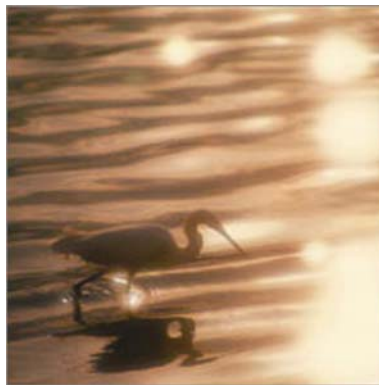
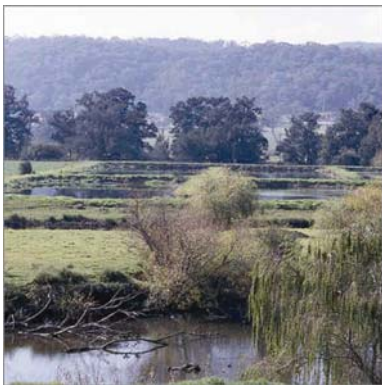


Prepared for

Rail Corporation NSW

Remedial Action Plan

**Former Macdonaldtown Gasworks – Burren Street,
Erskineville, NSW**

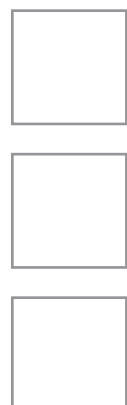


Final Report

December 2007

Reference: 359092

CH2MHILL



CH2M HILL Australia Pty Ltd
Level 7, 9 Help Street
CHATSWOOD NSW 2067
Phone 02 9950 0200
Fax 02 9950 0600

This document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission.

Reproduction of this document is prohibited without the express, written approval of CH2M HILL Australia Pty Ltd.

Executive Summary

This Remedial Action Plan (RAP) has been prepared for the Former Macdonaldtown Gasworks located at Burren Street, Erskineville (the Site). The location of the Site is presented on **Figure 1**. The Site is located between Erskineville and Macdonaldtown railway stations and encompasses an area of 7,732m².

This RAP has been prepared to enable Rail Corporation New South Wales (RailCorp) to meet their long term objectives for the Site, including addressing unacceptable human and ecological health risks posed by site contamination and to enable beneficial re-use of the Site for rail-related activities. Therefore this RAP has been prepared to enable RailCorp to:

- Enter into a Voluntary Remediation Agreement (VRA) with the NSW Department of Environment and Climate Change (DECC);
- Seek the requirements for Environmental Assessment pursuant to Part 3A of the Environmental Planning and Assessment Act, 1979 (EP&A Act, 1979);
- Call tenders for the site remediation;
- Commence community consultation processes; and
- Document procedures and management controls for the site remediation.

The following scope of work was undertaken in preparing this RAP:

- A review of background information.
- Liaison with RailCorp and the appointed DECC-accredited contaminated land Site Auditor.
- Perform the functions of the Principal Contractor to the extent required during preparation of the RAP.
- Conduct a site inspection to document the current site conditions, new railway infrastructure in the area and identify any sensitive receptors.
- Liaise with the NSW DECC and provide RailCorp with guidance regarding site remediation and long-term site management requirements.

The Site was acquired in 1888 by the railways department and has been under ownership to the present day. It was operated as a gasworks plant between 1892 and 1958, and related gasworks activities until the mid 1970's. Since that time the Site has remained unused and vacant. An above-ground gasholder structure (Southern Gasholder) is the most prominent relic that remains extant from previous operations as a gasworks site.

The Site lithological profile consists of surface fill materials, generally to depths of 1.5 metres below ground level (mbgl) but up to 4.0mbgl along the western site boundary. Fill materials overlay stiff plastic clays weathered from the underlying Ashfield shale parent rock that is highly fractured and becomes prominent at depths beyond 6mbgl.

The Site hydrogeological profile consists of a two layered groundwater system, a shallow perched system overlaying a deeper regional bedrock system. Perched groundwater occurs generally at depths of 2.0 – 2.5mbgl, but as shallow as 1.0mbgl in some areas. Deeper groundwater is part of the regional aquifer and occurs under semi confinement at depths in the weathered zone and more competent parent rock. The water level of the deeper

groundwater is generally above the perched groundwater, given its semi-confined nature. Flow direction of both groundwater systems is toward the south east.

Past operations as a gasworks site generated considerable quantities of coal tar that remains on the Site in contamination source areas including the Tar Wells, underground pipework and the below ground remnants of the Northern Gasholder. Other sources of contamination include surface ash/coke fill and asbestos impacted demolition wastes. Contamination sources, particularly coal tars, have significantly impacted the soils and groundwater to a degree that they have been declared by the NSW DECC to pose a significant risk of harm to human health and the environment. Soils and groundwater are impacted to varying degrees by:

- monocyclic aromatic hydrocarbons (MAH), which include benzene, toluene, ethylbenzene & xylenes (BTEX));
- polycyclic aromatic hydrocarbons (PAH);
- nonhalogenated phenolic compounds;
- heavy metals (in localised fill materials); and
- asbestos (in localised fill materials).

The contaminated groundwater plumes are limited to land owned by RailCorp, which is used for operational railway purposes.

To meet the long term objectives and make the Site suitable for beneficial re-use the preferred remedial options and/or combination of options were determined to be:

1. Installation of Site Security Fencing;
2. Collection of liquid wastes/sludges and disposal at a liquid waste facility;
3. Excavation, organic stabilisation treatment (at an alternate treatment site) and disposal of soil waste at a landfill facility under the NSW DECC General Approval for Immobilisation for coal tar materials – Approval #2005/14;
4. Excavation, thermal desorption treatment (at an alternate treatment site) and disposal of soil waste at a landfill facility;
5. Excavation and disposal of soil waste at a landfill facility under the NSW DECC General Approval for Immobilisation for ash materials – Approval #1999/05;
6. Excavation and disposal of asbestos impacted demolition waste at a landfill facility;
7. Excavation and disposal of untreated fill/soil waste at a landfill facility;
8. Beneficial Reuse and Recycle (including segregation of demolition waste) of suitable materials where appropriate;
9. Insitu (passive) chemical oxidation of residual source materials at depth subsequent to excavation and disposal of above materials; and
10. Long term Environmental Management Plan (EMP) including a Groundwater Management Plan (GMP) with a Monitored Natural Attenuation (MNA) approach.

In consideration of the remedial strategy, the main approach to removing unacceptable human and environmental health risks is to remove contamination sources to the extent practicable through excavation. This will be undertaken noting limitations and site constraints. Site validation will target human health from impacted soils to a certain depth,

while deeper impacts, which cannot be removed due to limitations and site constraints, will be addressed by developing the EMP and ongoing monitoring of groundwater using the MNA approach.

Important to the site remediation process will be to consider the significant heritage importance of the existing Southern Gasholder and the sensitivity of the adjoining residential homes and local neighbourhood of Erskineville. The site is irregularly shaped and the area available to locate remediation infrastructure and undertake remediation activities is limited. In this regard, it may be necessary for any remediation treatment processes to be undertaken off site at an alternative treatment site, prior to landfill disposal.

Given the archaeological and heritage importance of the Site, remediation will require assessment under Part 3A of the Environmental Planning and Assessment Act, 1979.

Remediation will require management during the site remediation process in consideration of Occupational Health and Safety, Community Consultation, Heritage, Traffic, Excavation Works and the Environment.

A long term EMP will be developed to document the requirement and objectives to conduct ongoing management of contamination issues at the Site. In this regard, potential human health risks, heritage items and groundwater management will be addressed. Source removal, groundwater management (including monitoring) and MNA approaches are considered the key attributes to addressing the long term objectives for the Site and protecting groundwater.

Table of Contents

1	Introduction	1
1.1	Background	1
1.2	Site Identification	1
1.3	Areas of the Site.....	2
1.4	Appreciation and Objectives	3
1.5	Scope of Work.....	3
1.6	Previous Site Assessment.....	3
1.7	Limitations	4
2	Site Overview	6
2.1	Site History.....	6
2.2	Site Heritage.....	6
2.3	Setting and Condition.....	6
2.4	Lithology	7
2.5	Hydrogeology	10
2.6	Future Site Use.....	10
3	Site Contamination Status	11
3.1	Soils	11
3.2	Groundwater	16
3.3	Surface Water.....	17
3.4	Vapours	18
3.5	Contaminants of Concern	18
3.6	Areas of Environmental Concern and Contamination Sources.....	19
3.7	Exposure Routes and Receptors of Contamination.....	19
3.8	Rationale for Soil Remediation.....	20
3.9	Extent of Remediation	20
3.10	Evaluating Risk Posed by Contaminated Groundwater	21
4	Remediation Goals and Validation Criteria.....	23
4.1	Soil Validation Criteria.....	23
4.2	Adopted Soil Criteria.....	26
4.3	Groundwater	28
4.4	Surface Water.....	29

4.5	Aesthetic Considerations	29
5	Site Remediation.....	30
5.1	Objectives	30
5.2	Remediation Policy	30
5.3	Review of Potentially Suitable Remedial Options.....	30
5.4	Preferred Remedial Options	31
5.5	Remedial Options Activities.....	37
5.6	Managing Groundwater Contamination.....	39
6	Environmental Planning and Approvals.....	42
6.1	State Environmental Planning Policy 55 – Remediation of Lands.....	42
6.2	State Environmental Planning Policy (Major Projects).....	42
6.3	Environmental Planning and Assessment Act	42
6.4	Contaminated Land Management Act.....	45
6.5	Protection of the Environment Operations Act	46
6.6	Environment Protection and Biodiversity Act.....	47
6.7	Environmentally Hazardous Chemicals Act, 1985.....	47
6.8	Heritage Act.....	48
6.9	Transport Administration Act.....	48
7	Remediation Planning and Permits	49
7.1	Transportation of Materials and Equipment.....	49
7.2	Materials Containing Asbestos	49
7.3	Excavations	49
7.4	Discharge of Water.....	50
7.5	Removal of Trees.....	51
7.6	Operation of a Treatment Facility.....	51
7.7	Waste Classification, Immobilisation and Disposal	51
7.8	Rail Industry Safety Inductions (RISI)	52
7.9	Confined Spaces	52
8	Remediation Management.....	53
8.1	Health and Safety	53
8.2	Community Consultation	55
8.3	Site Establishment	55
8.4	Heritage	58

8.5	Traffic	59
8.6	Excavation Works	60
8.7	Site Reinstatement.....	64
8.8	Environmental Management.....	64
8.9	General Contingency Plan	70
9	Site Validation.....	72
9.1	Excavated Areas	72
9.2	Waste Classification.....	72
9.3	Imported Material	73
9.4	Beneficial Re-Use of Excavated Material	73
9.5	Analysis of Validation Data.....	75
9.6	Quality Assurance and Quality Control Program.....	75
9.7	Waste Tracking	76
9.8	Validation Report	76
10	Long-Term Management.....	77
10.1	Site Users	77
10.2	Protecting Heritage Items	77
10.3	Groundwater Management	77
11	Conclusion	82
12	References	83

List of Figures

Figure 1	Site Location
Figure 2	Historic and Current Site Layout
Figure 3	Site Areas and Previous Sampling Locations
Figure 4	Remediation Areas and Excavation Depth Estimates
Figure 5	Site Access and Traffic Routes
Figure 6	Groundwater Monitoring Well Locations for MNA Program

List of Tables

Table 1	Summary of All Data for Fill & Silty Clay Material
Table 2	Summary of All Data for Natural Soil

List of Appendices

Appendix A	Site Photographic Record and Locations
Appendix B	Development of Risk-Based Depth Criteria
Appendix C	Evaluation of Short-list Remedial Options
Appendix D	RailCorp Infrastructure Engineering Standards – Geotechnical Guides
Appendix E	General Approvals for Immobilisation

Abbreviations	
ACLCA	Australian Contaminated Land Consultants Association
ANZECC	Australia New Zealand Environment and Conservation Council
ARHS	Australian Railway Historical Society
As	Arsenic
BaP	Benzo(a)pyrene
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes
CBD	Central business district
CCO	Chemical Control Orders
Cd	Central business district
CLP	Community Liaison Plan
Cr	Chromium
Cu	Copper
DEC	Department of Environmental and Conservation
DECC	Department of Environment and Climate Change
DCP	Development Control Plan
DNAPL	Dense Non-Aqueous Phase Liquid
DNR	Department of natural resources
DQIs	Data Quality Indicators
DQOs	Data Quality Objectives
ENCM	Environmental Noise Control Manual
EAR	Environmental Assessment Requirement
EPA	Environment Protection Authority
EP&A	Environmental Planning and Assessment
EPL	Environment Protection Licence
ESC 410	Earthworks and Formation, September 2006
GDE	Groundwater Dependant Ecosystem
GILs	Groundwater Investigation Levels
GMP	Groundwater Management Plan

Hg	Mercury
H&SP	Health and Safety Plan
LNAPL	Light Non-Aqueous Phase Liquid
MAH	Monocyclic Aromatic Hydrocarbons
MNA	Monitored Natural Attenuation
MNES	Matters of National Environmental Significance
NATA	National Association of Testing Authorities
NEPM	National Environment Protection Measure
Ni	Nickel
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCDD/F	Polychlorinated Dibenzo Dioxins and Polychlorinated Dibenzo Furans
PEPs	Protection of the Environment Policies
PID	Photo-Ionisation Detector
POEO	Protection of the Environment Operations
POEO GR	Protection of the Environment Operations (General) Regulation
PPE	Personal Protective Equipment
QA/QC	Quality assessment / quality control
RAP	Remedial Action Plan
RISI	Rail Industry Safety Inductions
RSA	Rail Services Australia
SEPP	State Environmental Planning Policy
SKM	Sinclair Knight Merz
EMP	Environmental Management Plan
SROH	Significant Risk of Harm
SWMS	Safe Work Method Statement
TA act	Transport Administration Act
TMP	Traffic Management Plan
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limits

VENM	Virgin Natural Excavated Material
VIP	Voluntary Investigation Proposal
VRA	Voluntary Remediation Agreement
Zn	Zinc

1 Introduction

In April 2007, Rail Corporation NSW (RailCorp) engaged CH2M HILL Australia Pty Ltd (CH2M HILL) to prepare this Remedial Action Plan (RAP) for the Former Macdonaldtown Gasworks located at Burren Street, Erskineville (the Site). The location of the Site is presented on **Figure 1**.

1.1 Background

In August 2000 the Site was declared by the NSW Environment Protection Authority (EPA) to pose a Significant Risk of Harm (SRoH) to human health and the environment. The declaration was made in consideration of the concentrations of contaminants in the soil and groundwater reported in previous site investigations.

RailCorp wish to remediate the Site such that long term objectives can be met, including:

- Removal of the SRoH declaration;
- Removal of the health risks to future site users;
- Removal of the risks to environmental receptors; and
- To allow the beneficial use of the Site for rail related activities.

This RAP has been prepared to provide an appropriate remedial strategy that would enable the long term objectives to be met. This RAP has also been prepared for the following purposes that will enable RailCorp to:

- Enter into a Voluntary Remediation Agreement (VRA) with the NSW Department of Environment and Climate Change (DECC¹);
- Seek the requirements for Environmental Assessment pursuant to Part 3A of the Environmental Planning and Assessment Act, 1979 (EP&A Act, 1979);
- Call tenders for the site remediation;
- Commence community consultation processes; and
- Document procedures and management controls for the site remediation.

1.2 Site Identification

The Site is located between Erskineville and Macdonaldtown railway stations, approximately 3km south west of the Sydney Central Business District (CBD) and encompasses an area of 7,732m². The Site is roughly triangular in shape, being part of the area referred to as the Macdonaldtown Triangle, and is bound to the north by rail land, to the south and east by a rail corridor, and to the west by a row of residences on Burren Street. **Figure 2** shows the general site layout and adjoining features.

Site identification information is presented in Table 1-1 below.

¹ The DECC was formed in 2007 and incorporates the Department of Environment and Conservation (DEC) and the EPA which forms part of the DEC. References to the EPA and DEC should be taken as also meaning the DECC, and vice versa.

Table 1-1 Site Identification	
Street Address	Burren Street, Erskineville NSW 2043
Lot and DP Number	Part Lot 50 in DP1001467
Site Area	7,732m ²
Geographical Coordinates	624700N; 343200E
Owner	Rail Corporation NSW
Zoning	Railways Zone (Sydney Regional Environmental Plan 26)
Current/Proposed Land Use	Vacant/Commercial-Industrial (for rail-related operations)
Local Government Area	City of Sydney
Parish	Petersham
County	Cumberland

1.3 Areas of the Site

During recent investigations (CH2M HILL, March 2007) to delineate impacts at the Site and to enable preliminary remediation options screening, the Site was stratified into eight areas based on an understanding of historical use and impacts, as shown on **Figure 3**. The stratified areas include:

- **Gasholders:** encompasses both Gasholder structures adjoining the western boundary. The Southern Gasholder remains intact with the superstructure standing approximately 12 metres above the ground surface. The above ground structure of the Northern Gasholder has been demolished, however the brick annulus structure remains intact beneath the ground.
- **Retort:** encompasses the footprint of the former Retort House, Tar Wells, Condensers, Coal and Shale Storage areas and other building structures associated with the gasworks operations (office, amenities, etc). These buildings and structures have been demolished and associated structures are no longer visible above the ground surface. However some underground structures remain in place, including the two Tar Wells, pipework, brick flooring and foundations and concrete slabs.
- **Gas Purifier:** encompasses the footprint of the former Purifier Beds, Scrubbers and Gas Meters. Similar to the Retort Area, structures only remain buried below the ground surface, with no above ground structures remaining.
- **Northeast:** includes the majority of the northeast section of the Site.
- **South Central:** includes the portion along the central southeast boundary.
- **Southwest:** includes the majority of the southern area of the Site.
- **Retaining Wall:** includes the filled area embankment along the northern site boundary.
- **Western Lot:** includes the small rectangular section of land that extends west to Burren Street.

1.4 Appreciation and Objectives

It is understood that an RAP is required to facilitate and realise RailCorp's long term objectives for the Site. It is noted that in enabling the long term objectives to be met, removing risks from the Site will only be possible following implementation of the preferred remedial strategy, which will more appropriately aim to remove, to the extent practicable, unacceptable risks to the long term use of the Site for primarily rail-related purposes.

The objectives of the RAP will be to:

- Set remediation goals and validation criteria such that the remediated site will satisfy to the extent practicable the long-term land use objectives of RailCorp;
- Document the preferred remediation strategies;
- Identify the approvals and licenses required for site remediation; and
- Document the environmental management approach to mitigate impacts to the surrounding environment during site remediation.

1.5 Scope of Work

RailCorp engaged CH2M HILL to undertake the following scope of work:

- Review background information.
- Liaise with RailCorp and the appointed DECC-accredited contaminated land Site Auditor.
- Perform the functions of the Principal Contractor to the extent required during preparation of the RAP.
- Prepare a Safe Work Method Statement (SWMS) for RailCorp's approval prior to undertaking site inspections.
- Conduct a site inspection to document the current site conditions, new railway infrastructure in the area and identify any sensitive receptors.
- Prepare this RAP.

In addition to the above scope, RailCorp required CH2M HILL to liaise with the NSW DECC and provide RailCorp with guidance regarding potential use of an off site treatment facility to facilitate site remediation, if required, and long-term groundwater management requirements.

1.6 Previous Site Assessment

The following is a list of the reports that have previously been prepared for the Site.

- Rail Services Australia "Eveleigh Gasworks - Site History" November 1999 (RSA, Nov 1999).
- CH2M HILL Australia "Phase I & II Environmental Site Assessments" June 2000 (CH2M HILL, June 2000).

- CH2M HILL Australia “Vegetable, Soil and Sediment Sampling – Letter Report” November 2000 (CH2M HILL, Nov 2000).
- CH2M HILL Australia “Soil & Groundwater Investigations of the Former Gasworks Area and Offsite” December 2001 (CH2M HILL, Dec 2001).
- Australian Railway Historical Society “A Brief History of NSW Railway Gasworks” June 2003 (ARHS, June 2003).
- Banksia Heritage & Archaeology “Macdonaldtown Station Works - Archaeological Assessment” April 2004 (Banksia Heritage, April 2004).
- GHD “Macdonaldtown Triangle (Former Cleaning Sheds) - Delineation and Classification Sampling” September 2005 (GHD, Sept 2005).
- Sinclair Knight Merz “Macdonaldtown Triangle (Former Gasworks Site) - Human Health and Ecological Risk Assessment” April 2006 (SKM, April 2006).
- Heritage Concepts “Archaeological Assessment and Remediation Management Strategy” November 2006 (Heritage Concepts, November 2006).
- CH2M HILL Australia “Delineation & Characterisation Sampling and Review of Remedial Options” March 2007 (CH2M HILL, March 2007).

These documents will be appropriately referenced throughout this RAP.

1.7 Limitations

This RAP is given strictly in accordance with, and subject to, the following limitations:

- The RAP was prepared for RailCorp in accordance with the Scope of Work agreed between CH2M HILL and RailCorp.
- CH2M HILL assumes no responsibility for conditions we were not authorised to investigate.
- This report is based, in part, on unverified information supplied to CH2M HILL from several sources during the project research. Therefore, CH2M HILL does not guarantee its completeness or accuracy, and assumes no responsibility for errors or omissions related to this externally supplied information.
- An understanding of the Site conditions depends on the integration of many pieces of information; some regional, some site specific, some structure-specific and some experienced-based.
- The advice tendered in this report is based on information obtained from the field investigation locations, test points, sample points and field and laboratory data, and is not warranted in respect to the conditions that may be encountered across the Site at other than these locations. It is emphasized that the actual characteristics of the sub-surface and surface materials may vary between adjacent test points and sample intervals and at locations other than where

observations, explorations and investigations have been made. Sub-surface conditions, including groundwater levels and contaminant concentrations can change in a limited space and time.

- The previous investigations reviewed during the preparation of this RAP identified actual surface and subsurface conditions only at those locations where samples were taken and when they were analysed. This data has been interpreted and an opinion rendered regarding the overall environmental conditions
- Because of the inherent uncertainties in sub-surface evaluations, changed or unanticipated sub-surface conditions may occur that could affect total project cost and execution. CH2M HILL does not accept responsibility for the consequences of variations in the site conditions.
- This report has not been prepared for the purpose of assessing the suitability of soil and fill on the Site for foundations or any Geotechnical purpose.
- This report should not be altered, amended or abbreviated, issued in part and issued incomplete in any way. CH2M HILL accepts no responsibility for any circumstances that arise from the issue of the report which has been modified as outlined above.
- This report has been prepared for the exclusive use of the Client relating to the property as described in the report. No warranty, expressed or implied, is made. There are no beneficiaries to this report other than the Client, and no other person or entity is entitled to rely upon this report without the written consent of CH2M HILL, and a written agreement limiting CH2M HILL's liability.

2 Site Overview

This section provides a summary of site history, heritage and other site information.

2.1 Site History

The Site was acquired in 1888 by the NSW State Government railways department and has been under State ownership to the present day.

The Site operated as a gasworks plant between 1892 and 1958. Gas was produced from coal and shale raw products and stored in two gasholders. Operations included raw product storage, gas production, waste disposal, filling and storage of tar wastes. To facilitate these operations, site structures and buildings included a Retort House, a Boiler, Condensers, Purifier Beds, a Scrubber, Tar Wells, above ground tar tanks, two Gasholders, service pipework, raw store areas for coal and shale, and other buildings likely to be offices, washrooms and compressors.

The historical layout of the former gasworks operation is presented on **Figure 2**.

The following gives the chronology of the Site, pre and post operation:

- 1891:- Design plans approved;
- 1892:- Construction completed. The detailed layout of the various components of the operation are slightly different to the design plans;
- 1942:- The use and location of two tar wells is documented on plans;
- 1950's:- The use of inferior coal during the coal strike of the 1950's causes damage to the plant machinery and as a consequence the gasworks ceased operations. The two Gasholders are used to store gas that was manufactured and piped from the Mortlake operations;
- 1958:- The gasworks is demolished, with the exception of the Southern Gasholder, which remains extant;
- 1970's:- During the mid 1970's the Site closed down and is no longer used for storing and pumping gas product;
- Present:- The Site remains as vacant railway land. The only significant above ground structure remaining is the Southern Gasholder.

2.2 Site Heritage

The Southern Gasholder is listed on the State Heritage Register and the Sydney Regional Environment Plan 26 (SREP 26) as part of the Eveleigh Railway Workshops. This structure is the only item from the gasworks site to be listed on the register.

2.3 Setting and Condition

The Site is generally a triangle shape that is somewhat irregular and completely secured with a perimeter fence. A narrow rectangular area extends west from the