KANSAS GEOLOGICAL SURVEY

1930 Constant Ave., Campus West
The University of Kansas
Lawrence, Kansas 66047-3726
phone 785-864-3965
fax 785-864-5317

Proposed Project for Application to the Kansas Department of Health and Environment for the Kansas Public Water Supply Loan Fund

Applicant: City of Manhattan
Water Supply Treatment Plant and Wellfield Improvements Project

Contact Person: Gerald M. McIntyre, P.E., Deputy Director of Public Works
Address: City of Manhattan
1101 Poyntz Avenue
Manhattan, KS 66502

Sent to the Kansas Geological Survey for environmental review.

Agency Review Comments:

One of the reasons stated for constructing new water-supply wells as a part of the wellfield improvements is to retire old wells for which it is more costly to treat the raw water due to higher hardness values. The map showing the location of the old and new wells suggests that the new wells are expected to produce water with lower hardness (and lower total dissolved solids) due to being close to the river. Wells located close to the river would be expected to draw a greater proportion of their water from the river than wells farther away from the river. The wells farther from the Big Blue River could be expected to draw in more ground water that had flowed through the Permian shale and carbonate rocks, water which would be expected to be in equilibrium with calcite (and possibly dolomite) at a higher carbon dioxide pressure than atmospheric and, thus, which can hold in solution more calcium and magnesium than the river water, which would be in equilibrium with the atmospheric pressure of carbon dioxide. In addition, some of the Permian strata in the Manhattan area contains a small amount of gypsum (calcium sulfate) which has a higher solubility than calcite. This increases the calcium (a component of hardness) as well as sulfate. The sulfate also complexes with calcium and magnesium and increases the ionic strength of the ground water, which further increases the amount of dissolved calcium and magnesium that the water can hold.

Thus, the wells that would be expected to have the highest hardness would be expected to be located at the greatest distance from the river along flow paths of ground water discharge to the river. These would be the seven wells farthest to the west on the west side of the river. The nine wells currently located on the west side of the river appear to be close enough to the river that there may not be a significant difference between the hardness of the water pumped from them in comparison with the hardness of water from the proposed new wells. However, the fact that there is probably a component of ground-water flow through the alluvial aquifer in the general downstream direction (to the south-southeast) and that the river meanders of the river channel occupy a band to the east of the western boundary of the alluvial aquifer, suggests that the four most easterly existing wells and the four proposed new wells might intercept ground water with a slightly higher river-water component during pumping than the more westerly wells along the river.

Another factor is the distance of the bottom of the screened interval of the wells above the bedrock surface and the lithology of the sediments near the bottom of the aquifer as well as at the top of the aquifer below the river channel. Bedrock strata with a good hydraulic connection to the bottom of the aquifer would allow more ground water from the Permian rocks to enter a well than if there were a poor hydraulic connection and a layer of clay at the bottom of the aquifer. Likewise, the thickness and hydraulic conductivity of low permeability sediments at the top of the alluvial aquifer and below the river channel can affect the rate at which river water would be drawn in by the pumping wells. In general, the longer (more continuous) a well near the river is pumping, the greater the proportion of river water that would be drawn in. Thus, if the hardness of the well water is an important concern, a strategy of pumping a smaller number of wells near the river than a larger number of wells spread across a greater distance might be considered for increasing the amount of river water drawn in.

Although the hardness would be lower for a greater amount of river water drawn in by the pumping wells, the City may also wish to examine the amount of atrazine in the well water obtained from wells near the river during spring runoff events. Atrazine levels during spring runoff events are often high in Kansas. The City could determine whether the fine-grained sediments generally present in the shallower parts of the aquifer are enough to adsorb most of the atrazine.

In general, the long-term benefits of the improvements of the new water supply treatment facility and wellfield should offset any short-term adverse environmental impacts during construction.

Recommended Action:

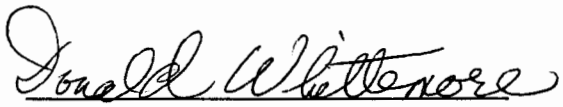
__X__ Clearance of project should be granted

____ Clearance of project should not be granted

____ Clearance of project should be delayed until the issues or questions have been clarified

____ Clearance of project should not be delayed, but the applicant (in the application) should address or clarify the questions or concerns indicated above

Donald Whittemore	Geohydrology Section, Kansas Geological Survey	9/28/06
Reviewer's Name	Division/Agency	Date



Reviewer's Signature

The above discussion represents our best assessment based on the information that the Kansas Geological Survey has about this locality and/or proposed project at the time of this writing. Other geologic conditions, not discussed herein, or for which the Kansas Geological Survey has no knowledge, may affect the viability or safe operation of this facility or property. The information provided in this letter is from regional or county-wide studies and should not be used as a substitute for detailed site characterization by a licensed geologist or engineer. It is the responsibility of the applicant to provide any required site characterizations.

CITY OF MANHATTAN
KANSAS
PUBLIC WORKS DEPARTMENT
water~wastewater~operations~engineering

August 31, 2006

Kansas Geological Survey
University of Kansas
1930 Constant Avenue, Campus West
Lawrence, KS 66047

Re: City of Manhattan Kansas Public Water Supply Loan Fund Project No. 2462 - Environmental Review

To Whom It May Concern:

The City of Manhattan, KS is preparing an application to the Kansas Department of Health and Environment for a loan from the Kansas Public Water Supply Loan Fund for the Water Treatment Plant and Wellfield Improvements Project. The project will take place for the most part on city property or within existing easements in Sections 7, 8 and 9, Township 10 South, Range 8 East.

This project includes an update of the 2001 water master plan population projections to reflect the impact of the recent expansion of Ft. Riley and the addition of Riley County Rural Water District #1 to the city's potable water system. It will also include a determination of what additional facilities will be needed in order to comply with anticipated water quality regulations and adopted water quality goals. The project involves process improvements to increase the treatment capacity of the City's Water Treatment Plant from 20 to 30-40 million gallons per day (MGD). These process improvements involve replacement and/or upgrades of existing systems. All construction at the water plant will take place on property currently owned by the city. However, the project also involves the construction of new wells on property to the east of the city's existing well field and the construction of a new pipeline from the well field to the Water Treatment Plant (see below for a more detailed description of those items).

The improvements to the well field will expand raw water capacity and reduce the City's dependence on the existing "old well field". These well field improvements include the construction of a parallel raw water transmission pipeline. The purpose of this pipeline is to provide redundancy and to increase the total raw water capacity of the existing and proposed transmission pipelines to 40 MGD. This new pipeline will also hydraulically separate the old well field from the newer well field. The well field improvements will also involve the construction of 4 new wells. These new wells will involve land acquisition to the east of the existing city wells along the Big Blue River. The project will incorporate a long-term plan to retire older wells that are more costly to treat due to higher hardness values.

785-587-4530 ~ Fax 785-587-2416 ~ 1101 Poyntz Avenue,
Manhattan, KS 66502-5497 http://www.ci.manhattan.ks.us/

CITY OF MANHATTAN
KANSAS
PUBLIC WORKS DEPARTMENT
water~wastewater~operations~engineering

The estimated costs for this project are:

Construction Cost	$ 8,662,393
Engineering Design	$ 1,120,205
Construction Engineering	$ 346,928
Contingencies	$ 4,102,460
Total Project Cost	$14,232,286

We would appreciate your review of the project description and location, and any comments you may have, within 30 days. Two site maps of the project and a project review form are enclosed for your use.

If you have any questions or would like any additional information on the project, please do not hesitate to contact me at 785-587-4530 or by e-mail at mcintyre@ci.manhattan.ks.us. Thank you.

Sincerely,

Jerry McIntyre, P.E.
Deputy Director of Public Works

JM/cek

Enclosures: Two Site Maps
Project Review Form

The following form may be used by the Review Agency/Commission for comments in response to the request for clearance from the proposed Public Water Supply Loan Fund Project.

_____ Army Corps of Engineers
_____ Kansas B iological Survey
_____ State Conservation Commission
_____ Kansas Corporation Commission
_____ Division of Water Resources/Kansas Department of Agriculture
_____ Kansas Geological Survey
_____ Kansas State Historical Society, State Historic Preservation Office
_____ Kansas Water Office
_____ Kansas Department of Wildlife and Parks
_____ US Dept. of Agriculture - Natural Resources Conservation Service
_____ Kansas Department of Health and Environment
_____ US Department of the Interior - Fish and Wildlife Service

Agency Review Comments: (to be completed by reviewing agency and returned to applicant contact person at name and address shown below)

Comments: _____

_____

_____

Recommended Action: (to be completed by the reviewing agency and returned to applicant contact person at name and address shown below.)

_____ Clearance of project should be granted

_____ Clearance of project should not be granted

_____ Clearance of project should be delayed until the issues or questions have been clarified

_____ Clearance of project should not be delayed, but the applicant (in the application) should address or clarify the questions or concerns indicated above.

_____ _____ _____

Reviewer's Name Division/Agency/Commission Date

Project Title: Public Water Supply Loan Fund Application

Applicant: City of Manhattan KS

Contact Person: Gerald M. McIntyre, P.E. Deputy Director of Public Works

Address: 1101 Poyntz Avenue

City, State: Manhattan, KS Zip: 66502 Phone: (785) 587-4530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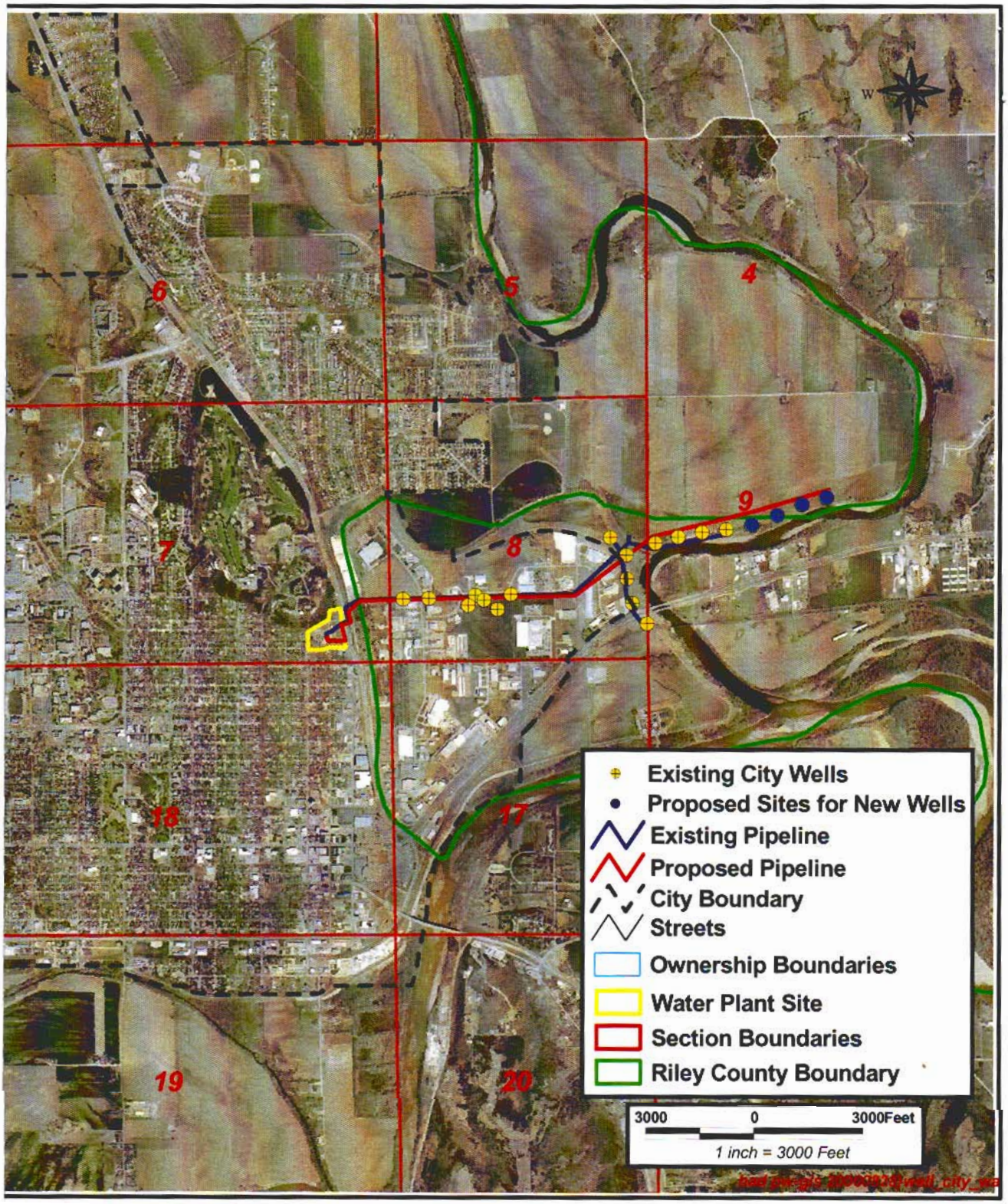
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Existing City Wells
Proposed Sites for New Wells
Existing Pipeline
Proposed Pipeline
City Boundary
Streets
Ownership Boundaries
Water Plant Site
Section Boundaries
Riley County Boundary
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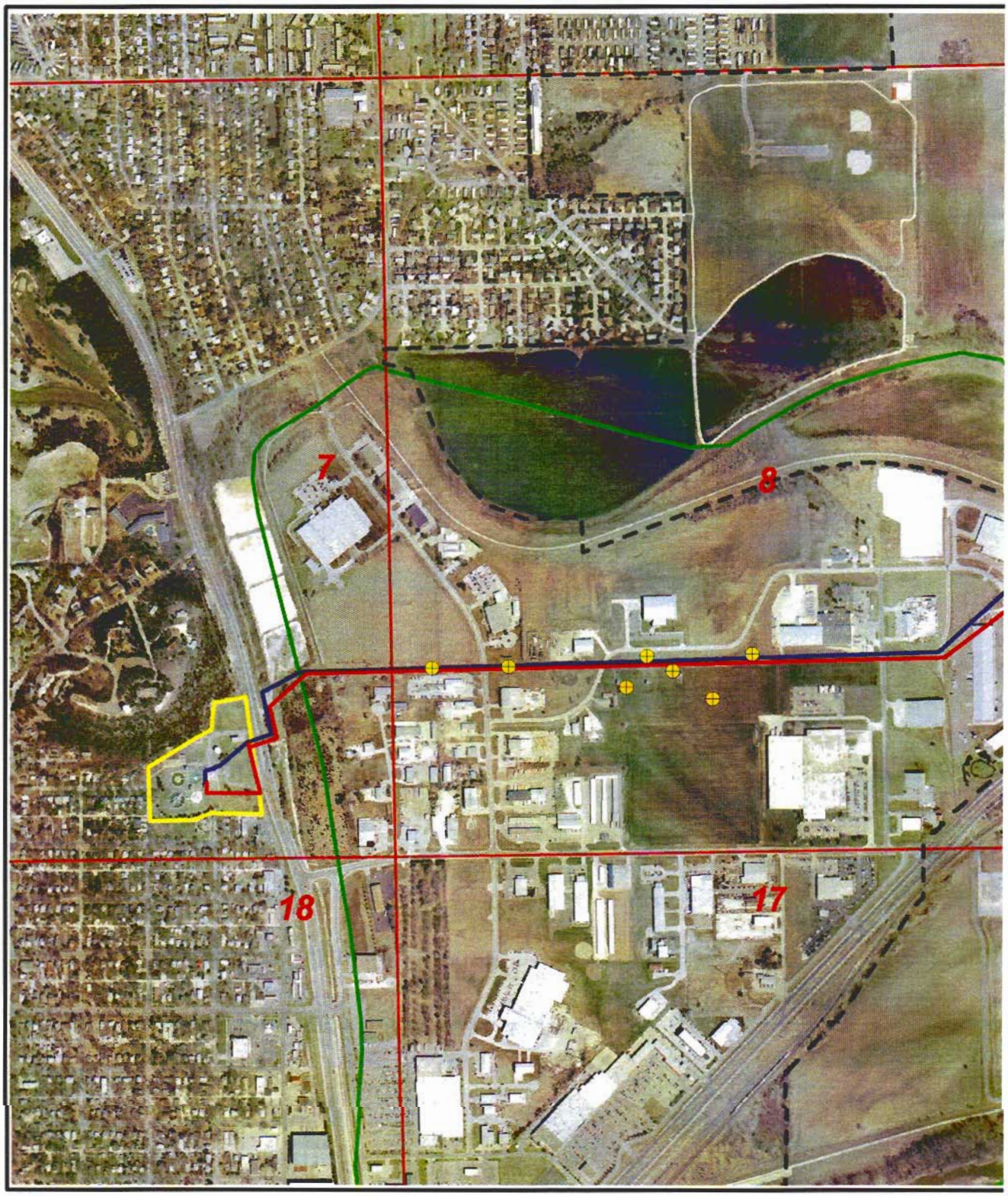
3000Feet
1 inch = 3000 Feet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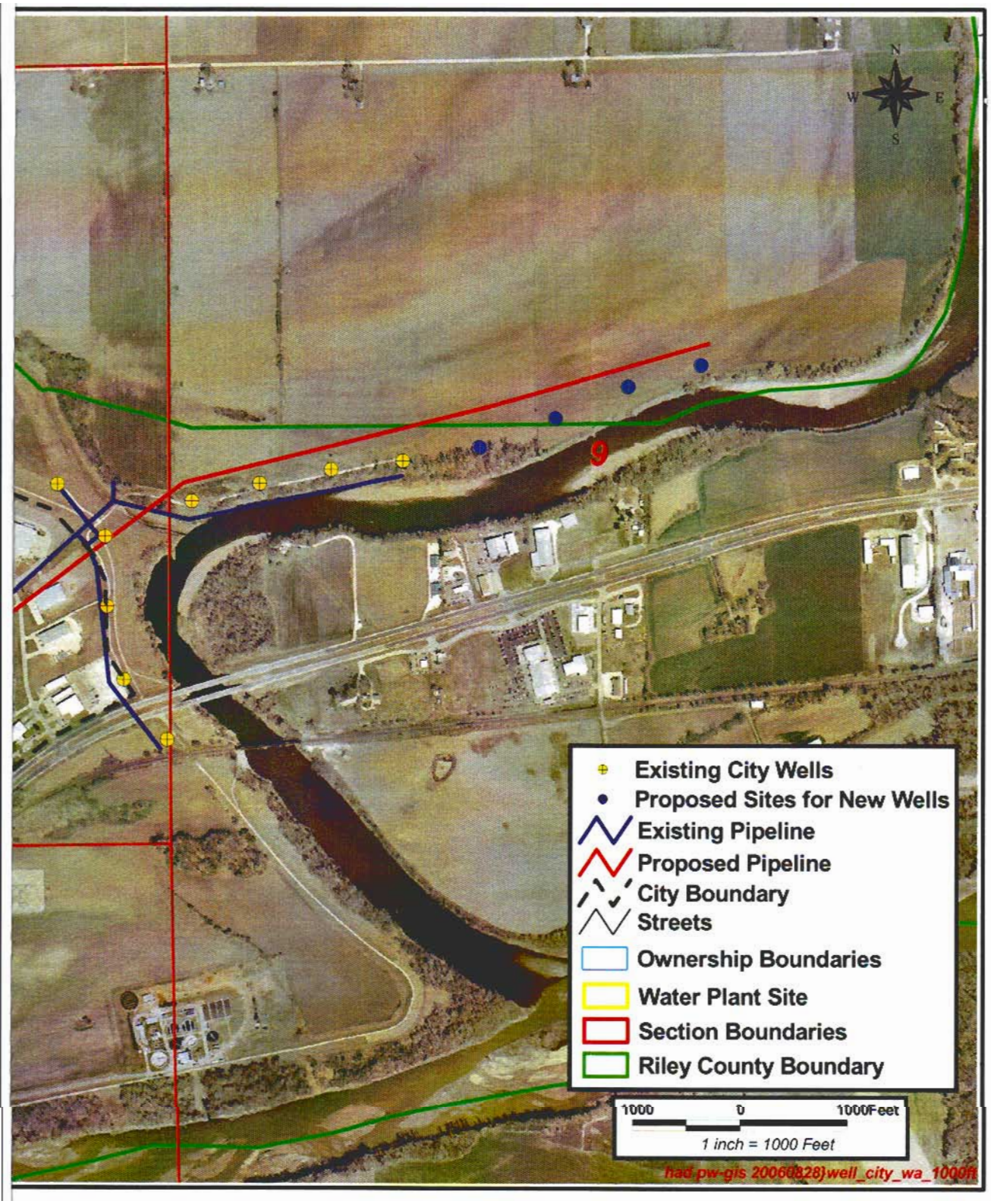
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Existing City Wells
Proposed Sites for New Wells
Existing Pipeline
Proposed Pipeline
City Boundary
Streets
Ownership Boundaries
Water Plant Site
Section Boundaries
Riley County Boundary
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