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Third Five-Year Review Report
for
Pagel's Pit Superfund Site
Winnebago County, Illinois

Prepared by:
United States Environmental Protection Agency
Region 5
Chicago, Illinois

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Approved by: Date:

Richard C. Karl, Director
Superfund Division
U.S. EPA, Region 5

9-20-12

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List of Acronyms

AOC	Administrative Order by Consent
AGQS	applicable groundwater quality standard of 35 IAC 811.320
ARARs	applicable or relevant and appropriate requirements
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cis-1,2-DCE	cis-1,2-dichloroethene
CQA	construction quality assurance
ESD	Explanation of Significant Differences
FS	feasibility study
GCCS	gas collection and control system
GIA	groundwater impact assessment
GMZ	groundwater management zone
HCTU	home carbon treatment unit
HI	hazard index
IAC	Illinois Administrative Code
IC	institutional control
IEPA	Illinois Environmental Protection Agency
ILCS	Illinois Compiled Statutes
IPCB	Illinois Pollution Control Board
LFG	landfill gas
LTRA	long-term remedial action
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
msl	mean sea level
N	nitrogen
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OU	operable unit
PAH	polynuclear aromatic hydrocarbons
PCE	tetrachloroethylene (perchloroethylene)
PRP	potentially responsible party
RA	remedial action
RPM	remedial project manager
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RI	remedial investigation
ROD	Record of Decision
SVOC	semivolatile organic compound
TCE	trichloroethene
U.S. EPA	United States Environmental Protection Agency
UU/UE	unlimited use or unrestricted exposure
VOC	volatile organic compound

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Executive Summary

The remedy for the Pagel's Pit Superfund site (Site), Winnebago County, Illinois, is set forth in a Record of Decision (ROD) dated June 28, 1991 for operable unit (OU) 1 and a ROD dated September 30, 1999 which includes the remedy for OU 2 and also amends the remedy for OU 1.

This remedy included:

- an engineered final cover system for the waste disposal area (OU 1);
- leachate extraction and transfer of the leachate to the local publicly owned treatment works for treatment (OU 1);
- gas extraction and the use of the gas for fuel or the flaring of the gas (OU 1);
- restoration of the aquifer outside the waste disposal area and the zone of attenuation to drinking water standards via monitored natural attenuation with a contingency for the groundwater downgradient of the Site (OU 1);
- deed restrictions limiting the development of the property and the placement of new wells on the property and adjacent to the Site, including the area west of Killbuck Creek (OU 1), and limiting the placement of new wells on the southeast corner property (OU 2); and
- Site monitoring, including monitoring of the groundwater in the southeast corner, and maintenance of all remedial action components (OU 1 and OU 2).

The contingency remedy for the aquifer restoration is an active system that would be implemented if it were determined that the groundwater contamination was not decreasing satisfactorily downgradient or the contaminated groundwater would become an immediate threat to a downgradient water supply. The U.S. Environmental Protection Agency (U.S. EPA) noted construction completion in the ROD dated September 30, 1999. The construction of the cover was completed with the acceptance by Illinois Environmental Protection Agency (IEPA), Bureau of Land, Permit Section of the construction quality assurance (CQA) report for the eastern portion in May 2002. The trigger for this third five-year review was the signing of the second five-year review on September 24, 2007. In late 2007, a landfill gas-to-electricity plant that uses gas from the Site became operational and was supplying power to the grid.

The assessment of this five-year review is that the remedy was constructed in accordance with the two RODs and is functioning as anticipated. The remedies for OU 1 and OU 2 are protective of human health and the environment in the short term because exposure pathways that could result in unacceptable risks are being controlled. Therefore the remedy for the entire Site is protective in the short term. Long-term protectiveness requires compliance with effective institutional controls (ICs). In order for the remedies for OU 1 and OU 2 to be protective in the long term, additional ICs are necessary and the effectiveness of the ICs and of the long-term stewardship procedures need to be evaluated. Long-term stewardship requires that effective ICs will be maintained and monitored along with maintaining the Site remedy. All required remedies are included in the active permits issued by IEPA.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Pagel's Pit		
EPA ID: ILD980606685		
Region: 5	**State:** IL	**City/County:** Winnebago County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: U.S. EPA
Author name: Bernard Schorle
Author affiliation: U.S. EPA
Review period: 9/11 to 9/12
Date of site inspection: 9/08/11
Type of review: Statutory
Review number: 3
Triggering action date: 9/24/07
Due date ***(five years after triggering action date)*****:** 9/24/12

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
None

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU 1 and OU 2	**Issue Category:** Institutional controls			
	Issue: 1A. Institutional Controls-- The additional ICs specified by the 1999 ROD need to be implemented and existing ICs need to be reviewed. 1B. Institutional Controls--Along with assuring that effective ICs are in place for all areas that do not support unlimited use, long-term stewardship must be assured, which includes maintaining and monitoring effective ICs.			
	Recommendation: 1A. Institutional Controls--The landfill owner will be directed to perform a study of the ICs. 1B. Institutional Controls--U.S. EPA will review the landfill owner's IC study and existing solid waste permit, develop an IC plan to identify required follow-up actions to assure that effective ICs are in place, and based on IC study, PRP will implement ICs as needed, and assure that effective procedures exist for long-term Site stewardship.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP/U.S. EPA	U.S. EPA	June 2013

Sitewide Protectiveness Statement

Protectiveness Determination:
Short-term Protective

Protectiveness Statement:
The remedies for OU 1 and OU 2 are protective of human health and the environment in the short term because the remedy is functioning as anticipated and exposure pathways that could result in unacceptable risks are being controlled. Therefore the remedy for the entire Site is protective in the short term. Long-term protectiveness requires compliance with effective ICs. In order for the remedies for OU 1 and OU 2 to be protective in the long term, additional institutional controls are necessary and the effectiveness of the institutional controls and of the long-term stewardship procedures need to be evaluated. Long-term stewardship requires that effective ICs will be maintained and monitored along with maintaining the Site remedy.

Pagel's Pit Superfund Site
Winnebago County, Illinois
Third Five-Year Review Report

I. Introduction

The purpose of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in a five-year review report. In addition, the five-year review report identifies issues found during the review, if any, and identifies recommendations to address them.

The United States Environmental Protection Agency (U.S. EPA) is preparing this five-year review report pursuant to Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. § 9621, and to the National Contingency Plan (NCP), 40 CFR Part 300. Section 121 of CERCLA states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section 104 or 106, the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

U.S. EPA interpreted this requirement further in the NCP. The NCP in 40 CFR §300.430(f)(4)(ii) states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

Region 5 of the U.S. EPA, which is the lead agency for the Site, has conducted the five-year review of the remedy implemented at the Pagel's Pit Superfund Site (the Northern Unit, sometimes called the North Unit, of Winnebago Reclamation Service's Winnebago Landfill) near Rockford, Illinois. This review was conducted for the entire Site by the remedial project manager (RPM) through May 2012. This report documents the results of the review.

This is the third five-year review for the Pagel's Pit Site. The triggering action for this statutory review is the signature date of the second five-year review report, September 24, 2007. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use or unrestricted exposure (UU/UE).

II. Site Chronology

Event	Date
Landfill began operation	7/17/72
Discovered landfill gas escaping from the landfill and began gas extraction	approximately 1980
Fund-lead remedial investigation (RI) and feasibility study (FS) began	10/1/84
Site proposed for the National Priorities List (NPL)	10/15/84
Finalized on the NPL	6/10/86
Administrative Order by Consent for the RI and FS	8/27/86 effective 10/16/86
Potentially responsible parties (PRPs) take over the RI and FS	8/27/86
Reports for the RI and FS submitted	March 1991
Proposed Plan for operable unit (OU) 1 released	4/16/91
Public meeting to discuss Proposed Plan and RI and FS reports	4/25/91
End of public comment period for the Proposed Plan for OU 1	5/16/91
Record of Decision (ROD) for OU 1	6/28/91
Consent Decree for OU 1 remedial design (RD) and remedial action (RA)	lodged 11/25/92 entered 2/11/93
RD began	12/14/92
On-site mobilization for RA began (closure of western portion of landfill)	7/14/97
RA began	8/8/97
Construction quality assurance report for western portion submitted to Illinois Environmental Protection Agency (IEPA)	2/23/98
Western portion construction quality assurance report accepted by the IEPA	6/18/98
Proposed Plan for OU 2 remedy and OU 1 remedy amendment released	about 8/13/99
Public meeting to discuss OU 2 proposed remedy and OU 1 proposed remedy change	8/25/99
Informal public meeting to expand on the discussion that began at 8/25/99 meeting	9/8/99
End of public comment period for the 1999 Proposed Plan	9/11/99
ROD for OU 2 remedy and ROD Amendment for OU 1 remedy change	9/30/99
Construction completion under CERCLA	9/30/99
Closure of eastern portion of landfill began	August 2000
Construction quality assurance report for eastern portion submitted to IEPA	September 2001
Eastern portion construction quality assurance report accepted by the IEPA	May 2002
First five-year review report	9/27/02
Second five-year review report	9/24/07
Site inspection for third five-year review	9/08/11

III. Background

Physical Characteristics

The former Pagel's Pit Site occupied about 90 acres and is located in southern Winnebago County at 8403 Lindenwood Road. It is on the west side of Lindenwood Road, south of Baxter Road, about 5 miles south of Rockford, Illinois. The solid waste landfill part of the Superfund Site began accepting wastes in 1972 under an IEPA permit and is designated as the Northern Unit

of the Winnebago Landfill Facility. The Northern Unit ceased accepting solid wastes in 2000 when it reached its permitted capacity; it encompassed about 42.7 acres. The operator has developed and operated a new landfill under an IEPA permit for the remaining acreage, located south of the Northern Unit, which is called the Southern Unit; it encompasses about 27.65 acres. These two disposal units are separate units but are authorized under a single IEPA permit, Permit No. 1991-138-LF. The Southern Unit, however, is not part of the Superfund Site. These two units, the groundwater monitoring wells, and some other features near the Site are shown in Figure 1. It is to be noted that the designations for some of the monitoring wells have changed over the years due to permit requirements. Wastes have also been disposed of on the land between the Northern and the Southern Units and on the side slopes of these two units above the land between them, an area which is call the Southern Unit Expansion. This area was permitted by the State under Subtitle D standards and is constructed with an earthen and high-density polyethylene liner with a leachate collection system. With the construction of the Southern Unit Expansion, the area of the Northern Unit has been reduced to about 31.59 acres. The total area of the Southern Unit Expansion is about 13.1 acres. There is another unit north of the Northern Unit, called the North Expansion Unit, which is now accepting wastes. This unit was constructed and is operating under a different permit (Permit No. 2006-221-LF).

Municipal refuse and sewage treatment plant sludge (non-hazardous solid wastes) were the primary wastes accepted at the Site. Other industrial wastes were accepted that are defined as "special wastes" in the Illinois statutes. An Illinois special waste is a broad category of wastes that does not meet the definition of municipal refuse. Special wastes are defined in 35 Illinois Administrative Code (IAC) Part 810 as "industrial process waste, pollution control waste or hazardous waste, except as determined pursuant to section 22.9 of the act and 35 Ill. Adm. Code 808."

The topography surrounding the landfill area is generally relatively flat to gently rolling. The landfill lies outside the 100-year floodplain of Killbuck Creek and is not within any designated wetland area. A small wetland area was identified near the waste disposal area but has since been moved and expanded under a U.S. Army Corps of Engineering permit.

The surficial unconsolidated deposits in the area of the Site are predominantly glacial drift ranging from a thin mantle over the dolomite in the bedrock uplands to the east of the Site to greater than 70 feet in the bedrock valley west of the Site. The unconsolidated deposits are predominantly sand and gravel underneath and north of the Site with a silty clay to the south of the Site. The underlying bedrock surface is highly variable. The dolomite bedrock is generally fractured but the intensity is variable. Chert layers or nodules were commonly noted on boring logs as were vugs, small void spaces, expected in dolomite, but cavernous zones are not present.

Land and Resource Uses

The Site is located in a predominately rural unincorporated area. It is bounded on the west by Killbuck Creek and on the east by Lindenwood Road. The contaminated groundwater has moved to the west side of Killbuck Creek, thus moving the boundaries of the Site beyond the 90 acres mentioned above. Killbuck Creek, a perennial stream, merges with the Kishwaukee River about 2.5 miles northwest of the Site. The Kishwaukee River merges with the Rock River about 1.5

miles northwest of the confluence of Killbuck Creek and the Kishwaukee River. The Site is located on a topographic high between Killbuck Creek to the west and unnamed intermittent streams to the north and the south. Land use around the Site has been a mix of agricultural, rural residential, commercial, and industrial. However the residences that were closest to the Site at the time of the remedial investigation no longer exist or are not used as residences. The Rockford Skeet and Trap Club is located near the entrance to the Site.

The Acme Solvent Reclaiming (Morristown Plant) Superfund site (Acme Solvent site) is located east of the Pagel's Pit Site; the Acme Solvent site is shown on Figure 1. The Acme Solvent site was proposed for U.S. EPA's National Priorities List (NPL) in December 1982 and was finalized on the list in September 1983. Around 1990 the general direction of groundwater flow in the area of the two sites was from east to west in the upper aquifer. Contamination released from the Acme Solvent site was carried toward the Pagel's Pit Site. Part of the remediation for the Acme Solvent site was the installation of a pump-and-treat system that includes downgradient extraction wells approximately half-way between the two sites and mass extraction wells closer to the Acme Solvent site. The system was placed into full-scale service in January 1996; the downgradient extraction wells were taken out of service in January 2000. The groundwater extraction and treatment system was placed in a long-duration pulse mode operation in September 2007 to address changes in site conditions and improve performance of the system in meeting ground water cleanup objectives. Under the pulse mode operational adjustment, the system is run intermittently and then maintained in stand-by status during inactive periods. Operation of the system has affected the groundwater flow directions between the two sites. The purpose of this system is to prevent or minimize the movement of contaminated groundwater from the Acme Solvent site toward the west, northwest, and southwest. The treated water is discharged into the intermittent stream that passes across the Acme Solvent site, lies north of the Pagel's Pit Site, and discharges into Killbuck Creek; generally the water infiltrates the ground before it reaches Killbuck Creek. The population of Winnebago County was approximately 295,000 in 2010 with about 139,000 people residing in Rockford.

History of Contamination

The Northern Unit is located at a former sand and gravel quarry. It opened for business on July 17, 1972. The unit has been sequentially constructed and filled in several sections. Development has generally occurred in an east to west direction, first in the southern half and then in the northern half as filling proceeded westward, but the western portion was the first part to be brought to the final permitted height. The landfill liner was constructed by grading and compacting the base and side walls of the landfill. Asphaltic concrete was installed over the sides and floor and compacted, resulting in a minimum two-inch thick layer. The surface of the asphalt was sealed with a cationic coal tar sealer. This sealed asphalt liner was covered with eight inches of sand.

A network of perforated pipes was installed in the sand on the sloping base. The pipes were connected to manholes where the liquid that drains from the wastes (leachate) collected. However, this original leachate collection system no longer functions. The leachate is now pumped from vertical dual leachate/gas extraction wells, which have been installed nearly to the base of the landfill, to a tank on the landfill's property. From there it is pumped through a force main to a

sewer connected to the wastewater treatment plant in Rockford. Landfill gas is collected and was originally flared. Presently it is being used as a fuel in combustion engines that generate electricity. The previously used flares remain in service as a backup for the engines. The system for landfill gas extraction has been developed over the years, since the discovery in about 1980 that landfill gas was leaking from the waste disposal area.

The Pagel's Pit Site was proposed for inclusion on the NPL in October 1984 because the nearby groundwater was found to be contaminated with arsenic, cadmium, and bis(2-ethylhexyl) phthalate. The Site was finalized on the NPL in June 1986.

Initial Response

U.S. EPA and a few of the PRPs for the Site reached an agreement embodied in an Administrative Order by Consent (AOC), with an effective date of October 16, 1986, that required the Respondents to the Order to conduct a RI and a FS at the Site. Portions of these studies were carried out by Warzyn Inc., who was retained by the PRPs who had signed the AOC. The reports for the remedial investigation and the feasibility study were submitted in March 1991. Additional investigations were later carried out under this AOC and a 1993 Consent Decree.

Based on the data from the remedial investigation, the water table occurs in the fractured dolomite bedrock east of and below approximately the eastern quarter of the Pagel's Pit Site. Under the remainder of the Site and west of the Site, the water table occurs in the unconsolidated materials. The overall direction of groundwater flow in the area of the two sites was from east to west in the upper aquifer during the RI. However, at the Acme Solvent site and along the southern edge of the waste disposal area of the Northern Unit, the flow was to the west-southwest, with the direction being more southerly at the Acme Solvent site. Along the northern edge of the waste disposal area the flow was toward the west-northwest.

A Proposed Plan for OU 1 was released to the public on April 16, 1991. This Proposed Plan presented a number of alternatives as possible remedies for the problems that had been identified at the Pagel's Pit Site. The Proposed Plan also included a description of the remedy preferred by U.S. EPA and IEPA. The Record of Decision (ROD) for OU 1, in which the remedy selected for the Site was described, was signed June 28, 1991. OU 1 is comprised of the landfill wastes and contaminated groundwater at the downgradient side of the Site. OU 2 is the groundwater contamination in the southeast corner of the Site that was undergoing further study at the time of the ROD for OU 1. The separation into operable units was made because the source of the contamination in the southeast corner had not been determined at the time of the 1991 ROD. The southeast corner (OU 2) was shown in the 1993 Consent Decree as a strip of land that extended from the waste boundary along the south side of the Northern Unit south to the then landfill property boundary. On the west it began a short distance east of the southernmost point of the waste disposal area and extended on the east to Lindenwood Road.

A Consent Decree, entered on February 11, 1993, requires several of the PRPs to perform the RD, RA, and operation and maintenance for the remedy selected in the 1991 ROD. This Consent Decree requires the operator of the landfill, one of the PRPs, to actually perform the remedial work and to pay U.S. EPA for some of its past costs. It requires the other PRPs (de minimis

parties) to pay U.S. EPA for some of its past costs and to contribute to a trust fund that was to be used to help pay for the remedial design and the remedial action.

The 1991 ROD did not require that the landfill be closed at that time. It could continue to operate until it had reached its permitted capacity. Regular monitoring of the groundwater and the leachate continued at the Site, which was conducted pursuant to the 1991 ROD and the operating permit that had been issued by IEPA for the landfill. This resulted in the installation of additional monitoring wells and the acquisition of further data on the groundwater and the leachate since the remedial investigation.

Chloride ion served as an indicator of groundwater that may have been affected by leachate from the landfill for many years. Chloride ion is generally recognized as a conservative, non-reactive parameter in groundwater systems. Based on the April 1998 groundwater data, the area containing elevated chloride ion concentrations extended from about midway along the north border of the landfill (east of well G15S (B15R)[1]), around the western end of the landfill, and along the south border of the landfill to at least the southwest area (well R42S (G115)) (see Figure 1 for the locations of the wells). This is the area that may have been affected by leachate from the landfill prior to any remediation. Generally, the affected area was relatively close to the waste boundary (within 100 to 200 feet), but a well on the other side of Killbuck Creek (well G34S) also had an elevated chloride ion concentration. Other wells west of the creek sometimes had elevated chloride ion concentrations in 1998 and before, particularly well G35D.

In accordance with the operating permit issued by IEPA, applicable groundwater quality standards (AGQSs) have been established for the Site. The Site groundwater standards were established by sampling groundwater wells located hydraulically upgradient of the Site. This method of sampling is called background sampling and establishes the quality of groundwater before it enters and passes beneath the Site. The sampling includes a large list of organic and inorganic compounds (constituents). The AGQS established for any constituent is the background concentration unaffected by site operations or an alternate standard established by petitioning the Illinois Pollution Control Board (IPCB). (See 35 IAC 811.320 for further information about AGQSs. Part 811 of 35 IAC is entitled "Standards for New Solid Waste Landfills".) As used here, background concentration means the concentration of a constituent that is established as the background in accordance with the Illinois regulations, usually from upgradient wells. Statistical tests and procedures are used in determining the background concentrations. The AGQS values for the Northern Unit were derived from wells G09M, G09D, G13S, G13D, and G20D. However, only well G20D was designated by IEPA as upgradient. The concentrations in all of these wells have been influenced by releases from the Acme Solvent site; this is especially true for well G20D.

The AGQSs are not the cleanup standards required by the 1991 ROD. The cleanup standards required by the ROD are maximum contaminant levels (MCLs) or non-zero maximum contaminant level goals (MCLGs), except that a cumulative carcinogenic risk of 1×10^{-5} and a cumulative HI of 1.0 are to be used for 1,1-dichloroethene, arsenic, and those contaminants without MCLs. However, groundwater cleanup standards below detection limits using U.S. EPA

1. The former designation is given in parenthesis. Some wells do not have a former designation.

approved methods for analysis of drinking water might be modified. MCLs and the 1 x 10^{-5} risk level were selected because concentrations in the neighborhood of 1 x 10^{-6} risk are often below reasonably achievable detection levels. Because the AGQS is determined using background quality, the AGQS may be greater or less than the MCL or other cleanup standard that has been established. In nearly all cases the AGQS is less than the MCL at the Pagel's Pit Site.

The AGQSs are used in defining a groundwater management zone (GMZ) in the downgradient direction under the current IEPA permit. The GMZ consists of the area where concentrations exceed the AGQSs. The GMZ is a three dimensional region containing groundwater being managed to mitigate impairment caused by the release of contaminants from a site. It is subject to a corrective action process approved by IEPA. (35 IAC 620.250 and 35 IAC 811.324 and 811.325) At this Site, the initial GMZ was defined by the extent of the chloride and ammonia contamination. The AGQS for chloride, dissolved and total, is 87.5 mg/l and the AGQS for dissolved ammonia-nitrogen is 0.9 mg/l. Roughly, in 1995, the GMZ, based on both the upper and lower zones, included the area from about the mid-points of the waste disposal area on the north and the south borders toward the west to the vicinity of well nests G16 (G116) and G34.

There is also a zone of attenuation around the waste disposal area within which concentrations of constituents in leachate discharged from the unit may exceed AGQSs. This zone is a volume bounded by a vertical plane at the property boundary or 100 feet from the edge of the unit, whichever is less, extending from the ground surface to the bottom of the uppermost aquifer and excluding the volume occupied by the waste. Once the groundwater concentrations in the GMZ are at or below the AGQSs, there will no longer be a GMZ. However, the zone of attenuation will always exist.

Volatile organic compounds (VOCs) have been found in the past in the shallow aquifer on, and in the vicinity of, both the Pagel's Pit and Acme Solvent sites. VOCs have been found both inside and outside of the area defined by elevated chloride concentrations at the Pagel's Pit site. During the 1988-90 remedial investigation, the highest concentrations of VOCs were found in wells on or near the Acme Solvent site. The next highest concentrations were found in the south-east corner of the Pagel's Pit site. During this initial remedial investigation a connection between the Acme Solvent site and the southeast corner of the Pagel's Pit Site was not definitely shown, possibly because there is fractured bedrock between and in the two areas through which ground-water would move primarily in the fractures. Later, well G20D (G120B) was installed between the two sites. Elevated levels of VOCs were found in water in this well which showed that contamination was moving from the Acme Solvent site toward the Pagel's Pit Site. Thus, it was shown that at least some of the VOCs present in the southeast corner could have come from the Acme Solvent site. However, it is likely that some of the contamination in the southeast corner was also coming from the landfill. Chlorinated benzenes were found in this area but were not found in wells closer to the Acme Solvent site.

In the GMZ during 1997 and 1998 (closure of the western portion of landfill began in August 1997), tetrachloroethene was the only organic compound whose concentrations exceeded the maximum contaminant levels (MCLs) established under the Federal Safe Drinking Water Act (MCL = 5 μg/l). The MCL for tetrachloroethene was exceeded in wells G16M (G116A), G16D (G116D), and G35S to the west of Killbuck Creek and in wells G41D (G132), G39S (G39), and

G03M (P4R) to the east of the creek. The maximum concentration was 12 μg/l, so the AGQS, which is 26 μg/l, was not exceeded. The concentrations of several other organics exceeded their AGQSs in the GMZ, including those of 1,4-dichlorobenzene in four wells. Three of these wells are in or very close to the zone of attenuation and the fourth is directly downgradient of the landfill. In the "background" wells (well G20D (G120B) and 4 of the 5 wells (not including well G14D (G114)) in the southeast corner), the concentrations of several substances exceeded their MCLs: tetrachloroethene in wells G09D (G109A) and G13D (G113A); trichloroethene in wells G20D (G120B) and G13D (G113A); cis-1,2-dichloroethene in well G13D (G113A); vinyl chloride in well G13D (G113A) (the MCL was also exceeded in well G14D (G114)); and 1,2-dichloropropane in well G13D (G113A). The concentrations of a few other organics exceeded their AGQSs in the southeast corner wells, including 1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene, and chlorobenzene. These numbers demonstrate the low levels of VOCs generally found in the GMZ. They also show the possible influence of the Acme Solvent site on the groundwater in the southeast corner because of the presence of several chlorinated ethenes. Well G20D (G120B) and the wells in the southeast corner are not part of the GMZ since they are not considered to be downgradient of the waste disposal area.

Killbuck Creek is also regularly monitored by the landfill operator. In 1998, none of the major chlorinated ethenes were detected in the creek, nor were several other VOCs, for which analyses were done. The ammonia concentrations in the creek generally increased between the upstream and downstream sampling points, which may indicate an effect from the landfill or from sources not related to the landfill. Elevated ammonia concentrations can also be due to agricultural activities. However, the chloride concentrations increased only slightly.

The results of the monitoring of the landfill leachate in the 1997 to 1999 period showed that the chloride and sodium concentrations in the leachate were generally somewhat higher than the ranges for typical landfill leachate. However the concentrations are now decreasing over time. During this period there were no detections of chlorobenzene, 1,4-dichlorobenzene, the two trichlorobenzenes, 1,2-dichloropropane, or any of the major chlorinated ethenes in the leachate.

An investigation for the remedial design of the OU 1 barrier well system specified in the 1991 ROD found that pumping a well located between the waste disposal area and the creek resulted in a much greater flow rate than had been anticipated when the ROD was issued. Also, the groundwater downgradient of the landfill was found to contain significant concentrations of ammonia. Ammonia had not been considered in the remedial investigation done for this ROD. If this groundwater were extracted as part of a system to prevent the movement of the contaminated groundwater downgradient, this ammonia would have to be removed before the treated water could be discharged, unless the concentrations were significantly decreased during pumping because of the introduction into the groundwater of uncontaminated water from the creek flowing to the extraction wells through the ground. Generally, the removal of ammonia, if it was needed, would involve raising the pH, stripping the ammonia, and then lowering the pH of the water to an acceptable level for discharge. These results led to the determination that the cost of the barrier well system and associated water treatment system would be much greater than had been estimated for the 1991 ROD, and the Agency agreed to defer implementation of the systems until alternatives could be investigated.

A Proposed Plan for the remedy for OU 2 and for a change in the remedy for OU 1 was released to the public in August 1999. This Proposed Plan also informed the public of the dates for the comment period, August 13, 1999 through September 11, 1999, and the public meeting which was held on August 25, 1999. At the request of some attendees at the August 25 public meeting, a second meeting was held on September 8, 1999 to further discuss the Proposed Plan. The ROD for OU 2, which also served as a ROD Amendment for OU 1, was signed September 30, 1999.

Basis for Taking Action

In the 1991 remedial investigation a baseline risk assessment was prepared to characterize the nature and estimate the magnitude of potential risks to public health and the environment. The potential risks were caused by the chemicals of concern and were based on current and possible future land use.

The chemicals of potential concern were selected on the basis of the following criteria: a) positively detected in at least one sample in a medium; b) detected at levels significantly above the levels in blank samples; c) detected at levels elevated above naturally occurring levels; d) only tentatively identified, but which may be associated with the site; and e) transformation products of chemicals demonstrated to be present. Those chemicals that met one of these five initial selection criteria were considered chemicals of potential concern. The exceptions to this were those chemicals detected in landfill leachate but not in other media and chemicals for which critical toxicity values had not been developed; these latter were evaluated qualitatively.

The chemicals of potential concern identified for the Site were:

Volatile Organic Compounds

acetone
benzene
bromoform
bromodichloromethane
carbon tetrachloride
chlorobenzene
chloroethane
chloromethane
chloroform
dibromochloromethane
1,1-dichloroethane
1,2-dichloroethane
1,1-dichloroethene
1,2-dichloroethene (both)
1,2-dichloropropane
1,3-dichloropropene
ethylbenzene
methylene chloride
tetrachloroethene
1,1,2,2-tetrachloroethane
toluene
1,1,1-trichloroethane
trichloroethene
vinyl chloride
xylenes (o-, m-, p-)

Pesticides/PCBs

none

Semi-Volatile Compounds

bis(2-ethylhexyl)phthalate
di-n-butylphthalate
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
diethylphthalate
PAHs (noncarcinogenic)

Metals/Inorganics

arsenic
barium
cadmium
chromium
cobalt
copper
iron
lead
manganese
nickel
nitrate & nitrite
silver
sodium
thallium
vanadium
zinc
cyanide

Potential future groundwater use as a water supply was found to represent the greatest risk to humans at the Pagel's Pit Site. Under this scenario, exposure would occur through groundwater ingestion and from dermal contact and inhalation while bathing. The calculation was done for the groundwater west of Lindenwood Road, including the southeast corner. The calculated cumulative hazard index of 5, not including cobalt exposure (found in only one well), compared to the Superfund goal of 1, indicated that exposure to the noncarcinogens in the groundwater might cause adverse health effects. The majority of the value of the hazard index was due to exposure to the 1,2-dichloroethenes, thallium, and zinc. The calculated cumulative cancer risk of $1x10^{-3}$ exceeded the U.S. EPA target risk range of 10^{-4} to 10^{-6}. The majority of this was due to exposure to vinyl chloride and arsenic.

The total 1,2-dichloroethene concentration (the lesser of the 95% upper-bound confidence limit of the arithmetic mean or the maximum concentration detected) used in the calculation for the risk in 1991 was 240 µg/l. (A risk or hazard quotient (the sum of the hazard quotients for substances that cause a similar effect is the hazard index) is directly proportional to the concentration; if the concentration has decreased, so has the risk or hazard quotient.) In April 1998 there were only five detects of 1,2-dichloroethene (all of the cis isomer) in the groundwater west of Lindenwood Road (31 wells sampled): 98 µg/l in well G13D (G113A) in the southeast corner and concentrations ranging from 6 to 7 µg/l in four downgradient wells. The detection limit was 5 µg/l. The dissolved thallium concentration used for the 1991 risk assessment was 2.8 µg/l (ranging from 2 to 6 µg/l). In April 1998 there were only two detects of total thallium (dissolved thallium was not analyzed for) at about 5.3 µg/l. The detection limit was 5 µg/l. The two thallium detects were in wells from the same general area. No thallium was detected in the leachate in the 1997 through early 1999 period, with detection limits of 1.5, 2.2, and 100 µg/l. The dissolved zinc concentration used for the 1991 risk assessment was 6.3 mg/l (ranging from 0.037 to 6.34 mg/l). In April 1998 there were 25 detects of dissolved zinc in the wells west of Lindenwood Road (31 wells sampled), ranging in concentration to 9.27 mg/l (in well G09D (G109A), in the southeast corner, where the next highest concentration was 1.73 mg/l in well G09M (G109)). The maximum in the downgradient wells was 4.18 mg/l. Hence, all but one of the detects of zinc were below 6.3 mg/l. The detection limit was 0.022 mg/l. The vinyl chloride concentration used for the 1991 risk assessment was 14 µg/l. In April 1998 there was only one detect of vinyl chloride, at 15 µg/l, and this was in a southeast corner well. The detection limit was 2 µg/l. The dissolved arsenic concentration used for the 1991 risk assessment was 8.4 µg/l (ranging from 2 to 46 µg/l). In April 1998 there were 10 detects of dissolved arsenic, ranging in concentration to 25 µg/l, but 8 of the detects were below 8.4 µg/l. The detection limit was 2 µg/l. Thus, the concentrations of the substances that were the significant contributors to the risks calculated in 1991 had generally been decreasing or remaining similar to the levels then, but it was clear that risks were still present above U.S. EPA's requirements for remedial action in 1999.

The environmental evaluation portion of the baseline risk assessment in 1991 was done to characterize the natural habitats which might be influenced by the Site. Killbuck Creek and the nearby wetlands were assumed to be the most sensitive ecological habitats near the landfill. Fish were considered the group of aquatic species that would be the most susceptible to chemical exposure in Killbuck Creek. Effects on fish are not expected based on the concentrations in the water in comparison to the Ambient Water Quality Criteria. Since this sensitive group of organisms appears to be safe from health effects, other aquatic ecosystem effects are not

anticipated.

Because of the unacceptable risk levels revealed by the human health evaluation, a remedy was developed for the Site. The primary concerns identified for the 1991 ROD were vinyl chloride and arsenic in the groundwater. Containment of landfill gas was also identified as a problem. Capping the landfill and the other measures taken (control of landfill gas pressure and reduction of the leachate level in the landfill) have been intended to reduce the release of leachate and prevent possible contact with the wastes and leachate, contaminated groundwater, and landfill gas.

IV. Remedial Action

Remedy Selected

The total remedy that has been selected for the Site (for both OU 1 and OU 2) as a result of the 1991 ROD and the 1999 ROD and ROD Amendment consists of the following components:

- a sanitary landfill cover for the waste disposal area;
- leachate extraction and transfer to the local publicly owned treatment works for treatment;
- gas extraction and flaring of the gas or using it for fuel;
- monitored natural attenuation with a contingency for the groundwater downgradient of the Site, the contingency (an active system to address groundwater by preventing the movement of the contamination downgradient and/or remove contamination in the contaminated groundwater downgradient of the landfill wastes, whichever is needed) to be used if the control of the contamination coming from the landfill wastes, the control of contamination coming from upgradient of the Site, and the natural attenuation processes do not lead to the eventual return of downgradient groundwater to beneficial use, do not appear to be doing so, or if the contaminated groundwater becomes an immediate threat to a downgradient water supply;
- deed restrictions that protect the source control measures through restrictions on construction and that prevent contact with contaminated groundwater through well installation restrictions in those areas containing contaminated groundwater, including areas west of Killbuck Creek; and
- Site monitoring, including monitoring of the groundwater in the southeast corner, and maintenance of all remedial action components.

The remedy for OU 2, the groundwater in the southeast corner, was institutional controls, which consist of deed restrictions prohibiting the installation of water production wells in that area. The groundwater will continue to be monitored as part of the operating permit for the landfill. It was determined that the contaminated groundwater in the southeast corner would move toward the west and join with the other contaminated groundwater, which was being addressed as part of OU 1 and the current operating permit for the landfill. The original remedy for OU 1 included groundwater extraction along the west side of the site. This was replaced with monitored natural attenuation with a contingency in the ROD Amendment because of the new information about the groundwater discovered after the 1991 ROD was issued, which is discussed in the "Initial Response" subsection above, and because IEPA favored the use of the GMZ under the operating

permit for addressing the groundwater contamination. The remedy for OU 1 is that listed above for the total remedy minus only those institutional controls specifically for the southeast corner.

Remedy Implementation

The remedy for OU1 has been implemented. The remedy for OU 2, the placement of institutional controls in the southeast corner, has not been implemented. Also, some additional institutional controls for OU 1, for the property on the west side of Killbuck Creek, still have to be implemented.

The final cover was constructed in two phases. First, the cover was installed on the western portion (approximately 16.6 acres) of the landfill after the wastes had reached the permitted elevation. This work was begun in July 1997. The design for this portion of the landfill was approved on August 8, 1997. *Construction Quality Assurance Acceptance Report Pagel Landfill Final Construction, Western Portion*, February 1998, was submitted to IEPA , Bureau of Land, Permit Section on February 23, 1998. The report was accepted on June 18, 1998.

The construction of the final cover for the eastern portion of the landfill was begun in August 2000 after the wastes had reached the permitted elevation in the rest of the landfill. *Construction Quality Assurance Acceptance Report Pagel Landfill Final Cover Construction--Eastern Portion*, September 2001, was submitted to IEPA , Bureau of Land, Permit Section in September 2001. Following the submittal of some additional information, the report was accepted in May 2002.

For both portions, the closure consisted of the following components:

- a grading layer;
- a 1-foot recompacted clay layer;
- a 40-mil flexible membrane liner;
- a drainage layer;
- a 2.5-foot protective layer;
- a 6-inch topsoil layer with fertilizer, seed, and mulch;
- storm-water terraces, letdowns, ditches, and culverts;
- a leachate extraction (leachate wells and pumps and associated piping) and conveyance system; and
- a gas collection system, including connection to a flare system.

The gas collection and control system (GCCS) included 35 vertical dual leachate/gas extraction wells, collection piping network, and leachate storage tanks. The collected gas was being directed to a flare at the time of the 2007 review, but was soon to be used as a fuel to generate electricity. There are gas probes located outside the waste boundary, which are monitored and evaluated under the current IEPA permit requirements.

It was necessary to perform additional work on the leachate extraction system following construction because of problems encountered with the in-well pumps. Consequently, the lowering of the leachate level in the landfill was initially slow in being accomplished. By the

time of the 2007 review, the leachate levels were essentially at the pump intake levels.

There were problems with controlling the landfill gas after cover construction was completed. A larger capacity system for handling the landfill gas being extracted from the landfill gas/leachate wells (2500 cfm versus the 1000 cfm system being used at the completion of the capping work) was installed in September 2002 to provide the required control of the landfill gas migration. In about mid September, the new system became operational and proper balancing was begun. Beginning in 2010 the 2500 cfm flare was moved to a new location adjacent to the Energy Center that is part of a planned flaring station with multiple flares that is designed to handle all of the gas from the various disposal units. The flare station will also provide backup capacity in the event of an outage of a single flare. The flare station currently has the 2500 cfm flare and a temporary 2200 cfm flare. In the fall of 2012 the 2200 cfm temporary flare will be replaced with a new permanent 4000 cfm flare.

Construction completion for the Site was deemed to have been achieved with the issuance of the 1999 ROD on September 30, 1999, which acknowledged that U.S. EPA's response at the Site was complete. All remaining construction activity was to be completed by the operator of the landfill in accordance with the requirements of Operating Permit No. 1991-138-LF issued by the Division of Land Pollution Control, Illinois Environmental Protection Agency. The long-term groundwater monitoring requirements of the 1999 ROD were already specified in the 1993 Consent Decree and were also required under the existing IEPA operating permit.

Institutional Controls

Institutional controls (ICs) are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for exposure to contamination and that protect the integrity of the remedy. ICs are required to assure long-term protectiveness for any areas which do not allow for UU/UE.

The deed restrictions for the waste disposal area and those areas nearby that were required under the 1991 ROD were implemented. A copy of the deed restriction form contained in the 1993 Consent Decree, notarized April 19, 1993, was filed with the Recorder of Winnebago County on April 20, 1993. The document includes restrictions on the use of the upper aquifer, prohibits residential use of the property, requires that any changes to structures, roads, etc. be approved by U.S. EPA, prohibits tampering with or removal of any containment or monitoring systems or other components of the remedial action unless authorized by U.S. EPA, and prohibits interference with the performance of the work or remedial action or with the maintenance of remedial measures. Additional restrictions as called for in the 1999 ROD need to be implemented.

The specific areas which do not allow for UU/UE are summarized in Table 1 on the following page.

Table 1. Institutional Controls Summary Table

Media, Engineered Controls, and Areas That Do Not Support UU/UE Based on Current Conditions	**IC Objective**	**Title of IC Instrument Implemented**
Constructed landfill cover and surface area of property beyond the landfill cap required for OU 1	No residential use. Agricultural use must be approved by U.S. EPA. Any installation, removal, or construction of any buildings, wells, pipes, roads, ditches or any other structures must be approved by U.S. EPA. Unless authorized by U.S. EPA, no one shall tamper with or remove any containment or monitoring systems or any components of the remedial action. There shall be no interference with the performance of the work or remedial action or with the maintenance of remedial measures.	Deed restriction, notarized April 19, 1993, and filed with the Recorder of Winnebago County on April 20, 1993
On-Site Groundwater for OU 1	Prohibit use of groundwater where contamination exceeds cleanup standards	Deed restriction, notarized April 19, 1993, and filed with the Recorder of Winnebago County on April 20, 1993
Off-Site Groundwater for OU 1	Prohibit use of groundwater where contamination exceeds cleanup standards	None
Groundwater for OU 2 (southeast corner)	Prohibit use of groundwater	None

More detailed maps which depict the physical areas mentioned in Table 1 will be developed as part of an IC study. The maps will include current conditions for the Site and areas which do not allow for UU/UE.

A review of the institutional controls is needed to assure that the remedy is functioning as intended with regard to the ICs and to ensure effective procedures are in place for long-term stewardship at the Site. The existing deed restriction must be evaluated and ICs must still be implemented for the additional requirements made in the 1999 ROD for the southeast corner and the downgradient groundwater. IC evaluation activities will include performing title work to verify ownership and whether prior-in-time encumbrances may interfere with the ICs, preparation of maps, and evaluation of whether additional ICs are needed. The IC evaluation activities will also evaluate whether effective procedures are in place for long-term stewardship to assure proper maintenance and monitoring of effective ICs. That would include regular inspection of ICs at the Site and annual certification to U.S. EPA that ICs are in place and effective. Once the IC evaluation activities have been completed, an IC plan will be developed by U.S. EPA. The Plan will incorporate the results of the evaluation of activities and plans for additional IC activities as needed, including planning for long-term stewardship.

Systems Operation and Operation and Maintenance

The landfill's operator performs the operation and maintenance required under the State's regulations for a closed landfill. Mostly, this consists of:

- groundwater monitoring;
- cap inspection and maintenance;
- operation and maintenance of the leachate extraction system, including leachate disposal to the local publicly owned treatment works through a force main to the sewer; and
- operation and maintenance of the landfill gas extraction system, which initially consisted of flares for the disposal of the gas but now consists of combustion engines that generate electricity with the flares as a backup.

As reported in the May 2012 report, *Status Report and Evaluation of Groundwater Corrective Actions and Groundwater Management Zone*, Andrews Engineering, Inc., the landfill facility has an extensive system of groundwater monitoring wells from which groundwater data are obtained. The groundwater monitoring wells are divided into two networks, one for the Northern Unit and one for the Southern Unit. The Northern Unit network contains 33 groundwater monitoring wells. Of those, five are designated as upgradient wells, 14 monitor the zone of attenuation , and one is a compliance boundary well at the edge of the zone of attenuation. Winnebago Landfill samples 13 additional wells on a quarterly basis as part of the GMZ monitoring network. The Southern Unit network currently contains 17 groundwater monitoring wells. Of these 17, six are designated as upgradient wells (two of which are Northern Unit upgradient wells) and 11 monitor the zone of attenuation. Some data (i.e., groundwater elevations and analytical results) from the NEU and Southern Unit have been used to characterize the hydrogeology for the Northern Unit.

There are a number of gas probes around the waste disposal area of the Northern Unit that are sampled. Results are reported after the analytical results are available.

V. Progress Since the Last Five-Year Review

The issues and the recommendations and follow-up actions listed in the 2007 five-year review included the implementation of additional institutional controls as well as the verification of the effectiveness of the existing controls. These issues and recommendations and follow-up actions are currently in process.

The landfill operator began placement of wastes in the area between the Northern Unit and the Southern Unit in December 2005. This is the Southern Unit Expansion, which has been permitted by the state. This area includes most of the southeast corner. Filling with wastes was completed in 2010. The monitoring wells and gas probes that were in this area were abandoned. The vegetative soil of the Northern Unit cover was removed in the area where wastes were to be placed; at least 2 feet of the protective soil layer of the cover for the Northern Unit was left in place and lies below the liner system of the Southern Unit Expansion. However, at both ends of this area the protective soil and the drainage layer of the Northern Unit were removed and replaced by one foot of sand. The area where wastes were to be placed was covered by a geosynthetic and clay liner overlain by a drainage layer like that used for the Southern Unit; this

is the liner system for the Southern Unit Expansion in this area. Wastes were placed above the drainage layer. This method of construction resulted in the leachate generated by the wastes placed in the Southern Unit Expansion draining to the leachate collection system of the Southern Unit rather than draining into the Northern Unit. This promotes drainage of leachate to the newly engineered waste unit. The Southern Unit and Southern Unit Expansion were capped in two phases, with the east half being completed in 2010 and the west half in 2011. The approval of the construction report is pending with IEPA.

Integrys Energy Services announced in December 2007 that all four combustion engines at its recently completed Winnebago Energy Center, a landfill gas-to-electricity plant located at the Winnebago Landfill, are now operational and supplying power to the grid. The landfill gas is collected from the Winnebago Landfill, including the Northern Unit, and is being used as a fuel in these combustion engines that drive generators that produce the electricity. Integrys Energy Services is the owner/operator of the Center. The previously used flares remain in service as a backup for the engines to control the landfill gas when engines are not in service or the flow of gas is more than the facility can handle.

The May 2012 *Status Report* is a five-year evaluation of the groundwater management zone in accordance with a condition of the landfill's permit. The report includes a review of current groundwater remediation activities, groundwater quality of all groundwater monitoring wells contained within the GMZ, trend analysis data in graphical and tabular formats for all GMZ parameters and wells, vertical and horizontal GMZ extent maps, cross-sections, potentiometric surface maps, and recommendations for the GMZ, if necessary.

In the report, the extent of the upper and lower zones of the GMZs are shown for the years 1995, 2004, 2007, and 2012; the landfill applied to the state in 1995 for permission to create a GMZ. (See the "Initial Response" subsection above for a discussion of the GMZ.) The 1995 GMZ was based on one sampling event and its depiction was made prior to the closing of the Northern Unit. The extent and location of both the upper and lower GMZs for 1995 and 2004 are quite similar. The GMZs are located to the west and the northwest of the waste boundary. The *Status Report* concludes that the overall horizontal extent of the upper zone GMZ has not changed significantly since 2007, although a significant reduction in the recorded concentrations and individual parameter extents is evident. The report says the same thing about the overall horizontal extent of the lower zone GMZ. Figures 2 and 3 show the horizontal extents of these two zones for 2012.

Besides the evaluations of the GMZ, the *Status Report* comments on various monitoring wells and on various contaminants and the trends in their concentrations for the time since 2007. In the table that presents the exceedances of AGQSs since 2007, there are very few reports for organics in the downgradient wells. At the time of the remedial investigation, elevated organic concentrations were a major concern. There are now only a few reports for organics in the upgradient wells in the southeast corner (G09M, G09D, G13S, and G13D) and in the monitoring well between the Northern Unit and the Acme Solvent site (G20D).

The May 2012 *Status Report* noted that the 1995 Permit Renewal incorporated the remedial actions chosen to remedy Winnebago Landfill's impacted groundwater. The GIA included in the application was directed toward assessing the potential impacts of the facility after completion of the remedial activities and was used to evaluate the effectiveness of the remedial design. Final cover was completed in July 2001 and the necessary upgrades to the leachate/gas extraction system were completed in 2002, finalizing the approved remedial measures. The GIA stated that the existing impacted groundwater would take an estimated five to ten years to achieve background concentrations. It was inferred that this timeline would commence upon completion of the remediation systems. Therefore, the effect of the remedial measures would become apparent sometime between 2007 and 2012. Although a few parameters are still detected at concentrations above the AGQSs, significant improvements to groundwater quality are evident as demonstrated by the decreases in individual parameter concentrations and GMZ extents. In addition, the organic constituents which prompted the remedial actions are typically not detected in groundwater downgradient of the facility. Based on the number of wells in and surrounding the Northern Unit and their respective screened intervals and parameter lists, no additional investigations are proposed at this time. Evaluation of the GMZ should continue as previously permitted in Condition VIII.23 of Permit No. 1991-138-LF, Modification 53. The GMZ shall continue to be monitored in accordance with current requirements. In the event a modification to the remedial performance monitoring program is necessitated, a permit application will be submitted identifying the subject changes.

VI. Five-Year Review Process

Administrative Components

The Illinois EPA and the landfill operator were formally notified about the review by U.S. EPA's Remedial Project Manager Bernard Schorle, who is conducting the review.

Community Notification and Involvement

An ad appeared in the *Rockford Register Star* on May 25, 2012 informing the community that a review was to take place, listing the major components of the remedy, and informing them where additional documents could be found. The public was also told that they could submit comments concerning the Site to U.S. EPA. One resident contacted the RPM by telephone and talked with him about landfills. Around the same time that this ad appeared there was a comment period in progress regarding the proposed siting of a new municipal landfill near the location of Pagel's Pit by the operators of Winnebago Landfill. There had been a public meeting in connection with the comment period and the caller asked questions about Pagel's Pit and landfills in general. No comments about Pagel's Pit were made.

There is an information repository for the Site located at the Rockford Public Library. Completed five-year review reports can also be obtained through the Internet at epa.gov/region5/superfund. A second notice announcing the completion of the five-year review and the availability of the report will be issued once the report is signed.

Document Review

For the review, the monitoring reports from the landfill operator that provide the results of the groundwater monitoring and the evaluation of the results, which are also submitted to the state as part of the requirement under the operating permit, have been reviewed. The main report that was consulted for this review was the May 2012 report, *Status Report and Evaluation of Groundwater Corrective Actions and Groundwater Management Zone*, Andrews Engineering, Inc. This report includes a table that contains historical groundwater analytical data for the GMZ parameters in the GMZ wells beginning with the first quarter of 1997 so that trends can easily be seen.

Data Review

The review consisted primarily of reviewing the reports that are submitted by Andrews Engineering, Inc. on behalf of the operator of the landfill. Most of these reports are documents that the operator has to submit to IEPA under the requirements of the permit. These reports are reviewed by U. S. EPA. The results of this data review are discussed in the "Progress Since the Last Five-Year Review" section of this report. A few parameters are still detected at concentrations above the AGQSs but significant improvements to groundwater quality are evident as demonstrated by the decreases in individual parameter concentrations and GMZ extents. In addition, the organic constituents which prompted the remedial actions are typically not detected in groundwater downgradient of the Site. Evaluation of the GMZ will continue and the GMZ shall continue to be monitored in accordance with the current requirements.

Site Inspection

Inspection of the Site was conducted on September 8, 2011 by the RPM, a representative of the landfill operator, and a contractor for the operator. The purpose of the inspection was to observe the Site and check on those things that are not generally reported on. The Site appeared to be in very good condition. The Winnebago Energy Center on the Site was also toured. The land north of the Northern Unit is now accepting waste. The home that was on the east side of Lindenwood Road opposite the southeast corner had been removed but an out building is still there. The landfill operator had purchased this property.

Interviews

No interviews with people not directly connected with the Site were conducted.

VII. Technical Assessment

Question A. Is the remedy functioning as intended by the decision documents?

Yes, the review of the available information indicates that the remedy is functioning as it was intended. Concentrations of contaminants have decreased over the years. However, even though institutional controls specified by the 1999 ROD have yet to be implemented, the stated IC objectives are being met.

Compliance with ICs is required to assure that the remedy continues to function as intended. Based on inspections and discussions, there appears to be compliance with the stated objectives of the land and groundwater use restrictions. To assure that the remedy continues to function as intended, ICs must be reviewed to assure their effectiveness, additional ICs must be implemented, and the ICs must be monitored and maintained. To that end, an IC study will be prepared to study existing ICs and determine what additional ICs are needed. An IC plan will be prepared to incorporate the results of the study and plan for additional IC activities, as needed.

Question B. Are the exposure assumptions, toxicity data, clean-up levels, and remedial action objectives used at the time of the remedy selection still valid?

Yes, there have been no major changes in the physical conditions of the Site that would affect the protectiveness of the remedy. The Site is being used as anticipated as part of a landfilling operation so the exposure assumptions that were made do not need to be changed.

The remaining applicable or relevant and appropriate requirements (ARARs) that still have to be attained deal with the quality of the groundwater. There are still exceedances of the AGQSs. The AGQSs were not specified as cleanup standards in the RODs. However, the operator must satisfy the conditions of the state operating permit which will require continued monitoring of the GMZ. There has been one significant change in an MCL. The MCL for arsenic has been lowered to 10 μg/l, which is also the value for the AGQS for total arsenic; it had been 50 μg/l when the 1991 ROD was issued. The cleanup standards will be reviewed in the future since some were based on risks calculated with data that may have been updated. No Site uses which are inconsistent with the implemented ICs or the remedy's IC objectives have been noted during the Site inspection or discussions with the owner's representative.

Question C. Has any other information come to light that could call into question the protectiveness of the remedy?

There has been no other known information that could call into question the protectiveness of the remedy.

VII. Technical Assessment Summary

According to the data reviewed, the Site inspection, and discussions with the owner's representative, the remedy is functioning as intended by the two RODs. There have been no changes in the physical conditions at the Site that would affect the protectiveness of the remedy. The Site is being used in a manner consistent with the required use restrictions. The additional institutional controls required under the 1999 ROD, when put into place, will complete the implementation of the remedy.

VIII. Issues

The issues identified during this review were:

1. Institutional Controls. The additional ICs specified by the 1999 ROD need to be implemented and existing ICs need to be reviewed.
2. Institutional Controls. Along with assuring that effective ICs are in place for all areas that do not support unlimited use, long-term stewardship must be assured, which includes maintaining and monitoring effective ICs.

IX. Recommendations and Follow-Up Actions

1. Institutional Controls. The landfill owner will be directed to perform a study of the ICs.
2. Institutional Controls. U.S. EPA will review the landfill owner's IC study and existing solid waste permit and develop an IC plan to identify required follow-up actions to assure that effective ICs are in place, to plan for implementation of additional ICs as needed, and to assure that effective procedures exist for long-term Site stewardship.

Table 2: Issues, Recommendations and Follow-Up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Mile-stone Date	Affects Protectiveness? (Y/N)	
					Current	Future
ICs-- The additional ICs specified by the 1999 ROD need to be implemented and existing ICs need to be reviewed.	The landfill owner will perform a study of the ICs.	PRP/U.S. EPA	U.S. EPA	March 2013	N	Y
ICs--Along with assuring that effective ICs are in place for all required areas, long-term stewardship must be assured, which includes maintaining and monitoring effective ICs.	U.S. EPA will review the landfill owner's IC study and existing solid waste permit, develop an IC plan to identify required follow-up actions to assure that effective ICs are in place, and based on IC study, PRP will implement ICs as needed, and assure that effective procedures exist for long-term Site stewardship.	U.S. EPA (with input from the Group)/ PRP	U.S. EPA	June 2013	N	Y

X. Protectiveness Statement

The remedies for OU 1 and OU 2 are protective of human health and the environment in the short term because the remedy is functioning as anticipated and exposure pathways that could result in unacceptable risks are being controlled. Therefore the remedy for the entire Site is protective in the short term. Long-term protectiveness requires compliance with effective ICs. In order for the remedies for OU 1 and OU 2 to be protective in the long term, additional institutional controls are necessary and the effectiveness of the institutional controls and of the long-term stewardship procedures need to be evaluated. Long-term stewardship requires that effective ICs will be maintained and monitored along with maintaining the Site remedy.

XI. Next Review

The next five-year review for the Pagel's Pit Site is required in September 2017, five years from the signature date of this review.

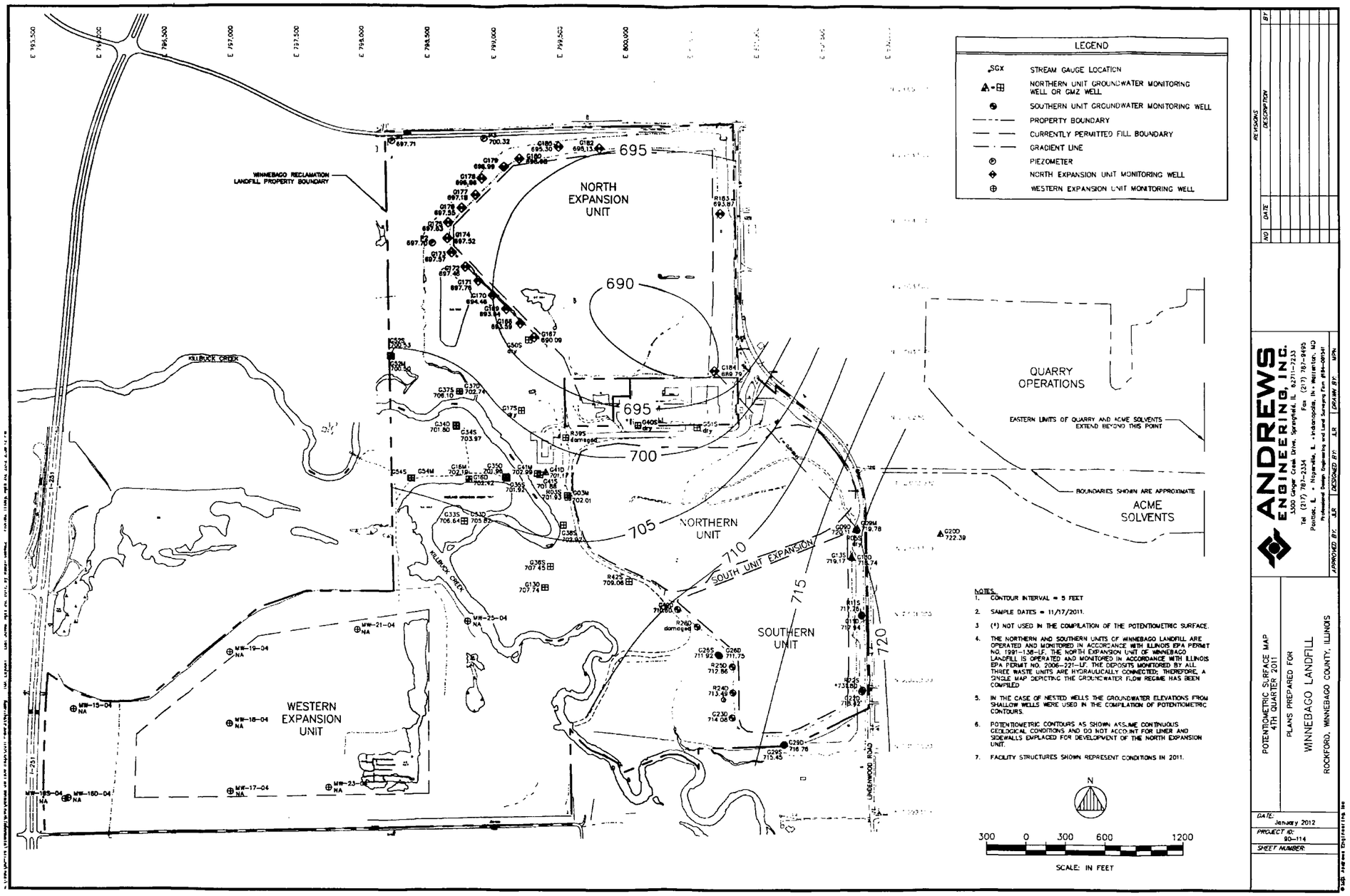

Figure 1. Map of Site with Potentiometric Surface for Fourth Quarter 2011

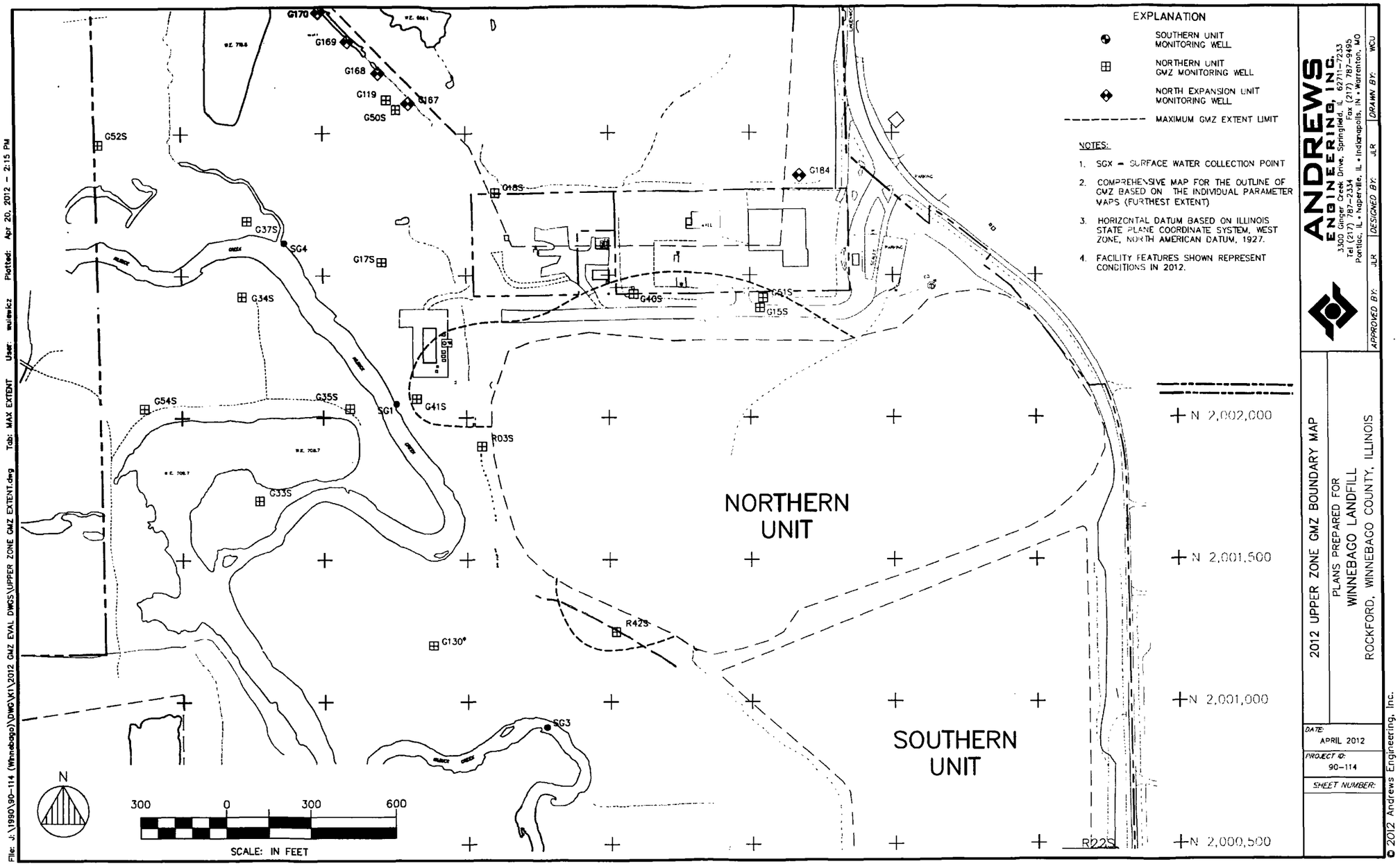

Figure 2. 2012 Upper Zone GMZ Boundary Map

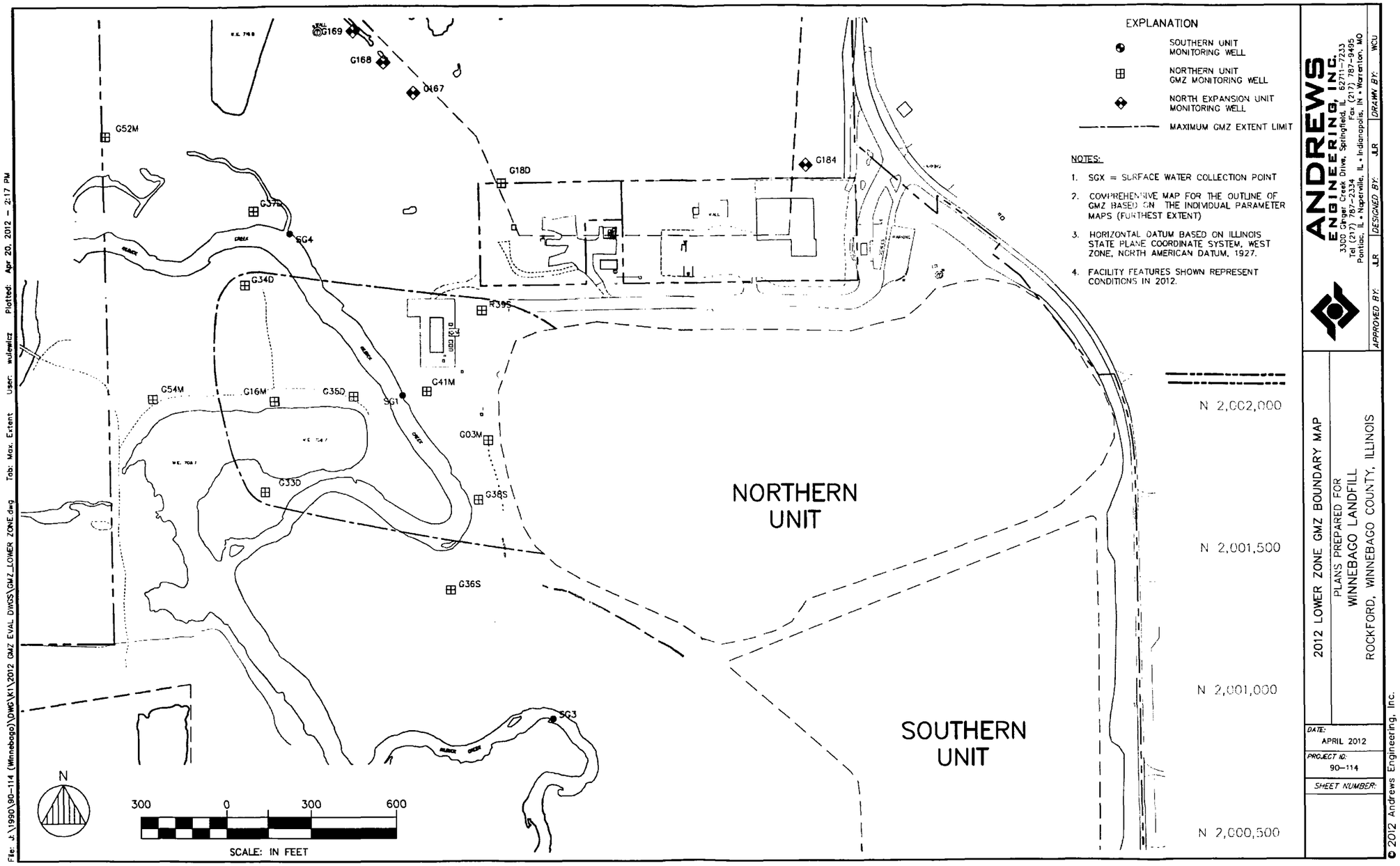

Figure 3. 2012 Lower Zone GMZ Boundary Map