July 2000
DNR Form 638-2

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

APPLICATION FOR A MUNICIPAL AND RURAL DOMESTIC GROUND WATER TRANSFERS PERMIT

INSTRUCTIONS

Complete items 1 through 10 by printing in ink or typing the appropriate information and by placing an (X) in the appropriate boxes.

The following information shall be provided on 8½ x 11 inch paper (or folded to such size). An answer is required for each item of A-H. Each answer must be clearly identified in the application. When using a ground water model, justify the applicability to the given geologic setting.

For Department Use Only

Application Number: MT-9
Date Filed: August 12, 2005
Receipt Number: A2116
Amount: $ 150.00

A. Discussion of impacts on surrounding ground water and surface water supplies. Include expected radius of cone of depression and how it was determined and location of any existing wells or water rights that may be impacted.
B. Statement of impacts on any existing threatened or endangered species in project area.
C. Pump test information, if available, including length of test, data from pump test, and location of observation wells.
D. Information on geology and hydrology of area such as thickness of aquifer, depth to water, aerial extent, transmissivity and how it was determined, and whether aquifer is confined or unconfined.
E. Description of type of well, including drawings.
F. Planned operation schedule. (Describe hours per day the wells will likely be pumped, whether there will be seasonal changes to schedule, whether there will be a rotation of wells pumped, and whether certain wells are only for backup purposes.)
G. Explanation of the basis for the amount of water requested. This should include current population and projected growth, daily per capita water use data, current industrial or other large uses and projected growth. The explanation should also include answers to the requirements for approval of the application stated in § 46-642, R.R.S., 1943, as amended, namely: whether request is reasonable, not contrary to the conservation and beneficial use of ground water, and not detrimental to the public welfare.
H. Map showing location of proposed wells, pipelines (exclusive of distribution lines) and the area of proposed use. The map shall be legible and at a scale of not less than one inch to the mile.

A non-refundable filing fee (payable to the Department of Natural Resources) can be computed from the table below and must accompany this application.

QUANTITY OF WATER REQUESTED (daily average)	COST
First 5,000,000 gallons per day	$50.00
Each additional increment (or portion) of 5,000,000 gallons per day	$20.00

1. Name, address and telephone number of Applicant:

City of North Platte
211 West 3rd Street
North Platte, NE 69101

(308) 535-6724
Attn: Jerry Deal

Name, address and telephone number of person to contact concerning application:

Chris A. Miller, P.E.
Miller & Associates Consulting Engineers, P.C.
109 East 2nd Street
McCook, NE 69001

(308) 345-3710

2. Identify the city, village, rural area or other entity to be supplied water:

City of North Platte Water Service Area

3. Maximum rate of withdrawal for which a permit is requested (complete both)

20,000 gallons per minute
28,800,000 gallons per day

Indicate whether the amount is for each well or a total rate for all wells.

Maximum rate for all wells

app

4. The daily AVERAGE amount of water requested: 28,584,000 w/permits A-10510 & A-16166 Gallons per day

5. Total quantity of water to be withdrawn annually (gallons). 4,000,000,000

6. Number of wells proposed: 10+ Number of existing wells: 18 municipal, 4 irrigation

7. Location of the proposed ground water wells and existing wells:
(Indicate 40-acre government subdivision, Section, Township, Range and County, and registration number(s) if applicable):
Provided in text accompaning application

8. Construction will start on or before December, 2005.

9. Construction will be completed on or before August 31, 2040.

10. If the permit is granted, does the applicant request imposition of statutory spacing protection for one year for test holes or wells to be constructed? [X] Yes [ ] No

If yes, indicate below the name and address of the owners and occupiers of land affected by the granting of such spacing protection, and a description of the land they own or occupy.

Hansen Ranch Co.
c/o Stephen D. Mossman, Attorney
134 South 13th Street #1200
Lincoln, NE 68508-1901

Section 24, T15N, R31W
Section 30, T15N, R30W
Section 13, T15N, R31W
Section 18, T15N, R30W
Section 17, T15N, R30W

Wells are registered with the following information:

Thomas F. Hansen Ranch
2120 Sunset Drive
North Platte, NE 69101

I certify that I am familiar with the information contained in this application, and that to the best of my knowledge and belief, such information is true.

M. Keith Richardson - Mayor
Applicant (Signature and Title)

8-8-2005
Date

Forward application and fee to:

State of Nebraksa
Department of Natural Resources
301 Centennial Mall South
P.O. Box 94676
Lincoln, Nebraska 68509-4676
(402)471-2363

SURVEY FOR THE ENDANGERED AMERICAN BURYING BEETLE (*Nicrophorus americanus*) IN LINCOLN COUNTY, NEBRASKA BUFFALO BILL AVENUE EXTENSION PROJECT JUNE 2006

Report to
USFWS and Nebraska Game and Parks

W. Wyatt Hoback
July 18, 2006

SUMMARY

Mr. Mark Peyton trapped for the American burying beetle (*Nicrophorus americanus*) at fifteen individual locations on the site of the proposed extension of Buffalo Bill Avenue, North Platte, Nebraska, from 16 June through 22 June. In addition, as a control, Peyton trapped for the American burying beetle at eight locations in the loess hills south of Maxwell, Nebraska during the same time period. No specimens of American burying beetle were located in the area of the proposed extension of Buffalo Bill Avenue. A total of 12 individual American burying beetles were captured, marked and released at five different locations within the Control area south of Maxwell

INTRODUCTION

The American burying beetle, *Nicrophorus americanus*, was listed as an endangered species under the Endangered Species Act by the Department of the Interior in July of 1989 (Federal Register, Vol.54 (133): 29652-5). Historically *N. americanus* was distributed throughout 35 states in the eastern and central United States and three provinces in Canada (Peck and Kaulbars, 1987). Presently the species is known to exist in only eight states, including Nebraska (Amaral, 2003).

Two specimens of American burying beetles were collected in light traps near North Platte, Nebraska in 1988 and again in 1993. The collection site for those specimens is close to the proposed extension of Buffalo Bill Avenue. Surveys were conducted near the project area in 1995 (Bedick, 1997) and in 2001 (Peyton, 2001) with no American burying beetles collected.

As a part of the biological inventory of the proposed extension of Buffalo Bill Avenue running south from North Platte to Lake Maloney, a survey for *N. americanus* was conducted to determine if the species exists in and around the area of proposed construction.

SURVEY AREA AND CONDITIONS

Peyton surveyed for *N. americanus* in two areas. The first was located in the loess hills south of Maxwell, Nebraska where previous surveys have located a significant population (Peyton, 2003). This area acted as a control to determine if weather conditions were conducive to *N. americanus* movement and activity. The second area was situated along the corridor of the proposed extension of Buffalo Bill Avenue from North Platte to the base of the dam at Lake Maloney.

The control area consists of rugged loess hills with extensive red cedar, cottonwood, and ash groves filling the valleys and hillsides. The proposed construction area consisted of existing blacktop and gravel roads running alongside or through housing developments, crop ground, pasture, and riparian areas.

Weather conditions as recorded at the North Platte Airport during the survey were normal for mid June in Nebraska with daytime highs ranging from 73 to 92*F with an average of 81*F. Nighttime lows ranged from 54* to 62* with an average of 57*F, and the overall 24-hour average temperature was 69*F. The National Weather Service's 30-year average high for this time period is 84*, with an average low of 55* and overall average of 69*F.

Table #1 shows the high, low, and average temperatures for North Platte as reported by the U.S. Weather Bureau for the seven days of the survey in comparison to the 30-year average for those same days.

Table 1: High, Low, and Average Temperatures on days of the survey compared to the National Weather Service 30-year Average for North Platte, Nebraska for that date.

Date	High	Low	Average		30-year high	30-year low	30-year average
15-Jun	92	64	78		83	54	68
16-Jun	73	62	68		83	54	68
17-Jun	76	58	67		83	55	69
18-Jun	88	54	71		84	55	69
19-Jun	83	55	69		84	55	69
20-Jun	NA	NA	NA		84	55	70
21-Jun	81	58	70		84	56	70
22-Jun	74	55	65		85	56	70

METHODS

To capture beetles a 14-liter plastic bucket was buried in the ground at each site so the lip of the bucket was flush with the surface of the ground. A wire mesh cover was attached to the buckets as a predator guard and a wood cover was placed over the bucket to protect beetles captured from rain and sunlight. The cover was raised above the lip of the bucket approximately four centimeters to allow access by the beetles.

Bait consisted of euthanized white lab rats. The rats were taken from the freezer and allowed to thaw on 13 June. On 15 June one decaying rat was placed whole in the bottom of each trap. A second decaying rat was added on 20 June. Traps were checked each morning from 16 June – 22 June when the traps were dismantled. The traps were checked between 6:00 am and 9:00 am each morning.

Traps sites 1 – 8 were installed in the loess hills south of Maxwell. Their UTM locations are provided in Table #2 and on Figure #1.

Traps sites 9 – 23 were in the Project area. . Their UTM locations are provided in Table #2 and on Figure #2.

One recording thermometer was placed in the control area and one in the project area. These thermometers (Optic StowAway Temperature Recorders, Onset Corporation) recorded the temperature every 2.5 minutes from the time of instillation on 15 June through 22 June.

RESULTS

No specimens of American burying beetles (*N. americanus*) were captured in the project area during the seven days of the survey. In the control area a total of 12 *N. americanus* were captured, marked, and released. There were no recaptures of marked individuals. *N. americanus* were captured in the control area on four consecutive nights 19 June – 22 June.

In addition 679 carrion beetles consisting of 12 different species were collected during the final three nights of the survey. In the control area 278 individuals of nine species were identified (Table 3). The catch/trap night of effort was 12/per trap per night. In the project area 401 individuals of 12 species were identified with a catch/trap night of effort of 9/trap per night. These numbers are similar but slightly lower than those found by other researchers in the Loess hills. In part the numbers may be a result of cooler weather the first few days of the study. Higher numbers of *N. carolinus* are usually encountered in sandier conditions and often are inversely correlated with American burying beetles (Hoback unpublished).

Table 3:

Buffalo Bill Avenue Extension Project
Trapping Results

	Control Area	Project area
Nicrophorus americana	12	0
Nicrophorus tomentosus	91	95
Nicrophorus marginatus	96	228
Nicrophorus obricollis	37	6
Nicrophorus guttula	2	5
Nicrophorus pustulatus	0	2
Nicrophorus carolinus	1	15
Heterosilpha ramosa	12	18
Necrodes surinamensis	0	3
Necrophila americana	0	5
Oiceoptoma inaequale	5	3
Thanatophilus truncatus	22	13
Thanatophilus lapponicus	0	8
Total	278	401
# beetles/trap	12	9
# of species	9	12

DISCUSSION

Nicrophorus americanus, the American burying beetle is the largest beetle in the genus *Nicrophorus* and presently the only one on the endangered species list (USFWS 1991).

N. americanus feeds on vertebrates that have died by some other cause. The species is nocturnal and locates its "prey" by following the odor of the decaying animal. For successful brooding, animals between 100 – 200g in mass are necessary. The prey must be small enough to bury, yet large enough to satisfy the nutritional needs of both the parents and the 5 – 10 offspring.

Once prey is located a beetle will give off pheromones that attract other beetles. Competition will ensue with one male and one female emerging as winners and in possession of the carcass. They will then work together to bury the prey. Once buried the beetles will skin the prey and cover it with an anal secretion. This reduces the odor produced by the rotting animal and thus effectively "hides" the prey from other scavengers (Ratcliffe, 1996).

Variables that may effect the presence or absence of *N. americansus* at a given site are many. Probably first and foremost is the presence of suitable prey. Secondly, the beetles must have soil that is conducive not only to burying the prey, but such that a brood chamber can be maintained and not flooded. Because of this it is uncommon to find *N. americanus* in soils that are sandy or in lowland forests (Lomolino et al. 1995). In Oklahoma distributions of *N. americanus* populations "...were biased toward forested sites with relatively deep soils." (Lomollino et al. 1996). In 1996 – 1999 the soils in Kansas where *N. americanus* were found were described as loose, well-drained soils, friable loam, and deep and moderately well drained (Guarisco, 1997 and 1999).

Trees are also apparently important. This is pointed out in Anderson (1982), which identified the northern deciduous forest as the primary habitat for *N. americanus*. Lingafelter (1995) indicates that based upon historical records in Kansas (pre-1940) that *N. americanus* was one of two species of burying beetles considered dominant in woodlands. Lomolino et al. (1996) noted that forested areas in Oklahoma were the primary habitat for the species. Both Bedick et al (1999) and Peyton (2003) associated the species in Nebraska with grasslands interspersed with trees.

Temperature fluctuations and humidity may also be important. Kozal (1990) and the Recovery Plan for *N. americanus* (1991) both note that *N. americanus* becomes active when nighttime temperatures exceed 15°C (60°F).

Kozal (1990) states that trapping success diminishes significantly when nighttime temperatures drop below 12*C (53*F). Bedick (1997) noted that it wasn't simply the nightly low temperature, but the rate of temperature drop that effected *N. americanus* activity.

However, it should be noted that while activity may increase when nighttime temperatures exceed 60 °F, the beetles are active at lower temperatures and beetles have been captured on nights when the temperature dropped well below 60°.

In surveys in South Dakota during 1995 nighttime lows dropped below 15°C (60°F) on three of the six nights in which *N. americansus* were captured. On 8/19/95, 14 individual *N. americansus* where captured and the low was 44°F. The largest number of individual *N. americansus* captured on a single night during the surveys were15 (Backlund and Marrone, 1995, Appendix A).

Peyton from 1994 through this survey trapped individual *N. americansus* in Nebraska on a total of 76 separate evenings. Of those, 35 (46%) were nights when temperatures dropped below 15°C (60°F). On 6/7/95, 48 individual *N. americansus* were captured when nighttime lows were measured at 50°F. The only other night more *N. americanus* were captured over that time period was on June 25, 1998 when 66 *N. americanus* were captured. Overnight lows for that evening were 61°F. (Appendix A).

Temperatures during this survey were slightly lower than 60°F recommended by Kozal and Creighton et al. (1993), as the "break point" for sampling. However, they were normal temperatures for the season and equal to both the average and median nighttime lows when *N. americanus* has been captured in Nebraska during other surveys. In addition specimens of *N. americanus* were captured in the control area on the nights the temperatures dropped below 60°F

CONCLUSIONS

Nicrophorus americanus is present in loess hills south and east of North Platte in Lincoln County Nebraska. However, no beetles have been located in, or near the site of the Buffalo Bill Avenue Extension in multiple surveys dating back to 1995. The only specimens captured in the area were single individuals attracted to light traps at the University of Nebraska Test Farm in 1988 and 1993.

Peyton extended the length of the survey from five to seven consecutive nights because nighttime temperatures dropped below 60° at North Platte each night from 17 June to 22 June. As can be seen from Table #4 the temperature at Trap #1 in the control area dropped below 60°F during 10 separate time periods. As expected, temperatures above 60 before midnight improved capture rates. Thus, the final 4 days of the survey should have produced American burying beetles if they were present in the Buffalo Bill extension area.

Table 4: Times when the air temperature dropped below 60*F

Cottonwood Canyon Control Area

Date	Time when temperature dropped below 60*f	Time when temperature rose above 60°F	Low	ABB Captured Yes/No
16-Jun	6:27 11:22 17:49	7:17 11:52 23:59	59.9 58.3 57.4	no
17-Jun	0:00 22:02	14:39 23:59	57.4 56.8	no
18-Jun	0:00	7:24	54.2	no
19-Jun	2:32	7:22	53	yes
20-Jun		Did not drop below 60*F		yes
21-Jun	4:32	7:27	56.1	yes

	22:54	23:59	58.1	
22-Jun	0:00	5:57	58.1	yes

At trap site #11 in the project area the temperature dropped below 60°F on seven different occasions (Table #5). Despite the fact that temperatures dropped below 60°F on multiple occasions, 12 specimens of *N. americanus* were located in the control area on four consecutive nights. This would indicate that temperatures were in fact high enough, long enough into the evening that *N. americanus* were active and, if in the project area, susceptible to being trapped at one of the 15 different trap locations.

Table 5: Times when the air temperature dropped below 60*F

South Buffalo

Date	Time when temperature dropped below 60*f	Time when temperature rose above 60°F	Low	ABB Captured Yes/No
17-Jun	4:10	10:35	58.8	no
	11:22	11:47	59.4	
	12:12	13:37	57.5	
18-Jun	5:27	6:02	58.8	no
19-Jun	3:20	6:30	54.9	no
20-Jun		Did not drop below 60*F		no
21-Jun	5:20	5:27	58.8	no
22-Jun	6:42	6:50	59.4	no

In addition to the fact that *N. americanus* were captured in the control area during the survey, 401 individual carrion beetles from 12 species were captured in the project area. These species are sympatric with *N. americanus* and while they may occupy slightly different niches in the ecosystem past experience tells me they are active under similar weather conditions. This view is consistent with Kozal (in USFWS, 1991) who stated that if other species of *Nicrophorus* are captured in sufficient numbers without catching any *N. americanus* that three days of trapping a location are sufficient to determine that *N. americanus* was not present at that location. In other areas of the country three nights of trapping at a single location are the norm. In 1995 during my initial surveys Peyton suggested that we should trap a minimum of five nights as an extra precaution. This has become the standard survey length in Nebraska. For this survey, because of cooler nighttime temperatures the survey was extend an additional two nights.

This survey was conducted under U.S. Fish and Wildlife Service Permit Number TE038221-0 and the State of Nebraska Scientific and Educational Permit #663.

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Bedick, J.C., B. Ratcliffe, W. Hoback, and L. Higley. 1999 Distribution, ecology, and population dynamics of the American burying beetle (*Nicrophorus americanus* Olivier (Coleoptera, Silphidae)) in south-central Nebraska USA. Journal of Insect Conservation 3:171-81.

Bedick, J.C. 1997. Distributing and ecology of the American burying beetle (*Nicrophorus americanus*, Olivier) in south-central Nebraska. A thesis presented to the Graduate College of the University of Nebraska.

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Ratcliffe, B. C. 1996 The Carrion Beetles (Coleoptera: Silphidae) of Nebraska. Bulletinof the University of Nebraska State Museum. Volume 13:60-65.

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_____ 2003. Range and Population size of the American burying beetle (Coleoptera: Silphidae) in the dissected hills of south-central Nebraska. Great Plains Research Vol. 13, No.1, Spring 2003: pp.127 –38.

U.S. Fish & Wildlife Service. 1991. American burying beetle (*Nicrophorus americanus*) recovery plan. Newton Corner, MA.

APPENDIX A

Dates, Nighttime Low Temperatures, and Number of *N. Americans*
Captured in South Dakota and Nebraska
During Surveys
1994 – 2006

APPENDIX B

Graphs showing temperatures recorded every 2.5 seconds from 15 June through 22 June at Trap Site #1 in the Control Area (Cottonwood Canyon) and at Trap Site #11 at the south end of the Project corridor.

APPENDIX C

Daily Results

Table 3:

Buffalo Bill Avenue Extension Project
Trapping Results

	Control Area	Project area
Nicrophorus americana	12	0
Nicrophorus tomentosus	91	95
Nicrophorus marginatus	96	228
Nicrophorus obricollis	37	6
Nicrophorus guttula	2	5
Nicrophorus pustulatus	0	2
Nicrophorus carolinus	1	15
Heterosilpha ramosa	12	18
Necrodes surinamensis	0	3
Necrophila americana	0	5
Oiceoptoma inaequale	5	3
Thanatophilus truncatus	22	13
Thanatophilus lapponicus	0	8
Total	278	401
# beetles/trap	12	9
# of species	9	12

Table 4: Times when the air temperature droped below 60*F Cottonwood Canyon Control Area				
Date	Time when temperature dropped below 60*f	Time when temperature rose above 60*F	Low	ABB Captured Yes/No
16-Jun	6:27 11:22 17:49	7:17 11:52 23:59	59.9 58.3 57.4	no
17-Jun	0:00 22:02	14:39 23:59	57.4 56.8	no
18-Jun	0:00	7:24	54.2	no
19-Jun	2:32	7:22	53	yes
20-Jun	Did not drop below 60*F			yes
21-Jun	4:32 22:54	7:27 23:59	56.1 58.1	yes
22-Jun	0:00	5:57	58.1	yes

Table 5: Times when the air temperature dropped below 60*F South Buffalo				
Date	Time when temperature dropped below 60*f	Time when temperature rose above 60*F	Low	ABB Captured Yes/No
17-Jun	4:10 11:22 12:12	10:35 11:47 13:37	58.8 59.4 57.5	no
18-Jun	5:27	6:02	58.8	no
19-Jun	3:20	6:30	54.9	no
20-Jun	Did not drop below 60*F			no
21-Jun	5:20	5:27	58.8	no
22-Jun	6:42	6:50	59.4	no

SURVEY FOR FINESCALE, REDBELLY DACE AND PLAINSTOPMINNOW IN WHITEHORSE CREEK, LINCOLN COUNTY, NEBRASKA

JULY 27, 2006

Report by
Dr. Wyatt Hoback
University of Nebraska-Kearney

SUMMARY

On July 27, 2006, W. Wyatt Hoback and Brian Peterson on the University of Nebraska at Kearney sampled 9 locations for fish in Lincoln County Nebraska north of the city of North Platte. The samples were taken in Whitehorse Creek and in an un-named tributary. Streams were accessed from bridges and samples consisted of at least 5 seine pulls per site covering an area of approximately 50 meters of stream. All samples were conducted using a 5 x 2 meter seine. GPS locations of all sites were recorded and site characteristics were noted. At each site at least two seine pulls were made through each type of habitat (open sand bottom channel, open gravel bottom, overhanging vegetation, backwater areas). Voucher specimens were collected, identified, and deposited in the UNK museum collection. A total of 12 species were collected among sites. No dace were collected in this survey. Plains topminnow, *Fundulus sciadicus* were collected at 4 sites.

INTRODUCTION

In Nebraska, 25 fish species are listed as At-risk or of special concern. Of these, northern redbelly dace, tadpole madtoms, and plains topminnow have been collected from Whitehorse Creek in Lincoln County between 1972 and 1991 by John Lynch. Finescale dace have not been previously recorded from Whitehorse Creek (Nebraska Game and Parks fish database).

Northern redbelly dace, *Phoxinus eos*, are widely distributed in the north half of North America, from the Rocky Mountain front to the East Coast, with isolated populations in Manitoba and Saskatchewan (Scott and Crossman 1973). In Montana, northern redbelly dace are fairly widespread east of the continental divide. Finescale dace, *Phoxinus neogaeus* have a similar range as northern redbelly dace but distribution in the United States west of Minnesota is limited to glacial relict populations (Scott and Crossman 1973; Hubbs and Lagler 1970). Hybrids of the two species are found throughout New England west to Nebraska, Colorado and Montana and into Alberta (Dawley et al. 1987).

Populations of finescale dace in South Dakota, Wyoming, and Nebraska are small, and isolated and have been declining steadily since European settlement of this region over 100 years ago. Finescale dace are currently listed as state endangered in South Dakota and state threatened in Wyoming and Nebraska (Stasiac and Cunningham 2006). In Nebraska, these populations occur north and west of North Platte.

Northern redbelly dace are ranked as endangered or threatened in Colorado (S1 State endangered), South Dakota (S3 State threatened), and Nebraska (S3 State threatened). The remaining populations are small and isolated and are threatened by introduced species. These dace were last collected in Whitehorse Creek in July 1991 by Lynch (Nebraska Game and Parks fish database).

The plains topminnow, *Fundulus sciadicus* is endemic to Nebraska where it historically occurred in more than 130 locations. However, despite Nebraska having the greatest historic distribution, *F. sciadicus* populations have declined over the last 30 years and it is now listed as a species of concern in Nebraska as well as surrounding states. Threats to the species involve water development activities that alter streamflows,

physical/chemical habitat degradation, stream fragmentation, and introduction of nonnative fishes. Because plains topminnows tend to be located in headwater and naturally intermittent reaches of prairie streams, they are highly vulnerable to losing habitat from activities that divert water from stream channels or that lower water tables (Rahel and Thel 2004). Because they occupy the same habitat but are much more prolific, western mosquitofish, *Gambusia affinis* are likely to significantly impact plains topminnow (Lynch 1988).

Tadpole madtoms, *Noturus gyrinus*, were reported by Lynch between 1988 and 1991 from Whitehorse Creek. A known population in Nebraska is at Frenchman Creek where they were likely unintentionally introduced as contaminant with channel catfish (http://nematode.unl.edu/tadpole.htm). Despite its status as introduced, Nebraska Game and Parks lists this species as Tier II and S3.

SURVEY AREA

We surveyed Whitehorse Creek and an un-named tributary in an area north of North Platte that potentially could be impacted by a future well-field. We sampled the stream using a seine at 9 different sites accessible from bridge overpasses.

Sites	UTM		Description
	northing	easting	
Site 1	40 41.344	99 25.298	Whitehorse Creek
Site 2	41 13.22	100 47.579	Whitehorse Creek West side of road
Site 3	41 13.221	100 47.579	Whitehorse Creek East side of road
Site 4	41 12.264	100 47.482	Unnamed tributary- small ditch from pond
Site 5	41 12.264	100 47.482	Whitehorse Creek
Site 6	41 12.264	100 47.482	Whitehorse Creek
Site 7	41 11.466	100 47.249	Unnamed tributary
Site 8	41 11.487	100 47.214	Unnamed tributary
Site 9	41 11.315	100 46.250	Unnamed tributary

SITE DESCRIPTION AND RESULTS

Surveys for fish were conducted at 9 sites accessed from the road at bridges. At each site, a serine (5 x 2 meter) was used to sample fish.

Site 1. This site is just north of North Platte on highway 83. The creek is over two meters wide here with very muddy bottom and large stands of reed canary grass growing into the channel. The creek was sampled both east and west of the bridge and sampling occurred in the main channel as well as under the vegetation from the banks. Only common species were collected including mosquitofish, an invasive suggested to impact plains topminnows..

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Fish	Number
Yellow bullhead	3
Mosquitofish	20
Sand shiner	3
Fathead minnows	10

Site 2. This site is on Highway 97 approximately 3 miles west of the junction with highway 83. Site 2 is on the west side (downstream side) of highway 83. The site is clear water with sandy bottom and moderate flow. There is some gravel and mostly native vegetation on the banks. The most common species collected was fathead minnow. Three plains topminnows were collected and an additional ten were observed. We also collected 2 sand shiners, *Luxilus cornutus*, a species on the Tier II list in Nebraska. The habitat is lightly grazed.

Fish	Number
Fathead minnow	20
Plains topminnow	3
Common shiner	2
Red Shiner	2
Sand shiner	5

Site 3. This site is on Highway 97 approximately 3 miles west of the junction with highway 83. Site 2 is on the east side (upstream side) of highway 83. Habitat is as site 2, but the creek meanders more, and flow slows prior to the road. There is a deeper pool by the culvert (~1.0 meters deep). We collected fathead minnow and common carp (an introduced species). Plains topminnow occurred in the vegetation and shallow waters. One specimen was collected and many more were seen.

Fish	Number
Common Carp	2
Fathead minnow	14
Red Shinner	1
Plains topminnow	1

Site 4. This site is south of highway 97 on a dirt road that runs south to Lamplaugh Lake. There is a small muddy stream that flows out of the lake and the bottom is very muddy. The banks are covered in cat-tails and reed canary grass. The habitat supports only mosquitofish, a non-native species implied in the reduction in plains topminnows and the Asian clam, *Corbicula fluminae*, an exotic species with unknown impacts in Nebraska.

Site 5. This site, located on Whitehorse Creek is a horseshoe bend west of highway 97 approximately 4.5 miles from the junction with highway 83. The creek is shallow with sandy and gavel bottom and low flow. Vegetation has been grazed and cattle use the creek as a water source. Plains topminnows occur associated with the vegetation and one specimen was collected. In addition, we collected four specimens of common shiner from this stretch.

Fish	Number
Fathead minnow	11
Red Shinner	2
Plains Topminnow	1
Common Shiner	4

Site 6. This site located on Whitehorse Creek is east of site 5 and upstream. The water forms a deep pool beside the bridge while it quickly grows shallower upstream. The bottom is sandy with some mud and gravel. Abundant emergent vegetation is present. Large numbers of plains topminnow were observed associated with this vegetation. In

addition to topminnow, we collected 4 common shiners associated with the deep pool by the bridge. Also a small largemouth bass was collected, probably an escapee from the pond upstream on Whitehorse Creek. The largemouth bass could pose a threat to topminnows and common shiners.

Fish	Number
Red Shiner	1
Largemouth Bass	1
Fathead minnow	15
Top minnow	1
Common Shiner	4

Site 7. This site is on an unnamed tributary at a culvert south of highway 97. The channel is about 2 meters wide, muddy bottomed and the water is cooler than Whitehorse creek. The bank contains large amounts of reed canary grass and Canadian thistle is present. Mosquitofish were abundant and we collected 1 white sucker. The creek appears to be impacted by horse grazing immediately upstream.

Fish	Number
Mosquitofish	2
White sucker	1
Red Shiner	4
Fathead minnow	4

Site 8. This site is further south on the un-named dirt road. It has a concrete bridge with "Huskers" painted on it and grating. The bottom is very muddy and water flow is slow. Large amounts of emergent vegetation is present. Only mosquitofish were present.

Fish	Number
Mosquitofish	5

Site 9. Also on the unnamed tributary, further south on the dirt road. The water flows faster here and the bottom is sandy. There is a large amount of submerged aquatic vegetation and there is reed canary grass which overhangs the water. In addition to common shiners, we collected a stonecat. We also collected a largemouth bass which could be a threat to minnow species in this area.

Fish	Number
Stonecat	1
Largemouth Bass	3
Fathead minnow	5
Common Shiner	4
Red Shiner	4

CONCLUSIONS

In the survey of 5 sites on Whitehorse Creek, we found two fish species of concern in Nebraska- plains topminnows and common shiners. In the unnamed tributary no fish of special concern were detected. Overall, the upper reaches of Whitehorse Creek were in good condition with only common carp and largemouth bass as exotic species. In the lower reaches of Whitehorse Creek and the unnamed tributary, mosqutofish were common.

This survey was conducted under the State of Nebraska Scientific and Educational Permit #104.

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Groundwater Model Assessment Report - Proposed City of North Platte Well Field

Prepared for Miller and Associates Consulting Engineers, PC by the Platte River Cooperative Hydrology Study Technical Committee[1]

Overview

By request of Miller and Associates Consulting Engineers, PC, McCook, Nebraska (hereafter referred to as Miller and Associates), the Platte River Cooperative Hydrology Study (COHYST) Technical Committee utilized the COHYST groundwater flow model of the COHYST Central Model Unit to provide an assessment of impacts to Whitehorse Creek and the High Plains aquifer in the area of the proposed city of North Platte, Nebraska well field. This report contains results from a series of model simulations designed to provide an assessment of future well field impacts on Whitehorse Creek and the regional aquifer.

Methodology

As requested by Miller and Associates, the COHYST development period groundwater flow model was used to determine future impacts of the proposed city of North Platte well field (fig. 1). To provide a comparative assessment of future impacts of the proposed well field, four scenarios were simulated with the COHYST model. These scenarios include

1) Ambient conditions with no additional stresses on the system

2) 26 irrigation wells (4 per section) in the proposed well field location pumping 12 inches per pumping season on 130 acres (per well) for 48 years

3) The proposed well locations pumping with seasonal averages of future predicted pumping rates provided by Miller and Associates

4) The proposed well locations pumping with an annual average rate to meet the future predicted needs for the city of North Platte

[1] The Platte River Cooperative Hydrology Study Technical Committee is comprised of engineers, scientists, and managers from several cooperating agencies in Nebraska that formed and investigative team in the late 1990's to produce models, databases, and other analyses in the Platte River basin from Columbus to Scottsbluff. Contact information for committee members regarding this investigation are:

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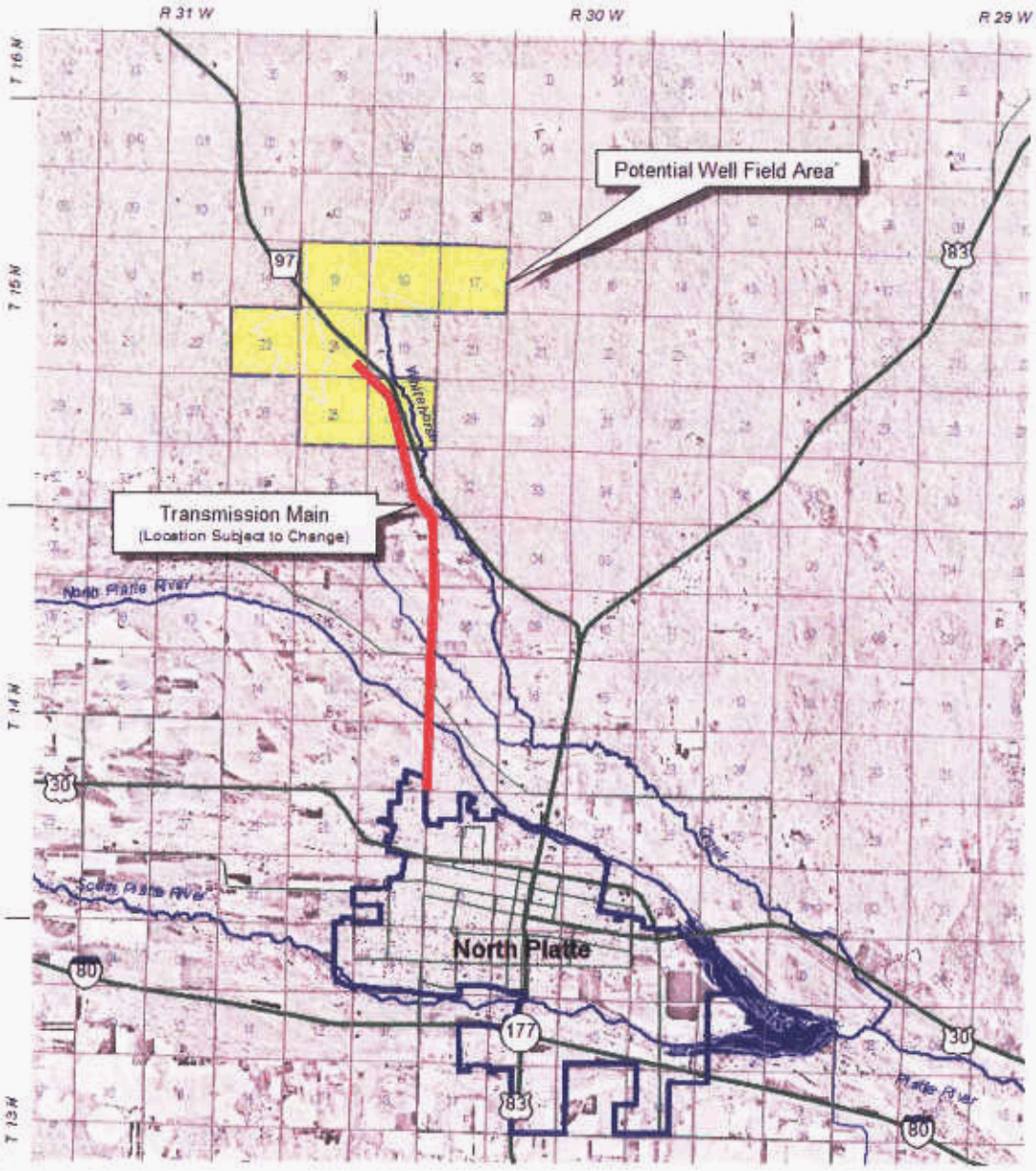
Duane Woodward, P.E., Central Platte Natural Resources District. Grand Island, NE. 308.385.6282, woodward@cpnrd.org.



North

Prepared By:

Miller & Associates
CONSULTING ENGINEERS, P.C.

Figure 1
Project Location
North Platte, Nebraska

Model Area

The area of interest is located approximately 7 miles north of the city of North Platte in central Lincoln County, Nebraska (fig. 1). Seven sections were selected by Miller and Associates for potential well locations within Township 15 North and Ranges 30 and 31 West. State Hwy 97 roughly bisects the well field area. The headwater area of Whitehorse Creek is located in section 9 of Township 15 north Range 30 west. Whitehorse Creek baseflow (stream flow comprised of groundwater contribution to flow only) has been estimated to range between 6 and 9 cubic feet per second (cfs) (COHYST, 2001). Periodic stream flows often exceed this range. However, this additional flow is comprised of surface runoff from precipitation events or irrigation runoff. The topography of the well field area is comprised of gently rolling to hummocky dunes on the southern edge of the Nebraska Sand Hills. The saturated thickness of the High Plains aquifer in this area ranges from 325 to over 425 feet. The High Plains aquifer increases in thickness in a northward trend across the area of interest in this report. The regional groundwater flow trends in a north/northwest to south/southeast direction. The aquifer in this area is comprised of Quaternary and Pliocene age sand and gravel unit which can approach 100 feet in thickness in the area of the proposed well field. Underlying the Quaternary/Pliocene sediments is the Ogallala Group, which can exceed 300 feet in thickness in the area of interest. The Ogallala Group consists of interbedded and unconsolidated silts, sands, gravels and semi-consolidated sandstones, siltstones, claystones. The top of the Oligocene Brule Formation (White River Group) is considered the bottom of the High Plains aquifer in this area of Lincoln County.

Model Characteristics and Data Inputs

The groundwater model used for the analysis presented in this report was designed, constructed, and calibrated by the COHYST Technical Committee (http://cohyst.nrc.state.ne.us/). The model was constructed using the MODFLOW-96 code. Data was added to and results retrieved from the model using the Groundwater Modeling System (GMS v. 3.1) pre/post-processor. The simulation used for this assessment represents a 48-year period that was considered the "groundwater development period" from 1950-98. The model accounts for area groundwater pumpage using data prepared for the COHYST simulation. The pumpage values assigned to wells were based on crop consumptive use estimated by Klocke and others (1990, table 1). Crop consumptive use minus effective precipitation is the estimated net irrigation requirement for the crop. Although the simulation described in this report is applied to a period beyond the "development period" as defined by COHYST, the land-use in the area of interest for the proposed well field has historically consisted of rangeland and has not been extensively developed in the last 50 years. Considering this condition in the area of interest, the COHYST model was deemed suitable for this analysis.

The model consists of 6 layers representing various hydrostratigraphic units within the High Plains aquifer. Layers 1-3 represent Quaternary- to Tertiary-age units that are typically unconsolidated. Layers 3, 4 and 5 represent the Ogallala Group, and Layer 6 represents the Arikaree Group, which is absent in this area. Model cells are uniform in size, covering an area of 160 acres (quarter square-mile). Cells in which the water table is initially below the bottom of the cell are set as inactive in the simulation, but allowed to become active (or "re-wet") if the water table rises above the bottom of the cell. The external model boundaries north of the area are comprised of a river and constant flow conditions. To the east, a constant flow boundary exists. These boundaries are over 30 miles from the area of interest and should not exert any influences on the simulations described in this report.

Aquifer characteristics such as horizontal and vertical hydraulic conductivity, specific yield, and specific storage were obtained after calibration of the COHYST model and were originally obtained from the COHYST geologic borehole database that comprises of geologic borehole logs from UNL-CSD/USGS testholes as well as irrigation, industrial, municipal, and domestic well logs in the study area.

Recharge to the model is derived from land-use and topographic characteristics. In this area, recharge can exceed 2.5 inches per year in Sand Hills.

Whitehorse Creek is simulated using the Stream Package within MODFLOW-96. Streambed elevations were obtained from the Nebraska Department of Natural Resources. The COHYST model initially simulates an aquifer discharge to the stream at 6 cfs. The North Platte River, into which Whitehorse Creek discharges, is simulated using the River Package.

Wells were simulated using the Well Package in MODFLOW-96. Well locations and pumping rates were first prepared using GIS coverages and entered into MODFLOW-96 within GMS. Although multiple wells may exist in a model cell, MODFLOW simulates one well per cell at the centroid of the cell with an accumulated rate of all wells within the cell. Note the gold squares in the cells containing wells in the simulation result figures indicate this format. Pumpage data and new well locations were provided by Miller and Associates.

Simulated Well Field Scenarios

Miller and Associates provided the COHYST Technical Committee with locations of 10 proposed production wells for the city of North Platte. For the first simulation of ambient conditions with no additional wells in the system, no wells exist in the system with exception of wells implemented in the COHYST model to satisfy the net irrigation requirement. The second test simulation simulated 26 hypothetical irrigation wells (as previously described) in quarter section locations of each section in the proposed well field area. Each well pumped at a rate of 12 inches per pumping season for an area of 130 acres. This simulation ran for 48 years. The hypothetical well locations are shown in figure 2.

Figure 3 shows the approximate well locations for the proposed well field provided by Miller and Associates. The 10 wells were simulated in two separate simulations. The first simulation applied temporally variable pumping rates. The COHYST model is structured to simulate pumping in a stress period representing the growing months of May-September. The remaining seven months is simulated in a stress period representing the non-growing season. From the data provided by Miller and Associates (see appendix), an average pumping rate (for months of May-September) was applied to the growing season stress period. A second averaged rate (October-April) was applied to the non-growing season for each of the 48 years simulated. The average growing-season pumping rate was 10,369 gallons per minute (gpm) distributed evenly to the 10 simulated wells. The average non-growing season pumping rate was 5,152 gpm distributed evenly to the 10 simulated wells. Values in MODFLOW-96 were converted to cubic feet per day. These pumping rates were applied to the initial stress period for the simulation. Current water pumpage for North Platte municipal use is approximately 60% of these pumping rates, therefore the simulation is considered to determine worst case scenario changes to the current groundwater/surface water system.

A second simulation using the proposed well locations in figure 3 applies an average annual rate of 7,449 gallons per minute, distributed evenly to each well and run constant for 48 years.

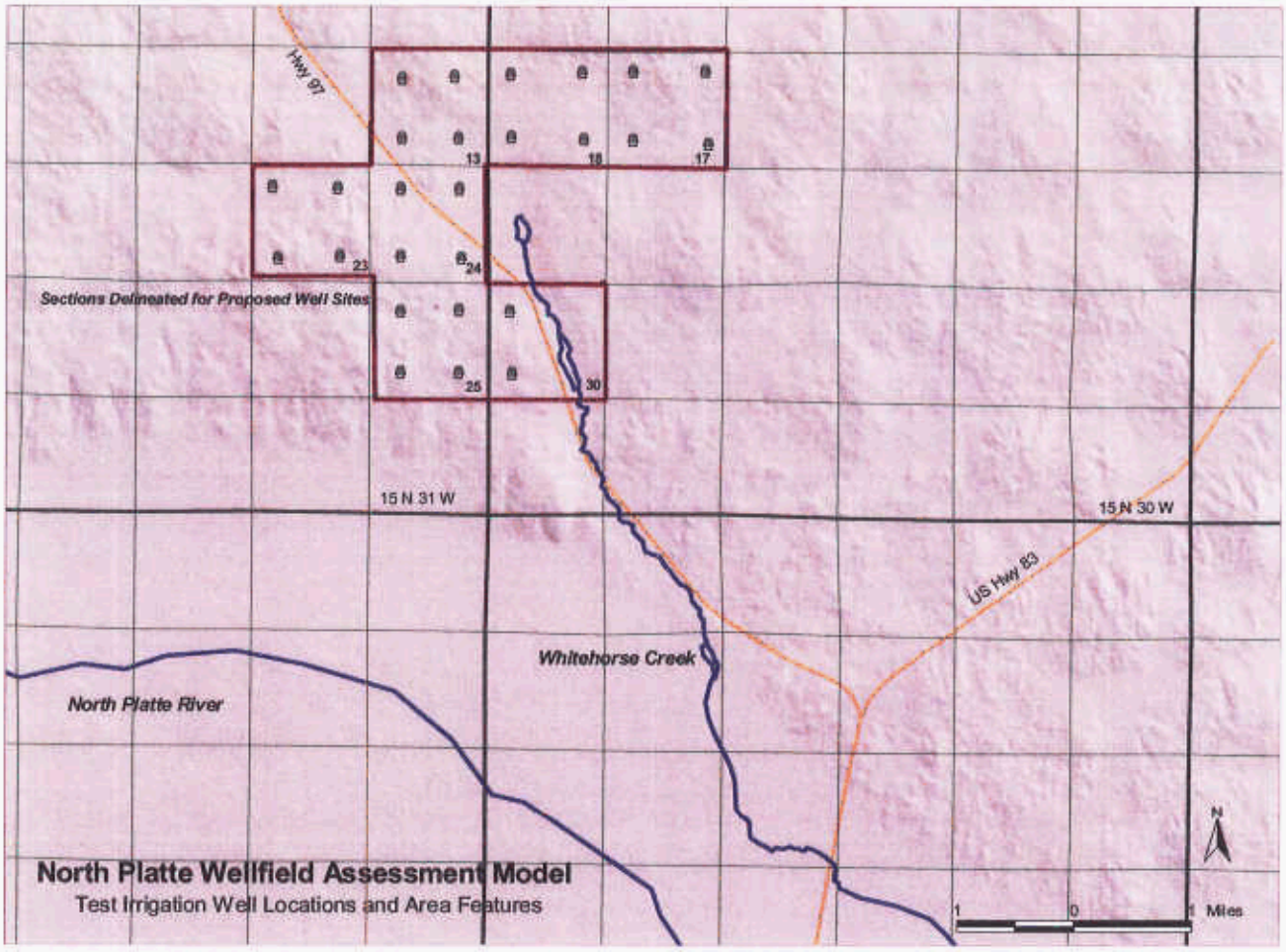


Figure 2. – locations of 26 hypothetical irrigation wells for test simulation.

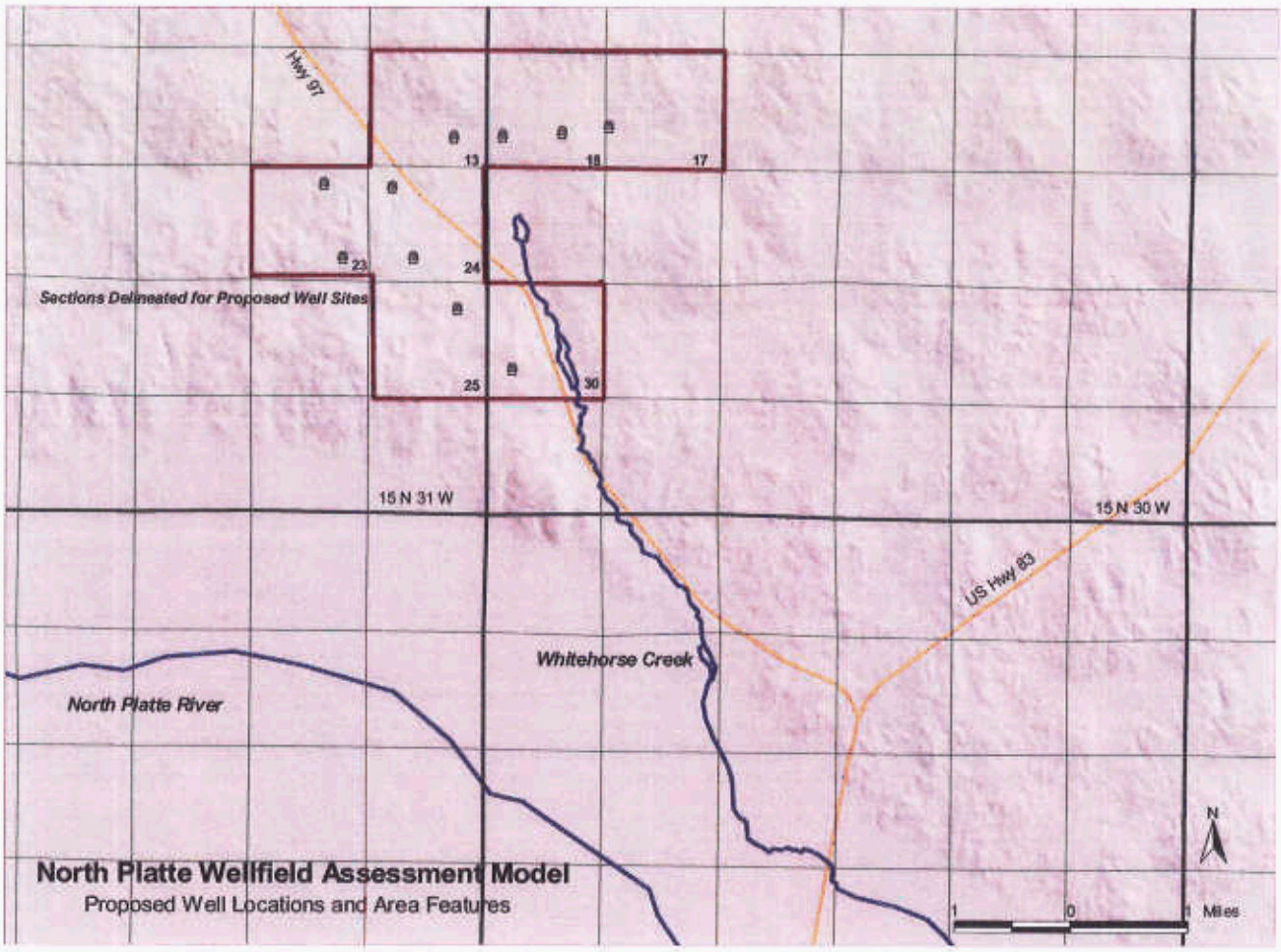


Figure 3. – locations of 10 proposed municipal production wells (wellhead symbols) for the city of North Platte.

Ambient Condition Simulation

The ambient condition simulation was produced to characterize baseline conditions of aquifer discharge to Whitehorse Creek. No additional pumping stresses we applied to the system for the 48 year simulation. Figures 4 shows water table elevation contours at the end of the simulation. Simulated discharge to Whitehorse Creek is summarized in the Long Term Impacts section.

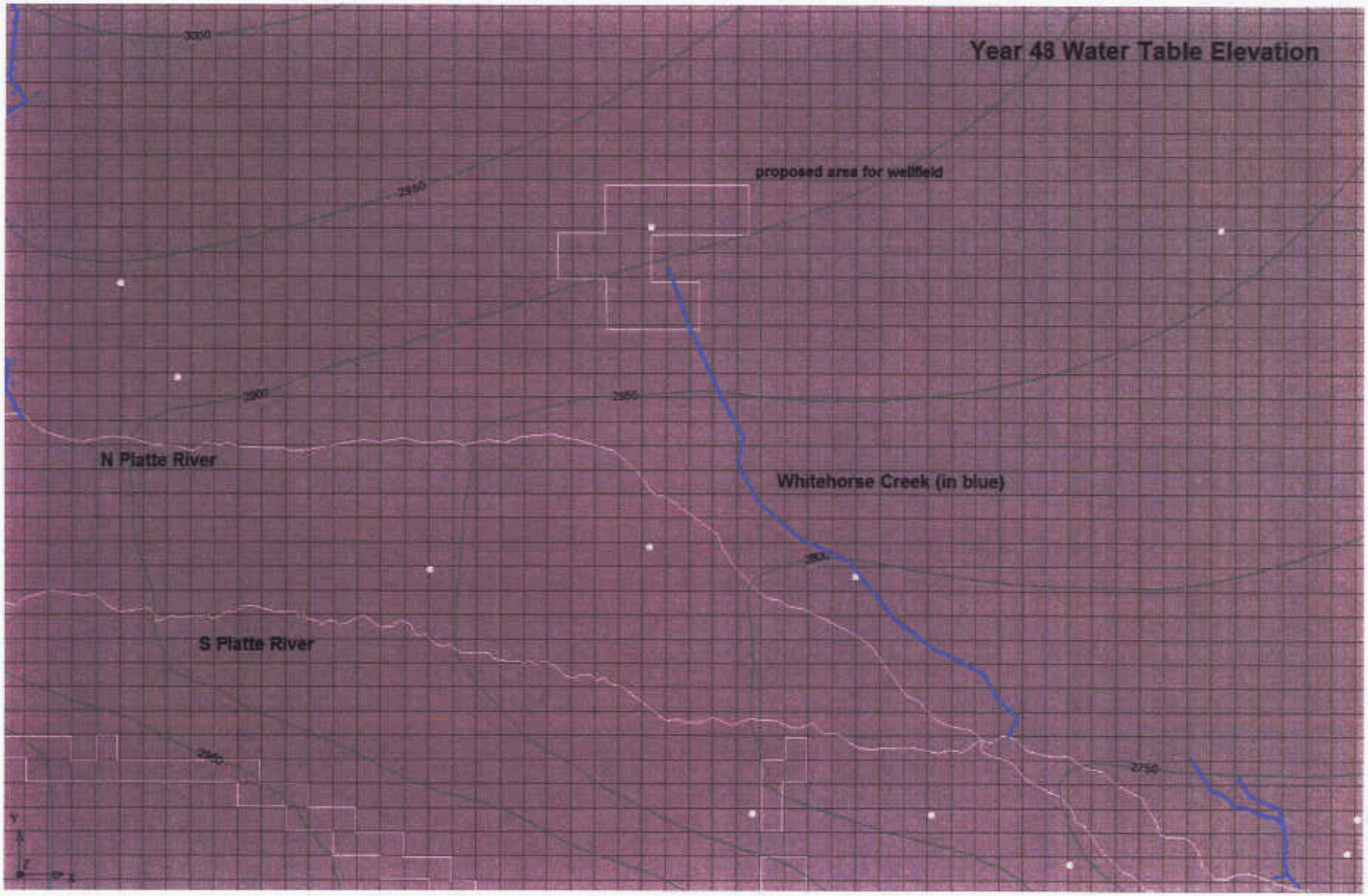


Figure 4. – Simulated water table elevations at the end of the 48-year ambient conditions scenario.

Test Irrigation Wells Simulation Results

For the simulation testing 26 hypothetical irrigation wells in the area of interest, the following figures show the elevation of the water table after 5, 10, 25, and 48 years. The actual well locations are marked with an x, whereas the simulated well location (centroid of the grid cell) is shown gold. Note that in the figures showing water level declines by color fill, the declines occurring to the southwest and northeast of the proposed well field area in the later stages of the pumping scenario are artifacts of the COHYST pumpage data sets where development occurred in the 1980s and 1990s. These areas of drawdown would occur with or without the test irrigation wells simulated in the area of interest for the proposed well field.

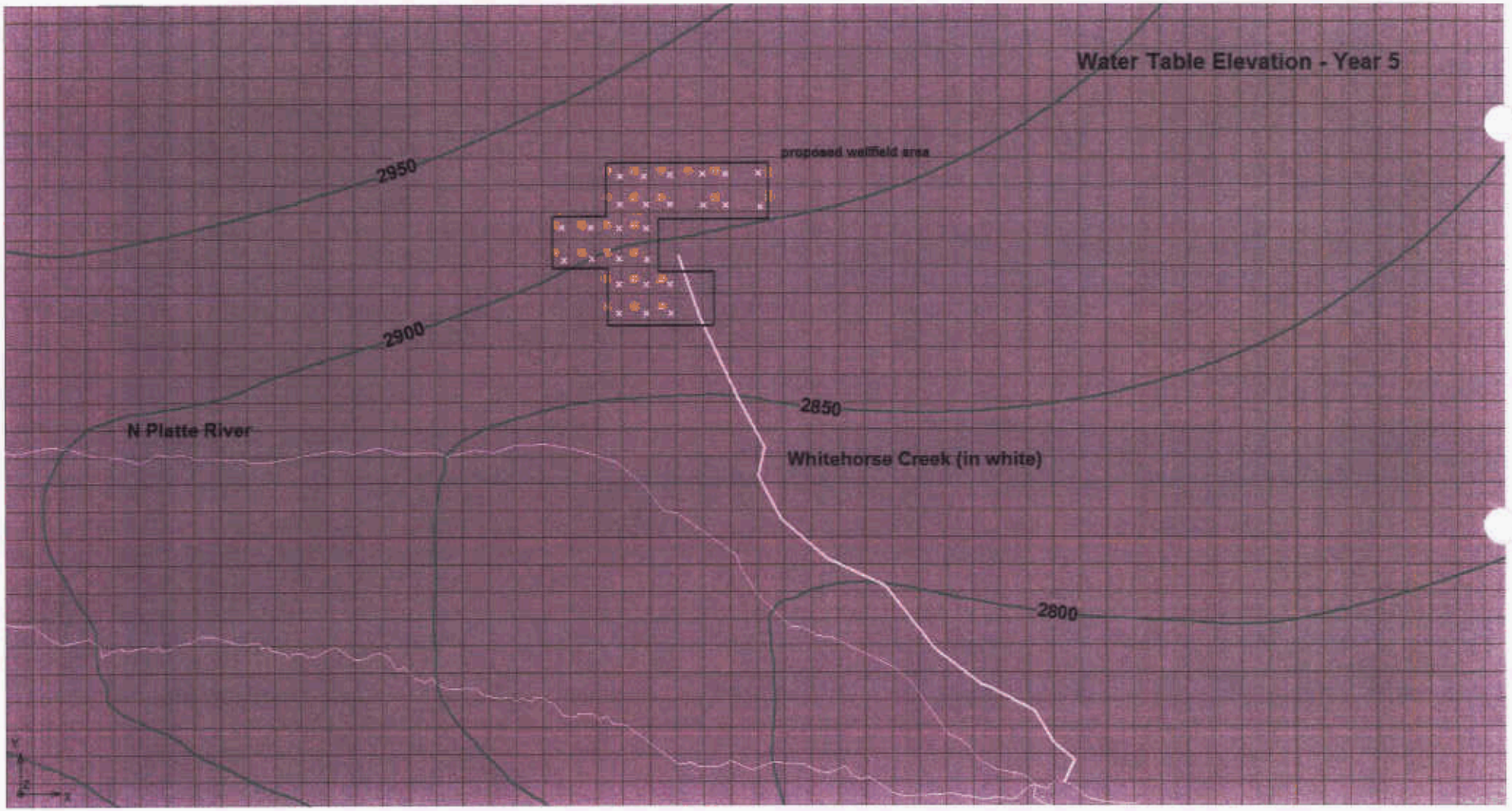


Figure 5. – Water table elevation with the test irrigation well scenario at year 5.

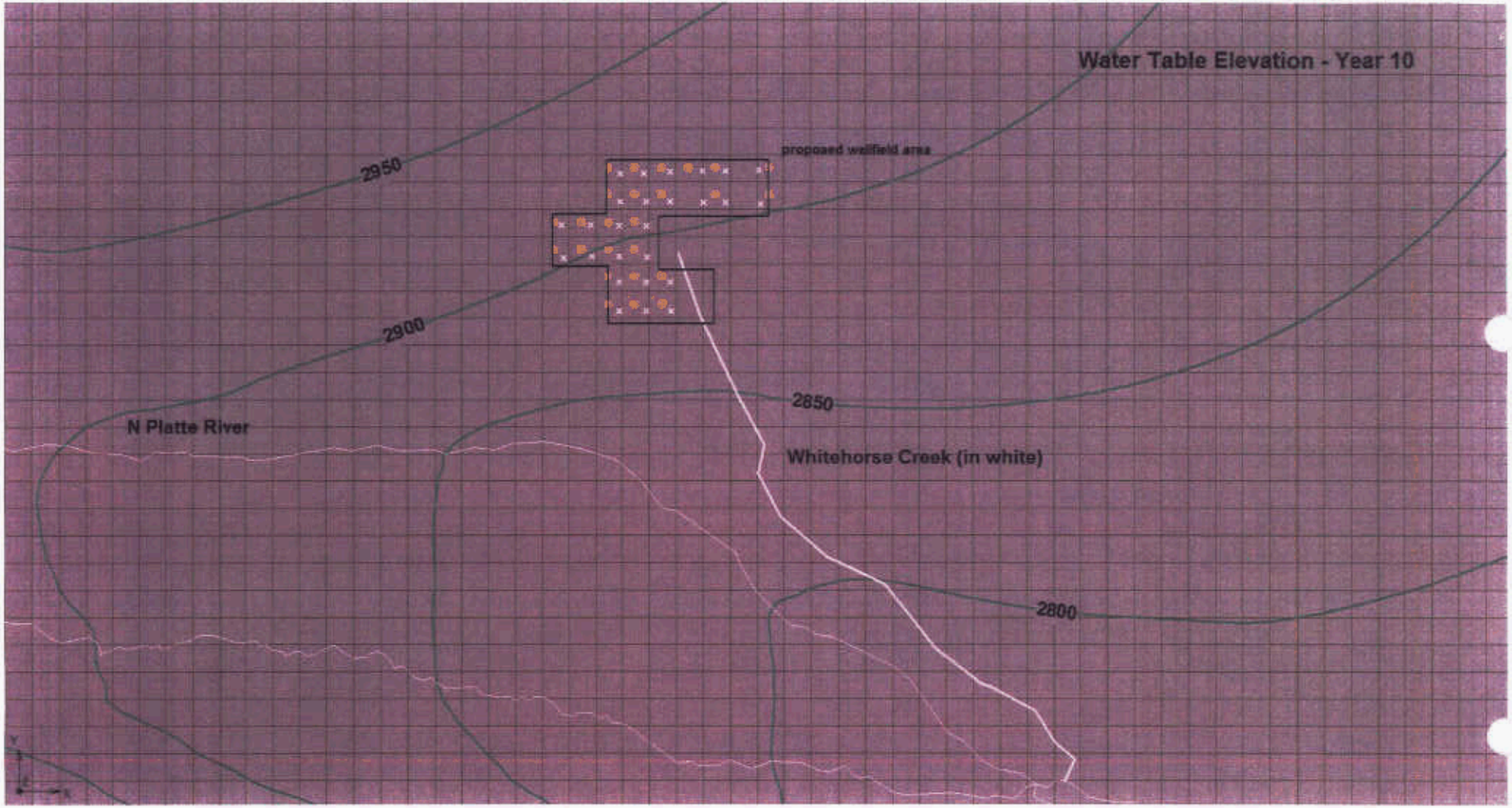


Figure 6. – Water table elevation with the test irrigation well scenario at year 10.

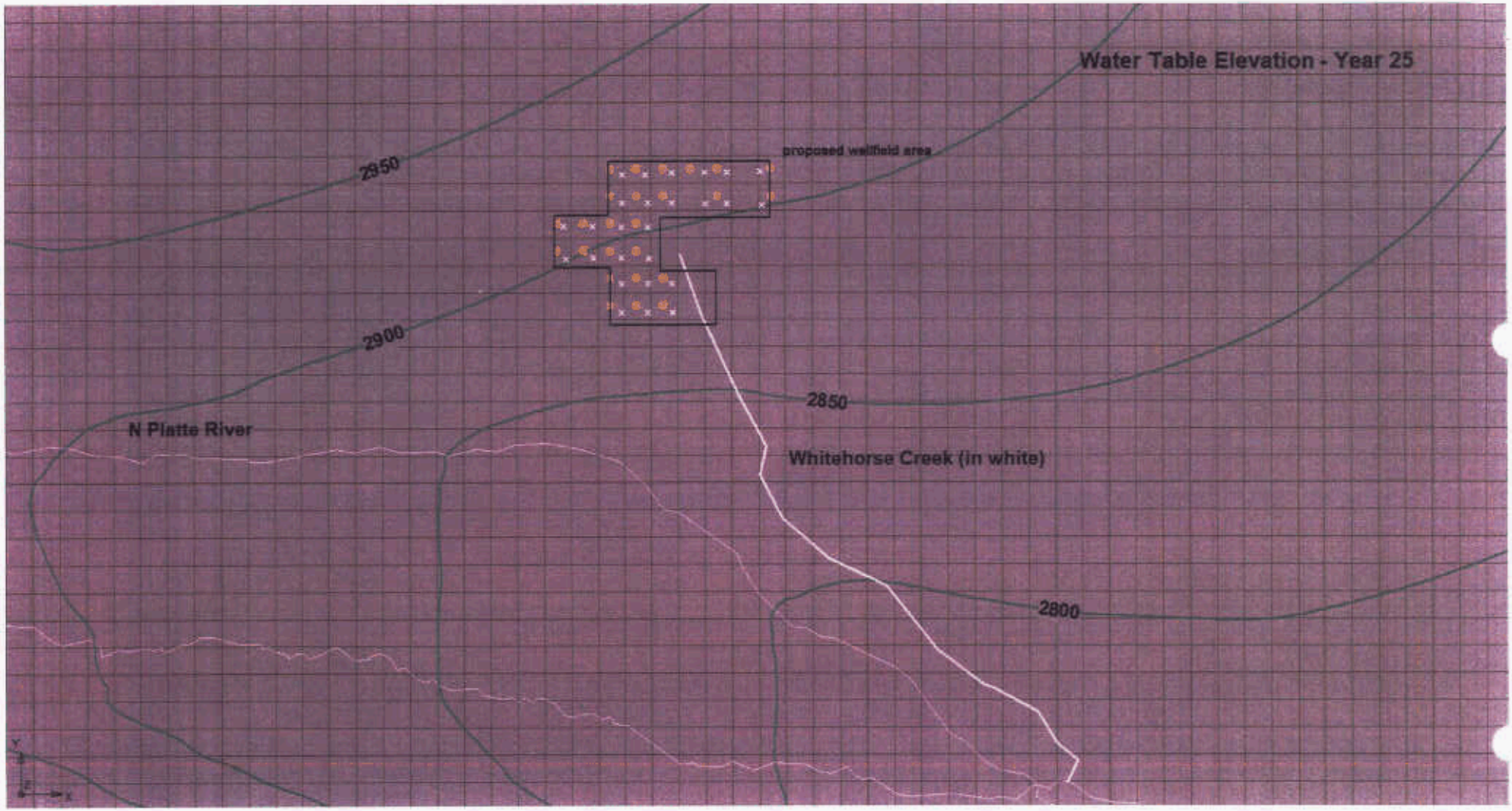


Figure 7. – Water table elevation with the test irrigation well scenario at year 25.

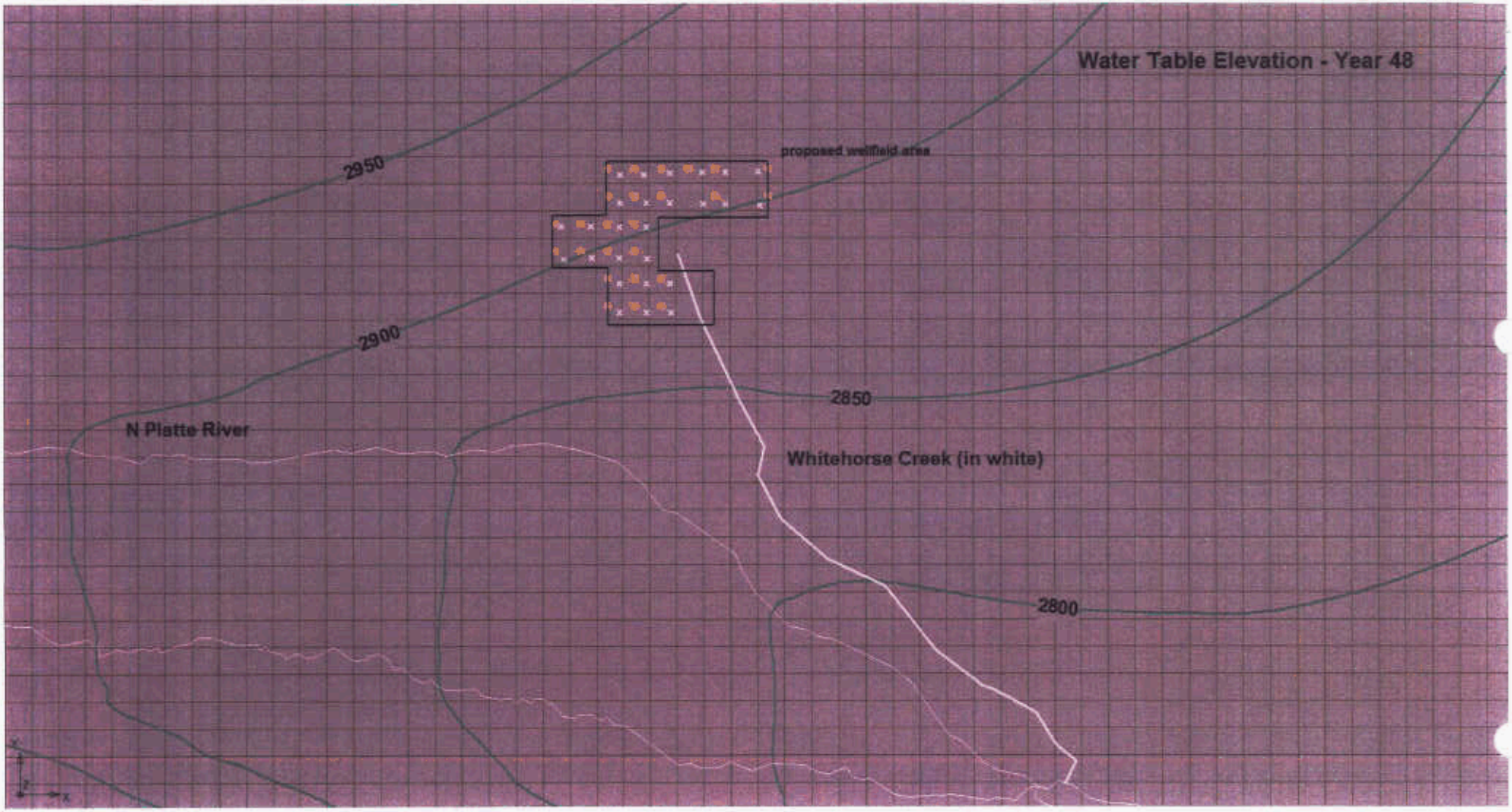


Figure 8. – Water table elevation with the test irrigation well scenario at year 48.

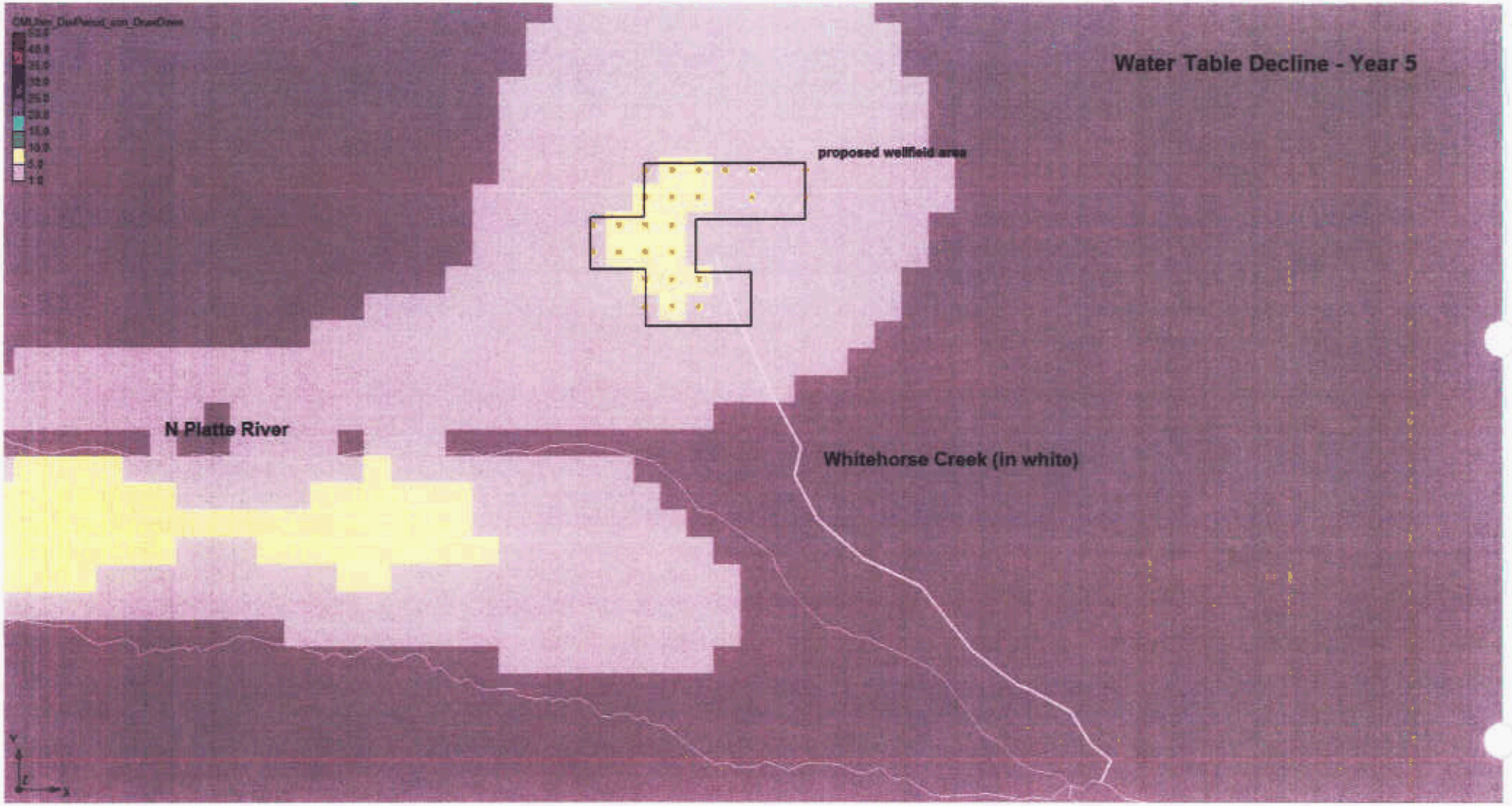


Figure 9. – Water table decline with the test irrigation well scenario at year 5. Color scaling in upper left corner of image.

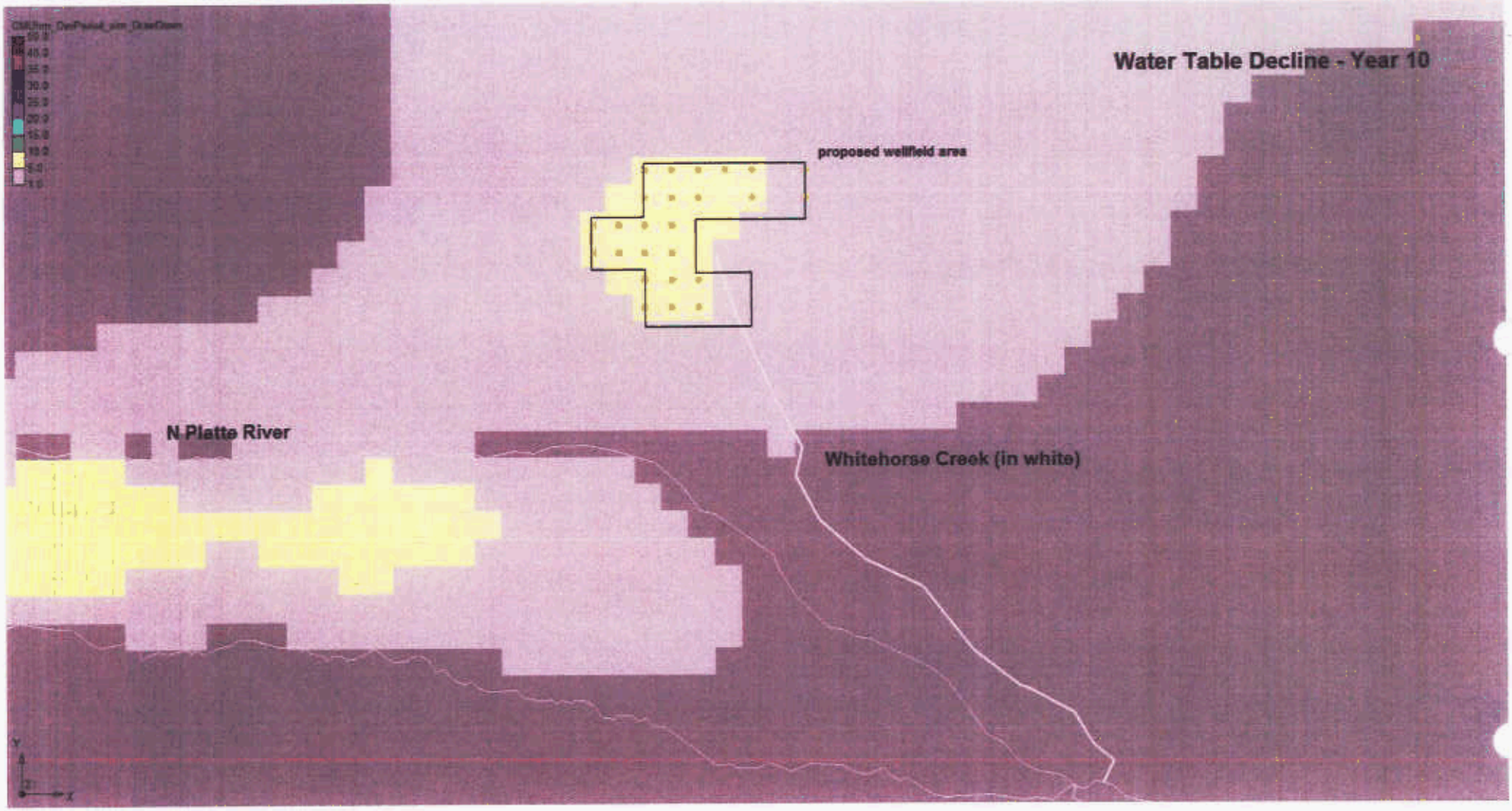


Figure 10. – Water table decline with the test irrigation well scenario at year 10. Color scaling in upper left corner of image.

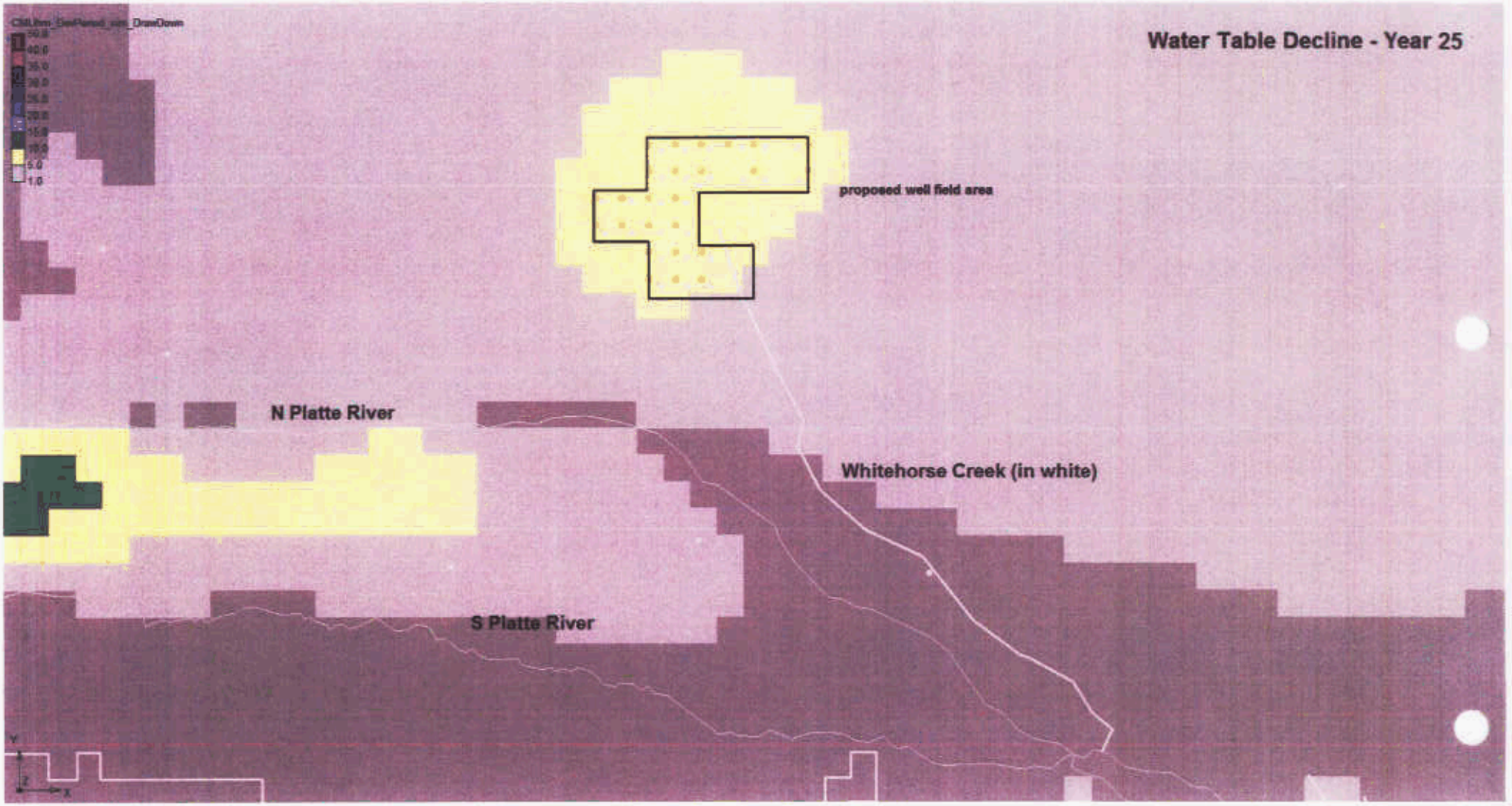


Figure 11. – Water table decline with the test irrigation well scenario at year 25. Color scaling in upper left corner of image.

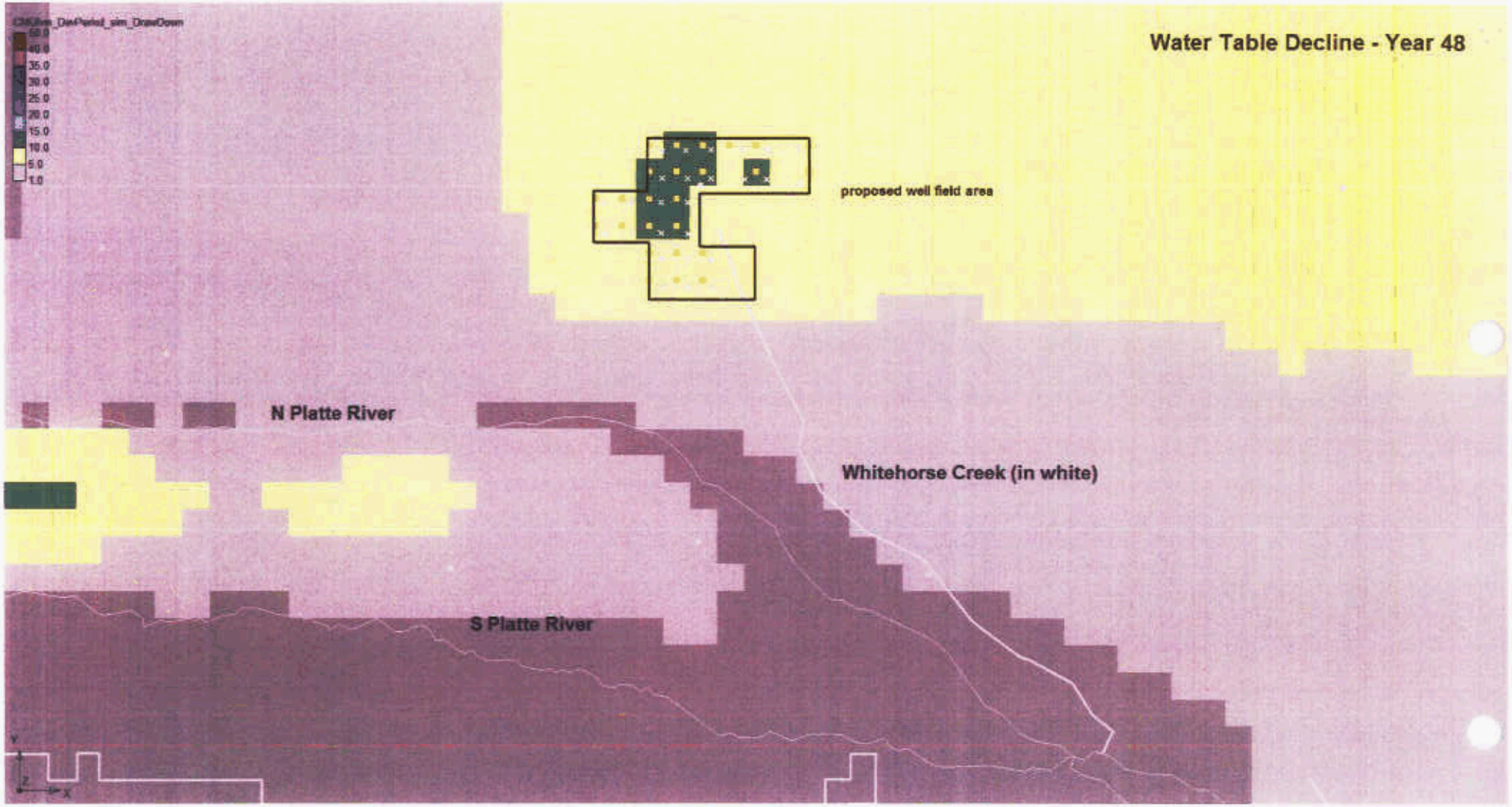


Figure 12. – Water table decline with the test irrigation well scenario at year 48. Color scaling in upper left corner of image.

Proposed Municipal Wells – Impacts with Variable Pumping Rates

For the simulation representing the proposed North Platte municipal well field pumping at variable rates, the following figures show the simulated water table elevations as well as the water level declines resulting from the well field pumping at years 5, 10, 25, and 48. The water table decline figures for years 5 and 10 at the end of the non-growing (or winter) stress period are included to show the slight change in water level declines with a reduced pumping rate. The actual well locations are marked with an x, whereas the simulated well location (centroid of the grid cell) is shown gold. Note that in the figures showing water level declines by color fill, the declines occurring to the southwest and northeast of the proposed well field area in the later stages of the pumping scenario are artifacts of the COHYST pumpage data sets where development occurred in the 1980s and 1990s. These areas of drawdown would occur with or without the proposed municipal wells simulated.

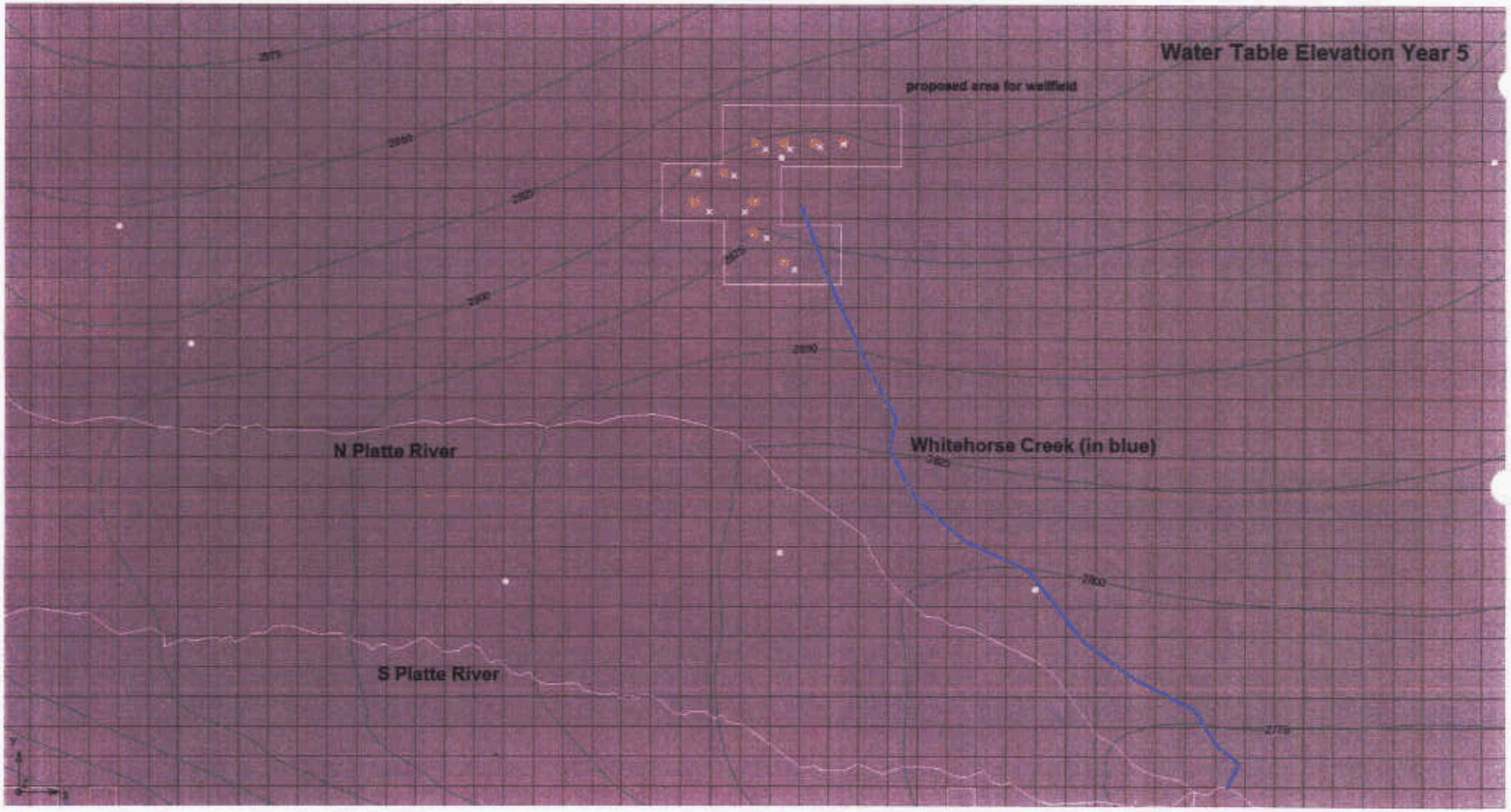


Figure 13. – Water table elevation with the 10 proposed municipal wells pumping at a variable rate for year 5.

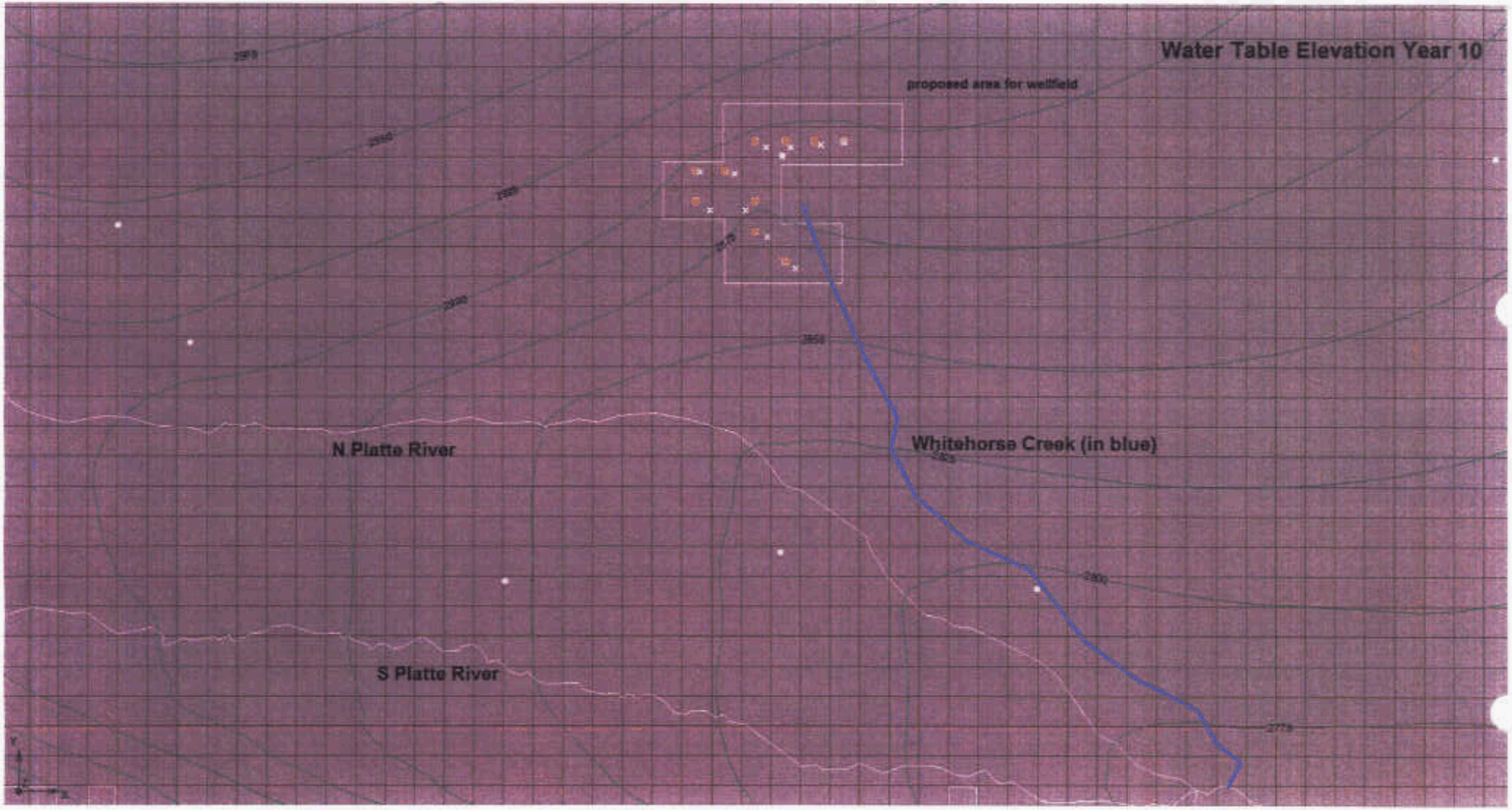


Figure 14. – Water table elevation with the 10 proposed municipal wells pumping at a variable rate for year 10.

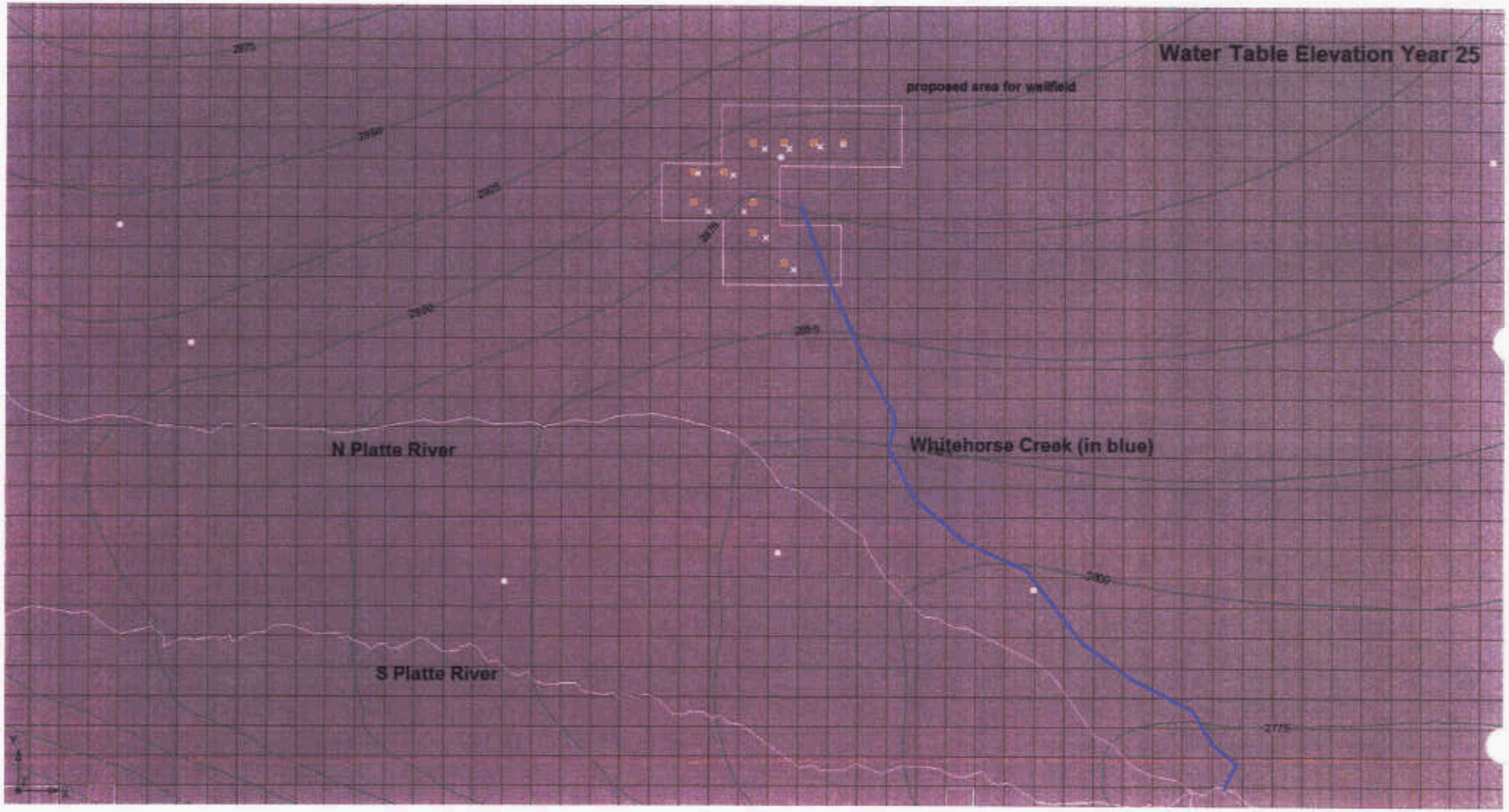


Figure 15. – Water table elevation with the 10 proposed municipal wells pumping at a variable rate for year 25.

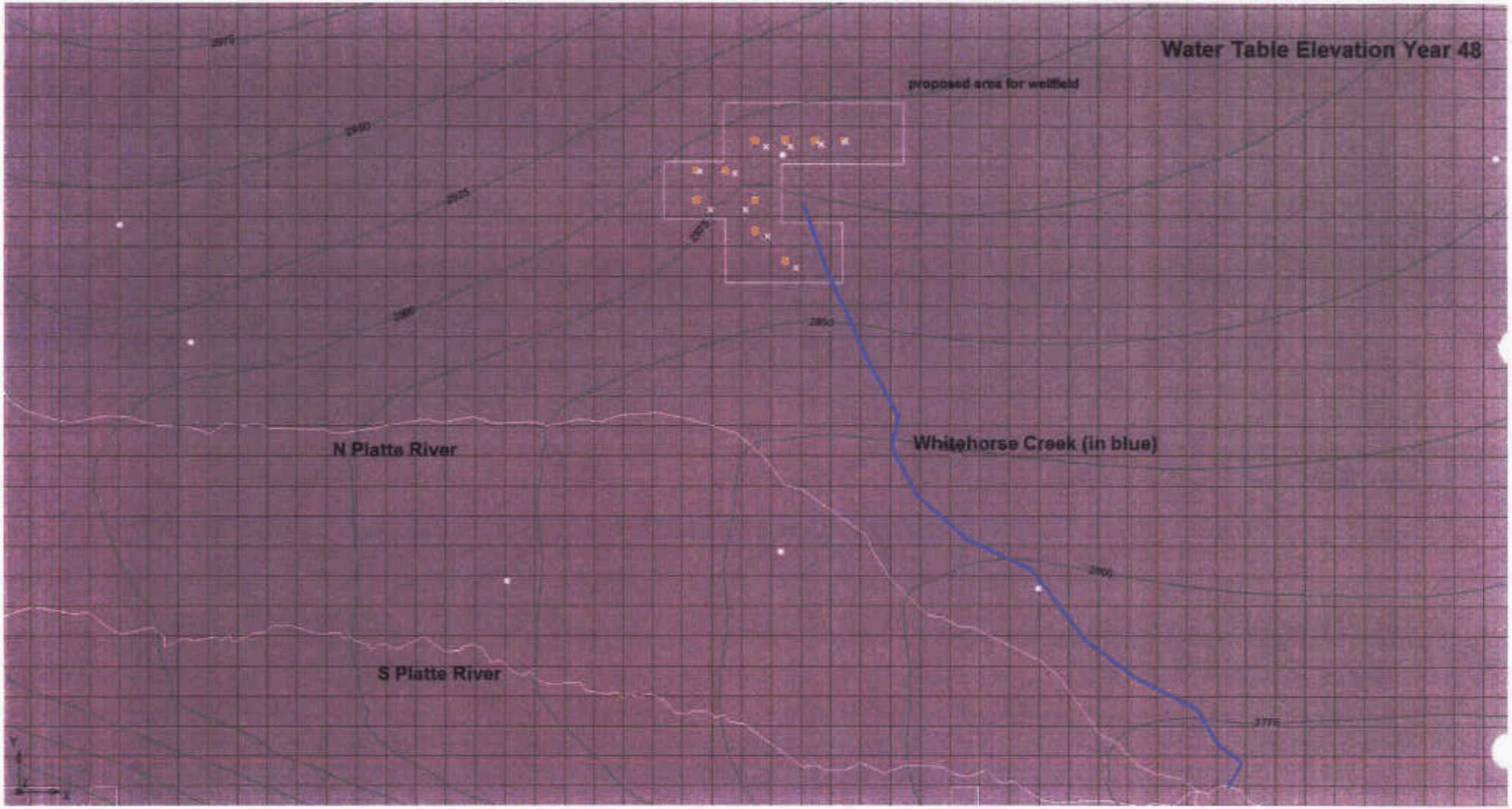


Figure 16. – Water table elevation with the 10 proposed municipal wells pumping at a variable rate for year 48.

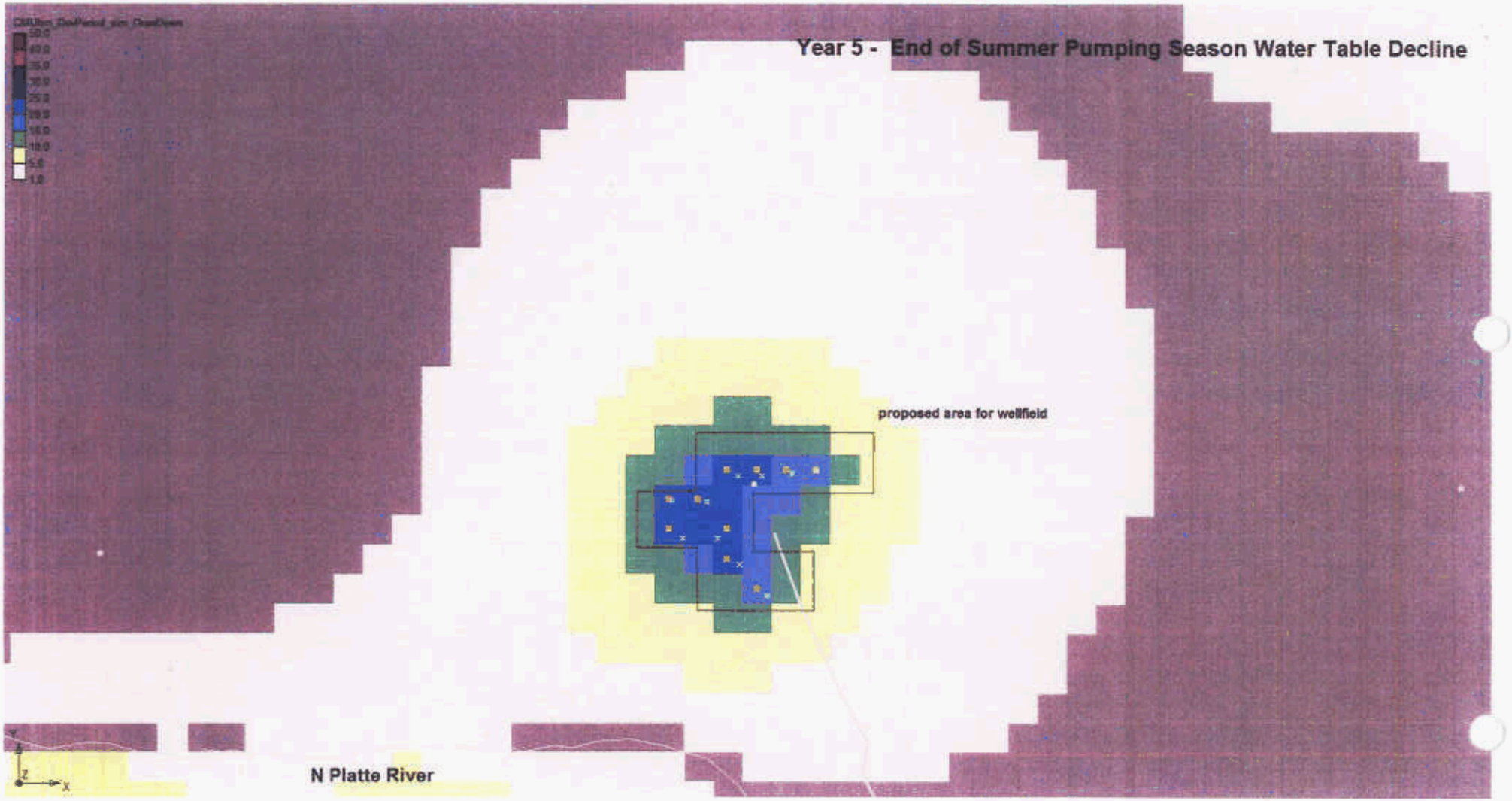


Figure 17. – Water table declines with the 10 proposed municipal wells pumping at a variable rate at the end of year 5 growing season. Note color scale in upper left part of figure.

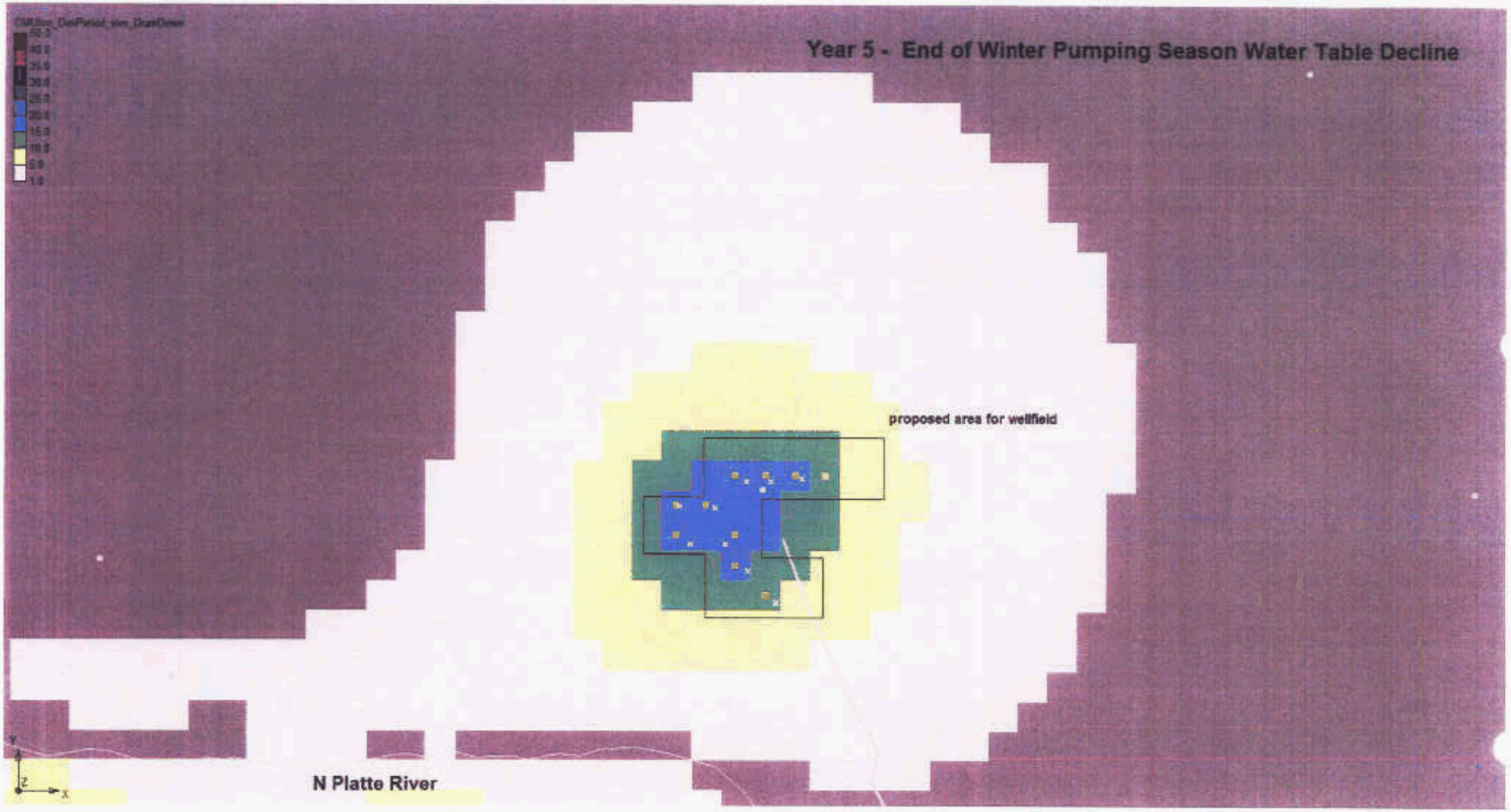


Figure 18. – Water table declines with the 10 proposed municipal wells pumping at a variable rate at the end of year 5 non-growing season. Note color scale in upper left part of figure.

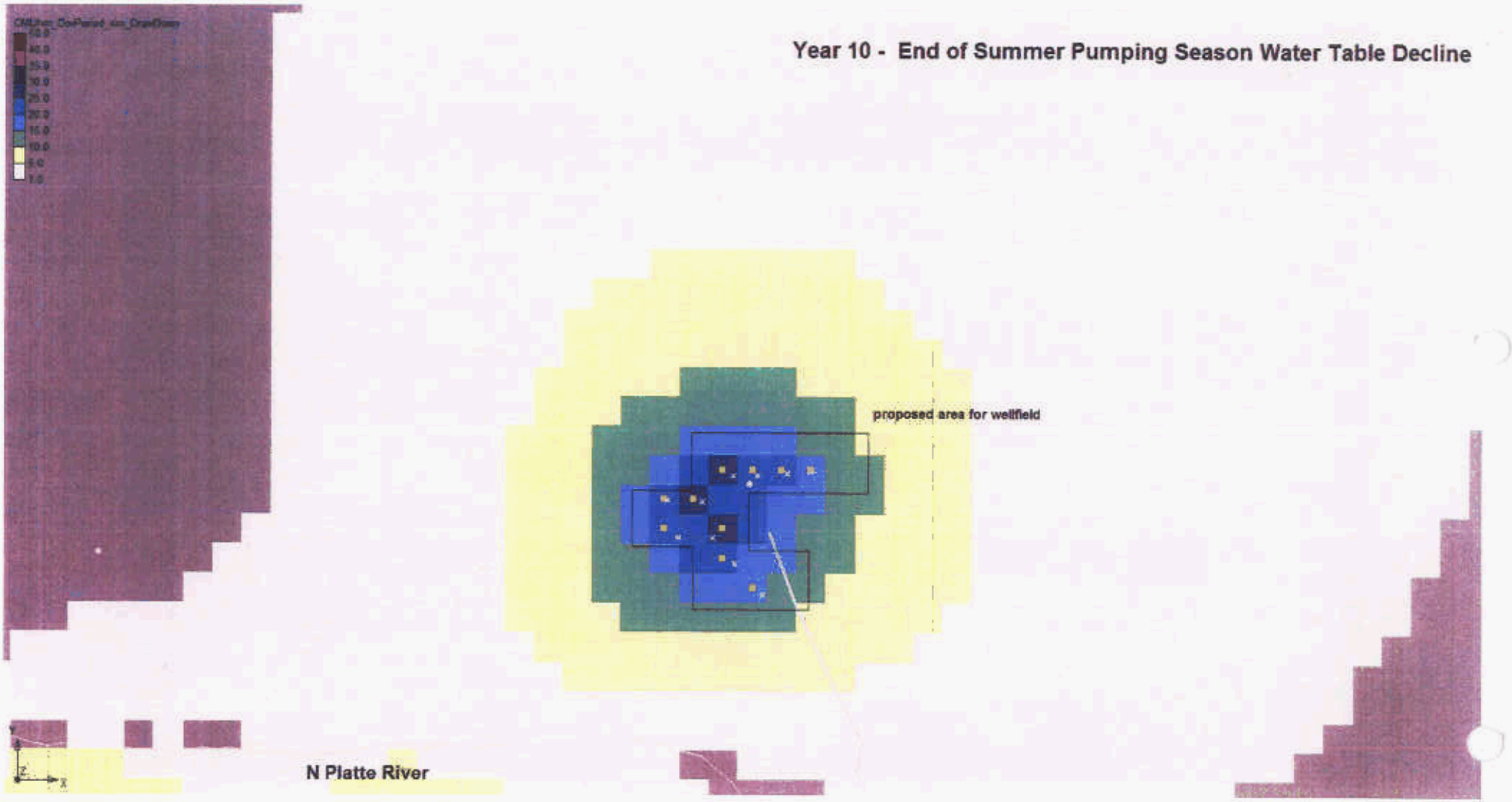


Figure 19. – Water table declines with the 10 proposed municipal wells pumping at a variable rate at the end of year 10 growing season. Note color scale in upper left part of figure.

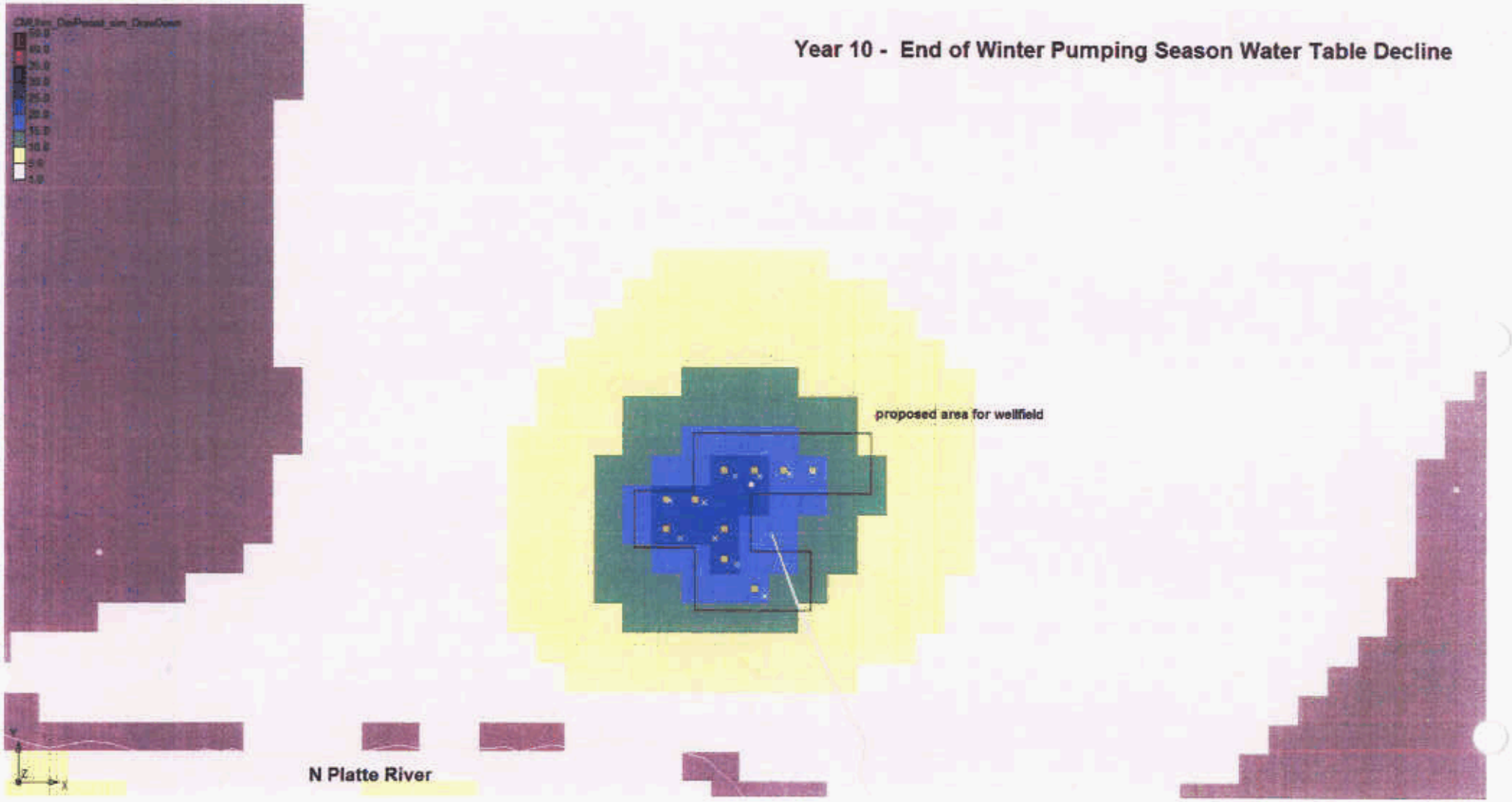


Figure 20. – Water table declines with the 10 proposed municipal wells pumping at a variable rate at the end of year 10 non-growing season. Note color scale in upper left part of figure.

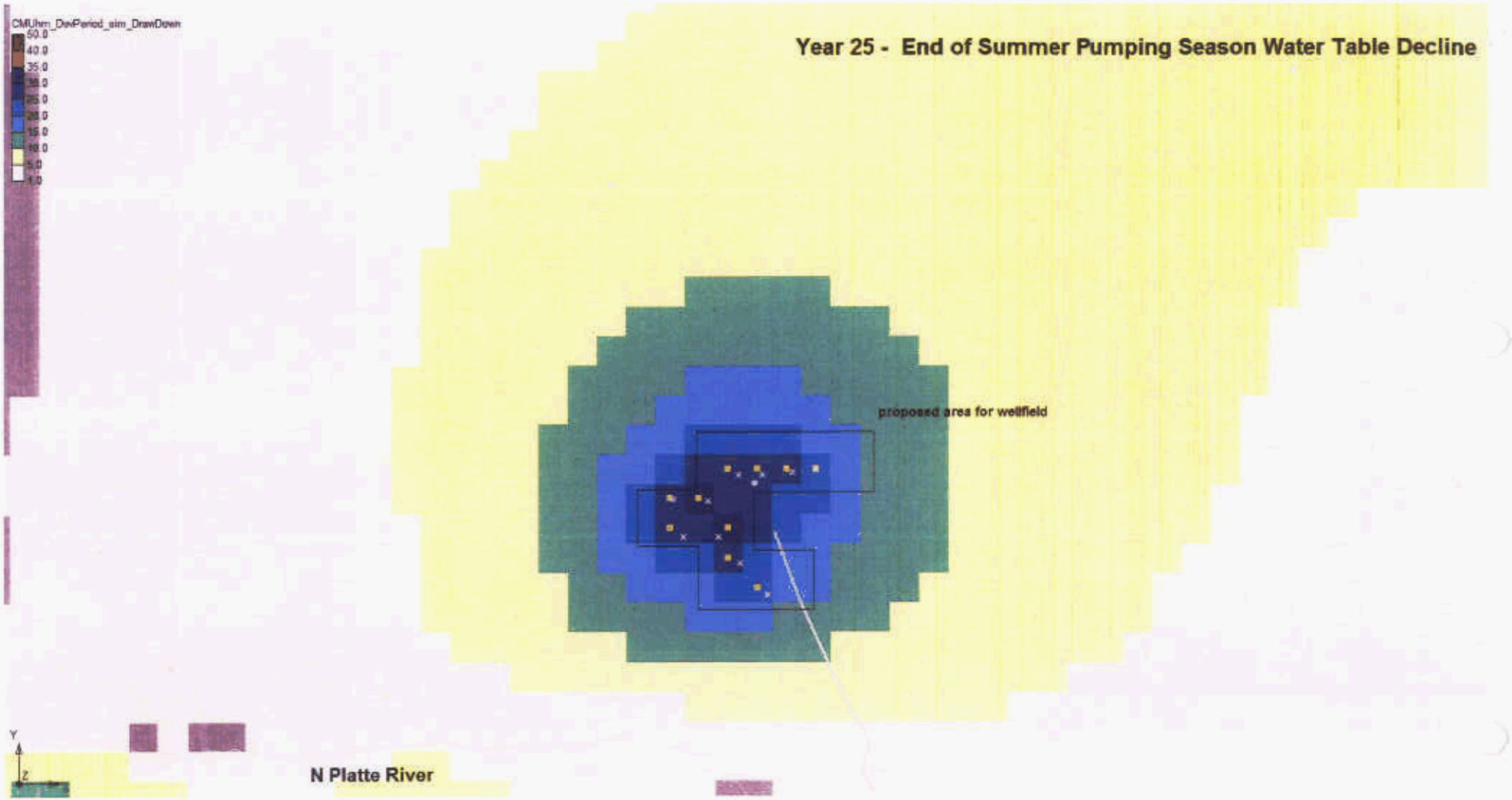


Figure 21. – Water table declines with the 10 proposed municipal wells pumping at a variable rate at the end of year 25 growing season. Note color scale in upper left part of the figure.

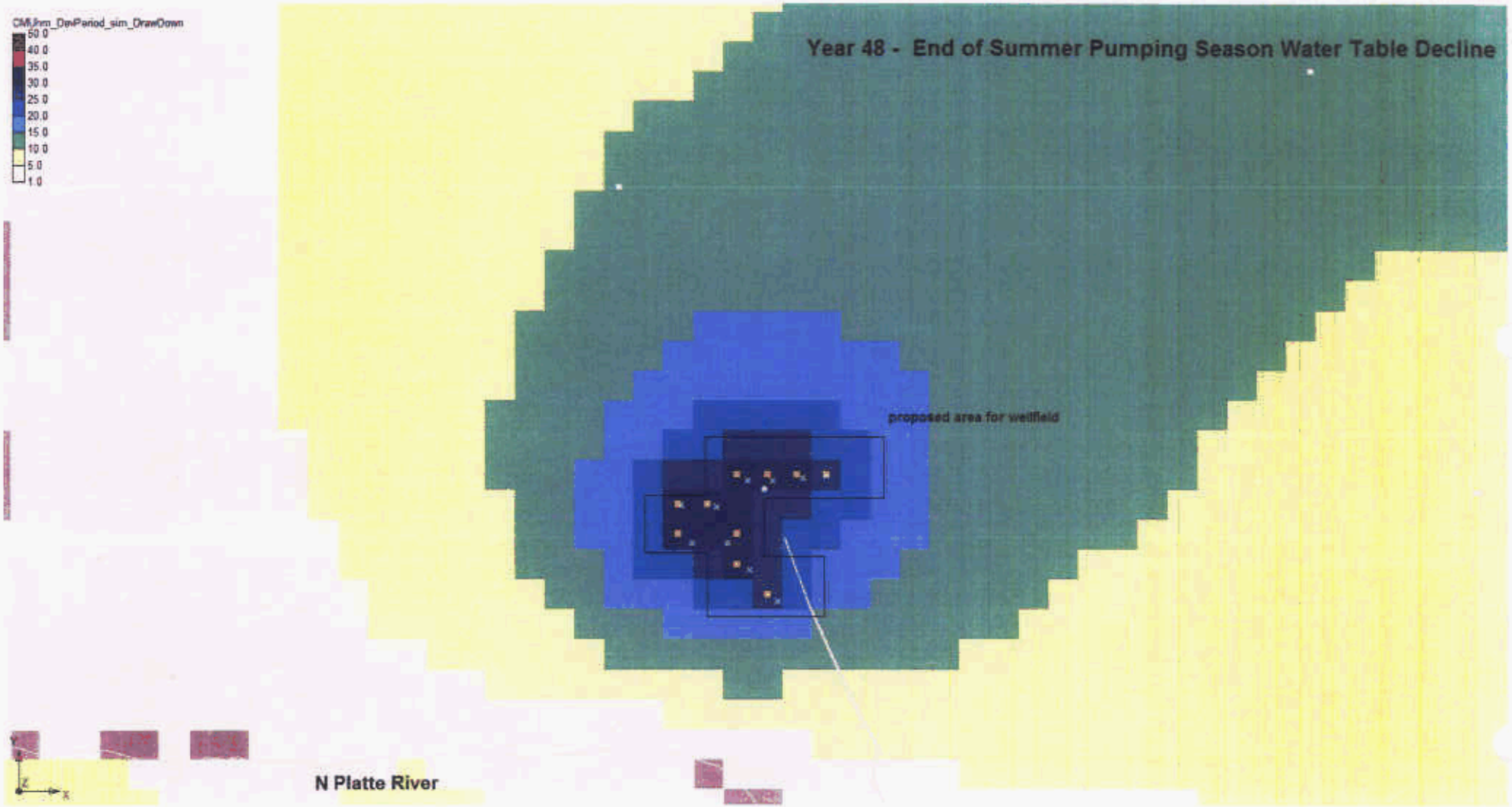


Figure 22. – Water table declines with the 10 proposed municipal wells pumping at a variable rate at the end of year 48 growing season. Note color scale in upper left part of figure.

Proposed Municipal Wells – Impacts with Average Pumping Rates

For the simulation representing the proposed North Platte well field pumping at variable rates, the following figures show the simulated water table elevations and the water level declines resulting from the well field pumping at year 5, 10, 25, 40, and 48. The actual well locations are marked with an x, whereas the simulated well location (centroid of the grid cell) is shown gold. Note that in the figures showing water level declines by color fill, the declines occurring to the southwest and northeast of the proposed well field area in the later stages of the pumping scenario are artifacts of the COHYST pumpage data sets where development occurred in the 1980s and 1990s. These areas of drawdown would occur with or without the proposed municipal wells simulated.

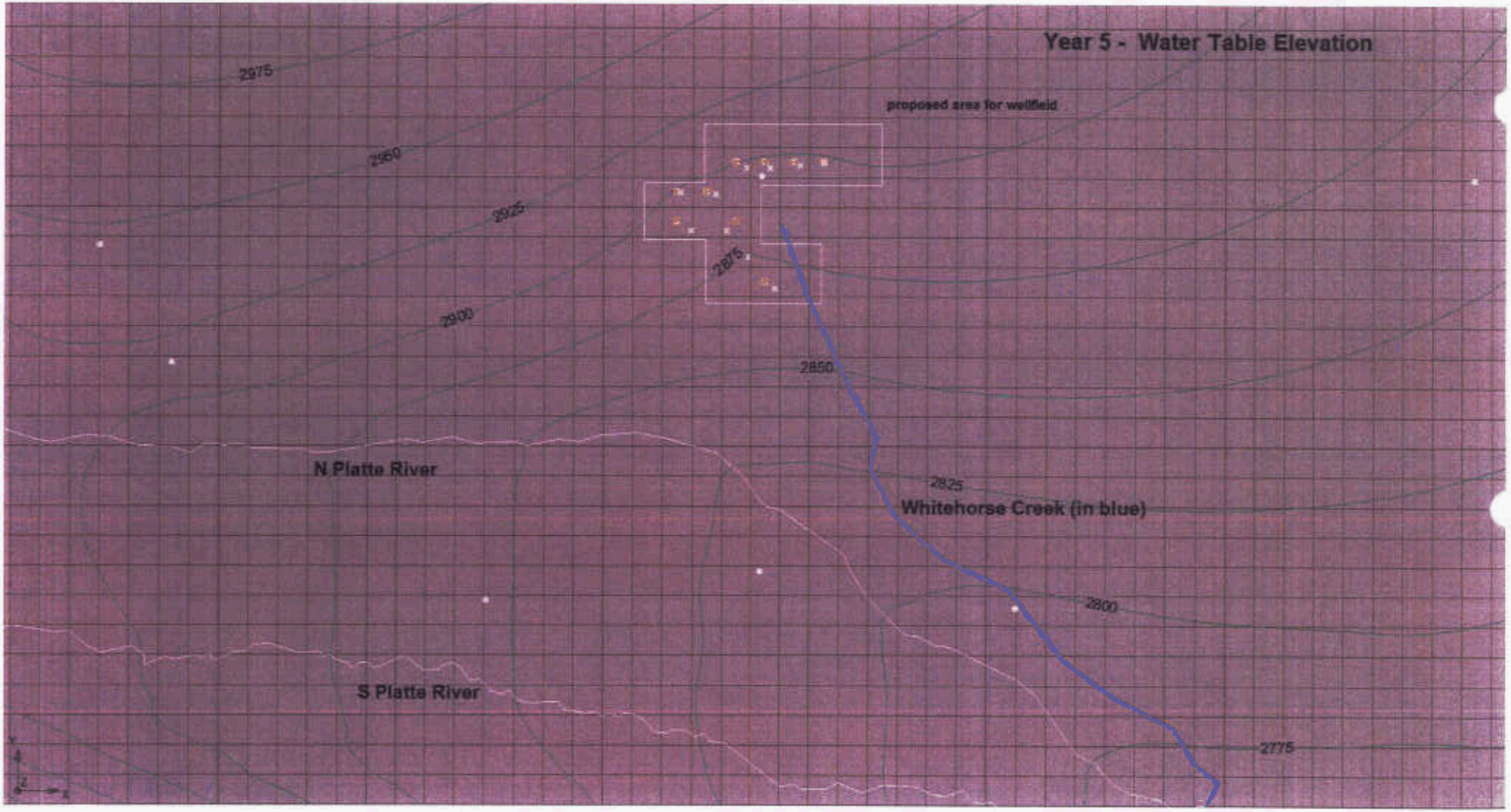


Figure 23. – Water table elevation with the 10 proposed wells pumping at an average rate for year 5.

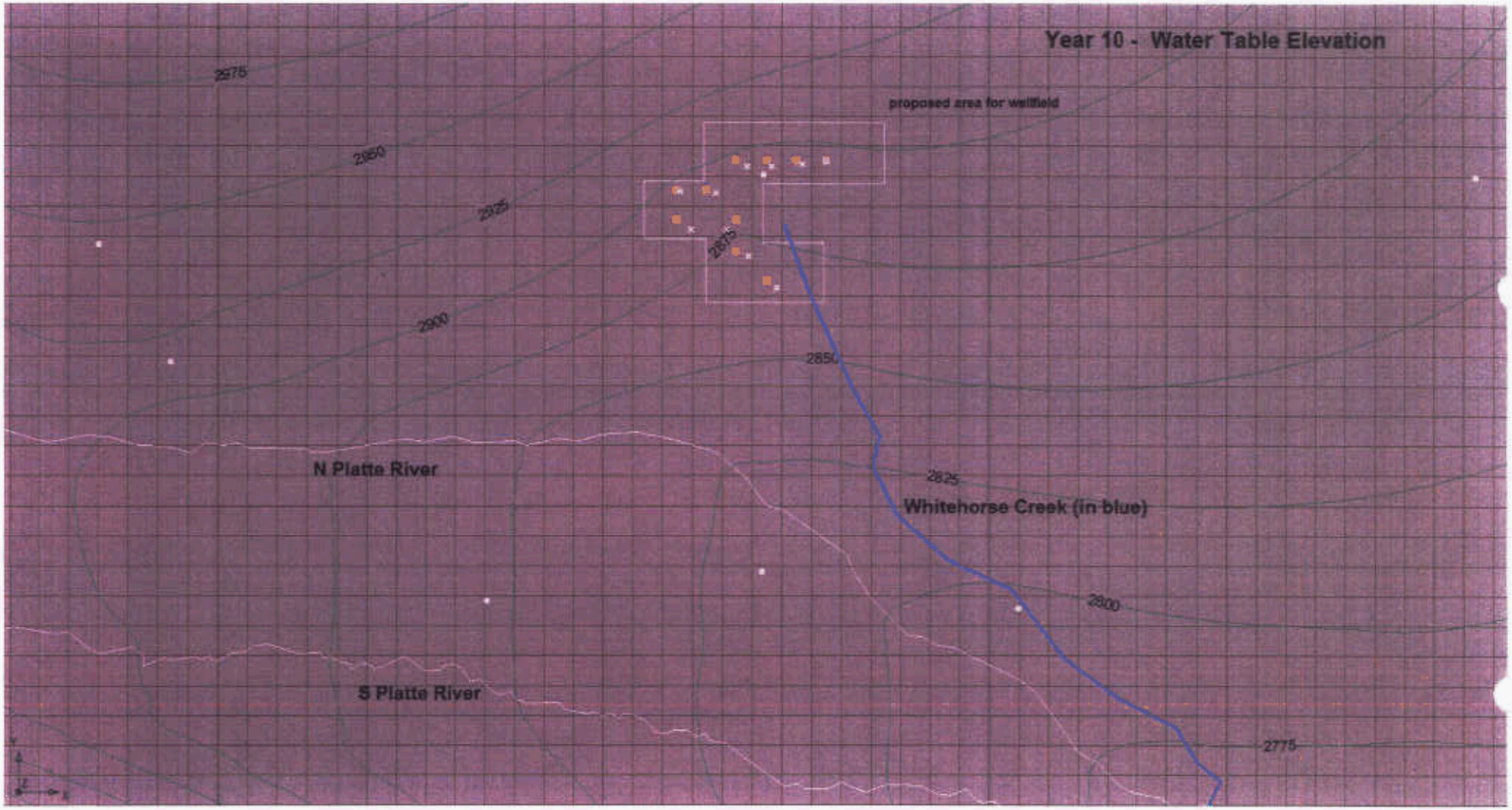


Figure 24. – Water table elevation with the 10 proposed wells pumping at an average rate for year 10.

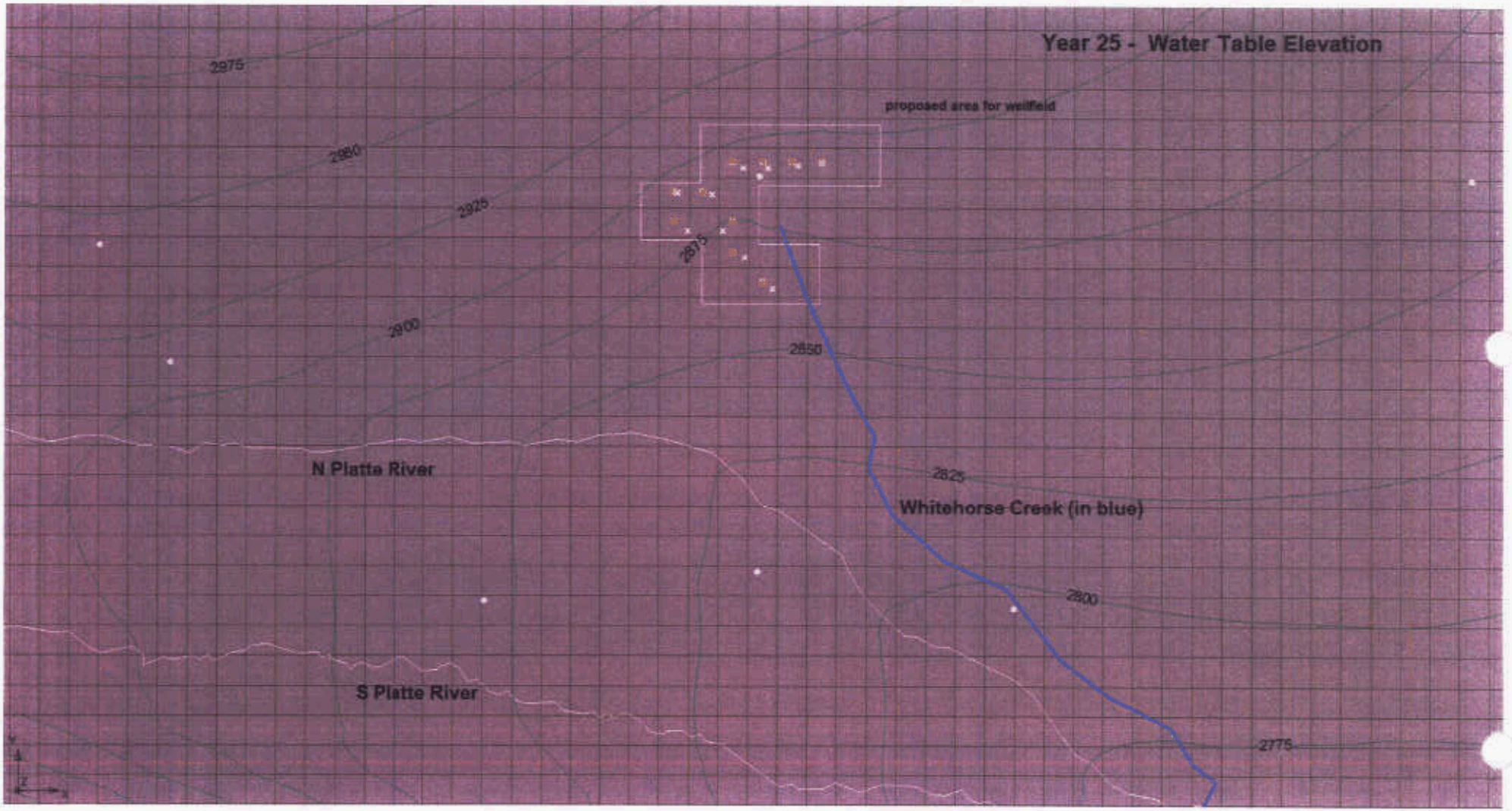


Figure 25. – Water table elevation with the 10 proposed wells pumping at an average rate for year 25.

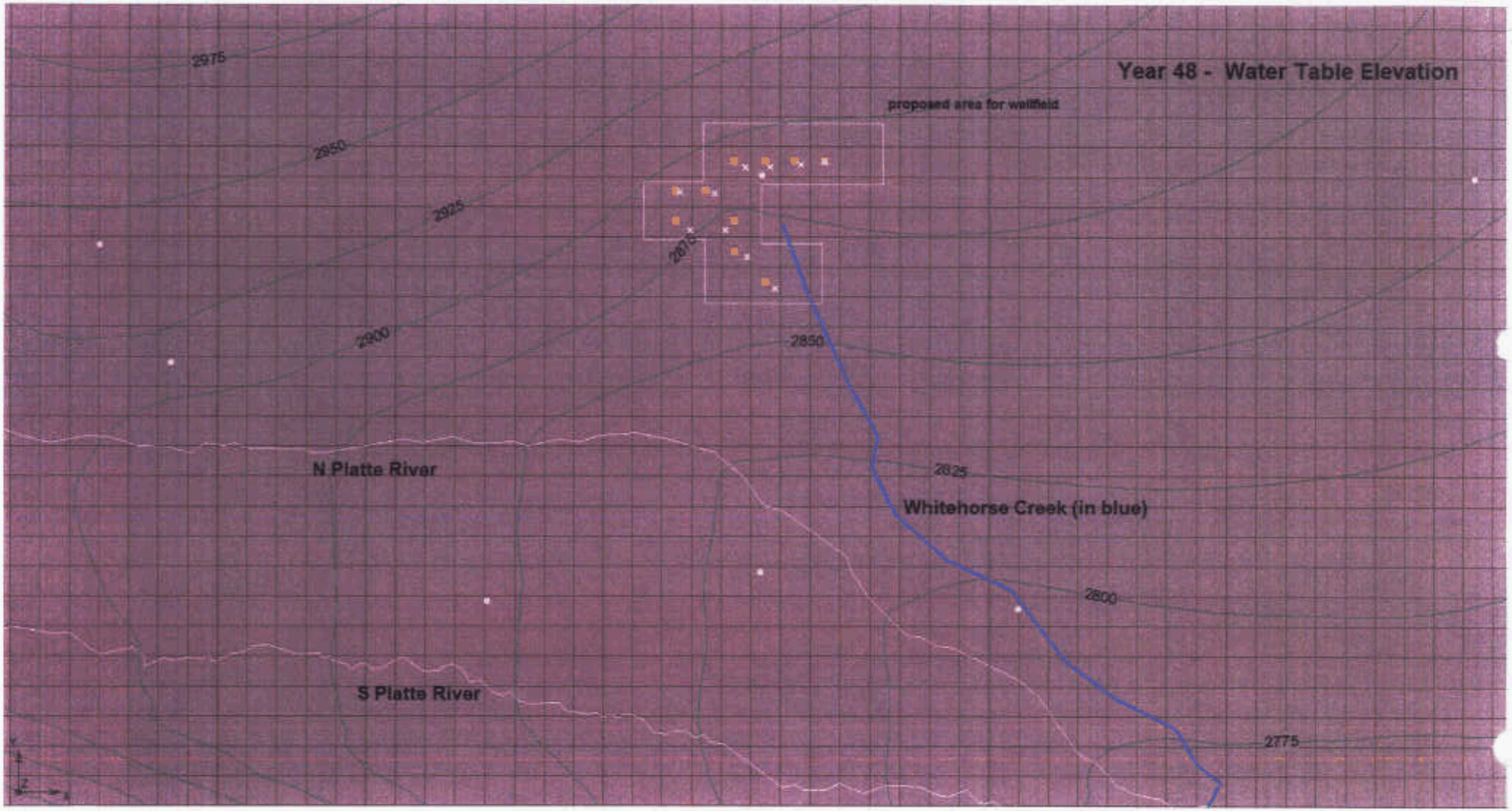


Figure 26. – Water table elevation with the 10 proposed wells pumping at an average rate for year 48.

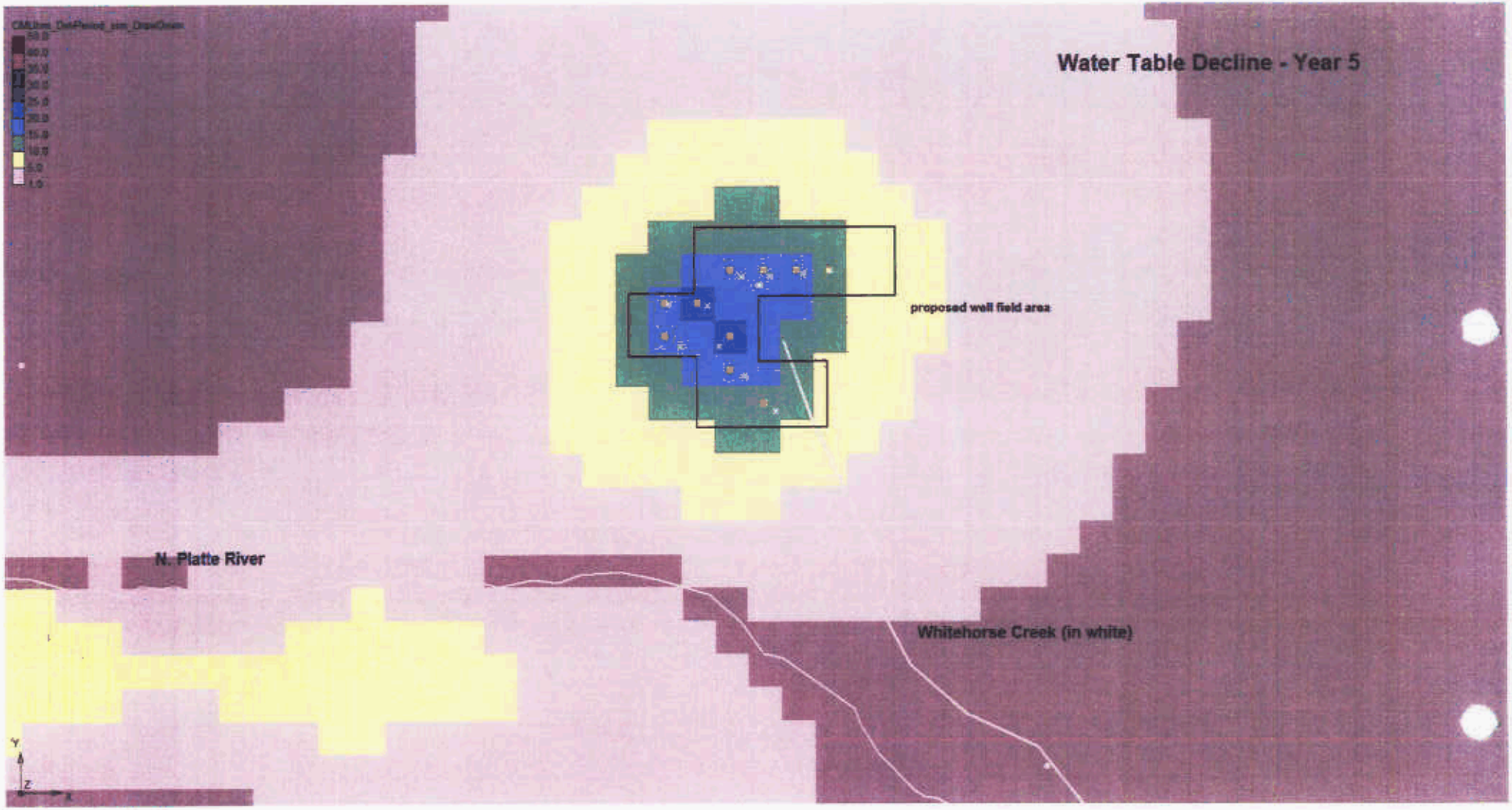


Figure 27. – Water table declines with the 10 proposed wells pumping at an average rate at the end of year 5 growing season. Note color scale in upper left part of figure.

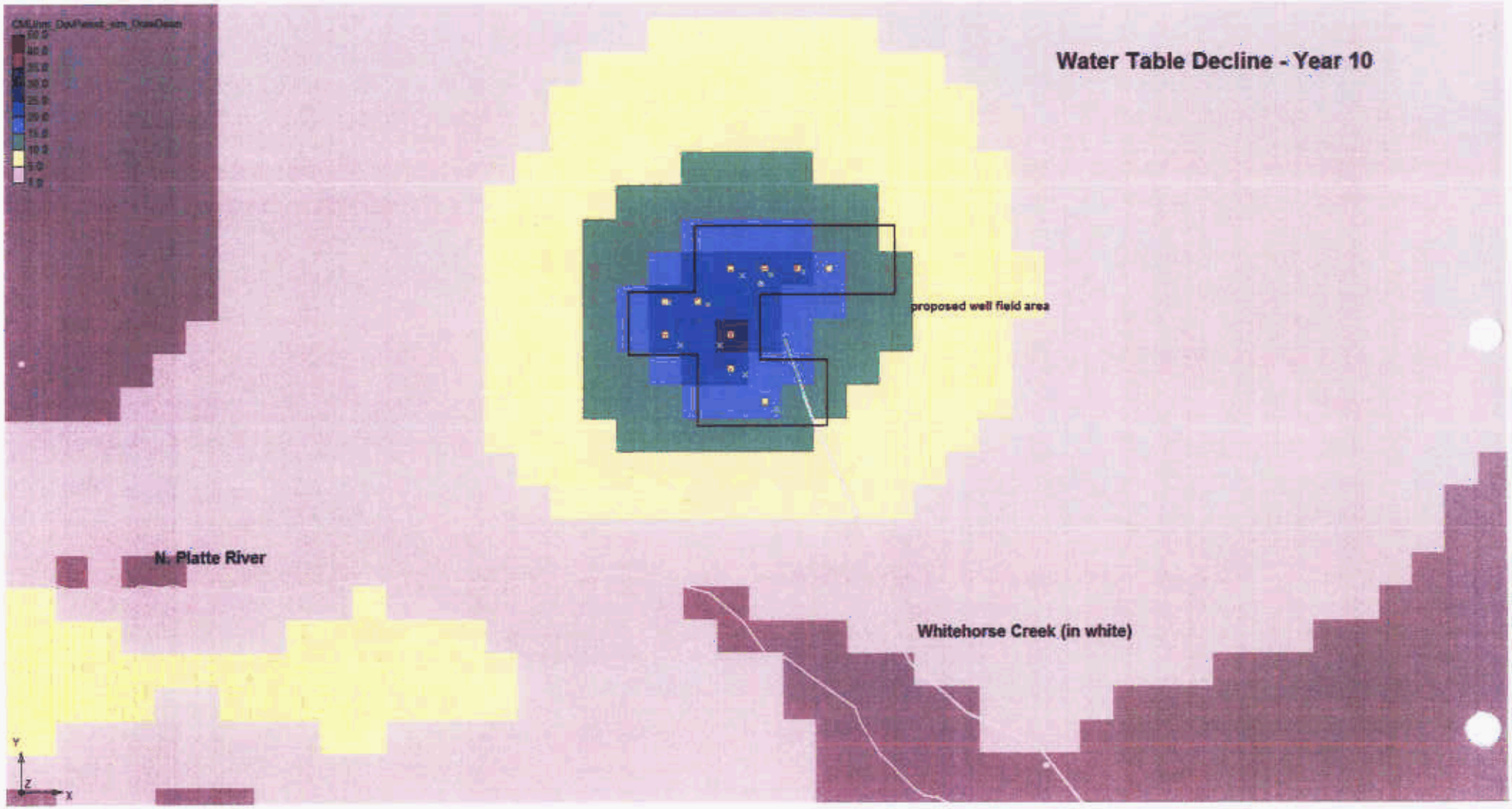


Figure 28. – Water table declines with the 10 proposed wells pumping at an average rate at the end of year 10 growing season. Note color scale in upper left part of figure.

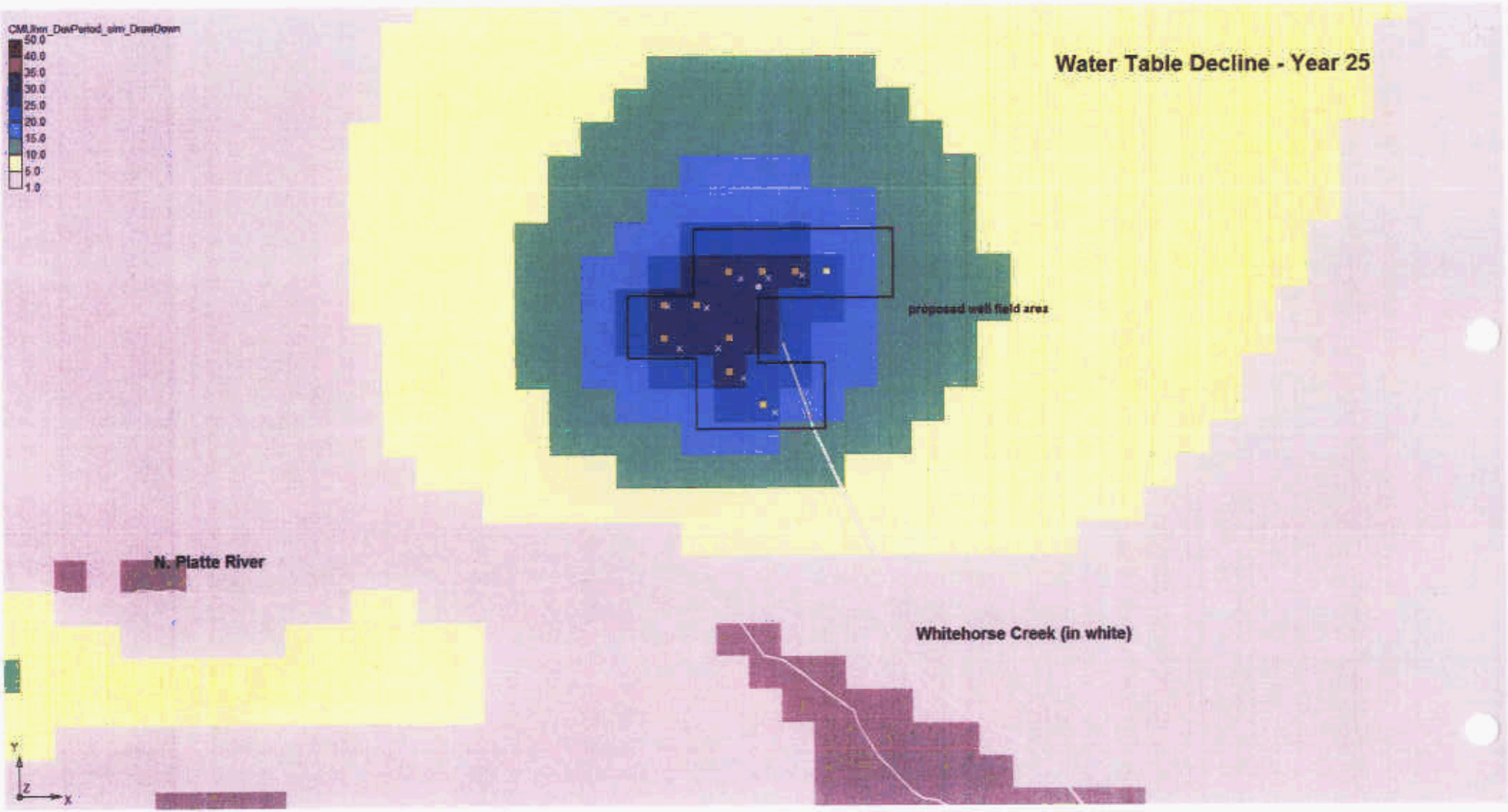


Figure 29. – Water table declines with the 10 proposed wells pumping at an average rate at the end of year 25 growing season. Note color scale in upper left part of figure.

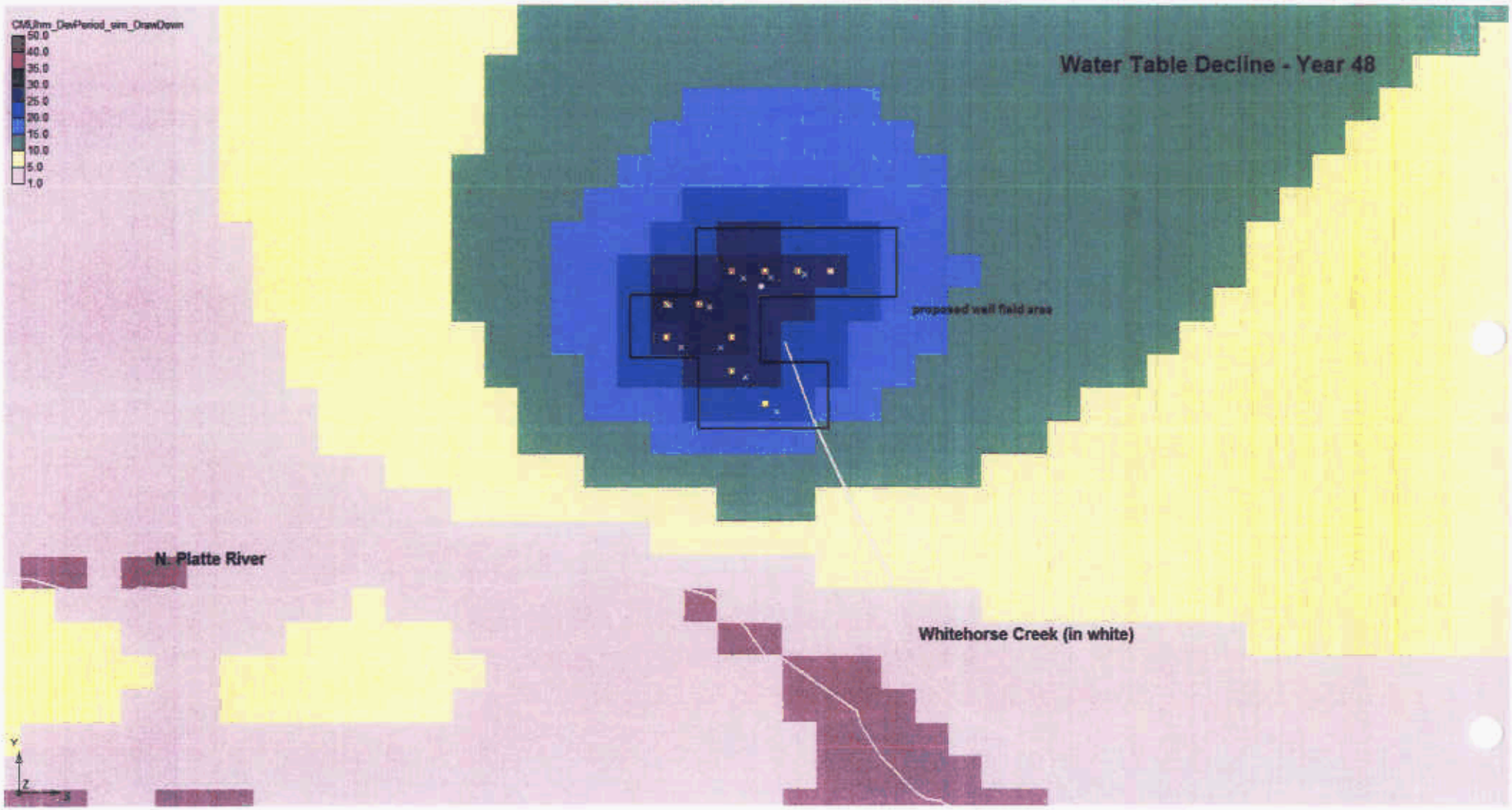


Figure 30. – Water table declines with the 10 proposed wells pumping at an average rate at the end of year 48 growing season. Note color scale in upper left part of figure.

Long Term Impacts

Each simulation was run for 48 years to provide long-term predictions to the High Plains aquifer and aquifer discharge to Whitehorse Creek. For the variable pumping scenario, a remaining saturated thickness map was produced (fig. 31) to determine the long-term impacts of pumping the proposed North Platte well field. The map shows contours representing the percent of remaining saturated thickness at year 48. Near the center of the well field, a 91 percent contour covers a small area. This indicates that in the center of the well field, the overall saturated thickness was reduced by nearly 10 percent by year 48 of the variable-rate pumping scenario. Note that the scale effects of the model cell size may not capture individual cones of depression around each well, some of which could be deeper than indicated in the water level decline figures. The amount of drawdown indicated in these maps seems reasonable as the proposed well field is located in a regional discharge zone based on regional water table maps and previous modeling studies.

The Whitehorse Creek discharge chart (fig. 32) indicates the long-term decrease in aquifer discharge to Whitehorse Creek for each pumping scenario described in this report. The proposed well field pumping scenarios produced analogous results with a decrease in discharge by just over 1 cfs in the 48 year timeframe. The presence of a relatively thick unit of fine material in the upper portion of the Ogallala Group (above the screened zones of the wells) likely restricts the immediate influence of the wells on Whitehorse Creek.

Summary

The results from the simulations described in this report for the impacts to Whitehorse Creek and the High Plains aquifer from the proposed North Platte well field indicate that water table declines approaching 40 feet in the well field area could be expected after 25 years of pumping, and that smaller less declines (5-15 feet) could be expected to propagate from the well field area as the well field is used over the next 50 years. The impacts to Whitehorse Creek approach 1.1 cfs after nearly 50 years of pumping. The most rapid decline in the aquifer discharge to Whitehorse Creek occurs in the first 25 years of the well field operation. During the next 25 years, the rate of decline lessens, but still continues in a trend of decreased baseflow to the stream. It should be emphasized that the current pumping rates for North Platte municipal wells are approximately 60% of what is simulated in either the temporal or average pumping rate scenarios, and that the results provided in this report indicate worst case scenario responses of the groundwater/surface water system.

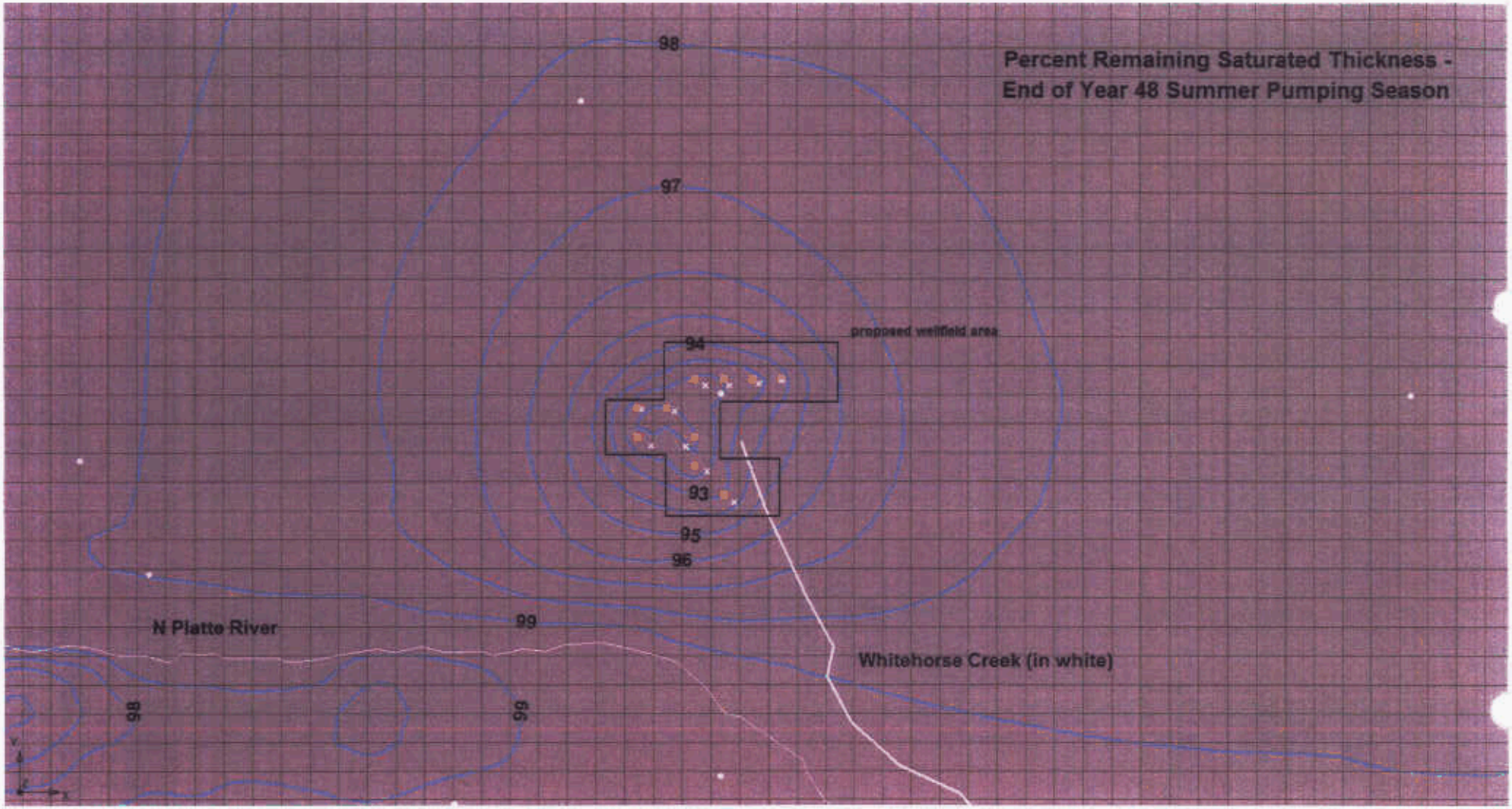


Figure 31. – Percent of saturated thickness remaining in aquifer at end of the 48-year variable pumping rate scenario.

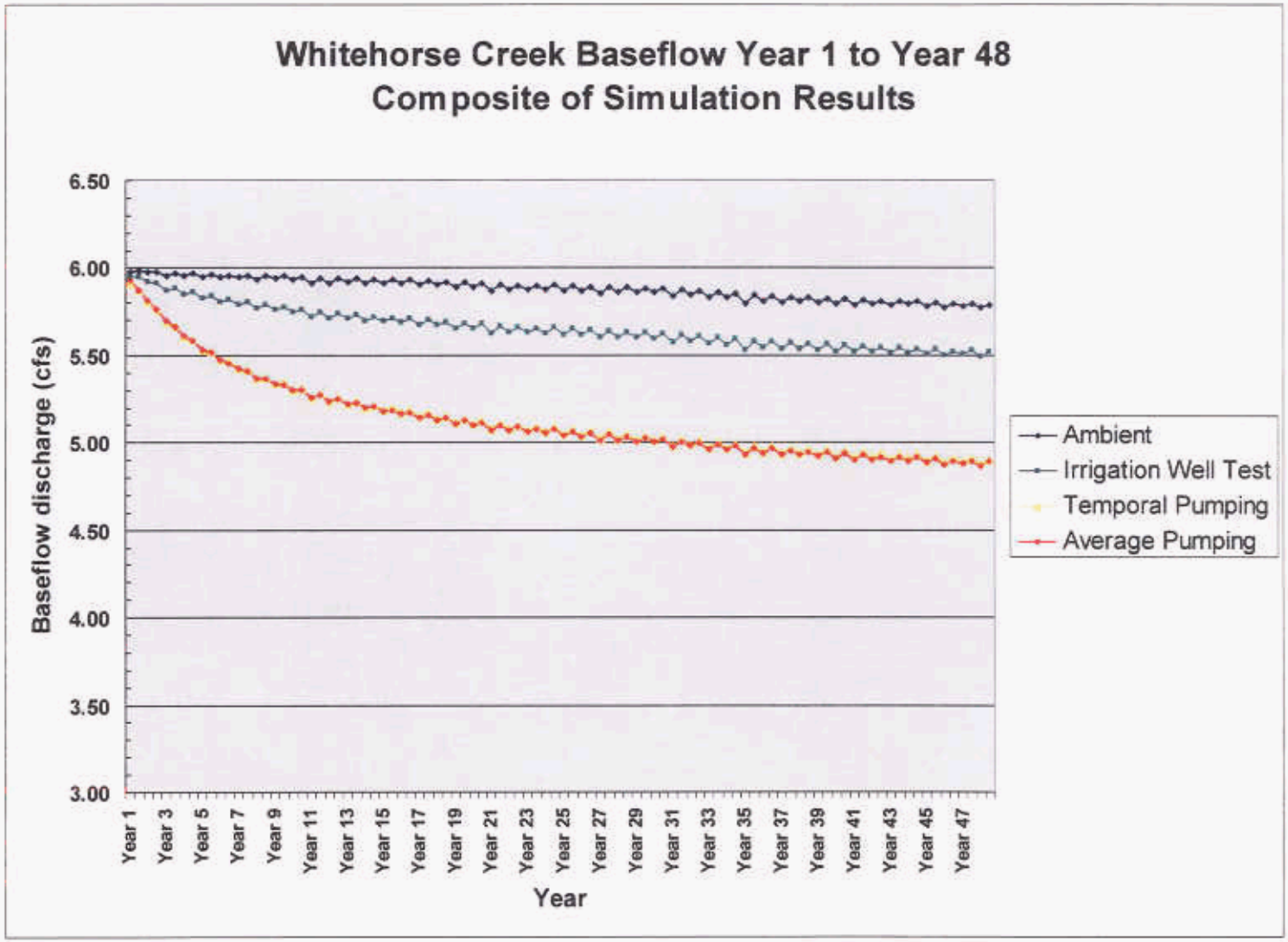


Figure 32. – Graph of long-term impacts to Whitehorse Creek for each 48-year pumping scenario. Note that the average and variable well field pumping rates overly one another (gold and red).

References

Carney, C.P., and Peterson, S.M., 2001. Estimated Groundwater Discharge to Streams from the High Plains Aquifer In the Central Model Unit of the COHYST Study Area for the Period Prior to Major Groundwater Irrigation. Available at http://cohyst.dnr.state.ne.us/adobe/dc012CMU_baseflw_01.pdf

Klocke, N.L., Hubbard, K.E., Kranz, W.L., and Watts, D.G., 1990, Evapotranspiration (ET) or Crop Water Use: Cooperative Extension, Institute of Agriculture and Natural Resources, University of Nebraska–Lincoln NebGuide G90-992, 4 p.

APPENDIX

Pumping Rates Provided by Miller and Associates

City of North Platte
Historical Pumping by Month

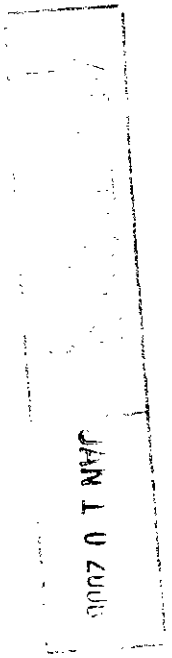
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	system Totals
1999	153,388,000	118,068,000	122,028,000	143,585,000	184,209,000	305,144,000	313,574,000	321,722,000	210,614,000	173,535,000	178,052,000	118,486,000	2,342,386,000
2000	151,701,000	115,923,000	117,199,000	254,976,000	250,329,000	347,688,000	358,378,000	340,235,000	276,151,000	204,075,000	113,836,000	150,133,000	2,682,324,000
2001	113,438,000	112,925,000	112,055,000	183,967,000	208,948,000	336,687,000	368,457,000	277,863,000	284,660,000	149,145,000	134,785,000	143,286,000	2,366,216,000
2002	112,764,000	114,839,000	116,805,000	220,457,000	217,778,000	441,705,000	411,842,000	340,976,000	257,938,000	205,821,000	114,076,000	143,935,000	2,699,036,000
2003	119,830,000	112,192,000	122,947,000	166,787,000	160,678,000	202,032,000	407,519,000	325,530,000	353,729,000	236,574,000	110,195,000	141,309,000	2,459,322,000
2004	124,298,000	121,329,000	159,111,000	177,444,000	237,667,000	264,964,000	248,703,000	244,268,000	295,837,000	151,403,000	123,528,000	134,015,000	2,302,567,000
2005	110,738,000	106,952,000	129,155,000	125,945,000	174,506,000	247,036,000	300,057,000	325,983,000	260,643,000	159,824,000			
AVERAGE	**126,593,857**	**114,604,143**	**125,614,286**	**179,023,000**	**204,873,571**	**309,322,286**	**342,661,429**	**310,939,571**	**277,367,429**	**182,911,000**	**129,078,667**	**138,524,000**	**2,480,308,500**
GPM	2,836	2,842	2,814	4,144	4,589	7,160	7,678	6,965	6,421	4,097	2,988	3,103	4,719
Future pumpage	4,481	4,491	4,446	6,548	7,251	11,313	12,128	11,005	10,144	6,474	4,721	4,903	7,456

Calculations for pumpage rates:

Future	Summer average rate:	10,369	gpm
	10,369	1,996,032.50	cu ft/d
		305,392,972.50	total cu ft for months highligl
		1,996,032.50	cu ft/d
		199,603.25	per well (10)
	Non pumping season rate	5151.8	gpm
	5152	991,722	cu ft/d
		210,244,958.00	total cu ft for time period
		991,721.50	cu ft/d
		99,172.15	per well (10)
Current	Summer average rate:	6,562	gpm
	6,562	1,263,185.00	cu ft/d
		193,267,305.00	total cu ft for months highligl
		1,263,185.00	cu ft/d
		126,318.50	per well (10)
	Non pumping season rate	3260.6	gpm
	3261	627,666	cu ft/d
		133,065,086.00	total cu ft for time period
		627,665.50	cu ft/d
		62,766.55	per well (10)

Average Annuals

Current	908,408.27	cu ft/d rate
	331,569,018.23	entire year volume cu ft
	908,408.27	cu ft/d
	90,840.83	per well (10)
Future	1,435,285.07	cu ft/d rate
	523,879,048.80	entire year volume cu ft
	1,435,285.07	cu ft/d
	143,528.51	per well (10)



APPLICATION FOR A MUNICIPAL AND RURAL DOMESTIC GROUNDWATER TRANSFER PERMIT

Additional Information for Items A-H

BACKGROUND

A March 2002 report entitled "Water System – Plan of Study" indicates wellhead protection for the existing wells is not possible and the wells need to be relocated. The report indicated "the City is in imminent danger of experiencing a shortage of water supply; source contamination and diminishing distribution capability to the Service Area and correction to the situation needs to be addressed in the immediate future." Due to identified groundwater contamination, the lack of wellhead protection, deteriorating conditions at existing wells and new federal water quality standards, the City of North Platte determined a new well field is needed to serve the existing and future population.

A. *Discussion of impacts on surrounding ground water and surface water supplies. Include expected radius of cone of depression and how it was determined and the location of any existing wells or water rights that may be impacted.*

The City of North Platte proposes to construct a new municipal well field with an initial capacity of approximately 14,000 gallons per minute (gpm) based on an optimal pumping volume of 2,000 gpm per well. The maximum rate of withdrawal for which a permit is requested is 20,000 gpm. The well field was chosen to be outside the last stream depletion line developed as part of the depletion study using the Cooperative Hydrology Study (COHYST) groundwater flow model. Existing City wells are located within the 40-year, 28-percent depletion line (28/40 line) and near the North Platte and South Platte Rivers. The percent of depletion for the existing wells is over 90%.

The initial siting of the proposed well field was located in Sections 17 and 18 of Township 15 North, Range 30 West and Section 13 of Township 15 North, Range 31 West, Lincoln County, Nebraska. During the siting process, the 28/40 line was re-evaluated and moved farther north thus placing the entire well field site in side the 28/40 line. The Twin Platte Natural Resource District (TPNRD) in conjunction with the Nebraska Department of Natural Resources (NDNR) has declared the groundwater basin where the proposed well field and the City are located an "over appropriated basin". TPNRD is in the process of developing an Integrated Management Plan (IMP) where allocations for municipal and industrial uses may be developed or assigned to control water consumption. The City of North Platte is taking an active part in the development of the regulations.

The revised location of the proposed well field is located in Sections 17, 18 and 30 of Township 15 North, Range 30 West and Sections 13, 23, 24 and 25 of Township 15 North, Range 31 West, Lincoln County, Nebraska. ***Figure 1 – Project Location*** illustrates the location of the proposed well field. Although no aquifer testing has been completed, a preliminary layout of 10 potential well sites has been determined based on Conservation and Survey Division transmissivity maps and topography of the land. These initial locations are depicted in ***Figure 2 – Potential Well Sites***. It should be

noted the number of wells may vary based on well production, aquifer testing and existing well spacing.

Figure 3 – Registered Wells shows the area of the proposed well field and the registered wells in, and surrounding the proposed site. There are some stock wells in the proposed well field site which are not registered. These locations are not depicted but were collected using a handheld GPS unit. The locations were used to determine setback distances in the placement of the proposed well sites. The majority of wells are stock and domestic wells located northwest of the well field site.

The City of North Platte is not aware of any objections to the groundwater transfer permit from surrounding well owners. The City has been negotiating land easements with the landowner and will be acquiring easements for the water main from other landowners and governmental agencies. The wells will be drilled to allow the City to rely primarily on this well field in the future as a source of municipal water. The headwaters of Whitehorse Creek appear to be approximately 2,500 feet south or down gradient from the northern most proposed wells. The North Platte River is over 2 miles southwest of the south edge of the proposed well field area. There is some concern that the well field could adversely impact the headwaters of the Whitehorse Creek. Upon approval from the NDNR for the transfer permit, the City of North Platte intends to install a cased well and perform test pumping to directly measure the cone of influence and determine aquifer characteristics upstream of Whitehorse Creek. Several observation wells will be installed to assist in the City evaluation of test pumping results. Based on test results, the well sites provided in Figure 2 may be adjusted to minimize impacts to surface water and nearby wells. As part of the test program, several test wells will be constructed and cased to provide water quality results for the Nebraska Department of Health and Human Services (NDHHS). The wells are indicated on Figure 2 as proposed cased test wells. There are three (3) surface water rights in the vicinity of the proposed well field site. The most relevant surface water appropriation is registered to Wesley Hansen in Section 30 Township 15 North Range 30 West. This is the body of water located in the proposed well field area. This right is for 94.6 acre feet (AC-FT) and is considered part of the Hansen Ranch Co., also known as the Thomas Hansen Ranch. The Hansen Ranch Co. also has domestic and stock wells located throughout their property, which totals approximately 12,500 acres of land. The municipal wells will be installed at least 1,000 feet from existing wells.

The other two surface water appropriations are registered to Alphonse Kosmicki in Section 12, Township 14 North, Range 31 West, which is over 2 miles south of the proposed well field.

The planned flow rate per well is 2,000 gpm. Data published by the Conservation and Survey Division for 1980 indicates a transmissivity of 100,000 gallons per day per foot (gpd/ft) in the well field area. A map of values in the area is shown in ***Figure 4 - Transmissivity Values.***

The drawdown at the well can be estimated based on the available data using the equation below.

$$\frac{Q}{s} = \frac{T}{2000}$$

Where:
Q = yield of well in gpm
s = drawdown in well in feet
T = transmissivity of the well in gpd/ft

The draw down for the proposed wells is estimated at 40 feet, based on a transmissivity of 100,000 gpd/ft and a flow rate of 2,000 gpm. Calculations of the capture zone (uniform flow field) for the same well parameters indicate the stagnation point will be approximately 1,433 feet down gradient of the pumping well using analytical equations. Using a modified Thies equation (μ< 0.05) by Cooper and Jacob (1946) the drawdowns a selected distance from the pumping well can be estimated using the following equation:

$$s = {}^{264Q}/_{T} \log\left({}^{0.3Tt}/_{r^2 S}\right)$$

Where:
Q = yield of well in gpm (assume 2,000)
s = drawdown in well in feet (to be solved for)
T = transmissivity of the well in gpd/ft (assume 100,000)
t = time in days (assume 90)
S = coefficient of storage (unit less) (assume 0.2)
r = distance in feet (varies)

Based on the above equation and assumptions the following table was generated. A drawdown of one foot will occur at approximately 3,000 feet from the pumping well.

TABLE 1
Drawdown using Modified Cooper Jacob (1946)

Distance from Pumping Well (feet)	***Drawdown at Distance (feet)***
1,000	6.0
2,000	2.8
3,000	0.9

The City anticipates decreasing their consumption of Platte River water flow by two substantial methods. The first method is the physical location of the supply wells. By relocating the City wells from an area of over 90% depletion to an area of 28% depletion in 40 years, the net increase stream flows could be in excess of 61,724,209,000 gallons based on North Platte's Annual average water use. In other words, by allowing the City of North Platte to move their point of groundwater withdrawal from an area of over 90% stream depletion to an area of 28% or less stream depletion, it could potentially increase

the stream flows in the Platte River by 62% of the current City of North Platte water use for 40 years in accordance with the COHYST model.

The rate and volume of stream depletions for the City of North Platte well field can be calculated by the current COHYST model or based on the original equations developed by C.T. Jenkins of the USGS originally printed in 1968. In the near future the COHYST model will have the stream depletion factors calculated by cell and can be used for river or stream depletion calculation. Until that time the depletions can be calculated by hand. Using Techniques described by Jenkins in Chapter D1, Book 4 of Hydrologic Analysis and Interpretation by the USGS, calculations were performed for the proposed well field. The assumptions to these equations are that the water withdrawal rate is uniform every year, the transmissivity does not change over time, the stream fully penetrates the aquifer and the temperature is constant in the stream. Some of these assumptions, especially uniform withdrawal, does not hold true for the North Platte well field.

Pumping of the proposed well field will begin slowly and gradually increase to the permit limits requested in this transfer permit. For the purpose of being conservative, we have developed stream depletion numbers for the proposed well field at the fully developed annual average capacity and compared it to the current well field capacity. When these two curves intersect in the future; at that point in time, the stream depletion is equivalent. The graphs for stream depletion will be presented after the water use is projected and the future pumping condition is selected.

However, it should be noted until the time when the curves intersect, the volume of water contained between the curves will be "saved" or "unused" and the City of North Platte should be entitled to a "credit" to the river to offset future depletions. This was discussed with NDNR staff and at this time the regulations do not allow for credits of this type to be applied.

The City is also in the design stage of renovating their wastewater treatment facilities. The City currently operates over 290 acres of lagoons, which allow high water losses through evaporation. The City is planning to construct a mechanical treatment facility to significantly reduce evaporative water losses. The City will reduce lagoon acreage by 290 acres. With a reduction of approximately 48 inches of evaporation over the surface area, the City will increase water returns (credit) to the river in the amount of 377,961,000 gallons per year. This amount is approximately 14% of the current city water use, which can be used for offsets in depletions and new developments.

B. Statement of impacts on any existing threatened or endangered species in the project area.

The States of Nebraska, Wyoming, and Colorado, and the US Department of the Interior have entered into a Cooperative Agreement (CA) partnership to address endangered species (whooping crane, piping plover, least tern, and pallid sturgeon) issues affecting the Platte River Basin. The initiative has two major purposes:

1. To develop and implement a "recovery implementation program" to improve and conserve habitat for four threatened and endangered species that use the Platte River in Nebraska.

2. To enable existing and new water uses in the Platte River Basin to proceed without additional actions required for the four species under the Endangered Species Act.

As part of this agreement Nebraska must develop tools to meet the two objectives above through sound management practices. This concept is incorporated in LB962. As part of this effort, a groundwater model was developed which identifies areas of river depletions that could adversely affect threatened and endangered species. As expected, the greater the distance from the river, the less development will impact the river depletions and endangered species. If development is pursued within the 28/40 line identified by the groundwater model, a mitigation plan to "replace" the water that would have eventually reached the river for the endangered species will be required. The City of North Platte, with its wastewater treatment facility improvements and physical relocation of the supply wells, is improving stream flows for threatened and endangered species.

Should the transfer permit be approved, consultation letters will be sent to the necessary government agencies to address threatened or endangered species along the construction route. The City of North Platte will address concerns raised in this process.

C. Pump test information, if available, including length of test, data from pump test, and location of observation wells.

No test pumping has been completed. The City of North Platte will install a well and perform test pumping to directly measure a cone of influence and determine aquifer characteristics. Plans and specifications for exploratory drilling and well construction have been prepared for submittal to contractors. Drilling has been placed on hold until approval is obtained from the NDNR and TPNRD.

The primary concern for the landowner and the City is protection of the headwaters of Whitehorse Creek. The installation and testing of a full-scale, cased, test well up gradient of the headwaters is designed to address this concern. Several observation wells will be installed to monitor water level changes during the pump test.

Should the results of the test pump indicate a higher number of lower capacity wells will be beneficial; the City would like the flexibility to meet flow requirements and not be limited to the number of wells installed. Based on conversations with the TPNRD and NDNR, the volume of withdrawal is the issue and not the number of wells for a municipality. If a greater number of wells will provide greater flexibility in operations and better use of the aquifer, the increased construction cost may prove beneficial to the City of North Platte.

D. Information on geology and hydrology of area such as thickness of aquifer, depth to water, aerial extent, transmissivity and how it was determined, and whether aquifer is confined or unconfined.

The proposed well field area has surface elevations varying from 2,910 feet to 3,060 feet. Groundwater elevations vary from 2,900 to 2,940 feet. Depths to water range from 10 to 160 feet. The well field is located in the Sand Hills topographic and groundwater regions according to The Groundwater Atlas of Nebraska. Surface

deposits in the area include Quarternary sand. The sand is underlain by Tertiary Miocene Ogallala Group materials including sand, sandstone, silt and gravel. The sand and Ogallala Group materials extend to 600 to 650 feet below grade in the proposed well field. The base of the aquifer is expected at approximate elevations ranging from 2,200 to 2,300. The formation below this level is the Tertiary Oligocene Brule Formation. The Brule Formation is not considered a large water bearing formation in this area.

In the proposed well field, the thickness of the aquifer is 600 to 650 feet excluding the Brule Formation. Saturated thickness, according to the Conservation and Survey Division, including the Brule Formation, is provided in ***Figure 5 – Saturated Thickness***. The unconfined aquifer is recharged through rainfall on the sand hills. The aquifer in this area discharges water to surface water at Whitehorse Creek and further south to the Platte River.

Test pumping has not been performed to provide transmissivity values for the aquifer at the proposed well field. Data published by the Conservation and Survey Division (CSD) for 1980 indicates a transmissivity of 100,000 gallons per day per foot based on sieve analysis. During the development of the COHYST model, the CSD transmissivity values were typically lower than actual field conditions.

Groundwater elevations are shown in ***Figure 6 – Regional Groundwater Elevations*** as digitized by the conservation and Survey Division 1995. The groundwater flow direction at the proposed well field is generally from north to south as shown in ***Figure 6,*** but may vary seasonally. The installation and testing of test wells and observation wells will provide the City with specific data to be used in the final placement of municipal supply wells.

E. Description of type of well, including drawings.

The proposed wells will be drilled utilizing rotary drilling methods. A 40-inch diameter hole and 24-inch diameter casing and screen are anticipated. The landowner is discussing requiring the City to use submersible wells in which the well size may be decrease to 20-inch diameter casing and screen depending on the motor size and pumping head conditions.

One hundred feet of stainless steel, wire-wrapped screen with a proposed slot size of 0.030 inches will be used based on similar wells in the area. The gravel pack and slot size will be selected based on sieve analysis results for formation samples. A drawing of the typical well construction is shown in ***Figure 7 –Well Construction Schematic***.

F. Planned operation schedule. (Describe hours per day the wells will likely be pumped, whether there will be seasonal changes to schedule, whether there will be a rotation of wells pumped, and whether certain wells are only for backup purposes.)

The City proposes to gradually construct and use wells at the proposed well field, as wells within the City are abandoned due to water quality or maintenance issues. Pumping at the proposed well field will reduce the impact of the City's water use on stream flows in the Platte River. The City discussed a variance from the Twin Platte Natural Resources District to allow construction of test wells. A meeting was held in North Platte on February 18, 2005, and direction was given to the City to begin the Transfer Permit process.

Ten wells are proposed to meet peak flow requirements based on a capacity of 2,000 gpm per well. The number of wells may be increased following aquifer testing, however the withdrawal amount requested will remain the same. Historic data indicate higher water use and the occurrence of peak flows during summer months, especially during July and August. The proposed wells will be used in conjunction with water storage in the City of North Platte. Flows will be balanced to provide pumping 24 hours a day to maintain water storage levels, with additional pumping during daytime and summer heavy use periods.

Pumping of wells may be varied due to the distance from the supply pipeline, depth to water, or water quality concerns. All of the wells will be installed for use as municipal supply wells to supply potable water at a design flow rate of 2,000 gpm, if the formation can support this rate of withdrawal.

G. Explanation of the basis for the amount of water requested. This should include current population and projected growth, daily per capita water use data, current industrial or other large uses and projected growth. The explanation should also include answers to the requirements for approval of the application stated in 46-642, R.R.S. 1943, as amended, namely: whether request is reasonable, not contrary to the conservation and beneficial use of groundwater and not detrimental to the public welfare.

The City of North Platte has eighteen municipal wells and four irrigation wells to serve the 2000 census population of 23,878. The well registration numbers and approximate legal descriptions for the existing municipal wells are provided in ***Table 2 -- Existing Municipal Wells.***

TABLE 2
Existing Municipal Wells

Well No.	*POEHHS*	*Reg. No.*	*Legal Description*
4	20041	G-128222	SWNW 17-13-30W Lincoln County
5	471	A-010510F	NENE 32-14-30W Lincoln County
6	311	A-010510H	SESE 32-14-30W Lincoln County
7	371	A-010510G	SESW 32-14-30W Lincoln County
8	611	A-010510D	SENE 31-14-30W Lincoln County
9	561	A-010510B	NWNE 4-13-30W Lincoln County
10	671	A-016166A	SWNE 33-14-30W Lincoln County
11	601	A-010510C	NENW 5-13-30W Lincoln County
12	631	A-016166D	NESW 33-14-30W Lincoln County
13	632	A-010510J	SWNW 3-13-30W Lincoln County
14	672	A-010510A	NWNW 34-14-30W Lincoln County
15	691	A-016166G	SENE 5-13-30W Lincoln County
16	633	A-016166H	NWNE 31-14-30W A Lincoln County
17	741	A-016166B	NESE 6-13-30W Lincoln County
18	461	A-010510E	NENE 32-14-30W Lincoln County
19	481	A-016166E	NENW 31-14-30W Lincoln County
20	751	A-016166C	NESW 9-13-30W Lincoln County
21	811	A-016166F	NWNW 6-13-30W Lincoln County

POEHHS = Point of Entry tracked by Nebraska HHS

The combined pumping capacity of the existing municipal wells is 13,600 gpm. The eighteen municipal wells four irrigation wells are within City limits and are shown in **Figure 8 –Municipal Wells.** Wells 6, 7, 9, 10 and 12 are not currently used due to water quality concerns.

As part of the transfer permit process, two different historical water use periods were researched. Long term trends looking at 21 years of data were compiled to look at future projections. A shorter duration of five years was used to establish the average pumping rate for calculation of the stream depletion factor to allow the current water supply to be compared to the projected water supply at the proposed location.

The 21 year summary of annual pumping is reproduced below in ***Table 3 – Annual Water Use 1984-2004.*** This data is graphically depicted in ***Figure 9 – Annual Water Production 1984-2004.*** The actual pumping records by year are illustrated using the diamond symbols. The straight line on the graph is a linear regression of the data demonstrating an upward trend which reflects increases in population, industrial growth and water use.

TABLE 3
Annual Water Use 1984-2004

Year	*Gallons Pumped*
1984	2,033,330,000
1985	2,163,958,160
1986	1,991,305,000
1987	2,120,037,000
1988	2,337,696,000
1989	2,384,775,000
1990	2,424,194,000
1991	2,371,248,000
1992	2,141,362,000
1993	1,960,510,000
1994	2,311,894,000
1995	2,274,146,000
1996	2,095,504,000
1997	2,371,922,000
1998	2,462,855,000
1999	2,342,386,000
2000	2,682,324,000
2001	2,396,216,000
2002	2,699,036,000
2003	2,459,322,000
2004	2,302,587,000

Using 21 years of water production, the linear regression line was projected out 80 years into the future. This is shown graphically in ***Figure 10 – Forecasted Water Production.*** According to the graph, in 50 years, the City's annual water production will increase by a billion gallons.

Water use records for the last 5 calendar years were compiled for the stream depletion calculation in the Groundwater Transfer Permit. ***Table 4 - Water Use 2000-2004*** provides water use data for the years 2000 through 2004 by well. Well meter records indicate a slight variation from year to year with 2004 having the lowest water use for the five year period. The average daily demand for the period 2000-2004 was approximately 6.8 million gallons per day (MGD). This is equivalent to a constant use of 4,735 gpm.

In 2001, peak flow reached 12,569 gpm or 92.4% of the 13,600 gpm maximum pumping capacity. When looking at the ratio of the peak (12,569 gpm) to the average daily flow (4,735 gpm) we see that for North Platte that the peak flows versus average flow ratio is approximately 2.7.

TABLE 4
Water Use 2000-2004 (Gallons)

Well No.	*2000*	*2001*	*2002*	*2003*	*2004*
5	30,873,000	18,298,000	75,920,000	8,098,000	83,000
6	47,562,000	19,624,000	55,446,000	13,814,000	1,420,000
7	149,618,000	103,745,000	84,984,000	34,035,000	13,085,000
8	367,666,000	388,642,000	359,858,000	352,337,000	290,798,000
11	400,462,000	386,921,000	362,484,000	409,580,000	440,834,000
13	135,994,000	119,935,000	87,265,000	49,585,000	33,210,000
14	81,852,000	84,568,000	85,570,000	62,358,000	3,918,000
15	264,734,000	224,965,000	307,361,000	226,996,000	72,085,000
16	356,251,000	314,397,000	266,190,000	234,175,000	205,340,000
17	201,010,000	144,506,000	231,715,000	214,932,000	358,647,000
18	94,668,000	69,656,000	53,315,000	63,206,000	18,232,000
19	12,208,000	6,197,000	20,281,000	7,720,000	128,099,000
20	89,423,000	147,345,000	274,858,000	281,360,000	358,542,000
21	449,995,000	367,417,000	433,809,000	414,126,000	370,194,000
Total	**2,682,316,000**	**2,396,216,000**	**2,699,056,000**	**2,372,322,000**	**2,294,487,000**

The City of North Platte's long term goal is to provide a well field to meet demand for 50 years at the proposed site. Based on ***Figure 10***, the annual water forecast for 2055 is 3.5 billion gallons of water. This is equivalent to an average pumping rate of 6,660 gpm. Applying the observed peaking factor of 2.7, a peak day flow rate will be 18,000 gpm. The proposed well field capacity goal is 20,000 gpm, which is listed as the maximum withdrawal rate on the transfer permit.

To calculate impacts to the Platte River via stream depletion, a conservative approach was taken. For comparison, it is assumed the average pumping rate of the current well field was 4,735 gpm and the projected average pumping rate for the new well field 7,500 gpm. This value of 7,500 gpm exceeds 50 year projection.

Using these rates, along with the physical location of the existing and proposed well fields, the storability of the aquifer, the transmissivity from ***Figure 4***; the stream depletion rates and factors were calculated for each location. Please see ***Figure 11 – Stream Depletion Graph/Calculations*** for the assumption summary and stream depletion graph generated.

The stream depletion factor of the existing well field is calculated as 43, which seems realistic for the map generated by the NDNR which places the existing well field in the area of Stream Depletion Factor (SDF) under 50. The proposed well field site located on both sides of the 15,000 SDF line and the calculations shown in ***Figure 11*** estimated a SDF of 14,377.

As you can see in ***Figure 11***, the stream depletion lines for the existing well field and the proposed well field do not cross until approximately 79 years has passed. Thus, if the City of North Platte were to develop the entire well field at once, begin pumping at the

average rate of 7,500 gpm to the system, allowing flow for a peak day of 20,000 gpm, it will take approximately 80 years to equalize the depletions the Platte River is seeing from the exiting wells and current water production.

As previously mentioned, the City should actually be allowed a credit for the first 79 years of stream depletion savings (area between the graphs) should they be allowed to complete this project to offset future depletion beyond 79 years.

The proposed well field will be developed in stages and the current supply wells will be used until the City determines use of each well is not feasible, or regulations require discontinued use.

The City has two existing groundwater transfer permits on file at the NDNR. These permits are A-10510 and A-16166. Permit A-10510 was originally filed in 1964 and was provided a priority date of February 12, 1889. The average daily flow associated with this permit is 16,920,000 gallons per day. This is equivalent to an average flow of 11,750 gpm.

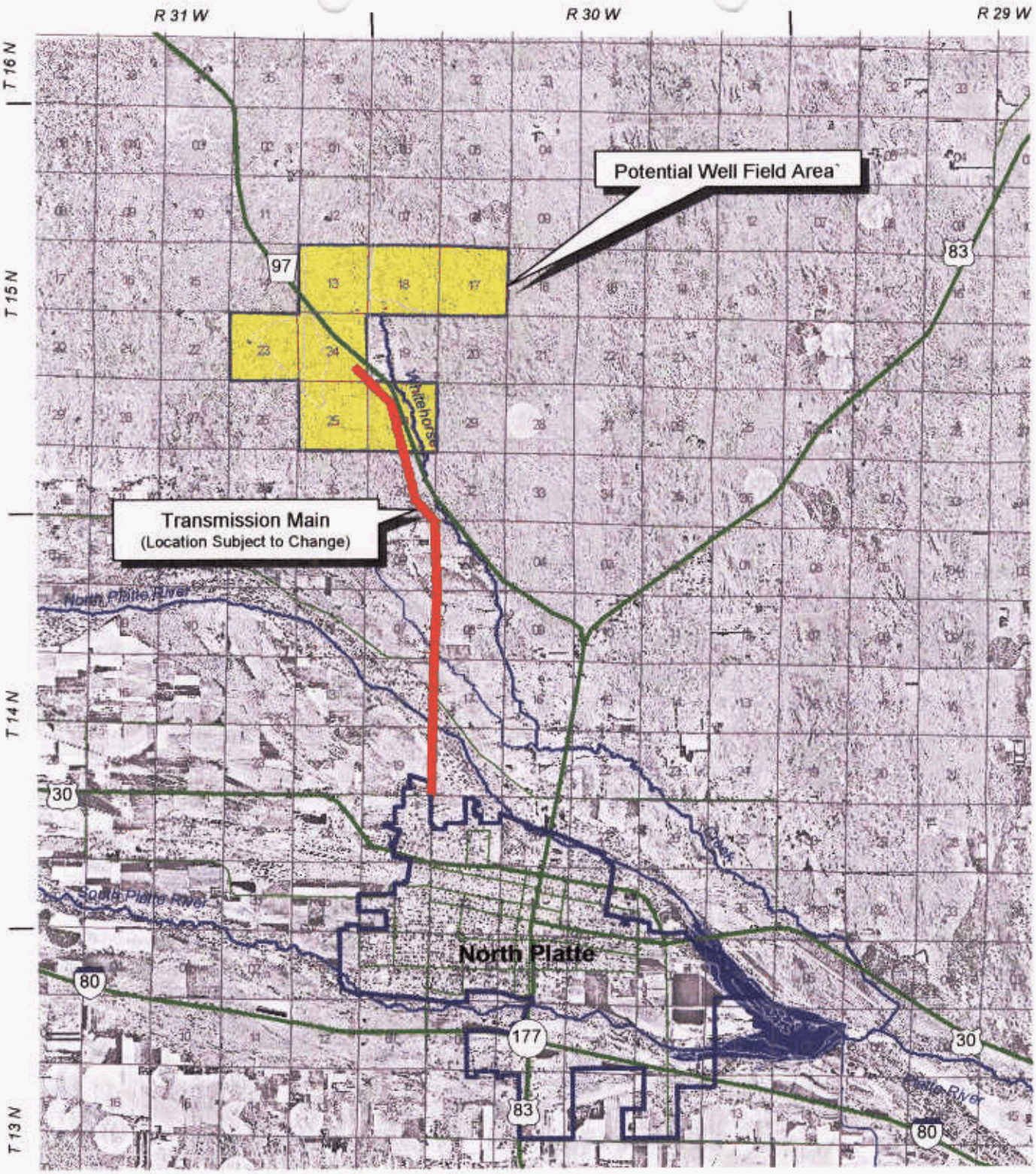
Permit A-16166 was filed on January 6, 1983. Its allotted water use is 11,664,000 gallons per day. The 11,664,000 gpd was provided plus the permit limits of A-10510 of 16,920,000 gpm. The total quantity of water which the City of North Platte is permitted for at this time is 28,584,000 gallons per day. This is equivalent to an average flow of 19,850 gpm.

Due to the priority dates of these permits and the quantity allocated, the City is requesting the new permit not increase the daily average amount (28,584,000 gallons) but allow this application to be filed in conjunction with the two existing ground water transfer permits. This is justified due to the long phasing process of pumping from the existing wells and development of the new well field. We have decreased the overall quantity of water requested in this application to reflect the projected water use of 4,000,000,000 gallons per year. Granting the permit as requested will limit withdrawals at the new well field to 20,000 gpm with supplemental water from the existing wells and transfer permits should the water use projections in this application be low.

The request to obtain quality drinking water for the citizens of North Platte is reasonable, is not contrary to the conservation and beneficial use of groundwater, and not detrimental to the public welfare. Approval of this permit should result in no net increase in withdrawals from the Platte River basin for 50 years based on the calculations and assumptions presented above.

H. Map showing location of proposed wells, pipelines (exclusive of distribution lines) and the area of proposed use. The map shall be legible and at a scale of not less than one inch to the mile.

Figure 1 shows the proposed well field and transmission main. ***Figure 12 – Service Area*** depicts an area one mile outside of the City limits for the City of North Platte. This area is constantly being modified by the City of North Platte during annexation processes. The City actually has zoning jurisdiction 2 miles outside of the City limits.



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Miller & Associates
CONSULTING ENGINEERS, P.C.

North

Figure 1
Project Location
North Platte, Nebraska

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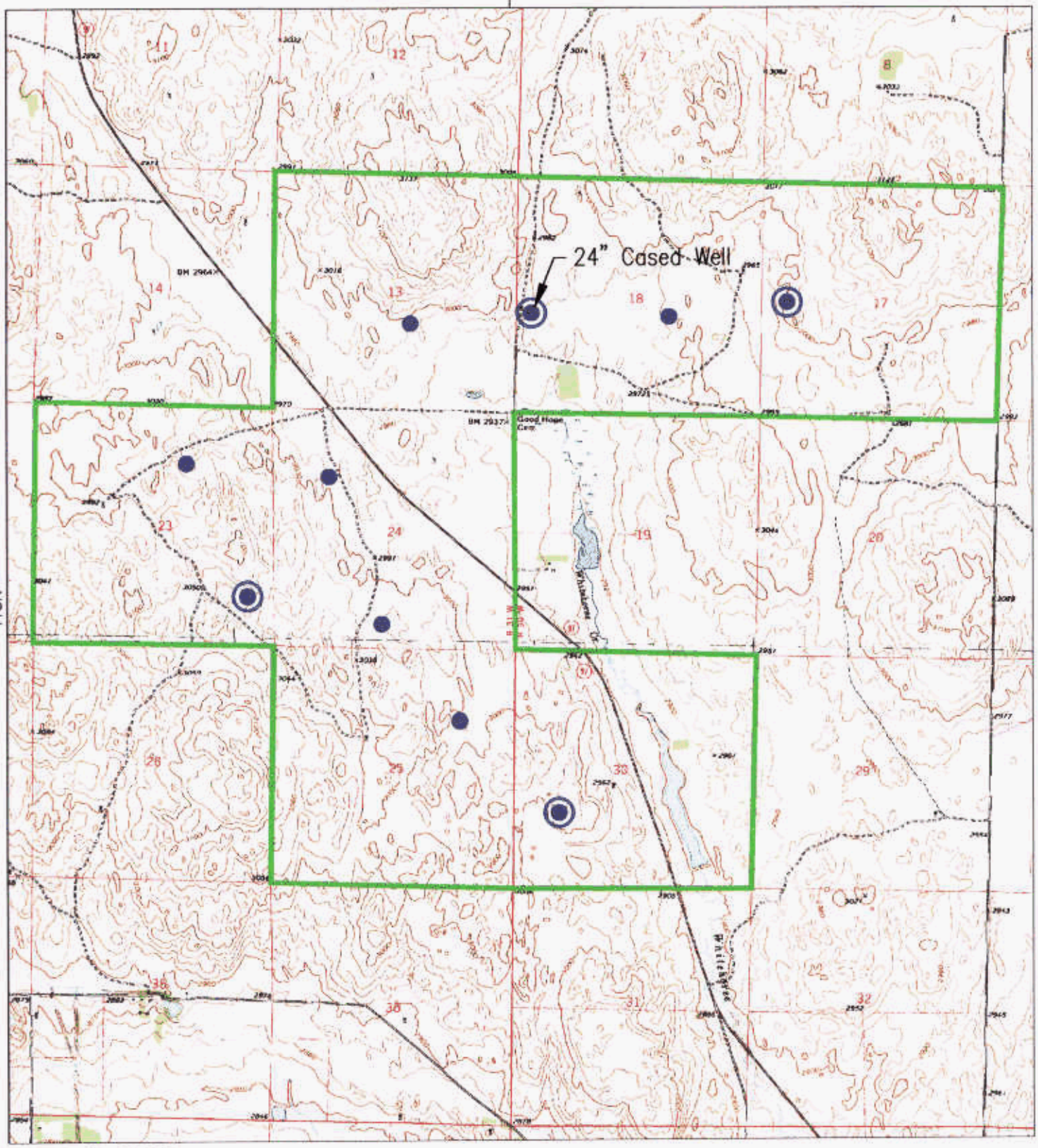


0 1500'± 3000'±

SCALE IN FEET

North

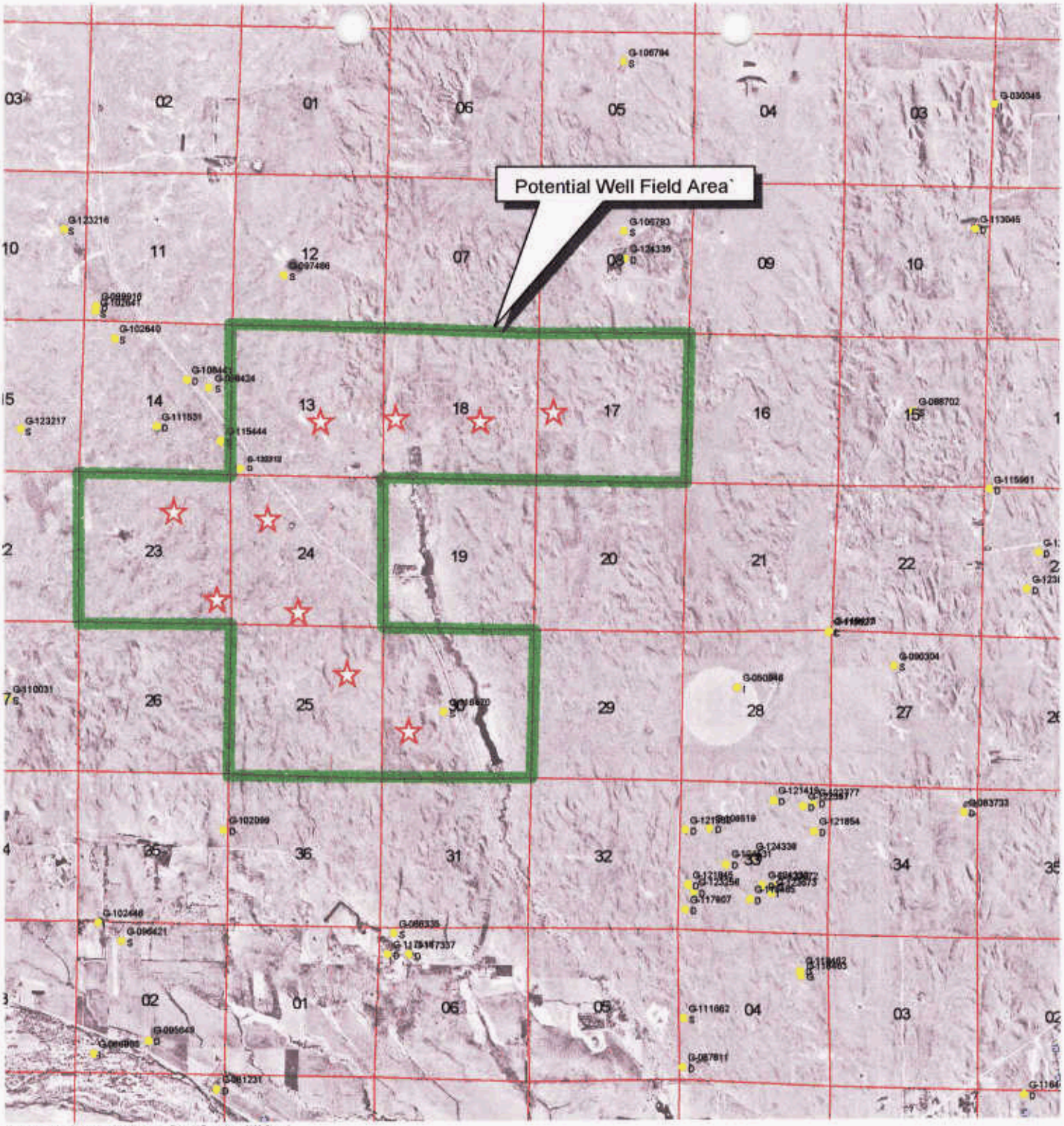
LEGEND

PROPOSED WELL LOCATIONS (Approximate)

PROPOSED CASED TEST WELLS

Miller & Associates

Figure 2
Potential Well Sites



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Note:

1. Registered well information provided by the Nebraska Department of Natural Resources, January 7th, 2004.
2. Aerial photography provided by the Nebraska Department of Natural Resources, 1999.
3. Registered well locations are positioned from well registration forms. Some errors may exist due to data input and inaccuracies within well registration records.

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CONSULTING ENGINEERS, P.C.

Legend

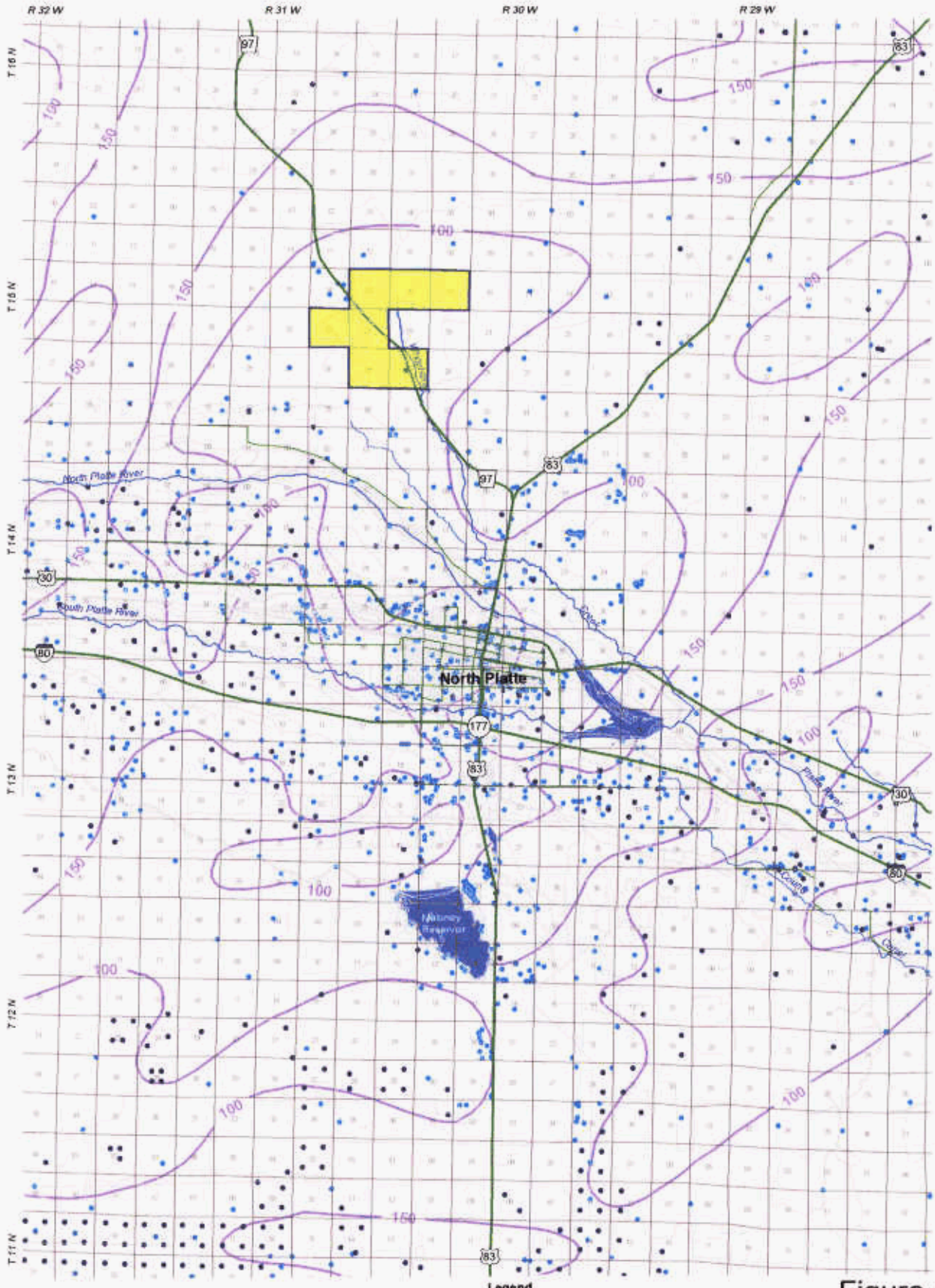
- Section Line
- Registered Well (Reg ID) (Well Use)
- Potential Well Sites

North

Figure 3
Registered Wells
North Platte, Nebraska

Note:

1. Registered well information provided by the Nebra[illegible]ural Resources Commission, December 2002.
2. Registered well locations are positioned from well re[illegible]vation forms. Some errors may exist due to data input and inaccuracies within well registration records.



Legend

- Selected Well for Study
- Non-Selected Well
- Transmissivity in thousand of gallons per day per feet. *Digitized from Conservation & Survey Division UNL - Pub 1980.*

North

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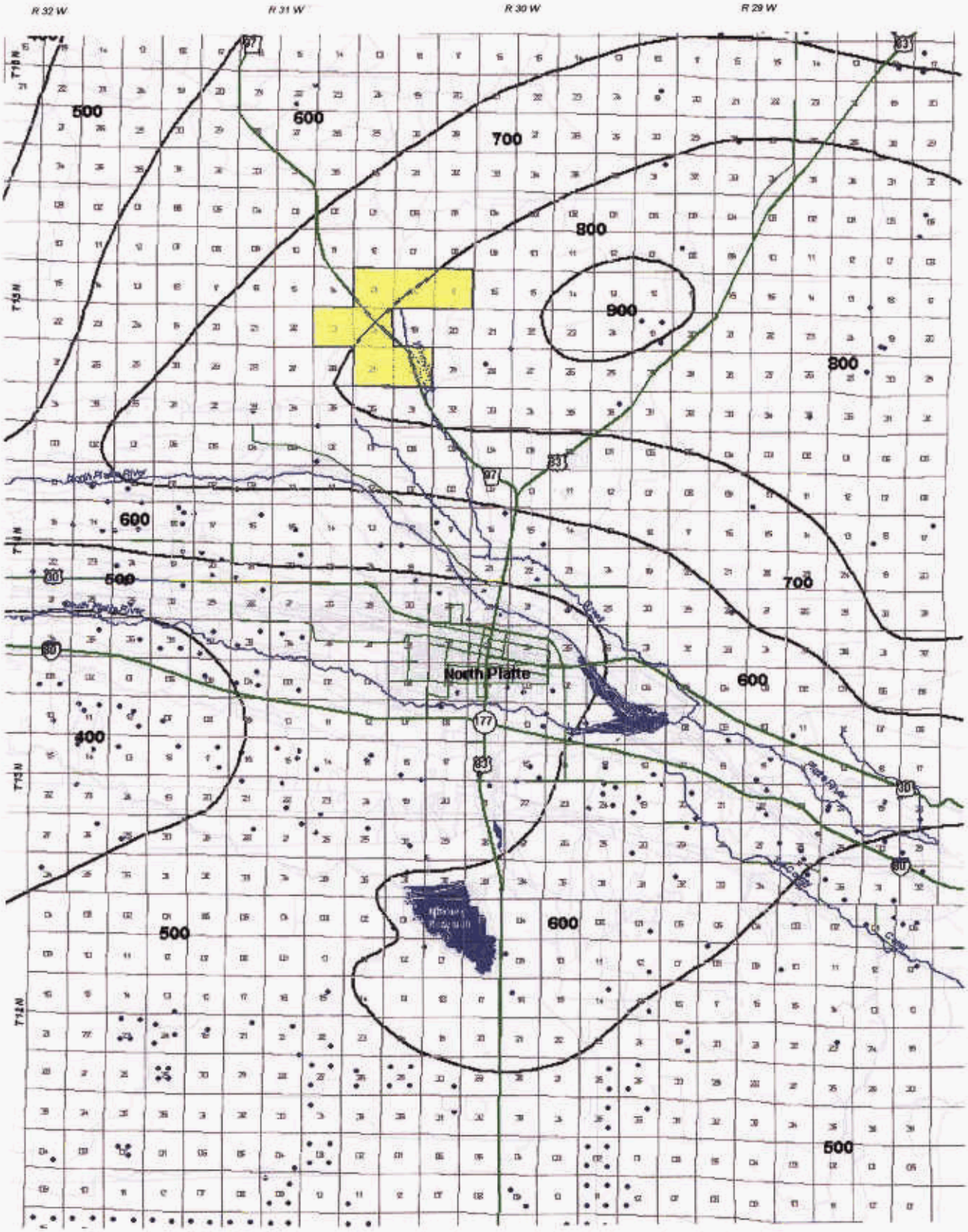
Figure 4
Transmissivity Values
North Platte, Nebraska

Note:

1. Registered well information provided by the Nebra[illegible]tural Resources Commission, December 2002.
2. Registered well locations are positioned from well r[illegible]ation forms. Some errors may exist due to data input and inaccuracies within well registration records.



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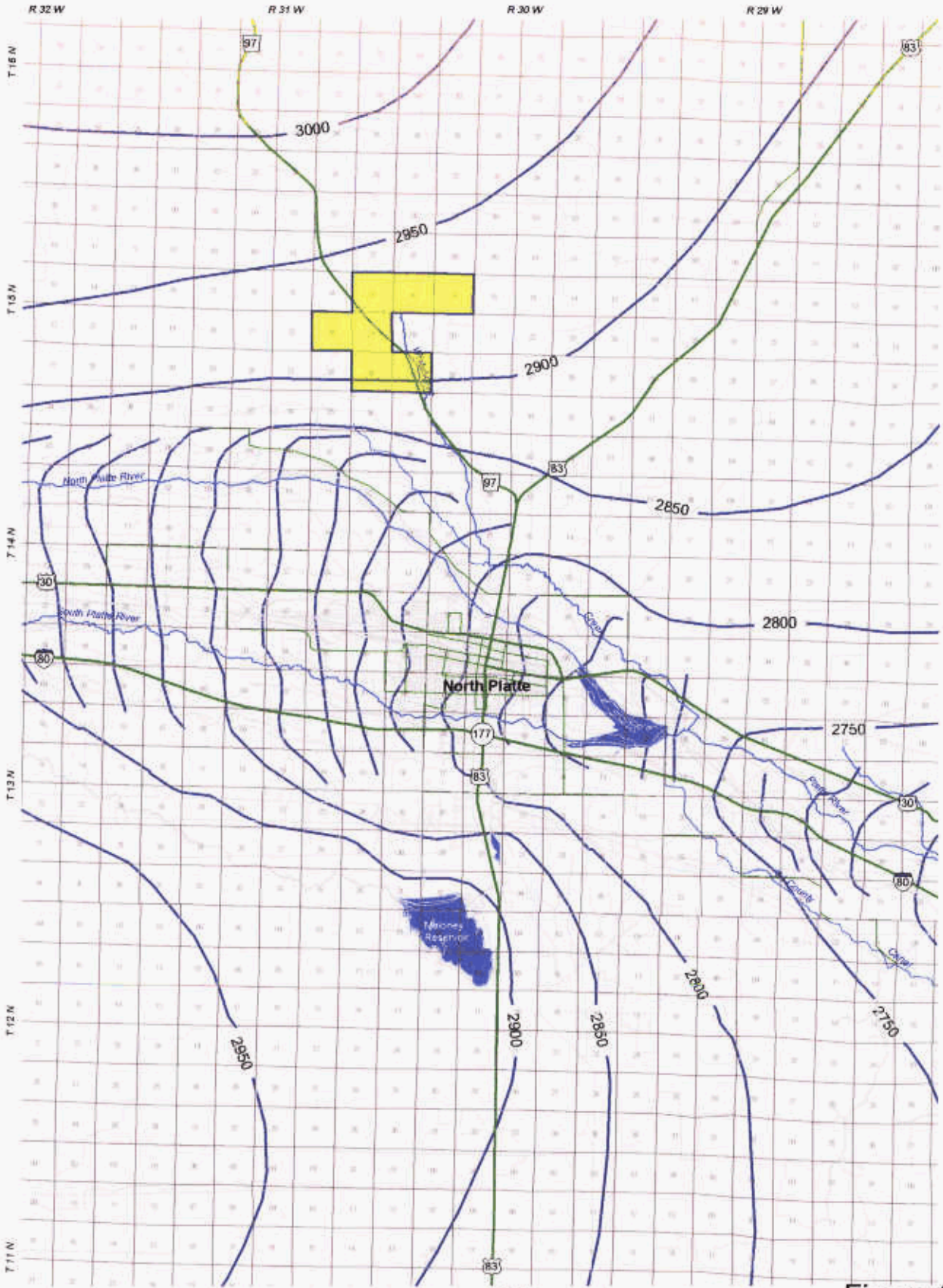
North

Legend

- Selected Well for Study

Thickness of Water data from Conservation &Survey Division, UNL. – Pub. 1998. Units in feet.

Figure 5
Saturated Thickness
North Platte, Nebraska



Legend

2250 — 1995 ground water contours were digitized by the Conservation and Survey Division, University of Nebraska-Lincoln, from Maps developed by the U.S. Geological Survey.

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Figure 6
Regional Groundwater Elevations
North Platte, Nebraska

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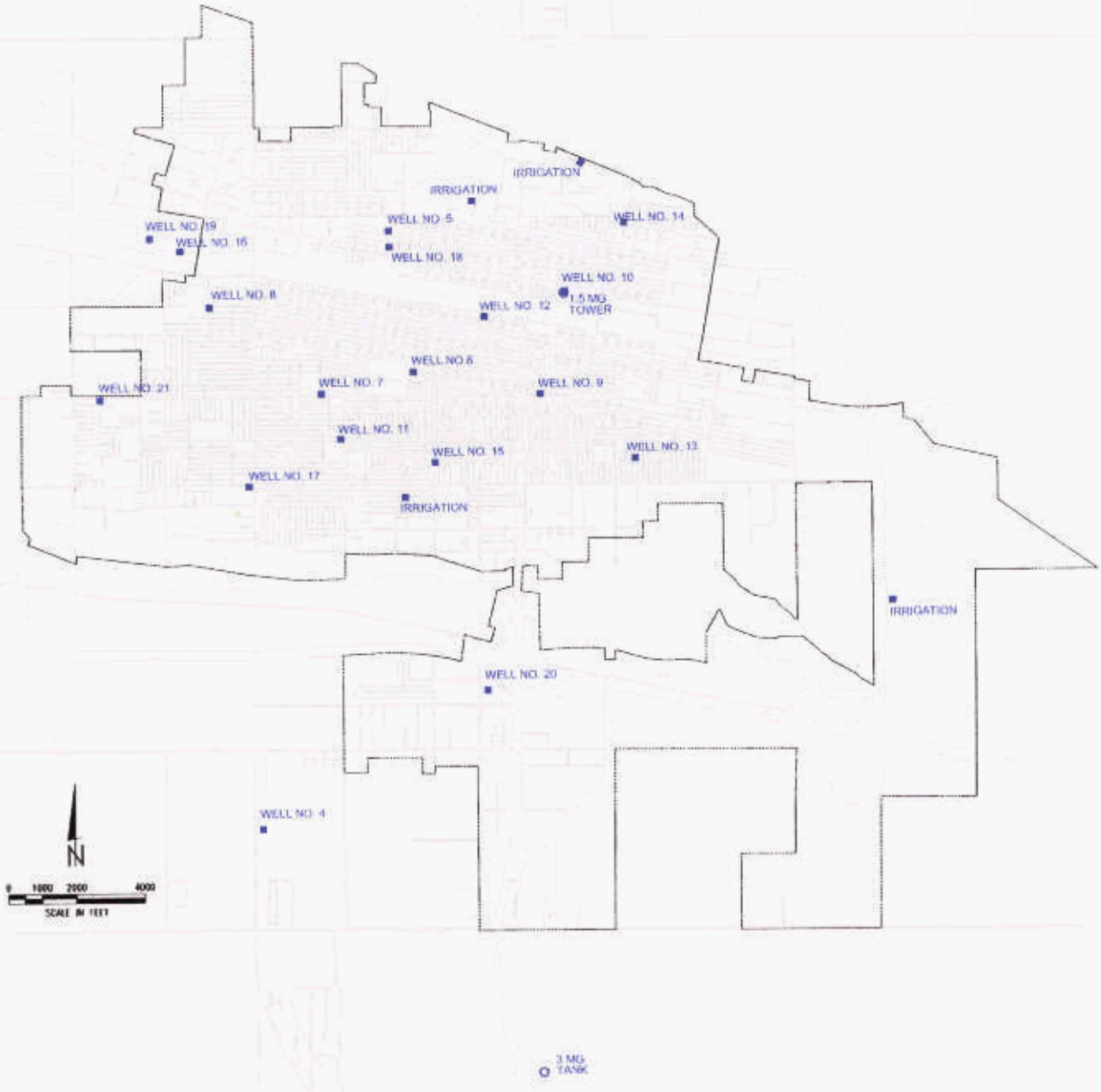
Figure 7
Well Construction Schematic
North Platte, Nebraska



Prepared By:

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Figure 8
Municipal Wells
North Platte, Nebraska

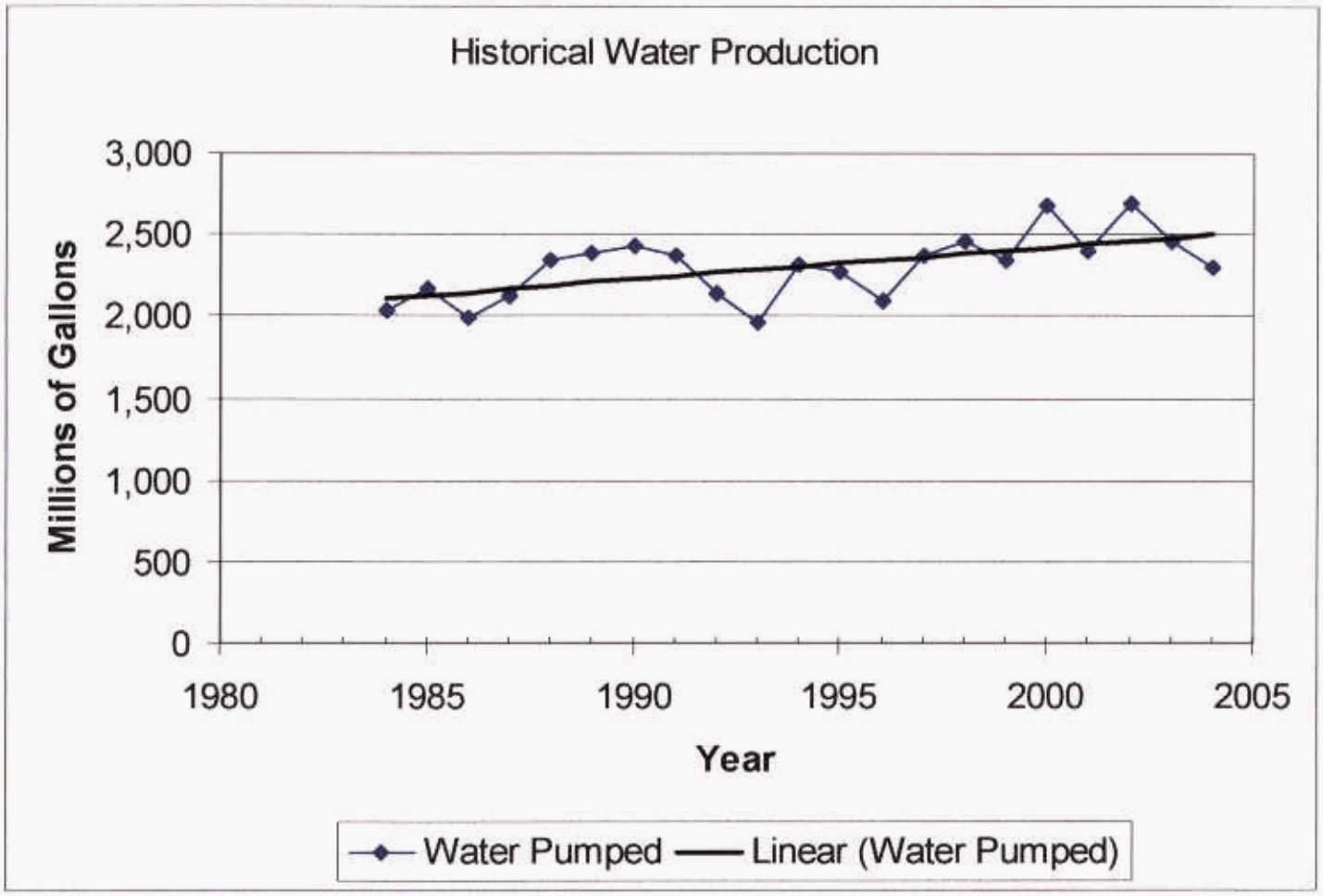

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Figure 9
Annual Water Production 1984-2004
North Platte, Nebraska

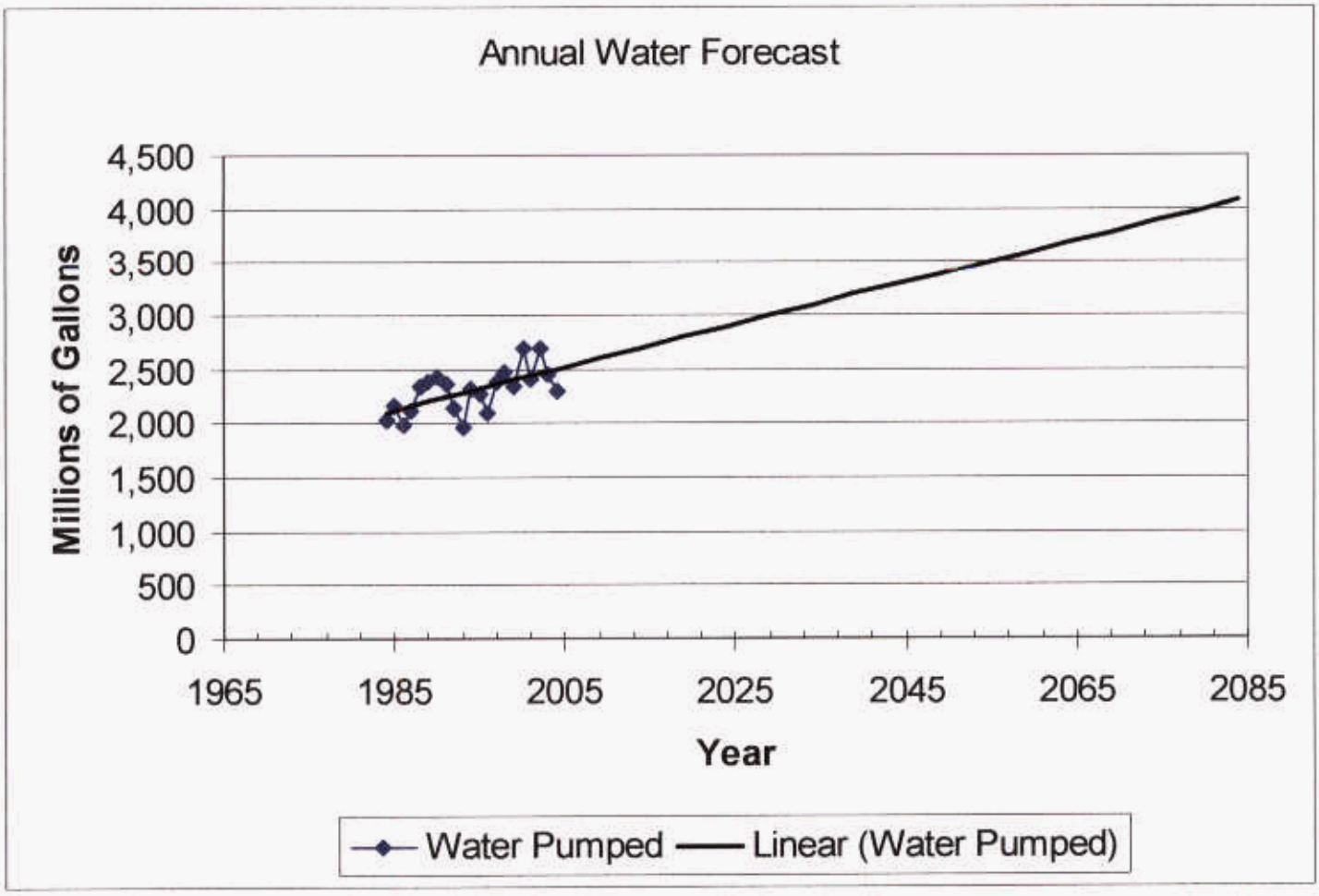

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Figure 10
Forecasted Water Production
North Platte, Nebraska

Formulas are taken from USGS Chapter D1 - Computation of Rate and Volume of Stream Depletion by Wells by CT Jenkins, Book 4

sdf = a^2S/T

a= perpendicular Distance from well
S= specific yield
T = Transmissivity
t = time
Q = pumping rate
tp = time pumping
ti = time after pumping stops
q = rate of stream depletion
Qt = net volume pumped during ti
Qtp = net volume pumped
v = volume of stream depletion
sdf = stream depletion factor

units are dimensionless and can be used with any units but MUST be consistent

	Existing Wells	Proposed Wells
a= feet	1700	31000
S=	0.2	0.2
T (gpd/ft)	100000	100000
T = Sq. Ft/d	13369	13369
t = day	365	365
Q (gpm)	4735	7500
Q = cfd	911551	1443850
sdf =	43	14377

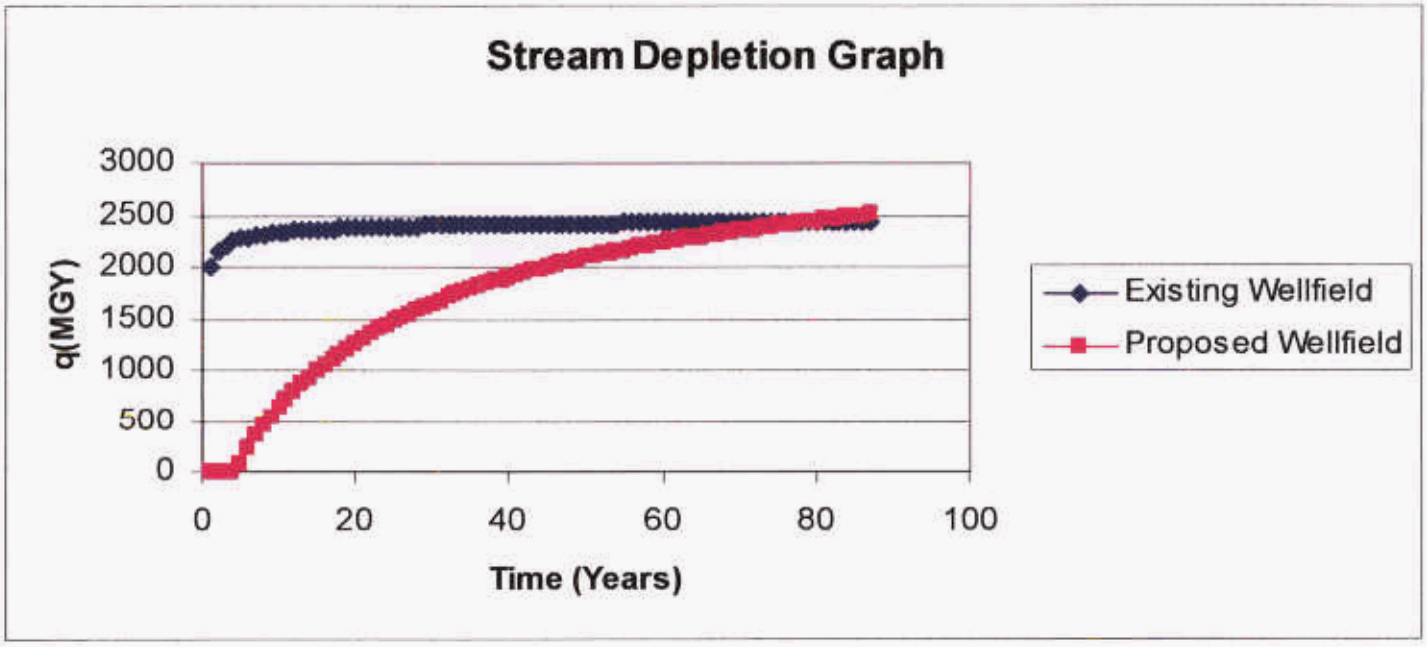

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Figure 11
Stream Depletion Graph/Calculations
North Platte, Nebraska

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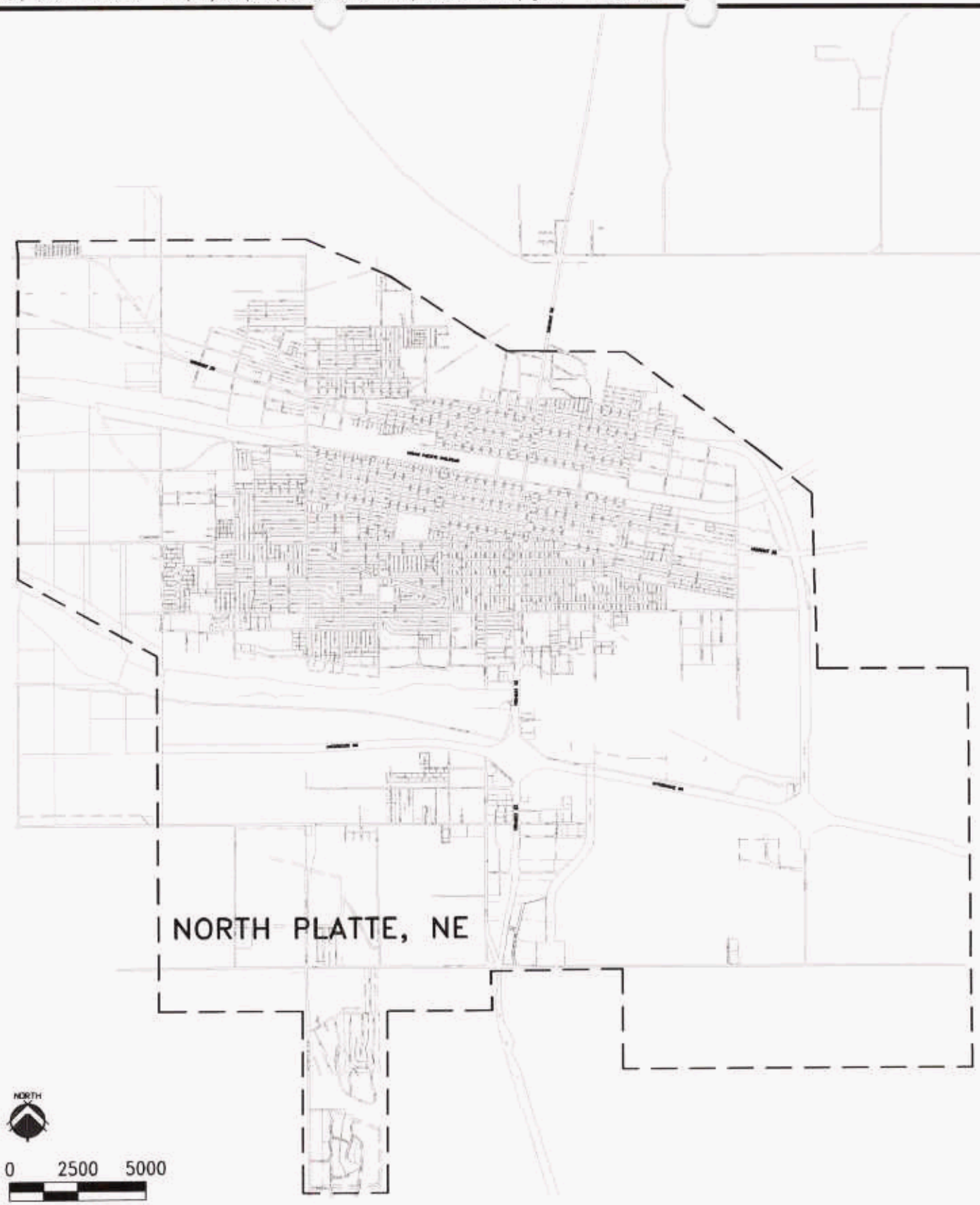

Miller & Associates

— — — SERVICE AREA
(Service Area Provided by the City of North Platte)

Figure 12
Service Area