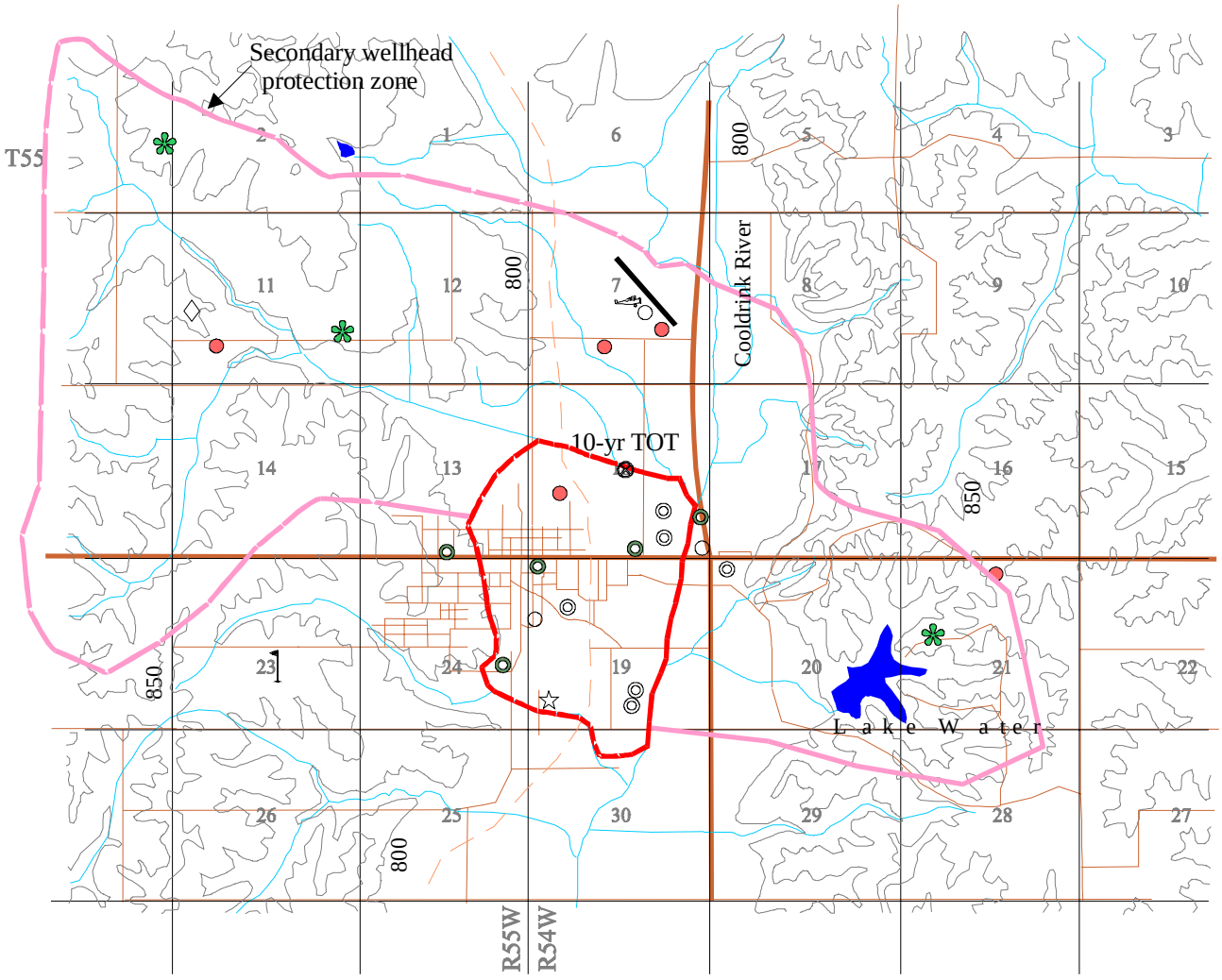
Handling methods used for the material:

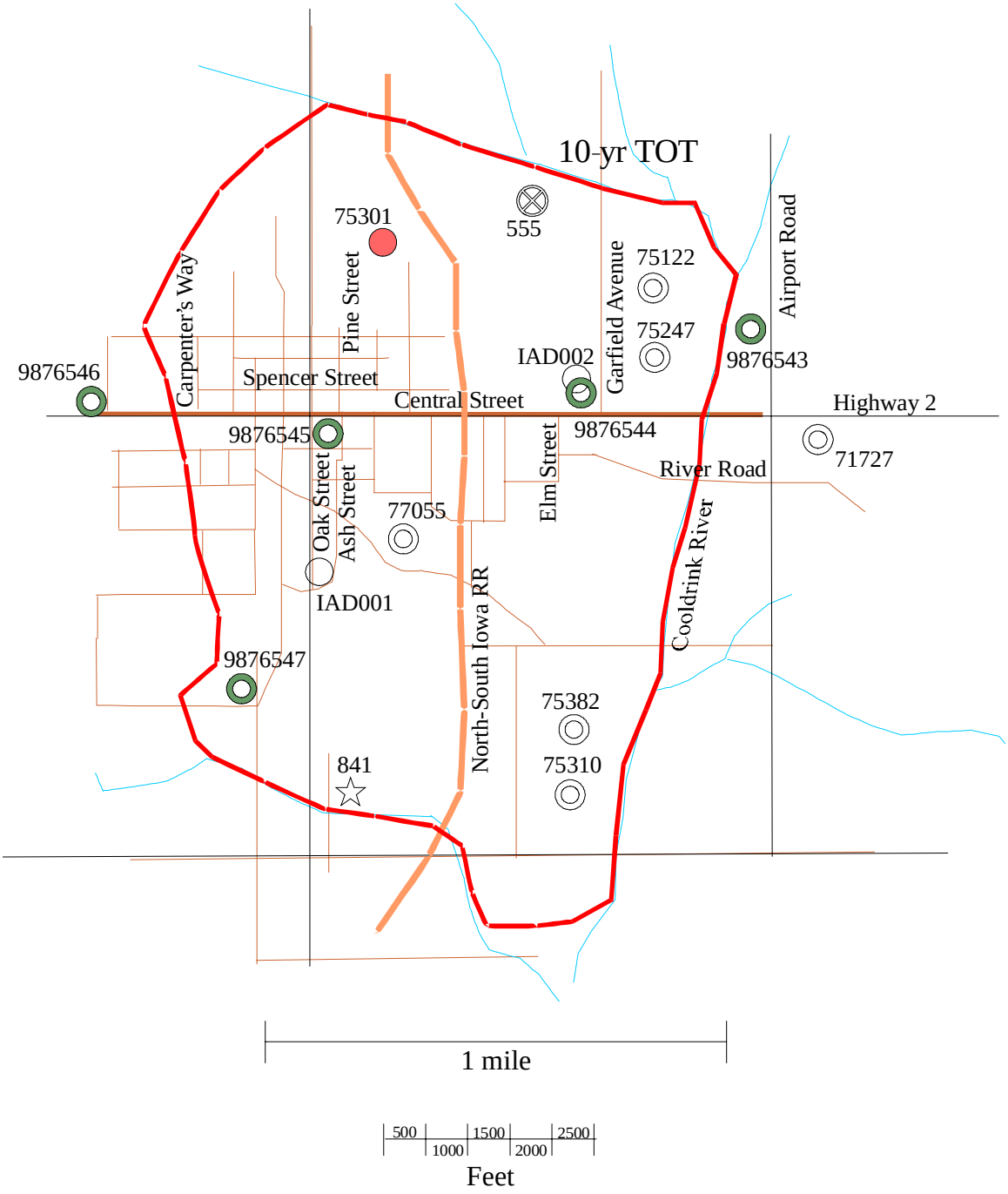
Describe any control/containment measures in effect for the material:

Are there Material Safety Data Sheets (MSDS) available for the material on the site?

Include additional notes, sketches, etc. on the back of this sheet.

APPENDIX B — Goodwater Well and Contaminant Source Data


Secondary wellhead
protection zone
T55
800
Cooldrink River
10-yr TOT
850
Lake Water
800
R55W
R54W
Contour interval = 25 feet
1 mile
GSB well
Private well
Water withdrawal facility
Wastewater treatment plant
Public water supply well
Underground storage tank
Hazardous waste generator
Livestock waste lagoon
Railroad



- Public water supply well
- Other well
- Facilities permitted for water use >25,000 gpd
- Wastewater treatment plant
- Underground storage tank
- Hazardous waste generator

DATA FOR WELL NO. 75010

==========

GENERAL INFORMATION

WNUMBER: 75010LOCATION: T. 55 N., R. 55 W., Sec. 11 SW SW NE SE LOC. ACC.: (calc. +/- 230')

QUADRANGLE NAME: GOODWATER COUNTY: LINCOLN STATE: IOWA

SURFACE ELEVATION: 820 ft. (alt. +/- 5') TOTAL DEPTH: 357 ft. BEDROCK DEPTH: 115 ft.

OWNER: GOODWATER SCHOOL DRILLER: GOOD WELL DRILLER DRILLING DATE: 09/12/1959

OTHER IDENTIFIER: #1 WELL TYPE: unkn

DRILLING METHOD: cable tool SAMPLE TYPE: cuttings AQUIFER: unkn

LOG TYPE: strip log ADD'L LOG TYPE:

==========

HYDROGEOLOGIC INFORMATION

No hydrologic information is available for well no. 75010

==========

WELL CONSTRUCTION INFORMATION

No construction information is available for well no. 75010

==========

GEOLOGIC INFORMATION

SYSTEM	SERIES	GROUP	FORMATION	MEMBER (SUBMEM.)	DEPTH TOP	ELEV. TOP	THICK -NESS	LITHOLOGY (SUMMARY)
			** sample gap **		0	820	10	Loes
QUAT					10	810	105	Till, Gtil
PENN		Marmaton			115	705	226	Sh. Ls
					341	479	16	Sh, Ls

A graphic log showing lithology and stratigraphy is available for well no.75010

DATA FOR WELL NO. 75100

GENERAL INFORMATION

WNUMBER: 75100LOCATION: T. 55 N., R. 54 W., Sec. 7 SE NE SW SW LOC. ACC.: (calc. +/- 230')

QUADRANGLE NAME: GOODWATER COUNTY: LINCOLN STATE: IOWA

SURFACE ELEVATION: 785 ft. (alt. +/- 5') TOTAL DEPTH: 224 ft. BEDROCK DEPTH: 85 ft.

OWNER: USGS DRILLER: GOOD WELL DRILLER DRILLING DATE: 04/04/1962

OTHER IDENTIFIER: D-7 WELL TYPE: exploration

DRILLING METHOD: rotary SAMPLE TYPE: core AQUIFER: unkn

LOG TYPE: strip log ADD'L LOG TYPE:

HYDROGEOLOGIC INFORMATION

No hydrologic information is available for well no. 75100

WELL CONSTRUCTION INFORMATION

No construction information is available for well no. 75100

GEOLOGIC INFORMATION

SYSTEM	SERIES	GROUP	FORMATION	MEMBER (SUBMEM.)	DEPTH TOP	ELEV. TOP	THICK -NESS	LITHOLOGY (SUMMARY)
			** sample gap **		0	785	31	Cl, fill
QUAT	Pleistocen				31	754	54	Till, Slt
PENN	Desmoinesi	Marmaton			85	700	139	Sh, Ls

A graphic log showing lithology and stratigraphy is available for well no.75100

DATA FOR WELL NO. 75225

==========

GENERAL INFORMATION

WNUMBER: 75225LOCATION: T. 55 N., R. 54 W., Sec. 7 SW SE NE NE LOC. ACC.: (calc. +/- 230')

QUADRANGLE NAME: GOODWATER COUNTY: LINCOLN STATE: IOWA

SURFACE ELEVATION: 780 ft. (alt. +/- 5') TOTAL DEPTH: 129 ft. BEDROCK DEPTH: 95 ft.

OWNER: USGS DRILLER: GOOD WELL DRILLER DRILLING DATE: 04/06/1962

OTHER IDENTIFIER: D-9 WELL TYPE: exploration

DRILLING METHOD: rotary SAMPLE TYPE: core AQUIFER: unkn

LOG TYPE: strip log ADD'L LOG TYPE:

==========

HYDROGEOLOGIC INFORMATION

No hydrologic information is available for well no. 75225

==========

WELL CONSTRUCTION INFORMATION

No construction information is available for well no. 75225

==========

GEOLOGIC INFORMATION

SYSTEM	SERIES	GROUP	FORMATION	MEMBER (SUBMEM.)	DEPTH TOP	ELEV. TOP	THICK -NESS	LITHOLOGY (SUMMARY)
			** sample gap **		0	780	5	fill
QUAT	Pleistocen				5	775	90	Till, Slt, S&G
PENN	Desmoinesi	Marmaton			95	685	34	Sh

A graphic log showing lithology and stratigraphy is available for well no.75225

DATA FOR WELL NO. 75301

==========

GENERAL INFORMATION

WNUMBER: 75301LOCATION: T. 55 N., R. 54 W., Sec. 18 SW SW NE LOC. ACC.: (calc. +/- 470')

QUADRANGLE NAME: GOODWATER COUNTY: LINCOLN STATE: IOWA

SURFACE ELEVATION: 785 ft. TOTAL DEPTH: 45 ft. BEDROCK DEPTH: 0 ft.

OWNER: MEYER, JEFF DRILLER: GOOD WELL DRILLER DRILLING DATE: 06/17/1988

OTHER IDENTIFIER: WELL TYPE: irrigation

DRILLING METHOD: rotary SAMPLE TYPE: cuttings AQUIFER: unkn

LOG TYPE: unkn ADD'L LOG TYPE:

==========

HYDROGEOLOGIC INFORMATION

No hydrologic information is available for well no. 75301

==========

WELL CONSTRUCTION INFORMATION

Well Construction Date: 06/17/88

CASING STRINGS:

(1) Diameter: 32.00 in. Type: STEEL Depth Top: 0.00 ft. Depth Bottom: 25.00 Amt: 25.00 ft.
(2) Diameter: 16.00 in. Type: STEEL Depth Top: +3.00 ft. Depth Bottom: 35.00 Amt: 38.00 ft.

SCREEN OPENINGS - PERFORATIONS:

(1) Diameter: 16.00 in. Depth Top: 35.00 ft. Depth at Bottom: 45.00 Amt: 10.00 ft.

GROUT: 0' – 25' BENTENITE GROUT

COMMENTS: 25' – 45' GRAVEL PACKED

==========

GEOLOGIC INFORMATION

No digital geologic information is available for well no. 75301

DATA FOR WELL NO. 75350

==========

GENERAL INFORMATION

WNUMBER: 75350 LOCATION: T. 55 N., R. 54 W., Sec. 21 NW NE NE NE LOC. ACC.: (calc. +/- 470')
QUADRANGLE NAME: GOODWATER COUNTY: LINCOLN STATE: IOWA
SURFACE ELEVATION: 855 ft. TOTAL DEPTH: 120 ft. BEDROCK DEPTH: 0 ft.
OWNER: ROBERT LIBRA DRILLER: GOOD WELL DRILLER DRILLING DATE: 08/15/61
OTHER IDENTIFIER: none WELL TYPE: private
DRILLING METHOD: auger SAMPLE TYPE: cuttings AQUIFER: unkn
LOG TYPE: strip log ADD'L LOG TYPE:

==========

HYDROGEOLOGIC INFORMATION

MAIN WATER TOP: 0 ft. MAIN WATER BOTTOM: 0 ft. AQUIFER: unkn
DATE: 08/15/61 STATIC WATER LEVEL: unkn ft. PUMPED WATER LEVEL: unkn ft. YIELD: 30.0 gpm

==========

WELL CONSTRUCTION INFORMATION

Well Construction Date: 08/15/61
REMARKS:
110' OF 6” casing, 5' of 4” screen

==========

GEOLOGIC INFORMATION

No digital geologic information is available for well no. 75350

A graphic log showing lithology and stratigraphy is available for well no.75350

PERMITTED PRIVATE WELLS

OWNER/APPLICANT (applicant) Permit No.: 111
Name: Ken Kolodner Application Date: 09/25/1988
Address: RR 1
Goodwater, IA 50000

PERMITTED WELL
Location: T.55N., R.55W., Sec.3, SE NE NE
Depth: 50.0
Use(1): Livestock/Agricultural Use(2):---
Contractor: Cont. Id.:

EXISTING WELLS (located on applicant's property)

	USES	LOCATION	STATUS
1)		T 55N R 55W Sec3 SE	Inactive, good cond.
2)		T 55N R 55W Sec3 NE	Inactive, good cond.

CERTIFICATION
Agent Name:

OWNER/APPLICANT (applicant) PermitNo.: 222
Name: Laura Risk Application Date: 10/13/1988
Address: RR 1
Goodwater, IA 50000

PERMITTED WELL
Location: T.55N., R.55W., Sec.11, SE NE SE
Depth: 60.0
Use(1): Livestock/Agricultural Use(2):---
Contractor: Cont. Id.:

EXISTING WELLS (located on applicant's property)

	USES	LOCATION	STATUS
1)	---	T 55N R 55W Sec11 SE	Active, in use

CERTIFICATION
Agent Name: Ed Nealson

PERMITTED PRIVATE WELLS

OWNER/APPLICANT (applicant)
Name: Bob Rowden
Address: RR 1
Goodwater, IA 50000

PermitNo.: 333
Application Date: 09/20/1989

PERMITTED WELL
Location: T.55N., R.54W., Sec.21, NW SW
Depth: 50.0
Use(1): Livestock/Agricultural Use(2):---
Contractor: Cont. Id.:

EXISTING WELLS (located on applicant's property)

	USES	LOCATION	STATUS
1)	---	T 55N R 54W Sec21	Inactive, good cond.

CERTIFICATION
Agent Name:

Permitted Water Withdrawal Wells (>25,000 GPD)

Permit No.: 555 Location: Sec. 18, Twp. 55, Rge. 54 W, Lincoln Co.
Permit Status: active Source(s): Well No. Wells: 1
Use Period: Production: 0 MGY Pumping Rate: 400 GPM

Use Information:
General farm crop irrigation

Well Information:

Aquifer	No. Wells	Depth
Unconsolidated	2	30 ft.

Permittee:
Meyer, J.
1051 Garfield Ave.
Goodwater, IA 50000

Iowa Department of Natural Resources
Geological Survey Bureau

Municipal Water-Supply Inventory

MUNICIPALITY: GOODWATER PWSID: 0003032
COUNTY: LINCOLN REGION: 7

CONTACT: HYDRO KING PHONE: (010) 555-0101 POPULATION: 2340
ADDRESS: Goodwater Public Water Supply YEAR: 01/01/1990
City Hall
GOODWATER, IA 50000-0000

WATER SOURCE: Groundwater
AVERAGE USE: 234,000 gpd 05/29/1992 - 08/03/1995 STORAGE CAPACITY: 250,000 gallons
MAXIMUM USE: 350,000 gpd / /

COMMENTS:
1995 Goodwater derives its water from wells #2, 3, 4, 5
1995 Treatment: hypochlorination; polyphosphate addition; aeration
1990 GOODWATER DERIVES ITS WATER FROM WELLS #2, 3, 4, 5
1990 TREATMENT: HYPOCHLORINATION; POLYPHOSPHATE ADDITION; AERATION FOR IRON REMOVAL
1986 GOODWATER DERIVES ITS WATER FROM WELLS #2, 3, 4, 5
1986 TREATMENT: HYPOCHLORINATION; AERATION

EDIT DATE: 11/10/1995

Municipal Water-Supply Inventory

DATA FOR: GOODWATER #2 PWSID\SEQ#: 0003032- 01
WNUMBER: 77055 USGS ID: 413950091321401

==========

GENERAL INFORMATION

LOCATION: T 55N R54W Sec 18 SE SE NW NW COUNTY: LINCOLN TOPOGRAPHIC MAP: GOODWATER
ELEVATION: 790 feet SITE TYPE: Drilled hole TOTAL DEPTH: 2020 feet BEDROCK DEPTH: 90 feet
DRILLER: Large Well Drilling Co. DRILL DATE: 01/01/1934 DRILLING METHOD: cable tool
WELL TYPE: Municipal WELL DEPTH: 2020 feet AQUIFER: Jordan
STATUS: Secondary ON LINE: 01/01/1934 ABANDONED: / / PLUGGED: / /
LOG TYPE: strip LOG QUALITY: SAMPLE TYPE: chips BEDROCK DEPTH: 90 feet STRIP LOG BY: JCP
LOG TYPE2: LOG QUALITY2: BASIN: 10170204 STRIP LOG DATE: 07/01/1935
COMMENTS: Acidized 1976 SUPPLY PERCENT: 10%
Standby well in 1956
Date also reported 1935

LOCATION: At water treatment plant EDIT DATE: 01/10/1995

==========

WELL CONSTRUCTION DATA FOR GOODWATER #2

HOLE SCHEDULE: WELL CONSTRUCTION DATE: 01/01/1934
(1) Hole diameter: 20.00 inches Depth to bottom: 100 feet
(2) Hole diameter: 18.00 inches Depth to bottom: 800 feet
(3) Hole diameter: 16.00 inches Depth to bottom: 1200 feet
(4) Hole diameter: 14.00 inches Depth to bottom: 1600 feet
(5) Hole diameter: 10.00 inches Depth to bottom: 2020 feet

CASING SCHEDULE:

(1) Diameter: 18.00 inches	Type: steel	Depth top: 0.0 feet	Depth bottom: 100 feet	Amount: 100 feet
(2) Diameter: 16.00 inches	Type: steel	Depth top: 0.0 feet	Depth bottom: 800 feet	Amount: 800 feet
(3) Diameter: 14.00 inches	Type: steel	Depth top: 800.0 feet	Depth bottom: 1200 feet	Amount: 400 feet
(4) Diameter: 12.00 inches	Type: steel	Depth top: 1200.0 feet	Depth bottom: 1600 feet	Amount: 400 feet

GROUT SCHEDULE:
(1) Type: cement Depth top: 0 feet Depth bottom: 100 feet

SCREEN OR PERFORATED CASING SCHEDULE:

GRAVEL-PACKED: false Gravel-packed top: feet Gravel-packed bottom: feet

PUMP SCHEDULE:
Pump type: TURB Diameter: inches Depth to intake: 500 feet Rated capacity: 350 gpm

COMMENTS: 16 inch @ 18 inch casing cemented together 0 feet to 100 feet

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HYDROGEOLOGIC INFORMATION FOR GOODWATER #2

MAIN WATER:
Main water top: 1500 feet Main water bottom: 2020 feet Pump rating: 300 gpm Pump yield: 300 gpm

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DRILLER's LOG FOR GOODWATER #2

0' – 90'	Quaternary
90' – 490'	Pennsylvanian
490' – 790'	Mississippian
790' – 1190'	Devonian
1190' – 1990'	Ordovician
1990' – 2020'	Cambrian

==========

WATER QUALITY DATA FOR GOODWATER #2

WATER QUALITY INFORMATION

Municipal Water-Supply Inventory

FIELD DATA

DATE OF COLLECTION: 02/18/1940 TIME: COLLECTOR: IGS MINERAL NUMBER: 300
SOURCE: Public well, 2020'
SAMPLING POINT: Wellhead
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? Yes IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 26.0 C pH: 7.40 ALKALINITY mg/l CaCO3 P: 0 mg/l T: 190 mg/l
SPECIFIC CONDUCTANCE: 3400 micromhos HOURS PUMPED: PUMPING RATE: 0 gpm

---

LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE:	3400	micromhos	pH:	7.40	SILICA (SiO2):	12.00	mg/l
SOLUABLE IRON (Fe):	1.200	mg/l			TOTAL IRON (Fe):	1.200	mg/l
FILTERABLE RESIDUE:	2360	mg/l			TOTAL RESIDUE:	2360	mg/l
HARDNESS as CaCO3:	680	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	190 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	32.000	NITRATE (NO3-):	0.700
SODIUM (Na+):	520.000	FLUORIDE (F-):	3.200
CALCIUM (Ca++):	160.000	CHLORIDE (Cl-):	540.000
MAGNESIUM (Mg++):	63.000	SULFATE (SO4--):	840.000
MANGANESE (Mn++) soluble:	< 0.010	BICARBONATE (HCO3-):	282.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	-----

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	-----	GROSS ALPHA:	-----
BARIUM (Ba):	-----	226RADIUM:	-----
CADMIUM (Cd):	-----	228RADIUM:	-----
CHROMIUM (Cr):	-----	GROSS BETA:	-----
COPPER (Cu):	-----	90STRONTIUM:	-----
LEAD (Pb):	-----		
MERCURY (Hg):	-----	222RADON:	-----
SELENIUM (Se):	-----		
SILVER (Ag):	-----		
ZINC (Zn):	-----		

COMMENTS:

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 07/17/1966 TIME: COLLECTOR: Water Superintendant MINERAL NUMBER: 12345
SOURCE: Public well, 2020'
SAMPLING POINT:
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? Yes IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 26.9 C pH: 7.40 ALKALINITY mg/l CaCO3 P: 0 mg/l T: 181 mg/l
SPECIFIC CONDUCTANCE: 3400 micromhos HOURS PUMPED: PUMPING RATE: 0 gpm

---

LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE:	3400	micromhos	pH:	7.40	SILICA (SiO2):	13.00	mg/l
SOLUABLE IRON (Fe):	2.500	mg/l			TOTAL IRON (Fe):	2.500	mg/l
FILTERABLE RESIDUE:	2420	mg/l			TOTAL RESIDUE:	2420	mg/l
HARDNESS as CaCO3:	637	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	181 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	34.000	NITRATE (NO3-):	4.200

SODIUM (Na+):	480.000	FLUORIDE (F-):	2.000
CALCIUM (Ca++):	157.000	CHLORIDE (Cl-):	530.000
MAGNESIUM (Mg++):	59.000	SULFATE (SO4--):	750.000
MANGANESE (Mn++) soluble:	< 0.010	BICARBONATE (HCO3-):	221.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	-----

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	-----	GROSS ALPHA:	-----
BARIUM (Ba):	-----	226RADIUM:	-----
CADMIUM (Cd):	-----	228RADIUM:	-----
CHROMIUM (Cr):	-----	GROSS BETA:	-----
COPPER (Cu):	-----	90STRONTIUM:	-----
LEAD (Pb):	-----		
MERCURY (Hg):	-----	222RADON:	-----
SELENIUM (Se):	-----		
SILVER (Ag):	-----		
ZINC (Zn):	-----		

COMMENTS:

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 09/01/1980 TIME: COLLECTOR: USGS MINERAL NUMBER: 34567
SOURCE: Public well, 2020'
SAMPLING POINT:
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? Yes IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 0.0 C pH: 7.2 ALKALINITY mg/l CaCO3 P: ---- mg/l T: ---- mg/l
SPECIFIC CONDUCTANCE: 3200 micromhos HOURS PUMPED: PUMPING RATE: 300 gpm

LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE:	3300	micromhos	pH:	7.37	SILICA (SiO2):	12.00	mg/l
SOLUABLE IRON (Fe):	2.300	mg/l			TOTAL IRON (Fe):	2.300	mg/l
FILTERABLE RESIDUE:	2450	mg/l			TOTAL RESIDUE:	2450	mg/l
HARDNESS as CaCO3:	641	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	187 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	32.000	NITRATE (NO3-):	5.700
SODIUM (Na+):	485.000	FLUORIDE (F-):	2.500
CALCIUM (Ca++):	159.000	CHLORIDE (Cl-):	535.000
MAGNESIUM (Mg++):	61.000	SULFATE (SO4--):	742.000
MANGANESE (Mn++) soluble:	< 0.010	BICARBONATE (HCO3-):	218.000
MANGANESE (Mn++) total:	< 0.010	CARBONATE (CO3--):	-----

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	0.010	GROSS ALPHA:	35
BARIUM (Ba):	< 0.100	226RADIUM:	12
CADMIUM (Cd):	< 0.010	228RADIUM:	-----
CHROMIUM (Cr):	< 0.010	GROSS BETA:	56
COPPER (Cu):	0.010	90STRONTIUM:	< 0.49
LEAD (Pb):	< 0.010		
MERCURY (Hg):	< 0.001	222RADON:	-----
SELENIUM (Se):	-----		
SILVER (Ag):	< 0.010		
ZINC (Zn):	0.170		

COMMENTS:

Municipal Water-Supply Inventory

DATA FOR: GOODWATER #3 PWSID\SEQ#: 0003032- 02
WNUMBER: 75122 USGS ID:

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GENERAL INFORMATION

LOCATION: T 55N R54W Sec 18 SE SE NW NW COUNTY: LINCOLN TOPOGRAPHIC MAP: GOODWATER
ELEVATION: 785 feet SITE TYPE: Drilled hole TOTAL DEPTH: 40 feet BEDROCK DEPTH: 0 feet
DRILLER: Local Well Drilling Co. DRILL DATE: 01/01/1948 DRILLING METHOD: drilled
WELL TYPE: Municipal WELL DEPTH: 37 feet AQUIFER: Alluvium
STATUS: Primary ON LINE: 01/01/1955 ABANDONED: / / PLUGGED: / /
LOG TYPE: LOG QUALITY: SAMPLE TYPE: BEDROCK DEPTH: 0 feet STRIP LOG BY:
LOG TYPE2: LOG QUALITY2: BASIN: 10170204 STRIP LOG DATE: / /
COMMENTS: **Drilled as an experimental test well in 1948; used occasionally prior to 1950**
1955: connected to the treatment plant [status between 1950 and 1955 is unclear]
Depth also reported 40', 39'
SUPPLY PERCENT: 30%
LOCATION: Near Cooldrink River EDIT DATE: 01/10/1995

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WELL CONSTRUCTION DATA FOR GOODWATER #3

HOLE SCHEDULE: WELL CONSTRUCTION DATE: 01/01/1948
(1) Hole diameter: 18.00 inches Depth to bottom: 40 feet

CASING SCHEDULE:
(1) Diameter: 16.00 inches Type: Steel Depth top: feet Depth bottom: 24.5 feet Amount: feet

GROUT SCHEDULE:

SCREEN OR PERFORATED CASING SCHEDULE:
(1) Diameter: 16.00 inches Slot: inches Depth top: feet Depth bottom: feet Amount: 15.0 feet

GRAVEL-PACKED: Gravel-packed top: feet Gravel-packed bottom: feet

PUMP SCHEDULE:
Pump type: TURB Diameter: inches Depth to intake: 30 feet Rated capacity: gpm

COMMENTS:

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HYDROGEOLOGIC INFORMATION FOR GOODWATER #3

MAIN WATER:
Main water top: 12 feet Main water bottom: 0 feet Pump rating: 80 gpm Pump yield: 80 gpm

DATE PUMPED: 01/01/52 TIME PUMPED:
STATIC WATER LEVEL: 12.5 feet PUMPING WATER LEVEL: 18.0 feet YIELD: 120.0 gpm DURATION: 8:00
AQUIFER PUMPED: Alluvium PUMP TEST: False PUMP METHOD: MEASUREMENT:
COMMENTS:

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DRILLER's LOG FOR GOODWATER #3

Driller's log:
0' – 10' gumbo
10' – 12' brown clay
12' – 13' medium sand
13' – 19' coarse sand, gravel, rock, & base of fine sand
19' – 23' coarse sand & gravel
23' – 27' coarse sand
27' – 29.5' coarse sand, gravel, rocks
29.5' – 31.5' clay
31.5' – 33' fine sand
33' – 34.5' coarse sand, small to large gravel rocks, clay
34.5' – 37' coarse sand, small to large gravel

==========

WATER QUALITY DATA FOR GOODWATER #3

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 07/17/1966 TIME: COLLECTOR: Water Superintendant MINERAL NUMBER: 12346
SOURCE: Public well, 37'
SAMPLING POINT: well house
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? No IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 0.0 C pH: 0.00 ALKALINITY mg/l CaCO3 P: ---- mg/l T: ---- mg/l
SPECIFIC CONDUCTANCE: ----- micromhos HOURS PUMPED: 300 PUMPING RATE: 90 gpm

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LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE:	1100	micromhos	pH:	6.50	SILICA (SiO2):	16.000	mg/l
SOLUABLE IRON (Fe):	-----	mg/l			TOTAL IRON (Fe):	2.900	mg/l
FILTERABLE RESIDUE:	783	mg/l			TOTAL RESIDUE:	805	mg/l
HARDNESS as CaCO3:	600	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	326 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	-----	NITRATE (NO3-):	1.800
SODIUM (Na+):	31.000	FLUORIDE (F-):	0.250
CALCIUM (Ca++):	164.000	CHLORIDE (Cl-):	35.000
MAGNESIUM (Mg++):	46.200	SULFATE (SO4--):	280.000
MANGANESE (Mn++) soluble:	0.890	BICARBONATE (HCO3-):	398.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	0.000

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	-----	GROSS ALPHA:	-----
BARIUM (Ba):	-----	226RADIUM:	-----
CADMIUM (Cd):	-----	228RADIUM:	-----
CHROMIUM (Cr):	-----	GROSS BETA:	-----
COPPER (Cu):	-----	90STRONTIUM:	-----
LEAD (Pb):	-----		
MERCURY (Hg):	-----	222RADON:	-----
SELENIUM (Se):	-----		
SILVER (Ag):	-----		
ZINC (Zn):	-----		

COMMENTS: FROM THE MINERAL ANALYSIS
Insoluble matter: 22.4
Total solids: 805
Fe2O3+Al2O3+Mn2O3: 2.4
Alkalies as Na+: 30.8
(Al+++): 0.9
N as NO2-: 0.004
PO4---: 0.04
(BO3---): 1.0

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 09/01/1980 TIME: COLLECTOR: USGS MINERAL NUMBER: 34568
SOURCE: Public well, 37'
SAMPLING POINT: well house
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? No IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 11.0 C pH: 7.1 ALKALINITY mg/l CaCO3 P: ---- mg/l T: ---- mg/l
SPECIFIC CONDUCTANCE: 1200 micromhos HOURS PUMPED: 300 PUMPING RATE: 90 gpm

LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE:	1300	micromhos	pH:	7.20	SILICA (SiO2):	16.000	mg/l
SOLUABLE IRON (Fe):	1.700	mg/l			TOTAL IRON (Fe):	1.700	mg/l
FILTERABLE RESIDUE:	781	mg/l			TOTAL RESIDUE:	781	mg/l
HARDNESS as CaCO3:	580	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	286 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	4.700	NITRATE (NO3-):	30.000
SODIUM (Na+):	21.000	FLUORIDE (F-):	0.300
CALCIUM (Ca++):	160.000	CHLORIDE (Cl-):	41.500
MAGNESIUM (Mg++):	43.700	SULFATE (SO4--):	280.000
MANGANESE (Mn++) soluble:	0.930	BICARBONATE (HCO3-):	349.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	0.000

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	< 0.010	GROSS ALPHA:	-----
BARIUM (Ba):	< 0.100	226RADIUM:	-----
CADMIUM (Cd):	< 0.001	228RADIUM:	-----
CHROMIUM (Cr):	< 0.010	GROSS BETA:	-----
COPPER (Cu):	< 0.010	90STRONTIUM:	-----
LEAD (Pb):	< 0.010		
MERCURY (Hg):	< 0.001	222RADON:	-----
SELENIUM (Se):	< 0.010		
SILVER (Ag):	< 0.010		
ZINC (Zn):	< 0.010		

COMMENTS:

Municipal Water-Supply Inventory

DATA FOR: GOODWATER #4 PWSID\SEQ#: 0003032- 03
WNUMBER: 75247 USGS ID:

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GENERAL INFORMATION

LOCATION: T 55N R54W Sec 18 SE SE NW NW COUNTY: LINCOLN TOPOGRAPHIC MAP: GOODWATER
ELEVATION: 781 feet SITE TYPE: Drilled hole TOTAL DEPTH: 45 feet BEDROCK DEPTH: 0 feet
DRILLER: Major Well Drilling Co. DRILL DATE: 01/01/1955 DRILLING METHOD: drilled
WELL TYPE: Municipal WELL DEPTH: 40 feet AQUIFER: Alluvium
STATUS: Primary ON LINE: / / ABANDONED: / / PLUGGED: / /
LOG TYPE: LOG QUALITY: SAMPLE TYPE: BEDROCK DEPTH: 0 feet STRIP LOG BY:
LOG TYPE2: LOG QUALITY2: BASIN: 10170204 STRIP LOG DATE: / /
COMMENTS: Main source of supply prior to 1975 SUPPLY PERCENT: 30%
1976: reconditioned by Major Well Drilling Co.

LOCATION: South of #3 EDIT DATE: 01/10/1995

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WELL CONSTRUCTION DATA FOR GOODWATER #4

HOLE SCHEDULE: WELL CONSTRUCTION DATE: 01/01/1955
(1) Hole diameter: 18.00 inches Depth to bottom: 45 feet

CASING SCHEDULE:
(1) Diameter: 16.00 inches Type: Steel Depth top: feet Depth bottom: 30.8 feet Amount: feet

GROUT SCHEDULE:

SCREEN OR PERFORATED CASING SCHEDULE:
(1) Diameter: 16.00 inches Slot: inches Depth top: feet Depth bottom: feet Amount: 15.0 feet

GRAVEL-PACKED: Gravel-packed top: feet Gravel-packed bottom: feet

PUMP SCHEDULE:
Pump type: TURB Diameter: inches Depth to intake: 30 feet Rated capacity: gpm

COMMENTS:

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HYDROGEOLOGIC INFORMATION FOR GOODWATER #4

MAIN WATER:
Main water top: 0 feet Main water bottom: 0 feet Pump rating: 80 gpm Pump yield: 80 gpm

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DRILLER's LOG FOR GOODWATER #4

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WATER QUALITY DATA FOR GOODWATER #4

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 07/17/1966 TIME: COLLECTOR: Water Superintendant MINERAL NUMBER: 12347
SOURCE: Public well, 45'
SAMPLING POINT: well house
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? Yes IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 0.0 C pH: 0.00 ALKALINITY mg/l CaCO3 P: ---- mg/l T: ---- mg/l
SPECIFIC CONDUCTANCE: ----- micromhos HOURS PUMPED: 300 PUMPING RATE: 90 gpm

---

LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE: 1150 micromhos pH: 7.00 SILICA (SiO2): 14.500 mg/l
SOLUABLE IRON (Fe): 2.6 mg/l TOTAL IRON (Fe): 2.6 mg/l

FILTERABLE RESIDUE:	840	mg/l			TOTAL RESIDUE:	840	mg/l
HARDNESS as CaCO3:	673	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	276 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	5.200	NITRATE (NO3-):	2.300
SODIUM (Na+):	30.100	FLUORIDE (F-):	0.300
CALCIUM (Ca++):	157.000	CHLORIDE (Cl-):	29.000
MAGNESIUM (Mg++):	45.300	SULFATE (SO4--):	283.000
MANGANESE (Mn++) soluble:	0.700	BICARBONATE (HCO3-):	388.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	-----

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	-----	GROSS ALPHA:	-----
BARIUM (Ba):	-----	226RADIUM:	-----
CADMIUM (Cd):	-----	228RADIUM:	-----
CHROMIUM (Cr):	-----	GROSS BETA:	-----
COPPER (Cu):	-----	90STRONTIUM:	-----
LEAD (Pb):	-----		
MERCURY (Hg):	-----	222RADON:	-----
SELENIUM (Se):	-----		
SILVER (Ag):	-----		
ZINC (Zn):	-----		

COMMENTS:

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 09/01/1980 TIME: COLLECTOR: USGS MINERAL NUMBER: 34569
SOURCE: Public well, 45'
SAMPLING POINT: well house
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? Yes IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 11.1 C pH: 7.1 ALKALINITY mg/l CaCO3 P: ---- mg/l T: ---- mg/l
SPECIFIC CONDUCTANCE: 1600 micromhos HOURS PUMPED: 300 PUMPING RATE: 90 gpm

LABORATORY ANALYSIS

SPECIFIC CONDUCTANCE:	1625	micromhos	pH:	7.40	SILICA (SiO2):	15.500	mg/l
SOLUABLE IRON (Fe):	2.1	mg/l			TOTAL IRON (Fe):	2.1	mg/l
FILTERABLE RESIDUE:	774	mg/l			TOTAL RESIDUE:	774	mg/l
HARDNESS as CaCO3:	655	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	264 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	4.500	NITRATE (NO3-):	35.000
SODIUM (Na+):	26.300	FLUORIDE (F-):	0.210
CALCIUM (Ca++):	157.000	CHLORIDE (Cl-):	34.000
MAGNESIUM (Mg++):	43.400	SULFATE (SO4--):	283.000
MANGANESE (Mn++) soluble:	0.810	BICARBONATE (HCO3-):	400.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	-----

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	< 0.010	GROSS ALPHA:	-----
BARIUM (Ba):	< 0.100	226RADIUM:	-----
CADMIUM (Cd):	< 0.001	228RADIUM:	-----
CHROMIUM (Cr):	< 0.010	GROSS BETA:	-----
COPPER (Cu):	< 0.010	90STRONTIUM:	-----

LEAD (Pb):	< 0.010		
MERCURY (Hg):	< 0.001	222RADON:	-----
SELENIUM (Se):	< 0.001		
SILVER (Ag):	< 0.010		
ZINC (Zn):	< 0.010		

COMMENTS:

Municipal Water-Supply Inventory

DATA FOR: GOODWATER #5 PWSID\SEQ#: 0003032- 05
WNUMBER: 75310 USGS ID:

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GENERAL INFORMATION

LOCATION: T 55N R54W Sec 19 SE SE NW NW COUNTY: LINCOLN TOPOGRAPHIC MAP: GOODWATER
ELEVATION: 788 feet SITE TYPE: Drilled hole TOTAL DEPTH: 50 feet BEDROCK DEPTH: 0 feet
DRILLER: Major Well Drilling Co. DRILL DATE: 01/01/75 DRILLING METHOD: rotary
WELL TYPE: Municipal WELL DEPTH: 50 feet AQUIFER: Alluvium
STATUS: Primary ON LINE: / / ABANDONED: / / PLUGGED: / /
LOG TYPE: LOG QUALITY: SAMPLE TYPE: BEDROCK DEPTH: 0 feet STRIP LOG BY:
LOG TYPE2: LOG QUALITY2: BASIN: 10170204 STRIP LOG DATE: / /
COMMENTS: SUPPLY PERCENT: 15%

LOCATION: in south well field EDIT DATE: 01/10/1995

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WELL CONSTRUCTION DATA FOR GOODWATER #5

HOLE SCHEDULE: WELL CONSTRUCTION DATE: 01/01/1955
(1) Hole diameter: 18.00 inches Depth to bottom: 50 feet

CASING SCHEDULE:
(1) Diameter: 16.00 inches Type: Steel Depth top: feet Depth bottom: 35.5 feet Amount: feet

GROUT SCHEDULE:

SCREEN OR PERFORATED CASING SCHEDULE:
(1) Diameter: 16.00 inches Slot: inches Depth top: feet Depth bottom: feet Amount: 15.0 feet

GRAVEL-PACKED: Gravel-packed top: 35 feet Gravel-packed bottom: 50 feet

PUMP SCHEDULE:
Pump type: TURB Diameter: inches Depth to intake: 30 feet Rated capacity: gpm

COMMENTS:

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HYDROGEOLOGIC INFORMATION FOR GOODWATER #5

MAIN WATER:
Main water top: 0 feet Main water bottom: 0 feet Pump rating: 90 gpm Pump yield: 90 gpm

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DRILLER's LOG FOR GOODWATER #5

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WATER QUALITY DATA FOR GOODWATER #5

WATER QUALITY INFORMATION

FIELD DATA

DATE OF COLLECTION: 09/01/1980 TIME: COLLECTOR: USGS MINERAL NUMBER: 34570
SOURCE: Public well, 50'
SAMPLING POINT: well house
WAS SAMPLE FREE TURBIDITY WHEN COLLECTED? Yes IS A POLYPHOSPHATE BEING USED? No
TEMPERATURE: 11.2 C pH: 7.1 ALKALINITY mg/l CaCO3 P: ---- mg/l T: ---- mg/l
SPECIFIC CONDUCTANCE: 1300 micromhos HOURS PUMPED: 24:00 PUMPING RATE: 80 gpm

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LABORATORY ANALYSIS

SOLUABLE IRON (Fe):	1.600	mg/l			TOTAL IRON (Fe):	1.600	mg/l
FILTERABLE RESIDUE:	770	mg/l			TOTAL RESIDUE:	770	mg/l
HARDNESS as CaCO3:	550	mg/l					
ALKALINITY mg/l CaCO3 P:	0	mg/l	T:	285 mg/l			

CATIONS (mg/l):		ANIONS (mg/l)	
POTASSIUM (K+):	4.500	NITRATE (NO3-):	20.000
SODIUM (Na+):	22.000	FLUORIDE (F-):	0.100
CALCIUM (Ca++):	159.000	CHLORIDE (Cl-):	42.000
MAGNESIUM (Mg++):	41.900	SULFATE (SO4--):	277.000
MANGANESE (Mn++) soluble:	0.900	BICARBONATE (HCO3-):	351.000
MANGANESE (Mn++) total:	-----	CARBONATE (CO3--):	-----

TRACE METALS (mg/l)		RADIOACTIVITY (pCi/l)	
ARSENIC (As):	< 0.010	GROSS ALPHA:	5
BARIUM (Ba):	< 0.100	226RADIUM:	-----
CADMIUM (Cd):	< 0.001	228RADIUM:	-----
CHROMIUM (Cr):	< 0.010	GROSS BETA:	10
COPPER (Cu):	< 0.010	90STRONTIUM:	-----
LEAD (Pb):	< 0.010		
MERCURY (Hg):	< 0.001	222RADON:	-----
SELENIUM (Se):	< 0.010		
SILVER (Ag):	< 0.010		
ZINC (Zn):	< 0.050		

COMMENTS:

Municipal Water-Supply Inventory

DATA FOR: GOODWATER #6 PWSID\SEQ#: 0003032- 04
WNUMBER: 75382 USGS ID:

==========

GENERAL INFORMATION

LOCATION: T 55N R54W Sec 19 SE SE NW NW COUNTY: LINCOLN TOPOGRAPHIC MAP: GOODWATER
ELEVATION: 785 feet SITE TYPE: Drilled hole TOTAL DEPTH: 55 feet BEDROCK DEPTH: 0 feet
DRILLER: Major Well Drilling Co. DRILL DATE: 01/01/1995 DRILLING METHOD:
WELL TYPE: Municipal WELL DEPTH: 55 feet AQUIFER: Alluvium
STATUS: Primary ON LINE: / / ABANDONED: / / PLUGGED: / /
LOG TYPE: LOG QUALITY: SAMPLE TYPE: BEDROCK DEPTH: 0 feet STRIP LOG BY:
LOG TYPE2: LOG QUALITY2: BASIN: 10170204 STRIP LOG DATE: / /
COMMENTS: Test well #95-2 made into production well SUPPLY PERCENT: 15%

LOCATION: in south well field, north of #5 EDIT DATE: 01/10/1995

==========

WELL CONSTRUCTION DATA FOR GOODWATER #6

HOLE SCHEDULE: WELL CONSTRUCTION DATE: 01/01/1955
(1) Hole diameter: 24.00 inches Depth to bottom: 55 feet

CASING SCHEDULE:
(1) Diameter: 18.00 inches Type: Steel Depth top: feet Depth bottom: 39.5 feet Amount: feet

GROUT SCHEDULE:
(1) Type: Bentonite Depth top: 0 feet Depth bottom: 39.5 feet

SCREEN OR PERFORATED CASING SCHEDULE:
(1) Diameter: 16.00 inches Slot: 0.125 inches Depth top: 40 feet Depth bottom: 55 feet Amount: 15.0 feet

GRAVEL-PACKED: true Gravel-packed top: 38 feet Gravel-packed bottom: 55 feet

PUMP SCHEDULE:
Pump type: TURB Diameter: inches Depth to intake: 30 feet Rated capacity: 100 gpm

COMMENTS: swedge nipple between 18” casing and 16” screen (0.5' swedge)

==========

HYDROGEOLOGIC INFORMATION FOR GOODWATER #6

MAIN WATER:
Main water top: 0 feet Main water bottom: 0 feet Pump rating: 90 gpm Pump yield: 90 gpm

==========

DRILLER's LOG FOR GOODWATER #6

==========

WATER QUALITY DATA FOR GOODWATER #6

==========

WELL PERMIT INFORMATION

GSB WELL NO.(WNUMBER): 71727 PWSID NO. 0000347 PWS SEQ. 1 WATER WITHDRAWAL NO. 0 SEQ. NO. 0

==========

GENERALINFORMATION

WNUMBER: 71727 LOCATION:T.55N.,R.54W.,Sec.20 NW NW NW NW NW LOC.ACC.:(meas.+/-230')
QUADRANGLENAME: GOODWATER COUNTY: LINCOLN STATE: IOWA
SURFACEELEVATION: 795 ft.(topo.map+/-5') TOTAL DEPTH: 40 ft. BEDROCK DEPTH: 0 ft.
OWNER: TURKEY BUZZARD CAFE DRILLER: GOOD WELL DRILLER DRILLING DATE: 11/05/63
OTHER IDENTIFIER:
WELL TYPE: commercial DRILLINGMETHOD: unkn SAMPLETYPE: cuttings AQUIFER: unkn
LOG TYPE: driller's log ADD'LLOGTYPE:

NOTES:

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HYDROGEOLOGIC INFORMATION

No hydrogeologic information is available for this well

==========

WELL CONSTRUCTION INFORMATION

No well construction information is available for this well

==========

LITHOLOGIC INFORMATION

No lithologic data is available for this well.

==========

STRATIGRAPHIC/GEOLOGIC INFORMATION

No stratigraphic/geologic information is available for this well

==========

WATER QUALITY INFORMATION

No water quality information is available for this well

==========

DATA FOR HAZARDOUS WASTE GENERATORS

==========

FACILITY ID NO: IAD001

NAME

GOODWATER AGROCHEMICAL COMPANY
510 S. CORN ST.
GOODWATER, IA 50000
COUNTY: LINCOLN

TYPE OF CONTAMINANTS: NO DATA AVAILABLE
AMOUNT OF CONTAMINANTS: NO DATA AVAILABLE

FACILITY ID NO: IAD002

NAME

BRAGGART CAR COMPANY
1017 E. CENTRAL ST.
GOODWATER, IA 50000
COUNTY: LINCOLN

TYPE OF CONTAMINANTS: NO DATA AVAILABLE
AMOUNT OF CONTAMINANTS: NO DATA AVAILABLE

FACILITY ID NO: IAD003

NAME

GOODWATER MUNICIPAL AIRPORT
2500 AIRPORT RD.
GOODWATER, IA 50000
COUNTY: LINCOLN

TYPE OF CONTAMINANTS: NO DATA AVAILABLE
AMOUNT OF CONTAMINANTS: NO DATA AVAILABLE

DATA FOR UNDERGROUND STORAGE TANK SITES

REGISTRATION ID NO: 9876543 LOCATION: T55N R54W SEC 18 SE NE
LEAKING UST NO: 0LTN00 STATUS:
NAME: COUNTY: LINCOLN BPD REGION:
RUNWAY GAS STATION
1017 AIRPORT RD
GOODWATER, IA 50000

REGISTRATION ID NO: 9876544 LOCATION: T55N R54W SEC 18 SE SW SW
LEAKING UST NO: 0LTG00 STATUS: NO LONGER IN USE
NAME: COUNTY: LINCOLN
BRAGGART CAR CO.
1017 E. CENTRAL ST.
GOODWATER, IA 50000

REGISTRATION ID NO: 9876545 LOCATION: T55N R54W SEC 19 NW NW NW
LEAKING UST NO: 0LTT00 STATUS:
NAME: COUNTY: LINCOLN
GOODWATER FAST STOP
212 E. CENTRAL ST.
GOODWATER, IA 50000

REGISTRATION ID NO: 9876546 LOCATION: T55N R55W SEC 13 SW SE SE
LEAKING UST NO: 0LTA00 STATUS:
NAME: COUNTY: LINCOLN
WEST SIDE GAS
413 W. CENTRAL ST.
GOODWATER, IA 50000

REGISTRATION ID NO: 9876547 LOCATION: T55N R55W SEC 24 SE NE
LEAKING UST NO: 0LTA00 STATUS: NOT IN USE
NAME: COUNTY: LINCOLN
C. THOMPSON
103 W. MORGAN ST.
GOODWATER, IA 50000

SANITARY TREATMENT PLANTS

WWTP ID: 841 Location: Twp. 55N, Rge. 54W Sec. 19 SW SW NE SW COUNTY: LINCOLN
ID NUMBER: 1234567 NAME: CITY OF GOODWATER STP TYPE: MUNICIPAL
CODE: 1 OUTFALL LOCATION: PLANT FACILITY TYPE: MINOR

DATA FOR AGRICULTURAL WASTE STORAGE FACILITIES

==========

FACILITY NAME: P.G. FARMER LOCATION: T55N R55W SEC 11 SW NW
CONSTRUCTION NO: 94-001 COUNTY: LINCOLN
PERMIT DATE: 9/15/94 ANIMAL TYPE: HOG
LIVE WEIGHT: 157,000 TREATMENT: BASIN
ADDRESS:
P.G. FARMER
P.O. BOX 534
GOODWATER, IA 50000

APPENDIX C — Goodwater Maps and Completed Forms

Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: 2/25/98 Time: 9:30 am

Map site ID: S5 County: Lincoln

Name of person conducting survey: Benny Billups

Business or occupant's name: Goodwater Cement Co. Phone: 555-7625

Owner's name: John Rock Phone: 555-4777

Site address or location: 1004 River Rd.

City: Goodwater State: IA Zip code: 50000

Location (describe): South side of road east of Elm St.
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

SE 1/4, of the NW 1/4, of the SE 1/4, of the NE 1/4, of Section 19 ,

Township 55 N,Range 54 W W/E

Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

Above ground fuel tanks; garage with truck maintenance supplies

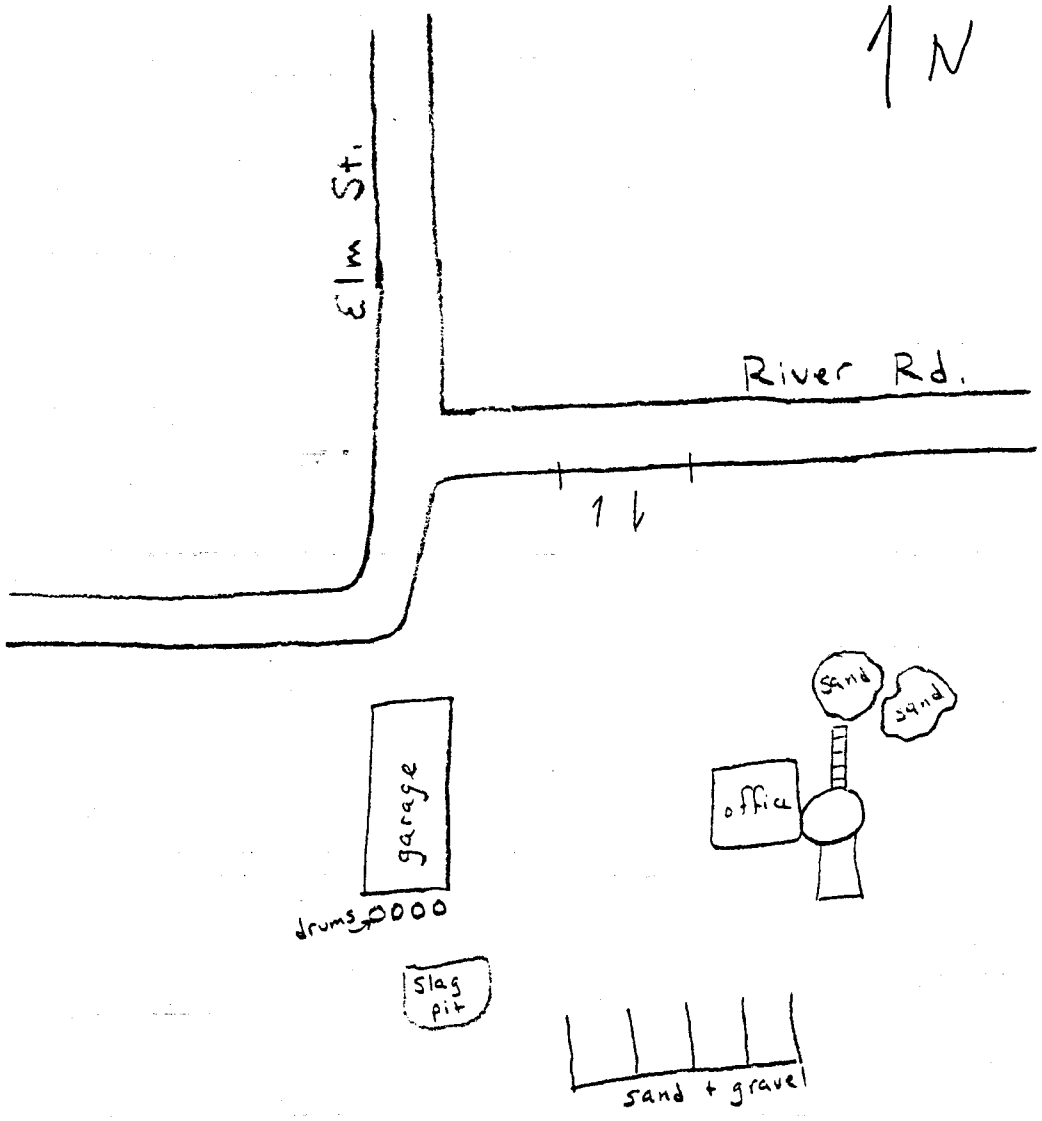
unidentified 55 gallon drums (hydraulic fluid?); cement trucks;

front-end loader

Conditions: cloudy and windy; unrestricted access
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.

Goodwater Cement Co. (55)



Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: **2/25/98** Time: 10:15 AM

Map site ID: **S7** County: **Lincoln**

Name of person conducting survey: **Benny Billups**

Business or occupant's name: **Braggart Car Co.** Phone: **555-5865**

Owner's name: **Tom Braggart** Phone: **555-3673**

Site address or location: **1017 E. Central St.**

City: **Goodwater** State: **IA** Zip code: **50000**

Location (describe): **North side of highway, just west of Garfield Ave.**
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

SE 1/4, of the **SW** 1/4, of the **SW** 1/4, of the **SE** 1/4, of Section **18** ,

Township **55** N, Range **54W** W or E

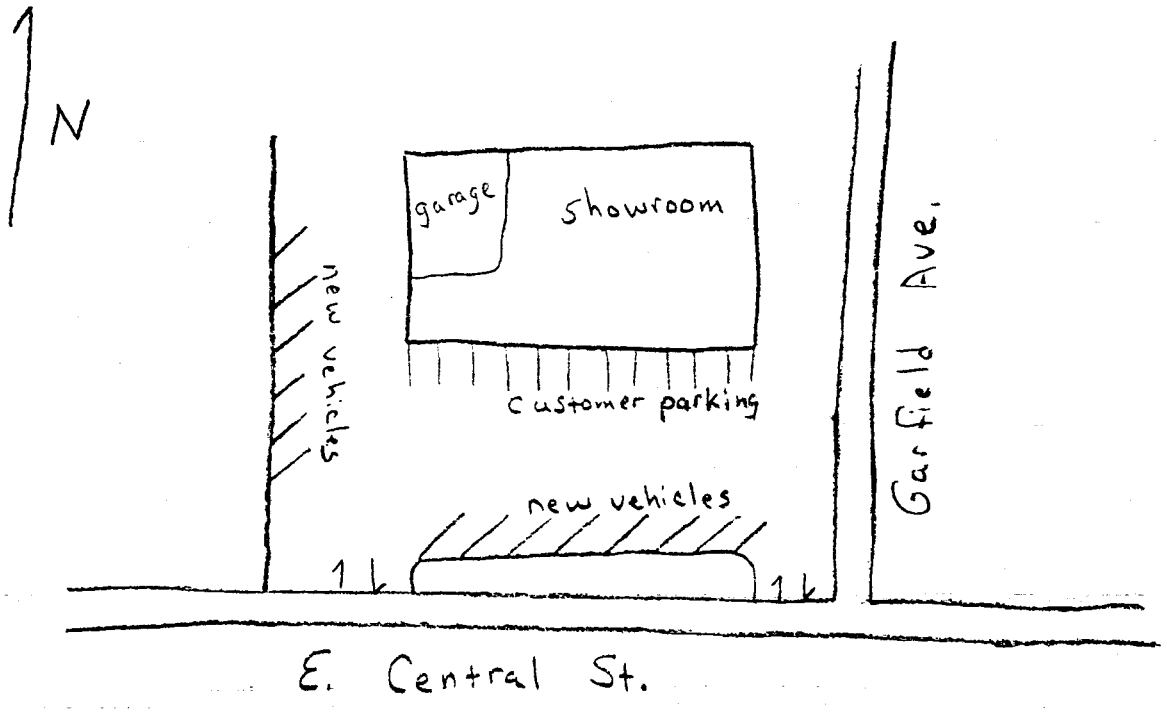
Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

Waste oils, solvents, other automotive wastes from the garage

Conditions: **Cloudy and windy, access unrestricted**
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.

Braggart Car Co. (57)



Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: 2/26/98 Time: 2:45 PM

Map site ID: W12 County: Lincoln

Name of person conducting survey: Bill Mitchel

Business or occupant's name: Jeff Meyer Phone: 555-3276

Owner's name: Same Phone: Same

Site address or location: 1051 Garfield Ave.

City: Goodwater State: IA Zip code: 50000

Location (describe): west side of Garfield Ave., 1/2 mile north of E. Central St.
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

____ 1/4, of the ____ 1/4, of the N 1/2 ~~1/4~~, of the SW 1/4, of Section 18 ,

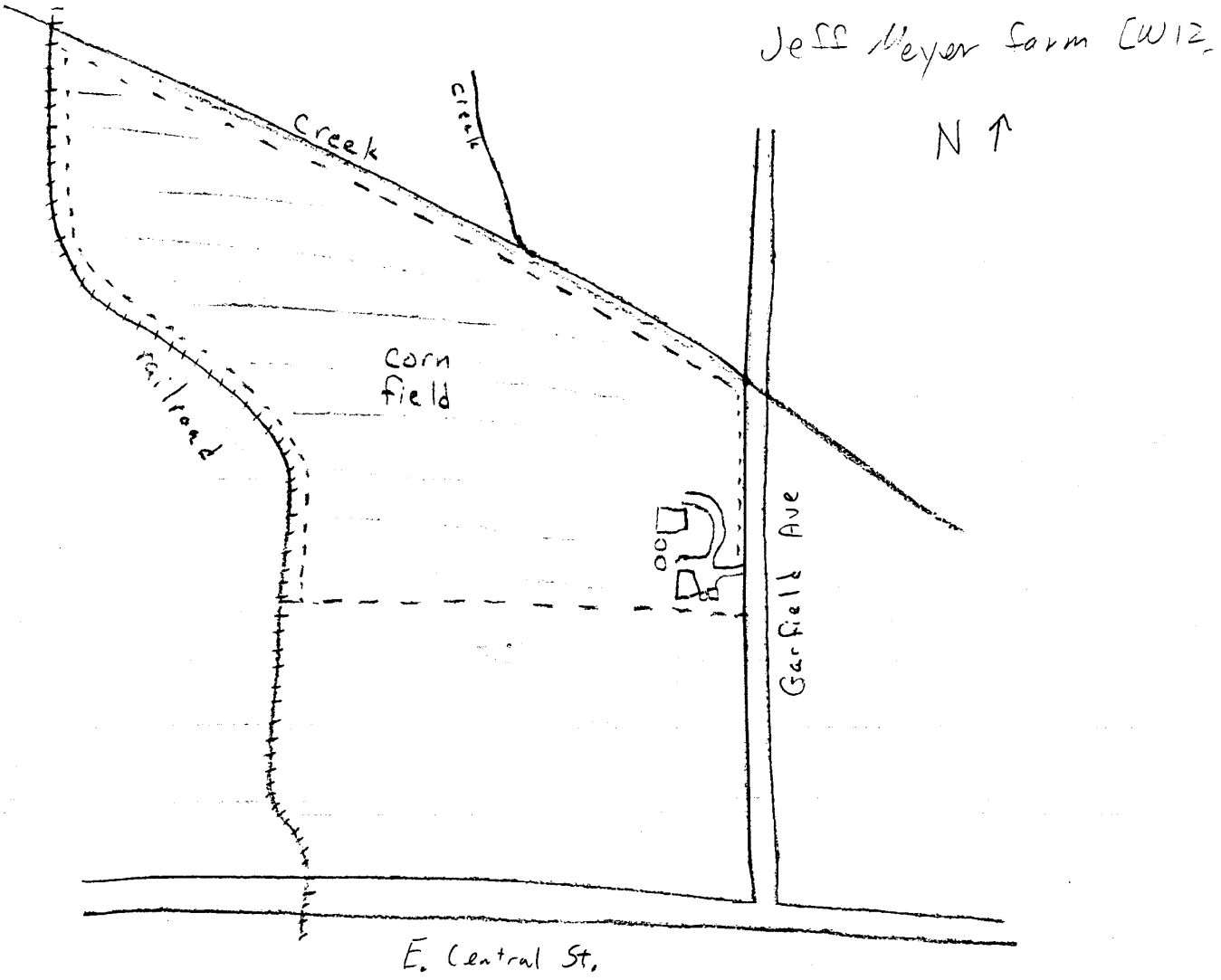
Township 55 N, Range 54W W or E

Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

Farm field: fertilizer, herbicide, and pesticides applied to field during growing season. Barn and farm sheds may contain agricultural chemicals, and oil and fuel for farm equipment.

Conditions: Clear; farm dog at residence
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.


Jeff Meyer Farm CW12
N
Creek
Ditch
Corn field
Railroad
Garfield Ave
E. Central St.

Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: 2/20/98 Time: 2:00 PM

Map site ID: T19 County: Lincoln

Name of person conducting survey: Dave Caudle

Business or occupant's name: Goodwater Builder's Supply Phone: 555-9663

Owner's name: John Nails Phone: 555-6245

Site address or location: 227 Carpenters Way

City: Goodwater State: IA Zip code: 50000

Location (describe): NE corner of intersection of Carpenters Way and Spencer St.
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

SW 1/4, of the SW 1/4, of the SE 1/4, of the SE 1/4, of Section 13 ,

Township 55 N, Range 55W W or E

Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

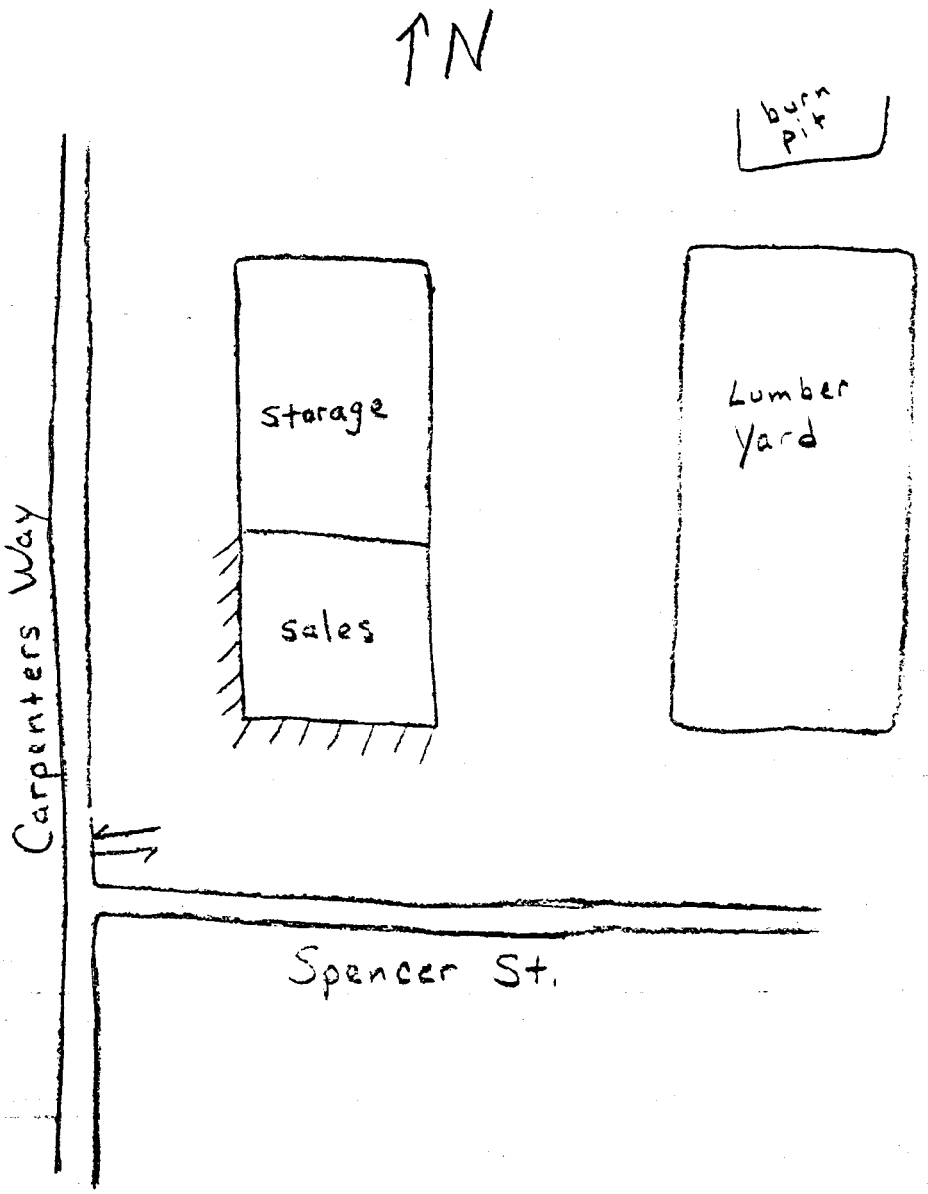
paints, solvents, glues, varnishes, wood treatments

remains from burning waste material

Conditions: clear, unrestricted access
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.

Map Site ID: T19
Goodwater Builder's Supply
2/20/98



Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: 2/24/98 Time: 10:30 AM

Map site ID: N12 County: Lincoln

Name of person conducting survey: Jason Pohl

Business or occupant's name: Goodwater Fast Stop Phone: 555-4127

Owner's name: Tom Quick Phone: 555-4758

Site address or location: 212 E. Central St.

City: Goodwater State: IA Zip code: 50000

Location (describe): SE corner of intersection of Central and Oak
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

NW 1/4, of the NW 1/4, of the NW 1/4, of the NW 1/4, of Section 19 ,

Township 55 N, Range 54W W or E

Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

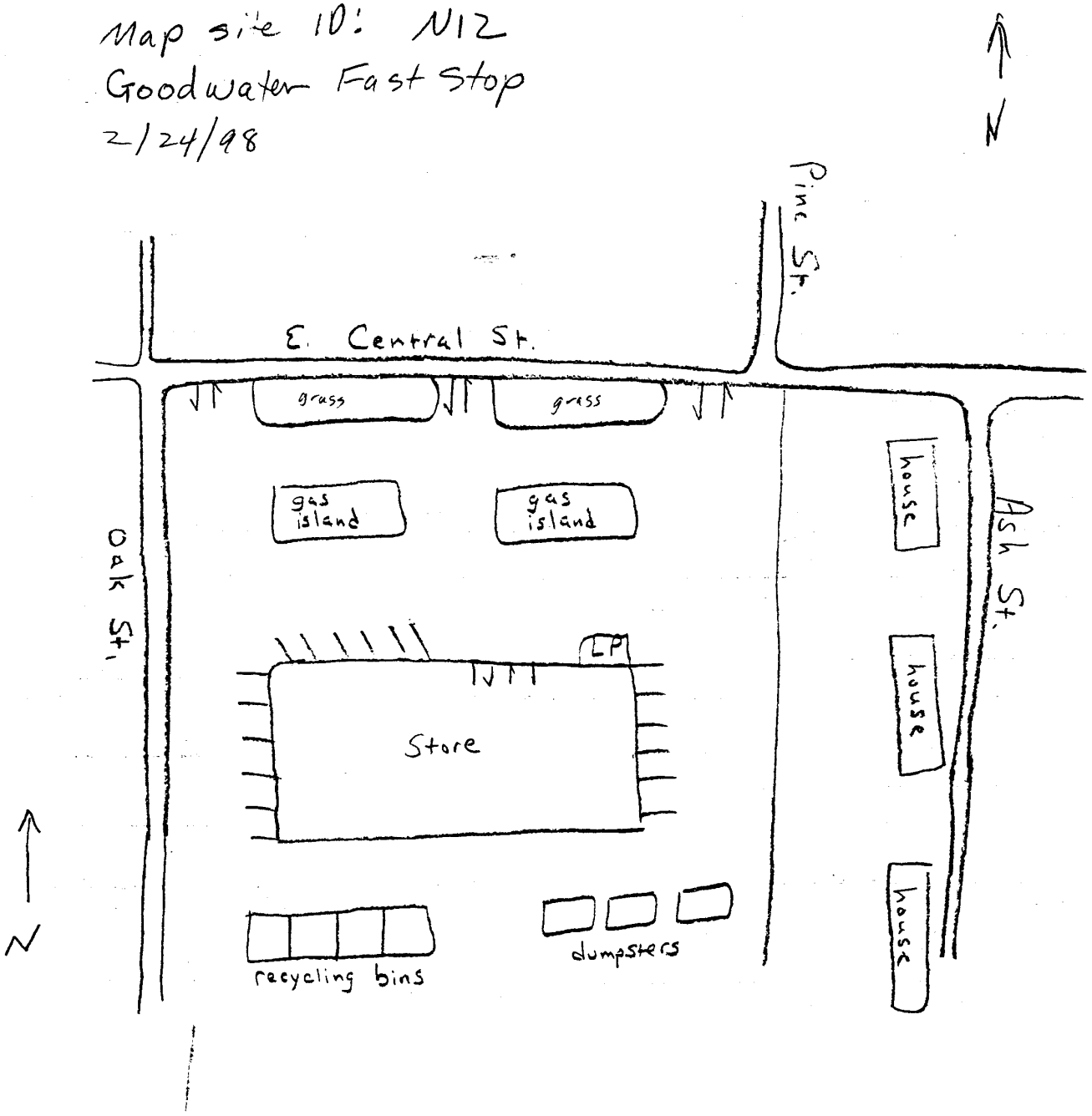
4 fuel pumps, below ground tanks, dumpsters, LP gas tanks for grills,

motor oil, and other automotive products, cleaning chemicals

Conditions: partly cloudy, 36°F, unrestricted access
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.

Map site ID: N12
Goodwater Fast Stop
2/24/98



Wellhead Protection Potential Contaminant Site: Field Survey Form

Date: **2/24/98** Time: **1:20 PM**

Map site ID: **J2** County: **Lincoln**

Name of person conducting survey: Jim Johnson

Business or occupant's name: **Goodwater Agrochemical** Phone: **555-4769**

Owner's name: **Jerry Jones** Phone: **555-7286**

Site address or location: **510 S. Ash St.**

City: **Goodwater** State: **IA** Zip code: **50000**

Location (describe): **West side of Ash St., just before curve**
(e.g. west side of Main St., north of alley, west side of fire station)

Legal description:

NW 1/4, of the **NW** 1/4, of the **SW** 1/4, of the **NW** 1/4, of Section **19** ,

Township **55** N, Range **54W** W or E

Description: (e.g., two above-ground fuel tanks; barrel of hydraulic fluid; small shed next to building containing (probably) motor oil, paint grease, and solvents.)

Above ground storage tanks, tanker vehicles, above ground fuel tanks;

unidentifed drums

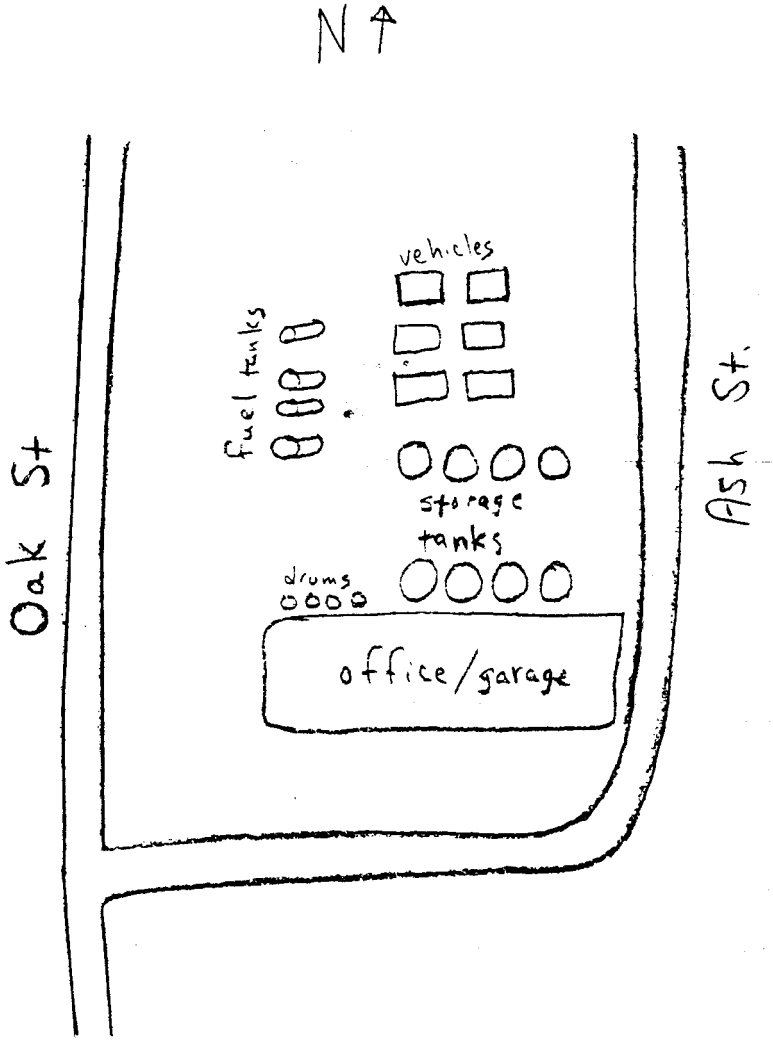
****Check with state environmental protection bureau/newspaper archive.for**

report of spill 1990-1991.

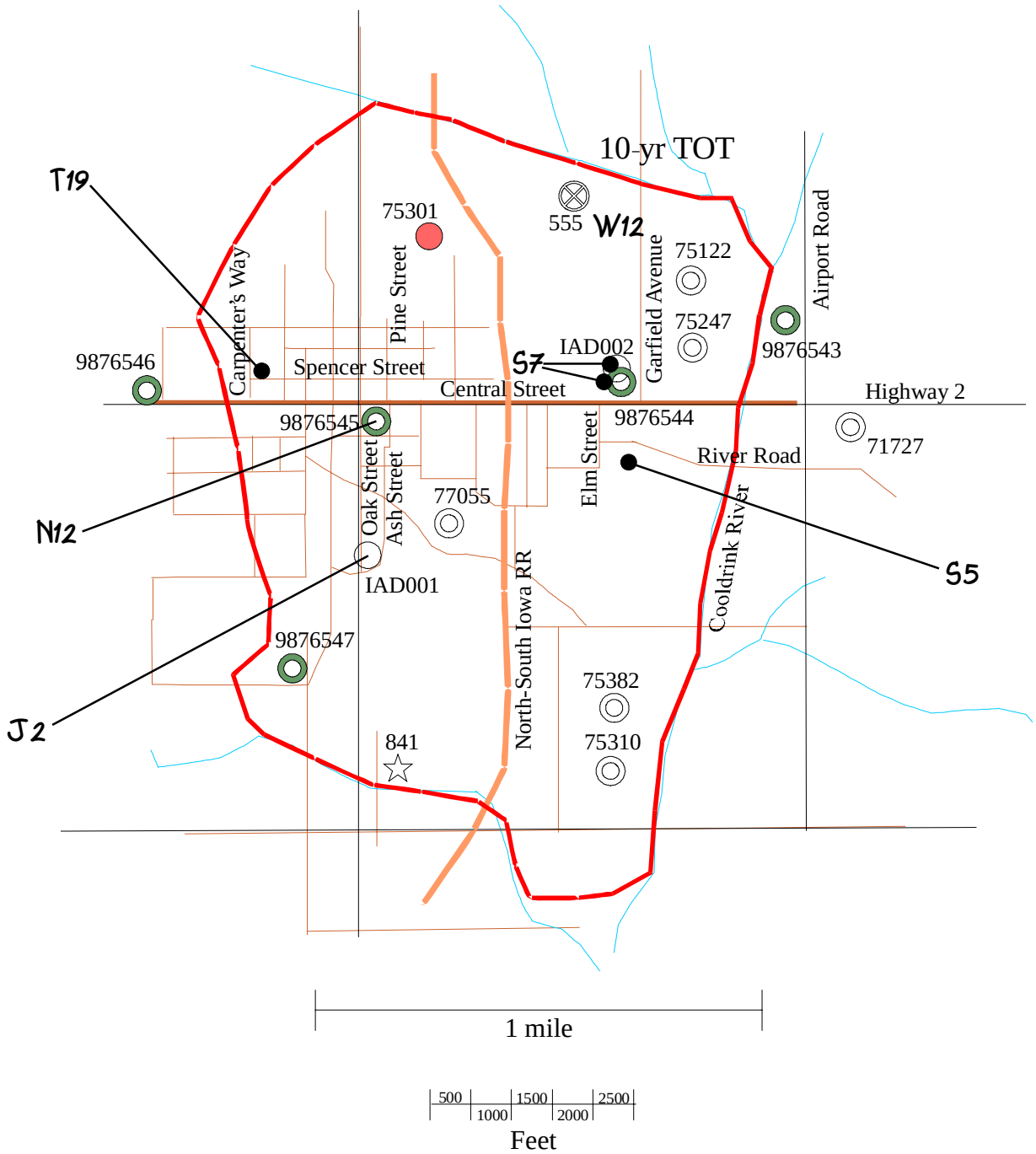
Conditions: **cloudy; part has unrestricted access; part is fenced**
(e.g., *weather:* snow cover, heavy rain; *access:* fenced, posted, dogs; *other:* saturated ground, hazardous)

Include a sketch map of the site on the back of this form. Note significant landmarks and include an arrow indicating direction, e.g. a north arrow. A dark pen or pencil is recommended.

Goodwater Agrochemical
Map site 10: JZ



2/24/98



- Public water supply well
- Other well
- Facilities permitted for water use >25,000 gpd
- Wastewater treatment plant
- Underground storage tank
- Hazardous waste generator

Well Vulnerability Worksheet

Well ID: Goodwater #2

	Yes	No	Don't know
1) Has your well ever yielded water with nitrate concentrations higher than 5 mg/l as N (half the MCL)?	☐	☒	
2) Does your well have a history of water quality detects for man-made chemicals or contaminants (excluding trihalomethanes (THMs))?	☐	☒	
3) Does raw water from the well have a history of fecal coliform bacteria?	☐	☒	
4) Does surface drainage flow toward the well, or has it been determined by IDNR to be groundwater under the influence of surface water?	☐	☒	
5) Is the well casing leaking?	☐	☒	☐
6) Is the well ungrouted or is the grout seal in poor condition?	☐	☒	☐

Summary:
To determine the well vulnerability, choose only one of the following:

		Score
If any "Yes" box was marked, mark this box	☐	2
If all "No" boxes were marked, mark this box:	☒	0
If "No" was marked for questions 1, 2, 3 and 4 and a "Don't Know" was marked for question 5 or 6, mark this box:	☐	1

Transfer the resulting score to the column for well vulnerability on the Site Prioritization Worksheet (p. A-6).

Well Vulnerability Worksheet

Well ID: Goodwater #3

	Yes	No	Don't know
1) Has your well ever yielded water with nitrate concentrations higher than 5 mg/l as N (half the MCL)?	☒	☐	
2) Does your well have a history of water quality detects for man-made chemicals or contaminants (excluding trihalomethanes (THMs))?	☐	☒	
3) Does raw water from the well have a history of fecal coliform bacteria?	☐	☒	
4) Does surface drainage flow toward the well, or has it been determined by IDNR to be groundwater under the influence of surface water?	☒	☐	
5) Is the well casing leaking?	☐	☒	☐
6) Is the well ungrouted or is the grout seal in poor condition?	☐	☒	☐

Summary:
To determine the well vulnerability, choose only one of the following:

		Score
If any "Yes" box was marked, mark this box	☒	2
If all "No" boxes were marked, mark this box:	☐	0
If "No" was marked for questions 1, 2, 3 and 4 and a "Don't Know" was marked for question 5 or 6, mark this box:	☐	1

Transfer the resulting score to the column for well vulnerability on the Site Prioritization Worksheet (p. A-6).

Well Vulnerability Worksheet

Well ID: Goodwater #4

	Yes	No	Don't know
1) Has your well ever yielded water with nitrate concentrations higher than 5 mg/l as N (half the MCL)?	☒	☐	
2) Does your well have a history of water quality detects for man-made chemicals or contaminants (excluding trihalomethanes (THMs))?	☒	☐	
3) Does raw water from the well have a history of fecal coliform bacteria?	☐	☒	
4) Does surface drainage flow toward the well, or has it been determined by IDNR to be groundwater under the influence of surface water?	☒	☐	
5) Is the well casing leaking?	☐	☒	☐
6) Is the well ungrouted or is the grout seal in poor condition?	☐	☒	☐

Summary:
To determine the well vulnerability, choose only one of the following:

		Score
If any "Yes" box was marked, mark this box	☒	2
If all "No" boxes were marked, mark this box:	☐	0
If "No" was marked for questions 1, 2, 3 and 4 and a "Don't Know" was marked for question 5 or 6, mark this box:	☐	1

Transfer the resulting score to the column for well vulnerability on the Site Prioritization Worksheet (p. A-6).

Well Vulnerability Worksheet

Well ID: Goodwater #5

	Yes	No	Don't know
1) Has your well ever yielded water with nitrate concentrations higher than 5 mg/l as N (half the MCL)?	☒	☐	
2) Does your well have a history of water quality detects for man-made chemicals or contaminants (excluding trihalomethanes (THMs))?	☐	☒	
3) Does raw water from the well have a history of fecal coliform bacteria?	☐	☒	
4) Does surface drainage flow toward the well, or has it been determined by IDNR to be groundwater under the influence of surface water?	☒	☐	
5) Is the well casing leaking?	☐	☒	☐
6) Is the well ungrouted or is the grout seal in poor condition?	☐	☒	☐

Summary:
To determine the well vulnerability, choose only one of the following:

		Score
If any "Yes" box was marked, mark this box	☒	2
If all "No" boxes were marked, mark this box:	☐	0
If "No" was marked for questions 1, 2, 3 and 4 and a "Don't Know" was marked for question 5 or 6, mark this box:	☐	1

Transfer the resulting score to the column for well vulnerability on the Site Prioritization Worksheet (p. A-6).

Well Vulnerability Worksheet

Well ID: Goodwater #6

	Yes	No	Don't know
1) Has your well ever yielded water with nitrate concentrations higher than 5 mg/l as N (half the MCL)?	☐	☒	
2) Does your well have a history of water quality detects for man-made chemicals or contaminants (excluding trihalomethanes (THMs))?	☐	☒	
3) Does raw water from the well have a history of fecal coliform bacteria?	☐	☒	
4) Does surface drainage flow toward the well, or has it been determined by IDNR to be groundwater under the influence of surface water?	☐	☒	
5) Is the well casing leaking?	☐	☐	☒
6) Is the well ungrouted or is the grout seal in poor condition?	☐	☒	☐

Summary:
To determine the well vulnerability, choose only one of the following:

		Score
If any "Yes" box was marked, mark this box	☐	2
If all "No" boxes were marked, mark this box:	☐	0
If "No" was marked for questions 1, 2, 3 and 4 and a "Don't Know" was marked for question 5 or 6, mark this box:	☒	1

Transfer the resulting score to the column for well vulnerability on the Site Prioritization Worksheet (p. A-6).

Aquifer Vulnerability Worksheet

Complete one Aquifer vulnerability worksheet for each aquifer.

Aquifer name: **Jordan**

(Hydrogeologic name: refer to well records)

What is the thickness of the confining materials, such as glacial till or shale, above the aquifer in the wellhead protection area?

		Score
<25 ft.	☐	4
25 - 50 ft.	☐	3
50 - 100 ft.	☐	2
>100 ft.	☒	1

Insert the score corresponding to the marked box into the aquifer vulnerability column on the Site Prioritization Worksheet (p. A-6).

Aquifer Vulnerability Worksheet

Complete one Aquifer vulnerability worksheet <u>for each aquifer</u>.

Aquifer name: **Alluvial (unconfined)**

(Hydrogeologic name: refer to well records)

What is the thickness of the confining materials, such as glacial till or shale, above the aquifer in the wellhead protection area?

		Score
<25 ft.	☒	4
25 - 50 ft.	☐	3
50 - 100 ft.	☐	2
>100 ft.	☐	1

Insert the score corresponding to the marked box into the aquifer vulnerability column on the Site Prioritization Worksheet (p. A-6).

Site Prioritization Worksheet

(complete as needed for each well)

Well ID: **Goodwater #2**

Map site ID (from page A-2) (contaminant source)	**Land-use type** (from page A-3)	**Land-use risk score** (from page A-3) Score: 1 to 5	**Distance of contaminant source from well** Score: <500' = 4 500-1500' = 3 1501-2500' = 2 >2500' = 1	**Well vulnerability** (from page A-4) Score: 0, 1, or 2	**Aquifer vulnerability** (from page A-5) Score: 1 to 4	**Total score** Sum of columns 3-6
S5	Industrial	5	2	0	1	8
S7	Retail: car dealer	5	2	0	1	8
T19	Commercial	4	2	0	1	7
N12	Retail: gasoline	5	3	0	1	9
J2	Industrial: agrochem.	5	3	0	1	9
W12	Agricultural	2	1	0	1	4
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Site Prioritization Worksheet

(complete as needed for each well)

Well ID: **Goodwater #3**

Map site ID (from page A-2) (contaminant source)	**Land-use type** (from page A-3)	**Land-use risk score** (from page A-3) Score: 1 to 5	**Distance of contaminant source from well** Score: <500' = 4 500-1500' = 3 1501-2500' = 2 >2500' = 1	**Well vulnerability** (from page A-4) Score: 0, 1, or 2	**Aquifer vulnerability** (from page A-5) Score: 1 to 4	**Total score** Sum of columns 3-6
S5	Industrial	4	3	2	4	13
S7	Retail: car dealer	5	2	2	4	13
T19	Commercial	4	1	2	4	11
N12	Retail: gasoline	5	1	2	4	12
J2	Industrial: agrochem.	5	1	2	4	12
W12	Agricultural	2	1	2	4	9
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Site Prioritization Worksheet

(complete as needed for each well)

Well ID: **Goodwater #4**

Map site ID (from page A-2) (contaminant source)	**Land-use type** (from page A-3)	**Land-use risk score** (from page A-3) Score: 1 to 5	**Distance of contaminant source from well** Score: <500' = 4 500-1500' = 3 1501-2500' = 2 >2500' = 1	**Well vulnerability** (from page A-4) Score: 0, 1, or 2	**Aquifer vulnerability** (from page A-5) Score: 1 to 4	**Total score** Sum of columns 3-6
S5	Industrial	4	3	2	4	13
S7	Retail: car dealer	5	3	2	4	14
T19	Commercial	4	1	2	4	11
N12	Retail: gasoline	5	1	2	4	12
J2	Industrial: agrochem.	5	1	2	4	12
W12	Agricultural	2	1	2	4	9
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Site Prioritization Worksheet

(complete as needed for each well)

Well ID: **Goodwater #5**

Map site ID (from page A-2) (contaminant source)	**Land-use type** (from page A-3)	**Land-use risk score** (from page A-3) Score: 1 to 5	**Distance of contaminant source from well** Score: <500' = 4 500-1500' = 3 1501-2500' = 2 >2500' = 1	**Well vulnerability** (from page A-4) Score: 0, 1, or 2	**Aquifer vulnerability** (from page A-5) Score: 1 to 4	**Total score** Sum of columns 3-6
S5	Industrial	4	1	2	4	11
S7	Retail: car dealer	5	1	2	4	12
T19	Commercial	4	1	2	4	11
N12	Retail: gasoline	5	1	2	4	12
J2	Industrial: agrochem.	5	1	2	4	12
W12	Agricultural	2	1	2	4	9
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Site Prioritization Worksheet

(complete as needed for each well)

Well ID: **Goodwater #6**

Map site ID (from page A-2) (contaminant source)	**Land-use type** (from page A-3)	**Land-use risk score** (from page A-3) Score: 1 to 5	**Distance of contaminant source from well** Score: <500' = 4 500-1500' = 3 1501-2500' = 2 >2500' = 1	**Well vulnerability** (from page A-4) Score: 0, 1, or 2	**Aquifer vulnerability** (from page A-5) Score: 1 to 4	**Total score** Sum of columns 3-6
S5	Industrial	4	1	1	4	10
S7	Retail: car dealer	5	1	1	4	11
T19	Commercial	4	1	1	4	10
N12	Retail: gasoline	5	1	1	4	11
J2	Industrial: agrochem.	5	1	1	4	11
W12	Agricultural	2	1	1	4	8
(1)	(2)	(3)	(4)	(5)	(6)	(7)

Site Prioritization Summary

Map site ID	Well(s)					Total for all wells	Rank order
	Goodwater #2	Goodwater #3	Goodwater #4	Goodwater #5	Goodwater #6		
S5	7	13	13	11	10	54	4
S7	8	13	14	12	11	58	1
T19	7	11	11	11	11	50	5
N12	9	12	12	12	11	56	2
J2	9	12	12	12	11	56	2
W12	4	9	9	9	8	39	6
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Instructions:

1) Insert Map site ID in column (1) and well ids in spaces provided across the top of the form.
2) Enter scores from column 7 on the Site Prioritization Worksheet (p. A-6) for each site in columns (2) through (6). Use one column for each well.
3) Add forms as needed to complete all sites and/or wells. Bring totals forward from previous sheets.
4) Sum the transferred scores and enter in column (7). Enter the rank order in column (8).

Wellhead Protection Contaminant Source Inventory: Interview Inventory Form

Use additional sheets as needed for each potential contaminant on the site.

Map site ID: **S5**

(from field survey form)

Interviewee: **John Rock (owner) 4/16/98**

Description and location of potential contaminant material:

Hydraulic fluid for trucks and machinery. Stored in drums outside the garage building on south wall

Volume or quantity of material on site:

3-55 gallon drums and empty drums (typically 4 or 5)

Handling methods used for the material:

Used as needed by mechanics. Drums sealed after use.

Describe any control/containment measures in effect for the material:

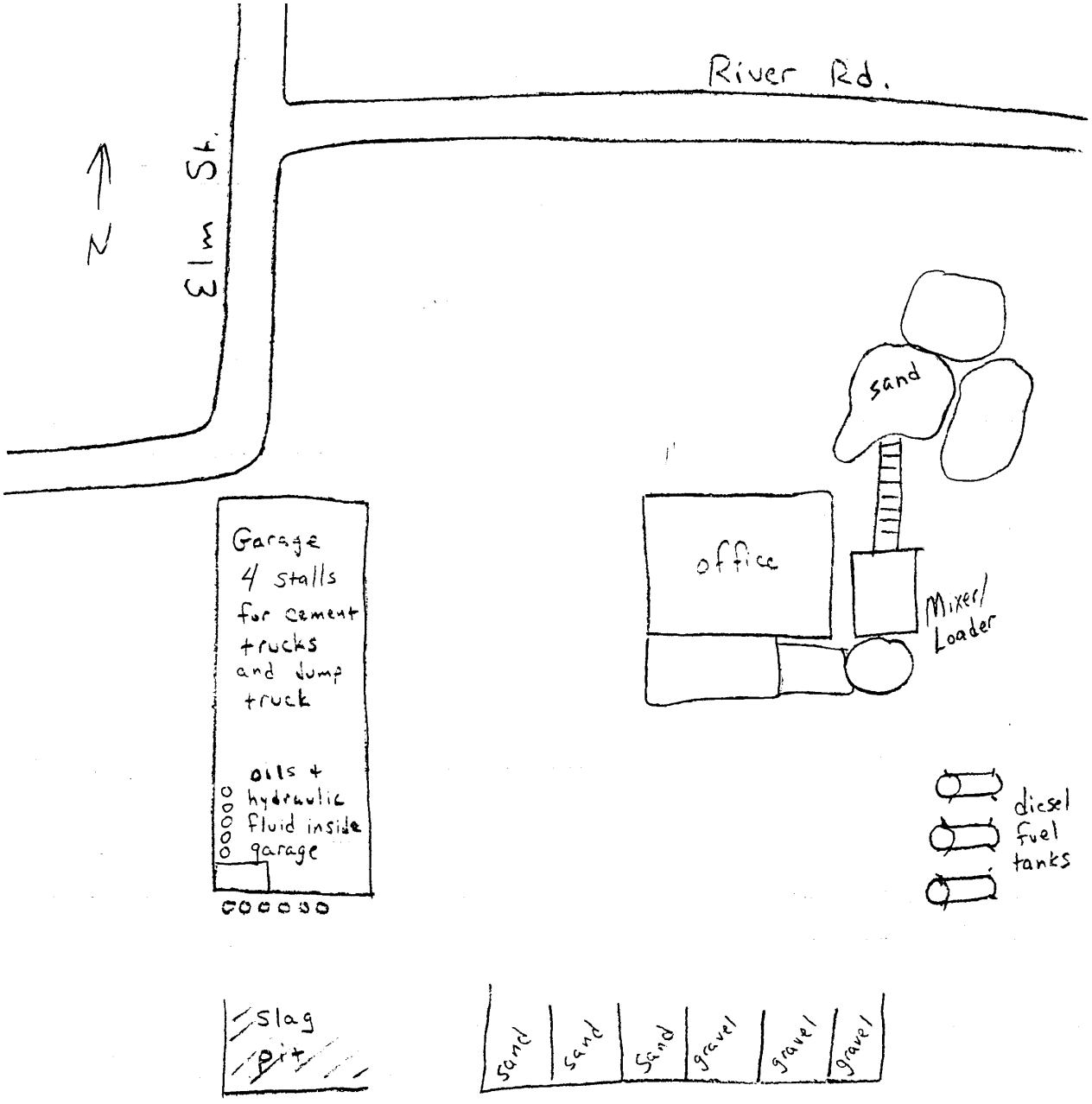
No, spills are typically small and cleaned up by employees.

Are there Material Safety Data Sheets (MSDS) available for the material on the site?

No

Include additional notes, sketches, etc. on the back of this sheet.

-map on back-


River Rd.
Elm St.
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sand
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Mixer/
Loader
Garage
4 stalls
for cement
trucks
and dump
truck
oils +
hydraulic
fluid inside
garage
diesel
fuel
tanks
slag
pit
sand
sand
sand
gravel
gravel
gravel

Wellhead Protection Contaminant Source Inventory: Interview Inventory Form

Use additional sheets as needed for each potential contaminant on the site.

Map site ID: **S5**

(from field survey form)

Interviewee: **John Rock (owner) 4/16/98**

Description and location of potential contaminant material:

Diesel fuel for trucks

Volume or quantity of material on site:

3-200 gallon above ground tanks in southeast part of site

Handling methods used for the material:

Fuel pumped into trucks as needed. Tanks are locked at night

Describe any control/containment measures in effect for the material:

No.

Are there Material Safety Data Sheets (MSDS) available for the material on the site?

No.

Include additional notes, sketches, etc. on the back of this sheet.

Wellhead Protection Contaminant Source Inventory: Interview Inventory Form

Use additional sheets as needed for each potential contaminant on the site.

Map site ID: **S5**

(from field survey form)

Interviewee: **John Rock (owner) 4/16/98**

Description and location of potential contaminant material:

Oil and other fluids used for truck maintenance. Stored inside garage in an unmarked cabinet in southwest corner.

Volume or quantity of material on site:

Varies. Typically low.

Handling methods used for the material:

Used as needed. Recycled when possible.

Describe any control/containment measures in effect for the material:

No.

Are there Material Safety Data Sheets (MSDS) available for the material on the site?

No

Include additional notes, sketches, etc. on the back of this sheet.