Five-Year Review Report

Second Five-Year Review Report for Ripon City Landfill Town of Ripon, Fond du Lac County, Wisconsin

September 2006

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

Approved by: Date:

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List of Acronyms and Some Abbreviations

ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
cis-1,2-DCE	cis-1,2-dichloroethene
ES	enforcement standard [see NR 140.05(7) of the Wis. Adm. Code]
FS	feasibility study
IC	institutional controls
LEL	lower explosive limit
MCL	maximum contaminant level
msl	mean sea level
µg/l	micrograms/liter
MW	monitoring well
NCP	National Contingency Plan
NPL	National Priorities List
P	piezometer
PAL	preventive action limit [see NR 140.02(3) and NR 140.05(17) of the Wis. Adm. Code]
PCE	tetrachloroethene
PHA	Public Health Assessment
PRPs	potentially responsible parties
RA	remedial action
RD	remedial design
RI	remedial investigation
ROD	Record of Decision
SMCL	secondary maximum contaminant level
SPM	state project manager
SVOC	semi-volatile organic compound
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
VC	vinyl chloride
VOC	volatile organic compound
Wis. Adm. Code	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources

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Executive Summary

On March 27, 1996 the United States Environmental Protection Agency (USEPA) concurred with the remedies for the Ripon City Landfill site (Site) identified in the Record of Decision (ROD) signed by the Wisconsin Department of Natural Resources (WDNR) on February 26, 1996. The remedy consists of two components: the source control operable unit and the groundwater operable unit. The selected source control remedy was a composite landfill cap and passive landfill gas venting in conjunction with a groundwater monitoring plan. For the groundwater operable unit, WDNR selected the no action alternative. WDNR stated that the groundwater contamination was not severe enough to warrant active groundwater remedial measures to restore groundwater quality and that implementing the source control operable unit remedy would result in decreased migration of contaminants from the landfill to the groundwater. The ROD remedy included, as an institutional control, placement of a deed restriction that prohibited disturbing the landfill cap except for maintenance purposes. In addition, the ROD recognized that Section NR 812.08 of the Wis. Adm. Code forbids construction of a potable or nonpotable well within 1200 feet of a landfill, which was an additional institutional control. The PRP Group constructed the source control remedy, obtained the institutional control for the property, and achieved construction completion for the Site with the signing of the Preliminary Close Out Report on September 25, 1996.

The assessment of this five-year review is that the source control remedy selected in the ROD was implemented in accordance with the ROD, but the remedy is not protective. In particular, the remedy has not been effective in protecting the drinking water aquifer and remediating the groundwater contamination plume. Monitoring since the previous five-year review demonstrates that the areal extent of groundwater contamination has increased since the PRP Group constructed the source control remedy and the plume has contaminated two residential wells. The State and the PRP Group have already taken additional response measures providing short term protection, including: (1) providing alternate water supplies to residences that were or could be affected by the expanded groundwater plume; (2) establishing a "Special Well Casing Pipe Depth Area" covering approximately 1.5 square miles around the landfill in which new wells shall be constructed or reconstructed to more stringent standards, pursuant to Section NR 812.12(3) of the Wis. Adm. Code; and (3) extending the scope of the monitoring program. The PRP Group is also studying the effectiveness of a temporary active gas extraction system that may reduce the contaminant plume in the aquifer. The remedy, with the additional measures taken, is expected to be protective of human health and the environment in the short term. However, the remedy is not protective in the long term because the area with contaminated groundwater has increased and additional monitoring is necessary to ensure that it is not continuing to expand; implemented interim measures are not enforceable, including the provision of alternate water supplies to any additional property where the contaminant plume may be found; and the source(s) of the groundwater contamination has not been adequately controlled. WDNR and USEPA will ensure that additional measures, including institutional controls, are implemented, maintained, and monitored to ensure the remedy's long-term protectiveness.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name (from *WasteLAN*): Ripon City Landfill		
EPA ID (from *WasteLAN*): WID980610190		
Region: 5	State: WI	City/County: Town of Ripon/Fond du Lac County
SITE STATUS		
NPL status: _x_ Final __ Deleted __ Other (specify) _____		
Remediation status (choose all that apply): __ Under construction _x_ Operating __ Complete		
Multiple OUs?* _x_ Yes __ No	Construction completion date: 9/25/96	
Has site been put into reuse? __ Yes _x_ No		
REVIEW STATUS		
Lead Agency: _x_ EPA __ State __ Tribe __ Other Federal Agency _____		
Author name: Bernard J. Schorle		
Author title: Remedial Project Manager	Author affiliation: USEPA, Region 5	
Review period:** 5/01 to 4/06		
Date(s) of site inspection: 5/16/06		
Type of review: _x_ Post-SARA ___ Non-NPL remedial action site ___ Regional discretion	___ Pre-SARA ___ NPL State/Tribe-lead ___ NPL-removal only	
Review number: __ 1 (first) _x_ 2 (second) __ 3 (third) __ Other (specify) _____		
Triggering action: __ Actual RA on-site construction at OU # ___ __ Construction completion __ Other (specify) _____	__ Actual RA start at OU # ___ _x_ Previous five-year review report	
Triggering action date (from *WasteLAN*): 5/22/01	Due date: 5/22/06	

*--"OU" refers to operable unit

**--Review period should correspond to the actual start and end dates of the five-year review in *WasteLAN*

Issues:

1. Groundwater contamination has continued to expand.
2. The passive gas collection system has not been sufficient to control the gas.

3a. Deed restrictions exist on the landfill property. However, due to expansion of groundwater contamination, the current groundwater use restrictions are not adequate; a study of institutional controls (ICs) has not been completed for the site.

3b. Long-term stewardship of the site must be assured.

Recommendations and Follow-Up Actions:

1. Evaluate the source control remedy for optimization or modification, evaluate the potential need for an active groundwater remedy, and ascertain whether or not the institutional controls need to be expanded.
2. Evaluate the effectiveness of the temporary active gas extraction system to determine if it sufficiently controls the gas.

3a. Complete an IC study.

3b. Complete an IC action plan.

Protectiveness Statement:

Since the previous five-year review, residences that were affected or that could be potentially affected by the expanded groundwater plume have been provided with an alternate water supply. A temporary active gas extraction system has been installed and its effectiveness is being studied. Therefore, the remedy is currently protective of human health and the environment because there is no evidence of exposure to Site-related contaminants. Long-term protectiveness requires that monitoring of the groundwater be continued, that possible further remedial measures be evaluated, and that effective ICs be implemented, maintained, and monitored.

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Ripon City Landfill Superfund Site
Town of Ripon, Fond du Lac County, Wisconsin
Second 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 the review are documented in a five-year review report. In addition, the five-year review report identifies issues found during the review, if any, and provides recommendations to address them.

The U.S. Environmental Protection Agency (USEPA) is preparing this five-year review report pursuant to §121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) (40 Code of Federal Regulations (C.F.R.) Part 300).

CERCLA §121 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.

The Agency interpreted this requirement further in the NCP; 40 C.F.R. §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.

The Wisconsin Department of Natural Resources (WDNR) and Region 5 of USEPA have conducted this five-year review of the remedy implemented at the Ripon City Landfill Superfund Site (Site) in the Town of Ripon (Fond du Lac County), Wisconsin, a National Priorities List (NPL) Site. This review was conducted for the entire Site by the remedial project manager (RPM) and the state project manager (SPM) for the period from May 2001 through April 2006. This report documents the results of the review.

This is the second five-year review for the Site. The triggering action for this statutory review is the acceptance of the first Five-Year Review Report on May 22, 2001. 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.

II. Site Chronology

Event	Date
Landfill Operations	1967-1983
WDNR and PRP Group agree to contract for remedial investigation, feasibility study, remedial design, and remedial action of source control operable unit	8/14/92
Proposed for placement on the NPL	6/23/93
Final on NPL	5/31/94
RI report	8/26/94
FS report	12/30/94
Public comment period	8/31/95-9/29/95
Public meeting	9/13/95
RD report approved by WDNR	1/26/96
ROD signed	3/27/96
Contractor for composite cap installation mobilizes at Site	5/13/96
Preliminary Close Out Report (construction completion under CERCLA)	9/25/96
Construction Documentation Report--Final Cover System	6/23/97
First Five-Year Review Report	5/22/01
Vinyl chloride detected in residential well for first time	October 2001
Municipal water supply pipeline extended from City of Ripon to and along Charles St. and first residences connected to the line	November 2002
Site inspection for second five-year review	5/16/06

III. Background

History of Landfill Operation and Physical Characteristics

The Ripon City Landfill [sometimes called "Ripon City of Ldfl (Hwy FF)" or "Ripon FF/NN Landfill"] Superfund site is located outside the northwestern city limits of the City of Ripon in the Town of Ripon, Fond du Lac County, Wisconsin. More specifically, it is located in the S ½ of the SE ¼ of Section 7, T16N, R14E, Town of Ripon. The map in Figure 1 shows the Site and some of the area around it; the landfill cap is outlined by the dashed line where the gas vent wells (GV wells) are located. The landfill is bordered on the north by a stand of trees, on the west by a road with a sand and gravel quarry on the other side, on the south by former residential property that now contains a dog park, and on the east by a former quarry. A wetland area is located to the southwest and is a shallow groundwater discharge area.

The facility had been a gravel pit before it was leased to Speed Queen in 1967 for the disposal of wastes. The City of Ripon began leasing the property in 1968 for the disposal of wastes, and in 1969 was issued a license to operate the landfill (WDNR license # 467). Later, the Town of Ripon joined with the City of Ripon in the operation of the landfill. The landfill operated until 1983, accepting municipal, commercial, and industrial solid wastes; approximately 3.3 million gallons of sludge from the Ripon wastewater treatment facility were disposed of at the landfill between 1977 and 1983. The landfill area was capped with clay in 1985, vegetation was established, and a gas venting system was placed along the western edge of the landfill. From 1985 to 1992, hay was grown on the cap; this was discontinued in 1993 because of disturbance to the clay

cap's integrity. The landfill has no liner or leachate collection system.

Land and Resource Use

The Site is located in a glaciated area of south central Wisconsin. The area near the Site consists of poorly sorted ground and end moraine deposits. Outwash deposits of sand and gravel are evident in the quarry located just west of the Site. The landscape slopes gently eastward. The landfill rises to the approximate elevation of County Trunk Highway (CTH) NN on the west [872 ft above mean sea level (msl)] and slopes downward to the east where it is approximately 20 feet lower.

The geology at the Site consists of approximately 180 feet of unconsolidated glacial deposits, primarily sand with some silty and clayey lenses and gravel, overlying the bedrock. The bedrock is the Cambrian Franconian Formation, a medium-grained sandstone approximately 150 feet thick at the Site.

The glacial unconsolidated deposits and the Cambrian sandstone are the two principal aquifers present in the area surrounding the landfill. The municipal wells and most private water supply wells use the sandstone as their water source. The lower limit of the Cambrian sandstone aquifer is delineated by the granite Precambrian basement at a depth of approximately 330 feet. Depth to ground water is variable and dependant on topography and precipitation. Groundwater is present at depths ranging from approximately 5 to 50 feet below ground surface, with the water table occurring at an approximate elevation of 820 feet above msl. The water table is approximately 20 feet below the base of the landfill.

It was found during the remedial investigation that the shallow ground water at or near the water table flows to the southwest toward a wetland area. This flow system has an average horizontal gradient of approximately 0.01 ft/ft. Shallow piezometers completed between 30 and 40 feet below the water table were used to confirm a southwesterly flow direction in the deeper unconsolidated deposits. The mean horizontal hydraulic gradient of the shallow potentiometric surface is approximately 0.005 ft/ft. Groundwater flow in the sandstone is to the west, based on regional information. Vertical hydraulic gradients are primarily upward and range from 0.001 to 0.096 ft/ft. The highest upward vertical gradients were seen to the south and southwest of the landfill. Three locations had downward gradients ranging from 0.001 to 0.013 ft/ft. There are private water supply wells at some of the residences south of the landfill; at least some of these are screened in the sandstone.

It has been reported that the highest hydraulic conductivities were observed in the sandstone while the lowest were noted in the wetland clay located to the northeast of the Site (2.0 x 10-5 ft/min). Horizontal gradients, hydraulic conductivities based on bail down testing, and estimated porosities were used in the past to calculate average groundwater flow velocities. Velocities calculated in the unconsolidated sand and gravel were approximately 650 ft/yr. However, in a focused feasibility study report submitted in October 2005, it was reported that calculated velocities in the shallow groundwater ranged from 0.02 to 708 ft/yr, with an arithmetic mean of 99 ft/yr.

Initial Response

In 1984, volatile organic compounds (VOCs) were detected in a private water supply well located approximately 350 feet south of the landfill. Sampling of a replacement well confirmed the elevated levels of VOCs at this location. This well was later abandoned, the house was relocated, and the City of Ripon purchased the property; the City recently converted this property to a dog park. Following the completion of a hazard assessment by WDNR, the Site was proposed for inclusion on the National Priorities List (NPL) in June 1993. It was added to the NPL in May 1994.

Several of the potentially responsible parties (PRPs) formed a group to investigate the Site. This group entered into a contract with the WDNR on August 14, 1992 to complete the following: conduct a remedial investigation (RI) to adequately characterize the Site; perform a feasibility study (FS) to identify and evaluate potential remedial options for the Site; prepare plans and specifications for a landfill cap and landfill gas extraction system for the source control operable unit; and implement the source control operable unit.

Extent of Contamination

This subsection describes the contamination present at the Site at the time of the remedial investigation.

The refuse in the landfill was approximately 30 feet thick on the western side near CTH NN and slopes to less than 10 feet thick on the eastern side of the landfill. Approximately 180,000 cubic yards of waste were placed in the landfill, which occupies about 7.3 acres. The volume of leachate in the landfill at the time was estimated to be between 6 and 11 million gallons. During the RI, samples collected from two leachate head wells were found to contain 10 VOCs. Both chlorinated solvents and their breakdown products and petroleum hydrocarbons, such as benzene, ethylbenzene, toluene and xylenes, were detected in the leachate.

The landfill was found to be producing a small amount of landfill gas consisting predominantly of methane and carbon dioxide. Methane was detected in monitoring wells and gas vents at concentrations which exceeded 25% of the lower explosive limit (LEL).

Eight VOCs were detected in groundwater monitoring wells during the remedial investigation. Vinyl chloride (VC), cis-1,2-dichloroethene (cis-1,2-DCE), benzene, trichloroethene (TCE), and tetrachloroethene (PCE) were present at concentrations exceeding the preventive action limits (PALs) of Chapter NR140 of the Wisconsin Administrative Code (Wis. Adm. Code). The concentrations of two of these compounds (VC and TCE) exceeded their respective NR 140 enforcement standards (ES). Three VOCs (TCE, cis-1,2-DCE, and VC) were detected in samples from more than one location. Concentrations of VC also exceeded the federal maximum contaminate level (MCL). (For the five compounds whose concentrations exceeded the PALs, the PAL is 10% of the ES. For four of these five, the ES equals the MCL; for VC the ES is 10% of the MCL.)

Concentrations of VOCs in the shallow (water table) groundwater exceeding NR 140 PALs were

limited to wells immediately adjacent to and downgradient (toward the southwest) from the landfill. The highest concentrations of VOCs were detected along the southern edge of the landfill, where in well MW-103 the concentration of VC reached a value that was more than two orders of magnitude greater than its MCL and the concentration of cis-1,2-DCE reached a value that was more than an order of magnitude greater than its MCL. Locations of the wells are shown on Figure 1. Note that some of the wells shown on this figure were installed after the remedial investigation had been completed. In the shallow well in the 107 well nest, about 400 feet downgradient from the southern edge of the landfill, VC and cis-1,2-DCE were not found during the RI but the concentrations of TCE did exceed the PAL. The only other monitoring well in the shallow groundwater further to the south did not have any VOCs at concentrations exceeding the PALs.

A discharge point for some of the shallow groundwater is the wetland located southwest of the Site. Concentrations of VOCs in groundwater entering the wetland area were low enough so as not to cause a problem in the wetland area.

In the deeper groundwater only vinyl chloride was found at concentrations exceeding the ES, at well nest 107. Contaminant concentrations in the deeper groundwater were measured at two depths at this location south of the landfill during the RI and at several adjacent locations during previous investigations. Contaminants were detected in the unconsolidated deposits and the Cambrian sandstone south of the landfill. However, modeling completed in 1991 indicated that the groundwater contamination did not pose a threat to the City of Ripon's municipal water supply wells. The private water supply wells located near the landfill were completed at the contact between the unconsolidated deposits and the sandstone. Sampling completed at private water supply wells during the RI indicated that no VOCs were present in these wells.

The remedial investigation activities are documented in a report dated August 26, 1994. The feasibility study report, dated December 30, 1994, presented remedial action alternatives for the source control and groundwater operable units.

More recently, groundwater contamination has been found further from the landfill than at the time of the remedial investigation. This is discussed later in this report.

Basis For Taking Action

On March 30, 1995, the Wisconsin Division of Health completed a Public Health Assessment (PHA) of the Site. The PHA concluded that groundwater beneath and next to the Site was contaminated with VOCs at concentrations that could pose a health hazard if this water were used for domestic purposes, such as drinking. In addition, leachate seeps along the eastern edge of the landfill could also represent health risks where people could come into contact with the seeps. The PHA concluded that if the use of contaminated groundwater for domestic purposes was restricted and the leachate seeps were eliminated then the Site would not pose a threat to human health.

Landfill gas was found in some of the groundwater monitoring wells indicating that some gas was escaping from the landfill.

Based on these facts, it was determined that remediation of the landfill was needed.

IV. Remedial Action

Remedy Selected

Remedial action objectives were developed for the Site to address the source of contamination, to provide short term and long term protection of human heath and the environment, and to meet the applicable or relevant and appropriate requirements. The site specific remedial objectives developed for the Site included:

- prevent direct contact with landfill contents;
- reduce contaminant leaching to the groundwater;
- control surface water run-on, run-off, and erosion;
- prevent off-site migration of landfill gas;
- restore groundwater quality to NR 140 standards; and
- monitor groundwater quality, landfill gas, and leachate for environmental control.

On March 27, 1996 USEPA concurred with the remedies for the Ripon City Landfill site that were identified in the ROD signed by WDNR on February 26, 1996. One component, or operable unit, of the remedy addressed the contamination source and the second component addressed the groundwater. The selected source control remedy was a composite landfill cap and passive landfill gas venting in conjunction with a groundwater monitoring plan.

Some of the components specified for the source control remedy were:

- a composite landfill cover (that is, a landfill cover containing both a plastic membrane and soil materials) over the entire waste disposal area;
- a passive landfill gas venting system installed through the landfill cover;
- monitoring groundwater, in both monitoring wells and selected residential wells, to determine the effectiveness of the landfill cap towards improving groundwater quality;
- monitoring for gas migration from the landfill using the gas probes installed around the landfill;
- fencing the landfill perimeter to restrict access;
- maintaining the landfill cover; and
- providing a deed restriction that prohibits disturbing the landfill cover.

The selected groundwater remedy was the no action alternative. WDNR stated that the groundwater contamination was not severe enough to warrant active groundwater remedial measures to restore groundwater quality, and that implementing the source control operable unit remedy would decrease migration of contaminants from the landfill to the groundwater. In addition to the monitoring program that is part of the source control remedy, the ROD recognized Chapter NR 812 of the Wisc. Admin. Code as a groundwater institutional control prohibiting the construction of new wells within 1200 feet of the landfill without a variance. This minimum separating distance does not apply to dewatering wells approved under section NR 812.09(4)(a); greater separation distances may be required for wells requiring plan approval under section NR 812.09.

Remedy Implementation

The design and construction of the remedy was managed by the PRP Group under the contract with WDNR. Work at the Site began in May 1996. The remedy was constructed as planned. No additional areas of contamination were identified. USEPA conducted a final inspection on September 10, 1996. The Site achieved construction completion with the signing of the Preliminary Close Out Report on September 25, 1996.

An as-built report dated June 23, 1997 was submitted. The cap consisted of: passive gas collection trenches that were placed within the waste, a 6- to 12- inch layer of sandy clay, a 24-inch layer of compacted clay, a 40-millimeter thick low density polyethylene geosynthetic membrane, a 12- inch layer of granular drainage material and piping, a geofabric filter over the granular drainage layer, a 18-inch layer of fill soil over the geofabric, and a final 6-inch layer of topsoil to establish vegetation. A fence restricts access. The trenches for the passive gas collection system were installed in a 150-foot grid network across the landfill. Thus, no portion of the landfill would be more than 75 feet from a collection trench. Slotted 4-inch diameter ADS (Advanced Drainage Systems. Inc.) high density polyethylene pipe was placed in the trench. Vertical vent pipes were connected to the slotted pipe at the trench intersections. These vertical pipes were connected to the geosynthetic membrane with a pipe boot that was clamped to the pipe.

Institutional Controls

Institutional Controls (ICs) are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential to 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 unlimited use or unrestricted exposure (UU/UE).

Consistent with the ICs selected in the ROD, Arline Sauer, the landfill property owner, signed on June 4, 1997, and filed with the Register of Deeds for Fond du Lac County on October 21, 1997, a Declaration of Restrictions on the property containing the Ripon landfill, also known as the Ripon FF/NN Landfill. The Declaration of Restrictions prohibits installing water wells, other than monitoring or leachate wells, prohibits certain specified Site uses, and prohibits any use that might damage or impair the effectiveness of any remedial action component constructed at the Site and any interference with the performance of the remedial work. The restrictions were declared to be a covenant running with the land.

The City of Ripon and the Town of Ripon, both members of the PRP Group, are now the owners of, and possess control over, the landfill property, through a February 2004 Personal Representative's Deed registered with the county.

During the Site inspection for this five-year review, the RPM traveled to the Fond du Lac County Register of Deeds office to inspect the records and ensure that the most recent deed transfer and property restrictions were on file. The most recent deed and restrictions were on file and available on computerized records. The clerk on duty noted that the reference numbers, contained on the documents, indicate permanent restrictions.

The ROD recognized that Chapter NR 812 of the Wisc. Admin. Code is a groundwater institutional control prohibiting the construction of new wells within 1200 feet of the landfill. In response to data indicating that the groundwater plume has expanded, the extent of which is still being determined, WDNR imposed additional controls through two memorandums dated July 15, 2004, to Wisconsin licensed well drillers. These memoranda, issued pursuant to Section NR 812.12(3) of the Wis. Adm. Code, impose a "Special Well Casing Pipe Depth Area" for an area surrounding and containing the landfill that cover approximately 1.5 square miles. Within this area, new wells must be constructed or reconstructed to more stringent standards specified in one of the memoranda. In addition, a water sample must be collected from each newly constructed or reconstructed well and the sample must be analyzed at a certified laboratory for VOCs. The area consists of an inner and an outer area. The inner area is approximately a rectangle whose east and west sides are about 1300 feet from the center of the landfill, whose north side is about 1000 feet from the center, and whose south side is about 3300 feet from the center. The outer area has sides that are 1300 to 1400 feet further from the center on the north and the east, about 2400 feet further on the west, and the same on the south. The different areas establish different well casing construction criteria.

Based on this limited review of the IC mechanisms selected and implemented: (1) for the property containing the landfill, the ICs are protective of the remedy and minimize the potential for human and environmental exposure to contaminants, and (2) for other properties near the landfill, this review indicates that the ICs are not adequate to protect the site remedy and to minimize the potential human and environmental exposures to contaminants from the aquifer. In particular, the record demonstrates that an adjacent property owner had implemented an aquifer dewatering program that adversely affected the hydrology at and around the landfill site; and the record demonstrates that contaminants have contaminated and threatened to contaminate neighboring private residential drinking wells at a time when no appropriate and enforceable IC was applicable to those neighboring properties.

Therefore, an IC plan that includes or is based on a study to verify the effectiveness and enforceability of the implemented ICs will need to be developed. The PRP Group and WDNR are expected to prepare this. The IC study will need to evaluate and identify enforceable legal and administrative controls which will provide the control mechanism(s) necessary and appropriate to protect the site remedy and to minimize the potential for human and environmental exposure from contaminants in the aquifer. The IC study will also evaluate administrative mechanisms to implement enforceable ICs. The Operation and Maintenance Plan should be amended accordingly, providing for a regular inspection and review of the ICs as required by the ROD, as implemented, as enforceable, and as necessary to minimize the potential for human and environmental exposure. These plans will be developed within six months of the date of signature of this Five Year Review Report.

Operation and Maintenance Sampling

The post remedial action sampling began in May 1996. The initial sampling requirements included: sampling 11 groundwater monitoring wells (7 monitoring wells and 4 piezometers) on a semi-annual basis for VOCs: sampling 7 potable drinking water wells located south-southwest of the landfill annually for VOCs; and sampling 3 leachate head wells (depending upon there

being a sufficient quantity of leachate available). A twelfth well was added in the second semiannual event. Four monitoring wells (2 monitoring wells and 2 piezometers) were removed from the sampling program in October 1998 when it was determined that these wells/piezometers were consistently free of detectable VOC concentrations. The concentrations of methane, carbon dioxide, and oxygen in the 12 passive gas vents, 3 leachate head wells, and 4 groundwater monitoring wells within and around the landfill were measured.

In the two rounds of groundwater sampling in 1996 (May and October), neither vinyl chloride nor cis-1,2-dichloroethene were found in wells MW-101 or MW-102; there was no trichloroethene in these wells and just a small amount of tetrachloroethene. (These four chloroethenes are related in that the higher chlorinated compound can undergo dechlorination to produce another chloroethene with less chlorine present. This can happen naturally.) Well MW-104 had about 7 micrograms/liter (µg/l) of VC (the MCL for VC is 2 µg/l), some cis-1,2-DCE and TCE, and no detection of PCE. Well MC-103 had 175 µg/l of VC and 790 µg/l of cis-1,2-DCE in the May sample (the October sample also contained significant amounts of these two), significant concentrations of TCE, and no detections of PCE. In November 1996, well MW-112 was sampled; it contained 15.5 µg/l of VC, about 58 µg/l of cis-1,2-DCE, and some TCE. These wells are all near the waste boundary and at the water table. Well MW-107 is also at the water table but not near the waste boundary; there were no detections of VC or cis-1,2-DCE but there was some TCE. The two deeper wells in the 107 well nest both had some VC.

V. Progress Since the Last Five-Year Review

As of the release of the Five-Year Review Report in May 2001, no detectable levels of VOCs had been found in the private water supply wells. The leachate head wells showed a significant decrease in the amount of leachate within the landfill. The base of the landfill is approximately at 841 feet above msl. The level of leachate in the landfill had dropped from approximately 853 feet above msl in 1993 to 842 feet above msl in 2000. This report also stated that the concentrations of VOCs in the groundwater monitoring wells had decreased since the installation of the composite cap. The number of wells with concentrations exceeding the PALs had decreased from 11 to 4. The concentrations of VC in the two deeper wells at well nest 107 had remained about the same as, or dropped somewhat from, their values during the remedial investigation.

Because of the discovery of an expansion of the groundwater plume a few months after the Five-Year Review Report was issued in May 2001, considerable work has been accomplished since then to try to determine the extent of the plume and ascertain the cause of the expansion and what measures might be needed to control it.

In October 2001, the well at the residence at the northwest corner of Koro Road and Charles Street was found to have 0.96 µg/l of VC and no detection of cis-1,2-DCE; this concentration of VC exceeded the NR 140 ES value of 0.2 µg/l. This well had been in the monitoring program since 1993 and there had been no detections of VOCs. Because of this discovery, the well at the residence just west of this one was sampled for the first time in November and it was found to have 7.0 µg/l of VC and a small amount of cis-1,2-DCE in the water. In November, several other residential wells in the same area were sampled but no other detections of VC in the residential wells were found. At the two deeper wells in the 107 well nest, the concentrations of VC be-

tween May 1996 and October 2001 generally ranged from 1 µg/l to 2 µg/l, with a couple of non-detects, in well P-107, compared to 3 µg/l to 6 µg/l at the time of the RI, and from about 1 µg/l to 5 µg/l in the deeper well P-107D, compared to 6 µg/l at the time of the RI, but were at 5.6 µg/l and 10 µg/l in 2001.

The impacted residences were initially provided with bottled water. Then a treatment system, consisting of an air stripper, was installed in each of the households. The two impacted residences were eventually connected to the municipal water supply after the water line was extended to the area. Eventually three other residences in the area were connected to the municipal water supply even though no VC had been found in their water.

As a result of the impacts to the private water supply wells, additional Site investigations have been performed. Four additional monitoring wells were installed to further define the hydrogeology and determine the area of the VC impacts to the groundwater. These wells are P-111D (first used in May 2002), P-113A (first used in October 2002), P-113B (first used in October 2002), and P-103D (first used in February 2004); the times of first use are based on reported water elevation measurements. Wells MW-3A and MW-3B, which had been installed by Alliant Energy for another investigation in 1991, were initially sampled in April 2002 and added to the monitoring schedule. Three private water supply wells were reconstructed as monitoring wells, P-114 (the Ehster's former well), P-115 (the Wiese's former well), and P-116 (the Hadel's former well). The Ehster's well is the second residential well that was found to contain VC, and the concentrations have generally ranged from 6 to 10 µg/l. The first residential well found to have VC, that at the Altnau's residence, has been abandoned; this well and the other private well that was abandoned have been abandoned in accordance with Wisconsin regulations. Since its first sampling (April 2002), well P-111D (bottom of well elevation at 704 ft above msl) has always had significant concentrations of VC, generally exceeding 10 µg/l. However, VC has never been detected in well P-111 (bottom of well elevation at 774 ft above msl). VC has not been detected in either well nest 113 wells. VC has sometimes (4 out of 14 sampling events) been detected in the water from well MW-3B, at concentrations ranging from the PAL to about twice the PAL, since April 2002. There have been no detections of VC in well MW-3A, the deeper of the two well nest 3 wells.

In May 2002, water table monitoring wells MW-101, MW-104, and MW-106 were found to be dry. This was eventually traced to a dewatering operation at the Northeast Asphalt, Inc. quarry located to the east of the Site, on the east side of County Highway FF. Reportedly, this dewatering was started in early 2002 and continued to May 2002. Eventually, water table monitoring wells MW-102, MW-103, and MW-107 also were found to be dry. The other three water table wells were never found to be dry but there were drops in the measured water elevations. By the October 2003 sampling event, all of the water table monitoring wells had enough water to get water level measurements. By the April 2004 sampling event, the water elevations had returned to levels similar to those found prior to May 2002.

Beginning in May 2002 and continuing through October 2004 VC was detected in the water from well P-102 (bottom of well elevation is 781 ft above msl) at concentrations ranging from 0.32 µg/l to 2.1 µg/l. This is the only period when VC has been found in well P-102. VC has never been detected in well MW-102 (bottom of well elevation is 819 ft above msl). VC was found in

well P-103 in October 2004, it was not found in January 2005, but it was found in each of the four sampling events since then, at concentrations ranging from 1.7 µg/l to 3.6 µg/l. Prior to this it had only been found once, at an estimated concentration of 0.1 µg/l in May 1996. After water again became available in well MW-103, the VC concentrations have been much lower, being in the range of 1.8 µg/l to 7.9 µg/l for the last three sampling events, through April 2005, whereas between May 2000 and February 2002 the VC concentrations generally ranged between 40 µg/l and 80 µg/l, with one concentration at 15 µg/l. No VC has been detected in well P-106, which is located in the direction of the dewatering operation. Well P-106 has had concentrations of trichloroethene that are generally close to the PAL of 0.5 µg/l at each sampling event for this well between October 1993 and October 2003; however in the four events since October 2003, there has been only one detection.

With the addition of more wells to the sampling program, the PRP Group's contractor placed the wells into four groups or layers. Layer 1 wells (9 wells) are the water table wells, which are screened in sand or sand and gravel. The elevations of the bottoms of the wells range from 821 to 812 ft above msl. Layer 2 wells (8 wells) are screened in sand or silt. The elevations of the bottoms of the wells range from 792 to 774 ft above msl. Layer 3 wells (7 wells) are screened in sandstone (one in sand and gravel). The elevations of the bottoms of the wells range from 704 to 681 ft above msl. Layer 4 wells (3 wells) are screened in sandstone or granite. The elevations of the bottoms of the wells range from 570 to 508 ft above msl. The three residential wells that have been converted to monitoring wells are Layer 3 wells. In well nest 107, the two deeper wells are Layer 2 and Layer 4 wells. In well nest 111, the two deeper wells are Layer 2 and Layer 3 wells. In well nest 113, the wells are Layer 3 and Layer 4 wells.

The Layer 1 flow has historically been towards the southwest. Groundwater flow in Layer 2 has historically been towards the southwest, also, but the flow direction changed during the dewatering activities at Northeast Asphalt when the flow was towards the northeast with water elevations more than 20 ft lower than normal. In Layer 3, the October 2003 and April 2004 levels indicated a southwesterly groundwater flow. More recently the flow direction is toward the southwest and then turns toward the west; this change resulted from the inclusion of the potentiometric surfaces measured in new wells P-113B and P-116, which were added subsequent to the April 2004 event.

Historic water level measurements from Layer 4 wells beginning in 2002 indicated a groundwater flow direction toward the southeast. The August and October 2005 groundwater measurements indicated that the potentiometric surface had apparently shifted so that the flow was toward the southwest and the January 2006 measurements indicated that the flow had shifted again and was now toward the northwest. The January 2006 measurements for the Layer 4 wells were taken across a 24 hour period between January 31 and February 1, 2006. It is suspected now that the apparent shifts in flow direction have been related to changes in water levels that can occur in a 24-hour period due to municipal water pumping cycles; one of the municipal wells is located to the south of well nest 3. Therefore, another round of water levels was collected from the three Layer 4 wells on March 30, 2006 within a 10 minute time span. These measurements indicated a flow direction to the southeast which seems to have confirmed the suspicions.

Eleven gas probes were installed around the perimeter of the landfill to study the migration of landfill gas from the landfill after the discovery of VC in the residential wells. Methane gas

concentrations have been measured at gas probes and monitoring wells around the landfill, and methane has exceeded 25% of its lower explosive limit (LEL) at several locations outside of the limits of the landfill. In addition, analyses of landfill gas samples have indicated that VC is present in some of the landfill gas samples

Based on the results of the additional investigations, the WDNR requested that the PRP Group evaluate alternatives to address the spread of the groundwater plume that has been found since the ROD was issued. A pilot test of an active landfill gas extraction at the Site was conducted in May 2005. The results of the pilot test indicated that active gas extraction from the existing landfill gas venting system is capable of reducing methane concentrations at the gas probes located outside the waste boundary.

A focused FS was submitted to WDNR in October 2005. The provision of municipal water for the affected area was selected as an interim measure and has been at least partially implemented by connecting some of the residents to this water supply. Active gas extraction was selected as an interim action to address the off-site landfill gas migration which may be introducing VC into groundwater. In March 2006, a temporary active gas extraction system was installed and started up at the Site using the existing gas vents and leachate head wells as the wells in the extraction system. Its effectiveness is presently being evaluated. Preliminary results of the active gas extraction system indicate that methane gas concentrations inside the landfill are being reduced and gas migration outside the landfill is being controlled. The review of the focused FS will be done after at least some of the results for the active gas extraction have been analyzed.

The final cover system is in excellent condition. There have been no visible ruptures or erosion in the soil cover, water does not pond on the cap, and the vegetation is thick and tall. Initially some stressed vegetation was noticed in the vicinity of well MW-104, possibly related to methane gas, but the vegetation has subsequently been naturally re-established in this area. No landfill cap maintenance has been required.

In February 2004, a Personal Representative's Deed was registered with the county transferring ownership of the land containing the landfill to the City of Ripon and the Town of Ripon.

In two memorandums to Wisconsin Licensed Well Drillers dated July 15, 2004, WDNR established, under the provisions of Section NR 812.12(3) of the Wis. Adm. Code, a "Special Well Casing Pipe Depth Area" for an area containing approximately 1.5 square miles that includes the landfill and some surrounding area. Within this area new wells are to be constructed or reconstructed to more stringent standards, which are specified in one of the memorandums. In addition, a water sample is to be collected from each newly constructed or reconstructed well and the sample is to be analyzed at a certified laboratory for VOCs. The area consists of an inner and an outer area. The inner area is approximately a rectangle whose east and west sides are about 1300 ft from the center of the landfill, whose north side is about 1000 ft from the center, and whose south side is about 3300 ft from the center. The outer area has sides that are 1300 to 1400 ft further from the center on the north and the east, about 2400 ft further on the west, and the same on the south. Compliance with the requirements of this "Special Well Casing Pipe Depth Area" do not alleviate the requirement to obtain a variance to construct a new well or reconstruct an existing well within 1,200 feet of the landfill.

VI. Five-Year Review Process

Administrative Components

USEPA initiated the second five-year review for the Site in the winter of 2006. While WDNR had drafted and finalized the first Five-Year Review Report, which was approved by USEPA, USEPA and WDNR determined in January 2006 that USEPA would perform the second five-year review with support from WDNR.

In January 2006, USEPA also informed the PRP Group's contractor of the initiation of the five-year review.

The review consisted of: document review; data review; community notification; site inspection; and report development and review.

Community Notification and Involvement

On April 27, 2006, USEPA's Office of Public Affairs placed an advertisement in the *Ripon Commonwealth Press* announcing that the five-year review was in progress. The advertisement said that comments could be submitted through May 8, 2006. In addition, USEPA mailed a flyer to a number of parties who had been involved with the Site in the past. This flyer provided information on the review and the comment period. No comments were received by USEPA concerning the review.

USEPA will inform the public of the completion of the review and the availability of the report once the report is signed.

Document Review

GeoTrans, Inc., Brookfield, Wisconsin, the contractor for the PRP Group, prepared the report, *Five Year Summary Report 2000-2005, Ripon FF/NN Landfill, Ripon, Wisconsin*, April 27, 2006. This report was used extensively for this five-year review. In addition, some of the periodic reports on the monitoring results and additional work that has been done investigating the landfill and the extent of the groundwater contamination have been reviewed. Documents reviewed include the ROD, GeoTrans' *Five Year Summary Report 1996-2000, Ripon FF/NN Landfill, Ripon Wisconsin*, January 10, 2001, and the previous five-year review. GeoTrans' *Focused Feasibility Study, FF/NN Landfill, Ripon, WI*, October 25, 2005, was also consulted for this report. However, the study will be formally reviewed after data is obtained on the active gas extraction system that began operation in March 2006.

Data Review

USEPA reviewed the data from the monitoring that has been performed since the completion of the construction of the original remedy. The monitoring program obtains data on groundwater, both from monitoring wells and from residential wells, landfill gas, and leachate. After it was discovered that the groundwater contamination had spread into other areas, the monitoring pro-

gram was expanded from that used immediately after construction completion. The PRP Group has performed a pilot test for an active gas extraction system at the landfill and is presently operating a temporary system to evaluate the effectiveness of an active system. The information reviewed has been discussed in various sections above.

Site Inspection

USEPA conducted an inspection on May 16, 2006 for this second five-year review. At that time, the RPM found the landfill cover, wells, and extraction system to be in good condition and in operating order. There was little odor and a low noise level. While the cover appeared to be in good condition, the RPM noted that in the southwest corner, the ground felt soft and it seemed as if there was water beneath the vegetation (there had been several days of precipitation prior to the inspection). However, no water was visible and there was no mud. There is a fence around some of the landfill which also appeared to be in good condition; the more visible sides are fenced.

The property south of the landfill is being used as a dog park, and at the time of the inspection, several people and dogs were in the park Across S. Koro road on the west side of the landfill is R & R Wash Materials, a quarry operation. Across County Highway FF, opposite the dog park, is another active quarry operation, Northeast Asphalt, Inc. At the quarry fence is a warning sign about deep water. To the north of the quarry is the Ripon Rifle and Pistol Club.

A check was made at the Fond du Lac County Register of Deeds office to see whether the most recent deed transfer and restrictions on the property containing the landfill are on file. The deed transfer and the restrictions were in the computerized records. The clerk on duty noted that the reference numbers contained on the documents indicate permanent restrictions.

VII. Technical Assessment

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

No.

In order for the remedy to be functioning as intended, effective ICs must be implemented, maintained, and monitored. To that end, an IC study and plan will be developed.

Data collected as part of the post-remedial monitoring revealed that the groundwater plume was expanding. This is contrary to the anticipated result for capping the landfill and installing a passive gas extraction system. The plume expansion was discovered shortly after the completion of the first five-year review. Subsequently, WDNR has required the PRP Group to perform additional work. The PRP Group has expanded the monitoring program and is investigating the use of an active gas extraction system at the landfill as a method to reduce the source of contaminants to the groundwater. The PRP Group has provided an alternate water supply for residents that had contamination in their wells and for some residents with wells within the path of contamination.

The landfill cover has reduced the amount of leachate in the landfill.

A Declaration of Restrictions was received for record on October 21, 1997 by the Register of Deeds, Fond du Lac County. The document had been signed by the property owner at the time, Arline Sauer, on June 4, 1997. The restrictions were for the property upon which the landfill, commonly known as the Ripon FF/NN Landfill, is located. Briefly, the restrictions prohibit the installation of water wells, other than monitoring or leachate wells, prohibit certain specified activities related to the use of the Site, and prohibit any use that might damage or impair the effectiveness of any remedial action component constructed at the Site and any interference with the performance of the remedial work. The restrictions were declared to be a covenant running with the land.

The deed restrictions have been registered with the county. The City of Ripon and the Town of Ripon, both members of the PRP Group, are now the owners of the landfill property. The Wisconsin regulation restricting construction of wells within 1,200 ft of a landfill still applies. And WDNR has established a "Special Well Casing Pipe Depth Area" for about 1.5 square miles of the area around the Site.

An IC study will be developed within five months of the date of the signature of this Five-Year Review Report; this is expected to be done by the PRP Group with oversight by WDNR. An IC plan will be developed within six months of the date of the signature of this Five-Year Review Report to evaluate the effectiveness of the existing land use restriction and determine if additional ICs are needed due to the expansion of the contaminant plume; this is expected to be done by the PRP Group and WDNR, with oversight by USEPA.

USEPA has no information on the costs of operation and maintenance at this time.

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?

No.

The Record of Decision stated, "The groundwater contamination that has migrated from this landfill is not severe enough to warrant active groundwater remedial measures to restore groundwater quality." Although a NR 140 ES (and USEPA MCL) standard had been exceeded 400 or 500 feet downgradient, it was deep enough in the aquifer and far enough from water supply wells that it was not considered a threat to human health and the environment. However, this exposure pathway did become complete when contaminated groundwater with a concentration of VC greater than the ES reached two residential wells.

There have been no major changes in the physical conditions at the Site that would affect the protectiveness of the remedy. There are no new applicable or relevant and appropriate requirements (ARARs) that will require a change in the remedy or additional remedial action. Additional remedial action may be required to address the unanticipated expansion of the area containing groundwater with unacceptable contamination. The provision of an alternate water supply, an additional remedial measure taken since the previous five-year review, ensures continued protectiveness.

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

Yes.

The discovery of exceedences of the ES for VC in some residential wells has already resulted in an interim remedial action measure being taken to ensure continued protectiveness of the remedy (alternate water supply). An active gas extraction system is being tested at the waste disposal area to determine if this will reduce the amount of VOCs that are escaping and contaminating the groundwater. Further groundwater monitoring and data analysis are necessary to determine the full extent of the contaminant plume, whether it is continuing to expand, and whether or not additional measures are needed for the groundwater. Additional evaluation will be conducted during the next 18 months.

Technical Assessment Summary

Based on the review of the analytical data collected for the Site over the last five years and the discussions with WDNR and the PRP Group's contractor, the remedy has required at least one enhancement, which has already been implemented (the provision of an alternate water supply for affected residences). Further enhancements may be required. An IC plan needs to be developed to ensure that current restrictions are adequate and to ascertain the need to expand the restrictions.

VIII. Issues

1. Groundwater contamination has continued to expand.
2. The passive gas collection system has not been sufficient to control the gas.

3a. Deed restriction exist. However, due to expansion of groundwater contamination, the current use restrictions may not be adequate; a study of institutional controls (ICs) has not been completed for the site.

3b. Long-term stewardship of the site must be assured.

IX. Recommendations and Follow-Up Actions:

1. Evaluate the source control remedy for optimization or modification, evaluate the potential need for an active groundwater remedy, and ascertain whether or not the institutional controls need to be expanded.
2. Evaluate the effectiveness of the temporary active gas extraction system to determine if it sufficiently controls the gas.

3a. Complete an IC study.

3b. Complete an IC action plan.

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Mile-stone Date	Affects Protectiveness? (Y/N)	
					Current	Future
Groundwater contamination expansion	Evaluate the source control remedy for optimization or modification, evaluate the potential need for an active groundwater remedy, and ascertain whether or not the institutional controls need to be expanded.	PRPs	WDNR	March 2008	N	Y
Gas collection inadequacy	Evaluate the newly installed active gas extraction system to ensure it remedies the problem.	PRPs	WDNR	March 2008	N	Y
ICs	Complete IC study	PRPs	WDNR	Feb. 2007	N	Y
ICs	Complete an IC action plan[1]	PRPs/WDNR	USEPA	March 2007	N	Y

X. Protectiveness Statement

Since the previous five-year review, residences that were affected or that could be potentially affected by the expanded groundwater plume have been provided with an alternate water supply. A temporary active gas extraction system has been installed and its effectiveness is being studied. Therefore, the remedy is currently protective of human health and the environment because there is no evidence of exposure to Site-related contaminants. Long-term protectiveness requires that monitoring of the groundwater be continued, that possible further remedial measures be evaluated, and that effective ICs be implemented, maintained, and monitored.

[1] The IC plan will include provisions for: a) completing an IC study to evaluate whether effective ICs have been implemented; b) implementing corrective measures, if necessary; c) developing IC maps; and d) ensuring that effective procedures are in place for long term stewardship. These procedures should include regular inspections of ICs at the Site and regular certifications to USEPA that ICs are in-place and effective, along with exploring the development of a communications plan and exploring the use of the state's one-call system.

XI. Next Review

The next five-year review for the Ripon City Landfill is required in September 2011, five years from the date of this review.

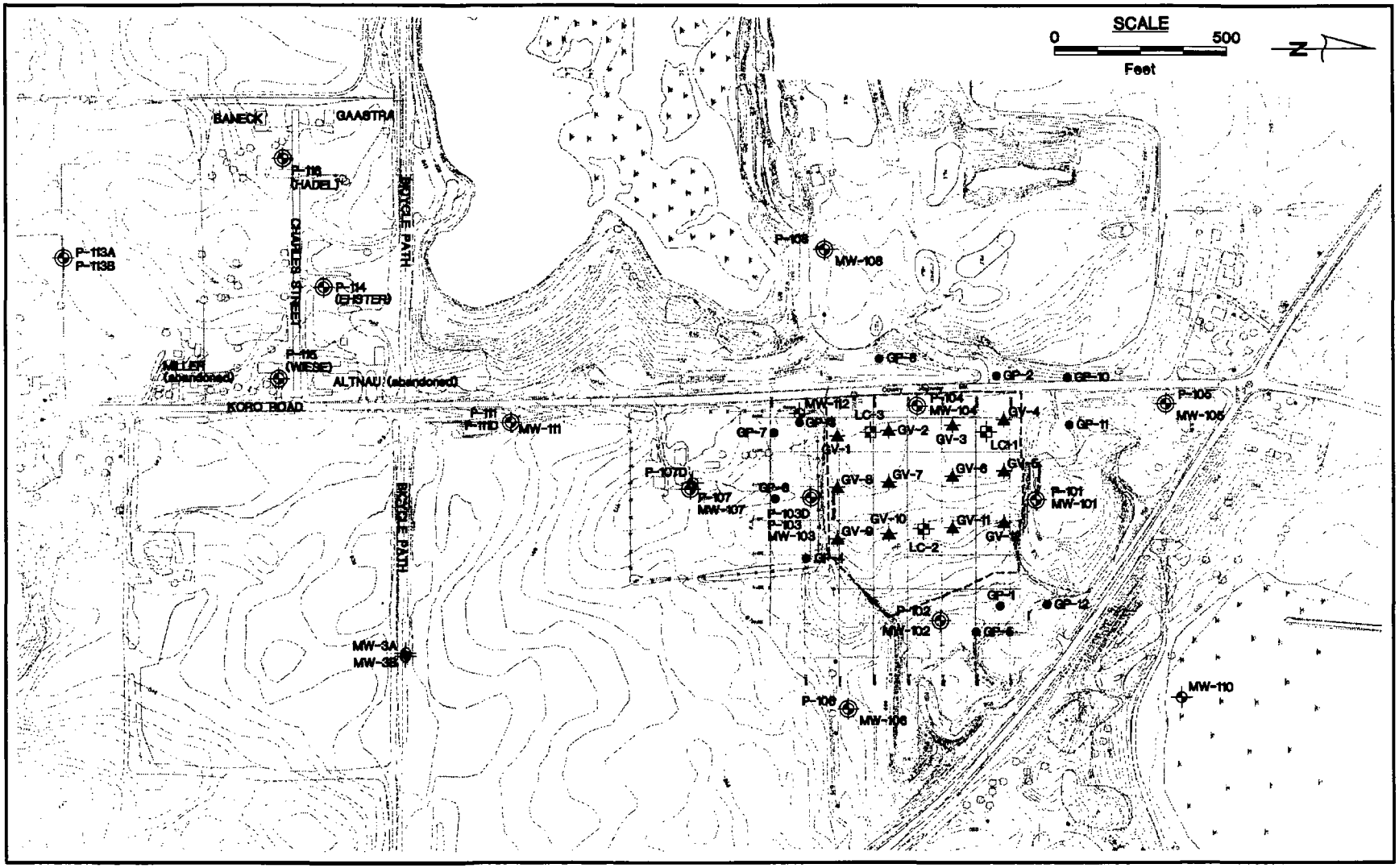

Figure 1. Map of area of the Ripon City Landfill site showing sampling locations (source: GeoTrans, Inc.)