

City of North Oaks

Review of Highway 96 Site Groundwater Impacts

March 2007

Prepared for:

City of North Oaks
Ramsey County, Minnesota

Prepared by:

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Key Findings

Review of Highway 96 Site

Groundwater Impacts for City of North Oaks



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MEMORANDUM

TO: Mayor and City Council of North Oaks
North Oaks Home Owners' Association
FROM: John B. Erdmann, Wenck Associates, Inc.
DATE: January 3, 2007
SUBJECT: Review of Highway 96 Site Groundwater Impacts – Key Findings

Following are the key findings of Wenck's review of groundwater impacts from the Highway 96 Site. An appendix containing further documentation of Wenck's review is being provided to the City of North Oaks.

1. The Minnesota Department of Health concluded in its March 2006 Health Consultation: "Because no exposures above existing health-based criteria are taking place, and routine monitoring of private and public wells in the area of concern in southeast North Oaks is occurring, the situation represents no apparent public health hazard." This is a reasonable finding because the provision of water treatment or alternative water supply adequately addresses the public health concern; and in the meantime, aquifer remediation is ongoing.
2. The extent of vinyl chloride contamination in the St. Peter Sandstone aquifer is adequately delimited. The three wells with vinyl chloride detections, at 12 and 13 West Shore Road and 2 Hummingbird Lane, are flanked side-gradient and downgradient by a large number of wells in which vinyl chloride has not been detected in any sample to date. Figure 1 illustrates the pattern of detections of vinyl chloride plus four other volatile organic compounds (VOCs) in residential wells around Gilfillan Lake. Five wells with one-time detections of a VOC other than vinyl chloride (out of four to 15 samples from each well) lie close to the three wells with vinyl chloride detections, indicating a somewhat larger plume of VOCs in general. To the north, south, and west of this "general VOC plume" are approximately 30 wells that have not had any VOC detection, out of typically five samples (actual number of samples ranging from one to 16). VOCs other than vinyl chloride have been sporadically detected north of Gilfillan Lake, but vinyl chloride has not been detected there.
3. VOCs have been detected in four wells out of eight in the vicinity that extend into the Prairie du Chien-Jordan aquifer, the aquifer directly underlying the St. Peter Sandstone. In 1993, vinyl chloride was detected in two former residential wells in the area now served by municipal water (Prairie du Chien well at 21 Gilfillan Lane, St. Peter-Prairie du Chien well at 19 Dove Lane). More recently, VOCs other than vinyl chloride have been detected in two currently used residential wells north of Gilfillan Lake (Jordan well at 9 Duck Pass Road, St. Peter-Prairie du Chien well at 20 Duck Pass Road). See Table 1 for further details. These observations caution against the replacement of contaminated St. Peter wells with Prairie du Chien wells.
4. The investigations and remedial actions performed to date have met industry standards and, in Wenck's view, have generally been a cut above average. The chronology of events (Table 2) and the reports reviewed by Wenck that were produced by Conestoga-

Rovers & Associates (Table 3) support this conclusion. That is not to say the work has been perfect in all regards.

5. A significant shortcoming, in Wenck's view, was the failure to anticipate the transport of vinyl chloride to the west side of Gilfillan Lake. The pattern of vinyl chloride occurrence in residential wells east of Gilfillan Lake observed in 1993 – 1994 did not preclude the extension of contamination beneath the lake. Thus, the transport distance to the west side had no lower bound, and so, of course, neither did the transport time. The prospect for contaminant arrival there had previously been recognized. One of the conclusions in the 1996 Annual Monitoring Report produced by Conestoga-Rovers & Associates in April 1997 was as follows: "No VOCs were detected in the residential wells sampled on the west side of Gilfillan Lake, which indicates that the remnant VOC plume has not reached the west side of Gilfillan Lake." Sampling data from the well at 12 West Shore Road (Figure 2) provides the clear indication of the remnant VOC plume's arrival on the west side of Gilfillan Lake between October 2002 and October 2004.
6. Another significant shortcoming, in Wenck's view, was the failure to remedy the substantial decrease over time in the on-Site extraction well flow rates. The EW-1/EW-1A flow decreased from around 30 gallons per minute (gpm) during the years 1989 – 1993, to around 12 gpm during 2002 – 2005 (see Table 4). The dimensions of the extraction wells' capture zone are directly proportional to the wells' flow rate. Thus, the well's width of capture and downgradient limit of capture decreased by more than half from the earlier to the later period. Although the extent of contamination in the source area probably shrank during the same interval, there does not seem to be a reasonable justification for a flow decrease of greater than 50%. A new on-Site extraction well, EW-2, was installed at the MPCA's insistence in late 2005.
7. Increased pumping from EW-1/EW-1A would not, however, have prevented the arrival of vinyl chloride in residential wells on the west side of Gilfillan Lake, as discovered in October 2004. The extraction system's purpose is source control. The system's location on the old dumpsite is appropriate for source control but does not enable capture of contaminants that had already left the Site as of the start of operation in 1989. By 1993, it was known that the "remnant VOC plume" (as later mentioned in the 1996 Annual Monitoring Report) extended at least 2,000 feet downgradient from the extraction wells' limit of capture.
8. Ironically, provision of municipal water to the residences on the east side of Gilfillan Lake undoubtedly hastened the arrival of vinyl chloride on the west side of the lake. The combined water use for 60 residences is approximately 20 gpm, on average, based on an estimated usage of 450 gallons per household per day. This means that the residential wells replaced by municipal water were, in terms of average flow rate, on a par with the on-Site extraction system. While these wells remained pumping, they

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tended to hold the remnant plume in place, though imperfectly. When the wells were replaced, their hold vanished.

9. The VOC plume's center of mass probably remains beneath Gilfillan Lake at present. Although the plume of vinyl chloride west of Gilfillan Lake is at present very narrow, the remnant plume that has been observed on the east side of the lake is roughly 2,000 feet wide (north-south extent). Thus, occurrences of vinyl chloride and other VOCs in additional wells on the west side of Gilfillan Lake should be anticipated.
10. Operation of the new extraction well in Ski Hill ravine, EW-3, will probably move contaminated groundwater to locations within its capture zone that are presently contaminant-free. This is a commonly occurring unintended consequence of groundwater extraction systems.
11. The existing and planned St. Paul Regional Water Services' wells have the potential to induce significant contaminant transport downward from the St. Peter to the Prairie du Chien in the Gilfillan Lake-Site vicinity. A study of drawdown effects commissioned by the St. Paul Regional Water Services and produced by Bonestroo Rosene Anderlik & Associates in September 2004 estimated drawdowns on the order of 20 feet in the Prairie du Chien and 10 feet in the St. Peter for the Gilfillan Lake-Site vicinity. Apart from the prospect of interfering with well use in the vicinity, the predicted drawdowns would increase downward leakage from the St. Peter (including groundwater in that aquifer contaminated with vinyl chloride and other VOCs) into the Prairie du Chien.

Tables

Table 1
Groundwater Data for Selected VOCs, June 1993 - January 2006
Residential Wells and Monitoring Wells that Penetrate the Prairie du Chien-Jordan Aquifer
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Location	Sample Date	1,1-DCA ug/L	1,2-DCA ug/L	DCDFM ug/L	DCFM ug/L	VC ug/L	Detected Sum ug/L
Current MDH Health Risk Limit		70	4	1000	--	0.2	--
Draft MDH Health Risk Limit		--	0.6	500	--	0.08	--
Area 3, east:							
<i>Former Residential Well - Prairie du Chien:</i>							
21 Gilfillan Rd	7/7/93	#	#	#	#	0.11	0.11
<i>Former Residential Well - St. Peter-Prairie du Chien:</i>							
7 Lily Pond Rd	7/27/93	#	#	#	#	#	0
<i>Monitoring Well - Prairie du Chien (upper):</i>							
MW17-L (255 ft)	10/19/05	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0
MW17-L (255 ft)	11/23/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
MW17-L (285 ft)	10/19/05	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	0
MW17-L (285 ft)	11/23/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
Area 3, west:							
<i>Monitoring Well - Prairie du Chien (upper):</i>							
MW19-L	12/23/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
MW19-L	1/10/06	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
Area 4, west:							
<i>Residential Well in Use - Jordan:</i>							
9 Duck Pass Rd	10/9/96	< 0.10	< 0.075	< 0.25	< 0.034	< 0.10	0
9 Duck Pass Rd	10/2/01	< 0.20	< 0.10	< 0.25	< 0.088	< 0.20	0
9 Duck Pass Rd	11/17/05	0.50	< 0.20	0.93	0.44	< 0.20	1.87
<i>Residential Wells in Use - St. Peter-Prairie du Chien:</i>							
20 Duck Pass Rd	6/24/93	#	#	#	#	#	0
20 Duck Pass Rd	4/19/94	< 0.10	< 0.075	*	< 0.034	< 0.036	0
20 Duck Pass Rd	10/12/99	< 0.20	0.16	0.30	< 0.088	< 0.20	0.46
20 Duck Pass Rd	10/14/03	< 0.097	< 0.12	0.20	< 0.19	< 0.14	0.20
20 Duck Pass Rd	11/17/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
20 Duck Pass Rd	11/17/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0

Groundwater Data for Selected VOCs, June 1993 - January 2006
Residential Wells and Monitoring Wells that Penetrate the Prairie du Chien-Jordan Aquifer
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Location	Sample Date	1,1-DCA ug/L	1,2-DCA ug/L	DCDFM ug/L	DCFM ug/L	VC ug/L	Detected Sum ug/L
Current MDH Health Risk Limit		70	4	1000	--	0.2	--
Draft MDH Health Risk Limit		--	0.6	500	--	0.08	--
1 Poplar Ln	8/5/93	#	#	#	#	#	0
1 Poplar Ln	10/9/96	< 0.10	< 0.075	< 0.25	< 0.034	< 0.10	0
1 Poplar Ln	10/1/02	< 0.20	< 0.10	< 0.25	< 0.088	< 0.20	0
1 Poplar Ln	3/29/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
1 Poplar Ln	5/23/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
1 Poplar Ln	11/10/05	< 0.20	< 0.20	< 1.0	< 0.50	< 0.20	0
Area 5, east:							
<i>Former Residential Well - St. Peter-Prairie du Chien:</i>							
19 Dove Ln	8/5/93	#	#	#	#	0.31	0.31
19 Dove Ln	9/2/93	#	#	#	#	#	0
19 Dove Ln	9/16/93	#	#	#	#	#	0
19 Dove Ln	9/16/93	#	#	#	#	#	0
Maximum Concentration		0.50	0.16	0.93	0.44	0.31	1.87
Sample Count		27	27	27	27	27	27
Number of Detections		1	1	3	1	2	5
Number > Current HRL		0	0	0	--	1	--
Number > Draft HRL		--	0	0	--	2	--

Data sources: Annual Monitoring Reports for 2003 (1994 - 2003 data), 2004, and 2005 by CRA.

Note: 1,1-DCA = 1,1-dichloroethane; 1,2-DCA = 1,2-dichloroethane; DCDFM = dichlorodifluoromethane; DCFM = dichlorofluoromethane; and VC = vinyl chloride. Data qualifiers have been trimmed and are ignored in statistics shown here; hence, estimated values (close to detection limits) are treated as though accurate. Asterisk indicates compound not analyzed in sample. Number sign indicates no value reported in source document, probably meaning non-detection.

Table 2
Chronology of Events
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date or Period	Event or Activity	Reference
1920s - mid-1960s	Private burning dump operates at Site	CRA, December 1986
1967-1968	Red Arrow purchases Site and continues dump operations	CRA, December 1986
1960s late	Site operations change from burning to land disposal	CRA, December 1986
1960s - 1970s early	Some hazardous waste accepted at Site	CRA, December 1986
1973 approximately	Site operations change from disposal to waste transfer	CRA, December 1986
1981	MPCA inspects Site after complaint about hazardous waste-dumping, finds no imminent hazard	CRA, December 1986
1984	MPCA asks EPA to inspect Site under routine protocol	CRA, December 1986
1985 - 1986	EPA Field Investigation Team installs 8 wells at Site in glacial drift, samples groundwater, finds VOCs	CRA, December 1986
1986 April	MPCA samples 5 residential wells near Site; finds some VOCs but no VC	CRA, December 1986
1986 July	MPCA issues Request for Response Action to 3 potentially responsible parties	CRA, December 1986
1986	RP (Reynolds Metals Company & Whirlpool Corporation) retain CRA	CRA, December 1986
1987 - 1988	RP remove 47 drums from North Disposal Area	CRA, January 1996
1988	MDH issues drinking water advisories for 3 residences (2 Blue Goose Rd, 7 & 11 Robb Farm Rd)	MDH, January 1991
1989 June	RP install extraction well EW-1 on Site and initiate groundwater extraction	CRA, January 1996
1991 January	MDH issues Site Health Assessment, finding bottled water provision sufficiently protects human health	MDH, Jan 1991
1991 January	MDH rescinds the three 1988 drinking water advisories	MDH, May 1991
1993 May	RP remove 305 drums from South Disposal Area	CRA, January 1994
1993 June	MDH issues Public Health Consultation, discussing 2 new drinking water advisories, other items	MDH, June 1993
1993	MDH issues Drinking Water Advisories for wells at total of 12 North Oaks residences	CRA, March 2006
1993	MPCA and CRA begin regular monitoring of 51 residential wells in area downgradient from Site	MPCA, October 7, 1993
1993 October 7	Minnesota Decision Document executed, specifying RP's remediation requirements	MPCA, October 7, 1993

Chronology of Events
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date or Period	Event or Activity	Reference
1994 spring	RPs provide public water supply from White Bear Township to 60 residences east of Gilfillan Lake	CRA, January 1996
1994 Aug - Dec	RPs remove 111 drums from North Pond and from North and South Disposal Areas	CRA, January 1996
1994 Oct - Dec	RPs transfer waste from South to North Disposal Area, consolidate and cover all waste there	CRA, January 1996
1994 November	RPs install dewatering sump in Consolidated Waste Area (former North Disposal Area)	CRA, January 1996
1995 January 9	Consent Order executed, changing Site's VC cleanup level from 0.1 to 2 ug/L, among other items	MPCA, January 9, 1995
1995 January	RPs install new extraction well EW-1A, initiate operation as replacement for EW-1	CRA, January 1996
1996 November	RPs install 3 passive methane vents in Consolidated Waste Area (former North Disposal Area)	CRA, March 2006
2000 May	Residential-converted monitoring well at 6 Wren Ln sealed	CRA, March 2006
2003 April 21	MDH issues Health Consultation for Weston Woods development, focused on indoor air quality	MDH, April 21, 2003
2003 August 27	CRA proposes to stop residential well sampling after extraction well shutdown, anticipated imminently	CRA, August 27, 2003
2004 September 12	MPCA approves August 27, 2003 monitoring plan with minor modifications	MPCA, September 12, 2003
2004 October 1	State Attorney General intervenes on access issue for new monitoring wells east of Gilfillan Lake	Netten, October 1, 2004
2004 October	Routine monitoring finds VC in 2 residential wells west of Gilfillan Lake (12 & 13 West Shore Rd)	CRA, March 2006
2004 Oct - 2005 May	CRA, MPCA sample 45 residential wells, mostly west of Gilfillan Lk, find VC also at 2 Hummingbird Hill	CRA, June 2005
2005 March 17	RPs offer to supply bottled water to any home west of Gilfillan Lake where well VC exceeds 0.08 ug/L	Payne, June 1, 2005
2005 April (approx)	Barr Engineering begins technical review on behalf of 12 West Shore Rd owner's attorney	Barr, April 25, 2005
2005 May 6	MDH issues drinking water advisory to 13 West Shore Rd resident	MDH, May 6, 2005
2005 June 1	RPs offer to install deeper (Prairie du Chien) well for 13 West Shore Rd resident	Payne, June 1, 2005
2004 July (approx)	Barr asks Fletcher Driscoll, hydrogeologist, to review Site-related documents on client's behalf	Barr, July 21, 2005
2005 July 21	Barr comments on June 2005 CRA report; calls for 21 new monitoring wells, other actions	Barr, July 21, 2005
2005 July 27	North Oaks City Council holds special session on Site-groundwater issues	Barr, August 9, 2005

Chronology of Events
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date or Period	Event or Activity	Reference
2005 August 17	City urges MPCA immediately to achieve permanent solution for Site-groundwater issues	Watson, August 17, 2005
2005 summer-fall	RP's gain access from HOHOA and 8 Edgewater Ln owner for new monitoring wells, incl in Ski Hill ravine	Salveson, Oct 20, 2005
2005 fall	RP's begin negotiations with home owners at 12 and 13 West Shore Rd for monitoring well access	Salveson, Oct 20, 2005
2005 Sep - Oct	RP's install 3 on-Site wells: extraction well EW-2, compliance monitoring wells MW-16D & B	CRA, March 2006
2005 Oct - Dec	RP's install 5 off-Site monitoring wells: MW-17A, B & L (east of Gilfillan Lk), MW-19B & L (west)	CRA, March 2006
2005 Jun - 2006 Jan	Per MPCA direction, CRA conducts further study, incl residential well sampling	CRA, February 2006
2006 March 9	City asks MPCA again for answers on present and future aquifer quality, future contaminant movement	Watson, March 9, 2006
2006 March 28	MDH issues North Oaks Health Consultation; finds current public health protections adequate	MDH, March 28, 2006
2006 April 10	MPCA responds to City's March 9 letter; states plume limits defined, public health protected	MPCA, April 10, 2006
2006 April 18	City amplifies views and insists on answers from MPCA regarding Site-groundwater issues	Watson, April 18, 2006
2006 April 20	NOHOA endorses Mayor's March 9 letter and emphasizes need for further investigation	Olson, April 20, 2006
2006 May 3	MPCA responds point-by-point to April 20 NOHOA letter	MPCA, May 3, 2006
2006 September 28	RP's execute access agreement with 15 West Shore Rd owner for groundwater investigation	Netten, October 5, 2006
2006 October 10	CRA proposes groundwater investigation at 15 West Shore Rd, in lieu of 12 or 13 West Shore Rd	CRA, October 10, 2006
2006 October 16	MPCA approves work plan for 15 West Shore Rd investigation	MPCA, October 16, 2006
2006 Oct - Nov	CRA installs monitoring wells at 15 West Shore Rd, conducts investigations there and in Ski Hill ravine	Campbell, Nov 28, 2006
2006 November	CRA installs and test-pumps new extraction well EW-3 in Ski Hill ravine	Campbell, Nov 28, 2006

References for Chronology:

Barr, April 25, 2005. Letter from Mark Deady, Barr Engineering, to F. Campbell, MPCA, re:Highway 96 Dump Site - Technical Inquiries.

Barr, July 21, 2005. Letter from M. Deady, Barr Eng., to F. Campbell & N. Fellows, MPCA, re: Groundwater and Residential Well Evaluation - North Oaks, Minnesota.

Barr, August 9, 2005. Letter from Mark Deady, Barr Engineering, to N. Fellows, MPCA, re:Highway 96 Dump Site - Barr's Response to...MPCA & Others..During..Session.

Chronology of Events
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date or Period	Event or Activity	Reference
	Campbell, Nov 28, 2006. Personal communication, telephone conference between F. Campbell, MPCA, and J. Erdmann, Wenck Associates, Inc.	
	CRA, December 1986. Evaluation Report - White Bear Lake Township Dump Site, Ramsey County, Minnesota.	
	CRA, January 1994. South Disposal Area Groundwater Investigation - Highway 96 Site, White Bear Township, Minnesota.	
	CRA, January 1996. Remedial Action Final Report - Highway 96 Site, White Bear Township, Minnesota.	
	CRA, August 27, 2003. Letter from E. Hoglund to M. Rys, MPCA, re: Proposed Groundwater Monitoring Plan - Highway 96 Site, White Bear Township, Minnesota.	
	CRA, June 2005. Groundwater and Residential Well Evaluation North Oaks, Minnesota - Highway 96 Site, White Bear Township, Minnesota.	
	CRA, February 2006. Groundwater and Residential Well Evaluation North Oaks, Minnesota - June 2005-January 2006 - Highway 96 Site, White Bear Township, Minnesota.	
	CRA, March 2006. 2005 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.	
	CRA, October 10, 2006. Letter from Sarah Illi to F. Campbell, MPCA, re: Proposed Groundwater Investigation, 15 West Shore Road, North Oaks, Minnesota.	
	MDH, January 1991. Highway 96 Dumpsite Health Assessment.	
	MDH, May 1991. Addendum to the Health Assessment for Highway 96 Dump White Bear Township (Jan 1991).	
	MDH, June 1993. Public Health Consultation - Highway 96 Dump and North Oaks Groundwater Contamination.	
	MDH, April 21, 2003. Health Consultation - Weston Woods Development Site, White Bear Township.	
	MDH, May 6, 2005. Letter from James Kelly to M. Eisenschenk, 13 West Shore Rd, North Oaks.	
	MDH, March 28, 2006. Health Consultation - North Oaks Private Well Contamination Associated with the Highway 96 Dump, City of North Oaks, Ramsey County, Minnesota.	
	MPCA, October 7, 1993. Minnesota Decision Document. Highway 96 Dump, White Bear Township.	
	MPCA, January 9, 1995. Consent Order. In the matter of the Highway 96 Dump, Ramsey County.	
	MPCA, September 12, 2003. Letter from M. Rys to E. Hoglund, CRA, re: Proposed Ground Water Monitoring Plan, Highway 96 Site, White Bear Township, August 27, 2003.	
	MPCA, April 10, 2006. Letter from Michael Kanner to T. Watson, Mayor, North Oaks, re: Highway 96 Dump Superfund Site, City Letter of March 9, 2006.	
	MPCA, May 3, 2006. Letter from Tim Sherkenbach, MPCA, to L. Olson, President, NOHOA, re: Highway 96 Dump Superfund Site.	
	MPCA, October 16, 2006. Letter from N. Fellows and F. Campbell to S. Illi, CRA, re: Proposed Groundwater Investigation, 15 West Shore Road, North Oaks, Minnesota.	

Chronology of Events
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date or Period	Event or Activity	Reference
Netten, October 1, 2004.	Letter from Carmen Netten, Asst. Att. Gen., MN, to David Eide, attorney for NOHOA, re: Highway 96 White Bear Dump Superfund Site.	
Netten, October 5, 2006.	Letter from C. Netten, Asst. Att. Gen., MN, to D. Colton, Leonard Street Deinard, and D. Kelly re: Highway 96 White Bear Dump Superfund Site.	
Olson, April 20, 2006.	Letter from Eugene Olson, President, NOHOA, to Sheryl Corrigan, Commissioner, MPCA, re: Highway 96 Superfund Dump Site.	
Payne, June 1, 2005.	Letter from James Payne, Environmental Law Group, to F. Campbell, MPCA, re: Highway 96 Site, Well Advisory at 13 West Shore Road, North Oaks.	
Salveson, Oct 20, 2005.	Letter from Erik Salveson, Gray Plant Mooty, to Daniel Colton, Leonard Street Deinard, re: Proposed Access Agreement for Monitoring Wells.	
Watson, August 17, 2005.	Letter from Thomas Watson, Mayor, North Oaks, to F. Campbell, MPCA, re: Highway 96 Superfund Dump Site.	
Watson, March 9, 2006.	Letter from T. Watson, Mayor, North Oaks, to F. Campbell, MPCA, re: Highway 96 Superfund Dump Site.	
Watson, April 18, 2006.	Letter from T. Watson, Mayor, North Oaks, to F. Campbell, MPCA, re: Highway 96 Superfund Dump.	
Notes:		
Barr = Barr Engineering, Inc., Bloomington MN		
CRA = Conestoga-Rovers & Associates Limited, consultants for RPs		
EPA = U.S. Environmental Protection Agency		
MDH = Minnesota Department of Health		
MPCA = Minnesota Pollution Control Agency		
NOHOA = North Oaks Home Owners' Association, Inc.		
RPs = Responsible parties (Reynolds Metals Company & Whirlpool Corporation in this case)		
VC = Vinyl chloride, compound of major concern near Highway 96 Site		
VOCs = Volatile organic compounds		

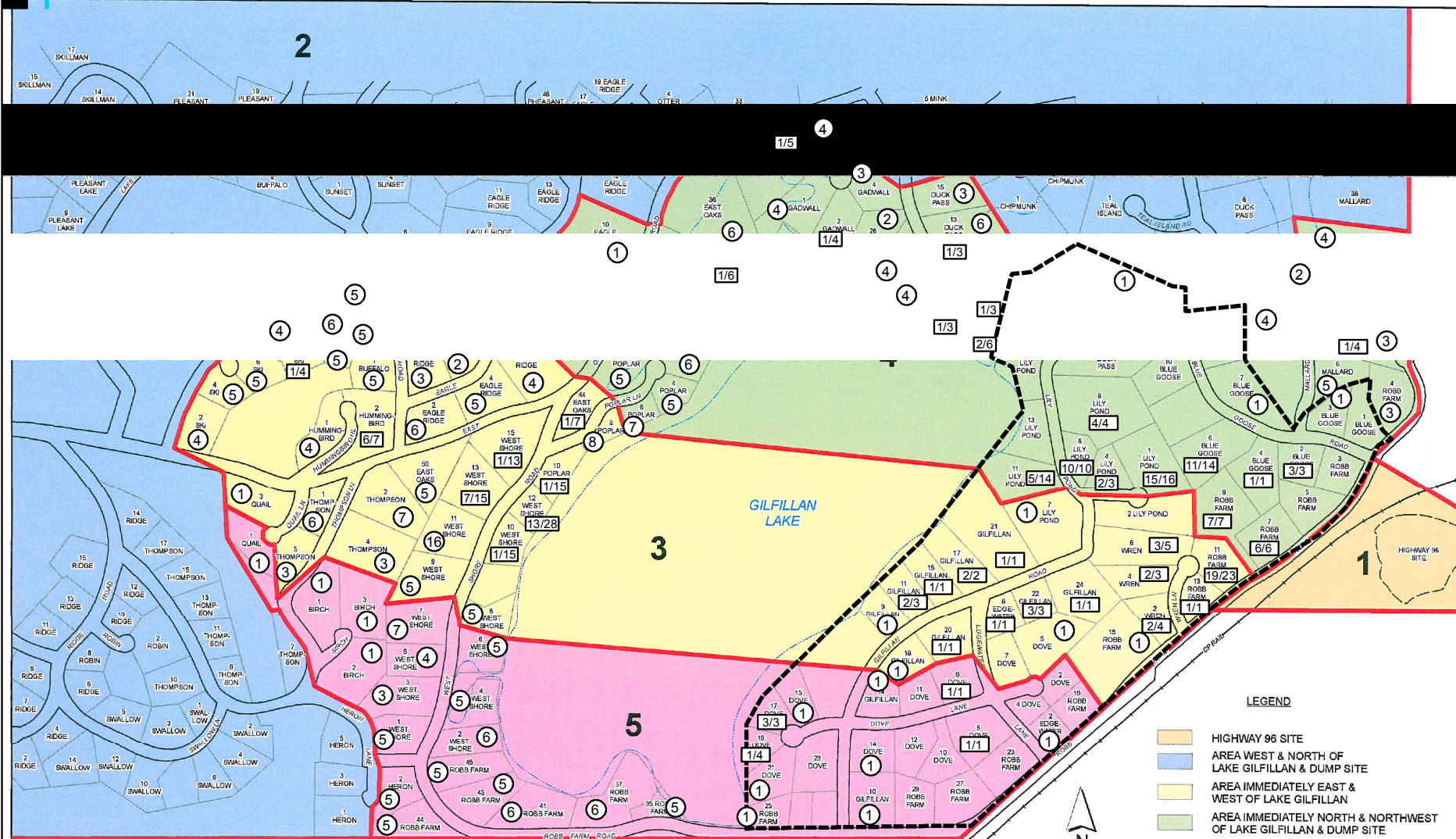
Table 3
List of Reports by Conestoga-Rovers & Associates Limited Reviewed for the Present Study
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date	Report Title
Dec-86	Evaluation Report - White Bear Lake Township Dump Site, Ramsey County, Minnesota.
Mar-88	Remedial Investigation/Interim Response Action Plan - White Bear Lake Township Dump Site, White Bear Lake, Minnesota.
Nov-90	Comments on Health Advisories - Highway 96 Dump, White Bear, Minnesota.
Aug-92	Evaluation of Groundwater Remediation on Local Pond and Lake Levels - Highway 96 Site, White Bear Township, Minnesota.
Oct-93	North Oaks-Southeast Area Groundwater Investigation - Highway 96 Site, White Bear Township, Minnesota.
Jan-94	South Disposal Area Groundwater Investigation - Highway 96 Site, White Bear Township, Minnesota.
May-94	Phase II Response Action Plan - Construction Details - Highway 96 Site, White Bear Township, Minnesota.
Jan-96	Remedial Action Final Report - Highway 96 Site, White Bear Township, Minnesota.
Apr-97	1996 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.
Mar-04	2003 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.
Mar-05	2004 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.
Jun-05	Groundwater and Residential Well Evaluation North Oaks, Minnesota - Highway 96 Site, White Bear Township, Minnesota.
Feb-06	Groundwater and Residential Well Evaluation North Oaks, MN - June 2005-January 2006 - Highway 96 Site, White Bear Township, MN.
Mar-06	2005 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.

Table 4
Extraction Well Flow History
Review of Highway 96 Site Groundwater Impacts for City of North Oaks

Date or Period	Approximate System Flow Rate (gpm)	Well in Operation	Reference
1989 June 14 - 20	31	EW-1	CRA, July 21, 1989
1989 Jun - 1994 Jan	20 - 40	EW-1	CRA, January 1996
1992	45 (approx)	EW-1	CRA, May 4, 1992
1994 Feb - Mar	24 - 26	EW-1	CRA, May 10, 1994
1994 Jan - Dec	decrease from 30 to 12	EW-1	CRA, January 1996
1995 January	30	EW-1A	CRA, January 1996
2002 - 2003	11 - 14.5	EW-1A	CRA, March 2004
2004 Jan-Dec	12 - 15	EW-1A	CRA, March 2005
2005 Jan-Dec	12 - 14	EW-1A	CRA, March 2006
2005 Sep-Dec	--	EW-2 installed	CRA, March 2006
References:			
CRA, July 21, 1989. Letter from R. Frehner to C. Twaroski, MPCA, re: Highway 96 Dump - Interim Remedy.			
CRA, May 4, 1992. Letter from S. Mockenhaupt to M. Horneff, MPCA, re: Highway 96 Dump - Progress Update.			
CRA, May 10, 1994. Letter from S. Mockenhaupt to B. Van Ryswyk, MPCA, re: Highway 96 Site - Extraction Well EW1.			
CRA, January 1996. Remedial Action Final Report - Highway 96 Site, White Bear Township, Minnesota.			
CRA, March 2004. 2003 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.			
CRA, March 2005. 2004 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.			
CRA, March 2006. 2005 Annual Monitoring Report - Highway 96 Site, White Bear Township, Minnesota.			

Figures



EXPLANATION

- ③ Well with no VOC* detections; 3=total number of samples
 1/15 Well with VOC* detection(s); 1=number of samples with detection(s), 15=total number of samples
 VOC* here specifically means vinyl chloride, 1,1-dichloroethane, 1,2-dichloroethane, dichlorodifluoromethane, or dichlorofluoromethane



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GEOGRAPHIC AREAS - DETAILED MAP North Oaks, MN

CITY OF NORTH OAKS

Map of VOC Detections in Residential Wells, 1993-2005

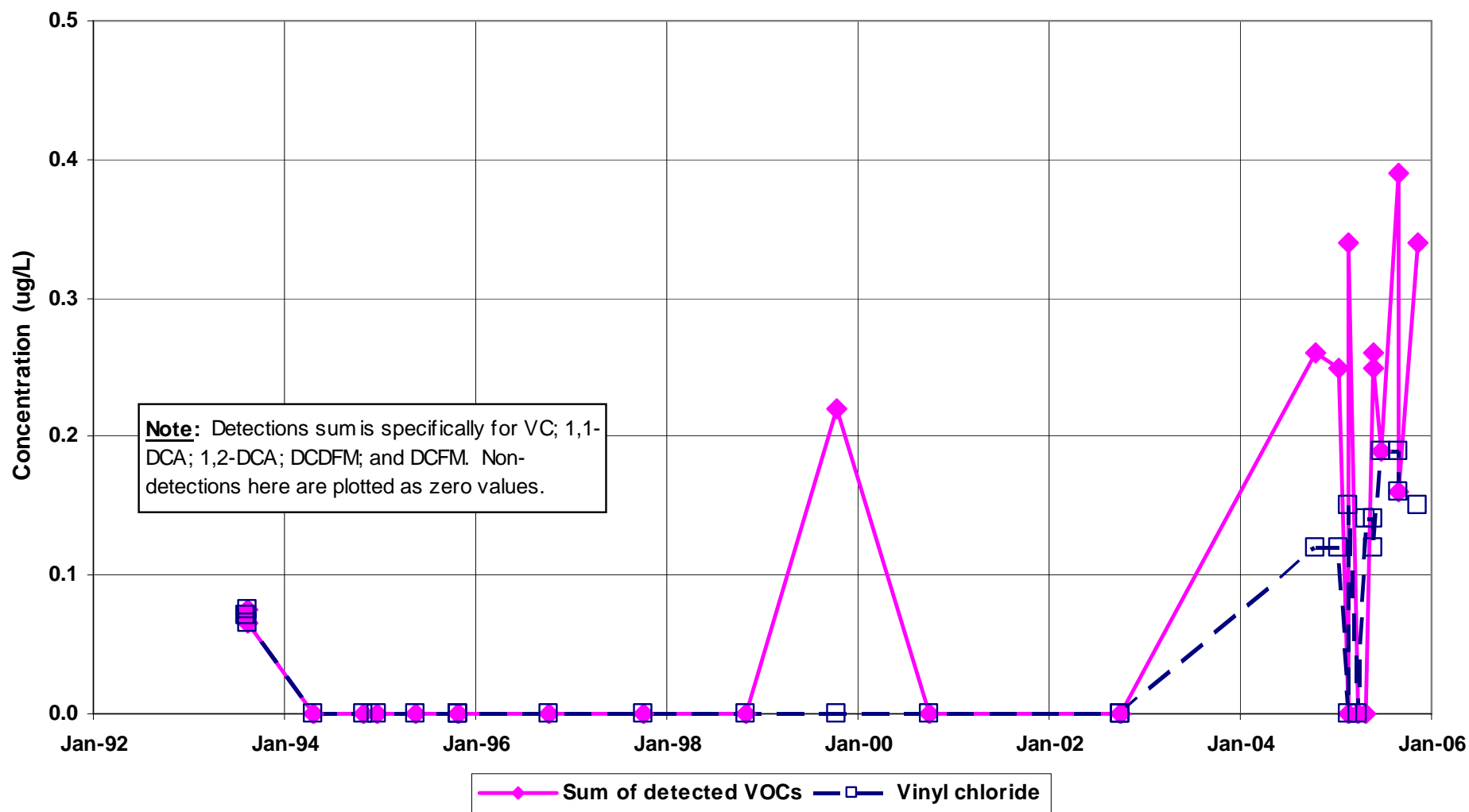


Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
 Environmental Engineers Maple Plain, MN 55359-0429

JAN 2007

Figure 1



CITY OF NORTH OAKS

VOC Concentrations, 1993 – 2005 St. Peter Residential Well at 12 West Shore Rd



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Environmental Engineers Maple Plain, MN 55359

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FIGURE 2

Recommendations

Review of Highway 96 Site

Groundwater Impacts for City of North Oaks



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MEMORANDUM

TO: Mayor and City Council of North Oaks
North Oaks Home Owners' Association
FROM: John B. Erdmann, Wenck Associates, Inc.
DATE: January 3, 2007
SUBJECT: Review of Highway 96 Site Groundwater Impacts – Recommendations

Following are Wenck's recommendations to the City of North Oaks concerning groundwater impacts from the Highway 96 Site.

1. Communicate Wenck's finding to the Minnesota Pollution Control Agency (MPCA) that vinyl chloride and other VOC occurrences should be anticipated in additional wells on the west side of Gilfillan Lake.
2. Urge the MPCA to continue residential well sampling in the western portion of Area 3 at frequencies appropriate to each well's location. Higher frequency monitoring is needed for wells along the west shore of Gilfillan Lake, and for wells near the vinyl chloride plume axis. A minimum frequency of annual sampling is recommended for the remaining portions of Area 3 west.
3. Urge the MPCA to require groundwater extraction at EW-3 at a rate that will ensure capture of the full width of Area 3 west.
4. Urge the MPCA to consider means other than deeper wells for providing safe water to residents with impacted St. Peter wells. Point-of-entry treatment with granular activated carbon may be a preferable alternative.