4.0 Project Description

4.1 VISION STATEMENT

To address the needs of the City and to set a general direction for change, a Vision for the future of waste management in the City was needed. The vision statement is set out below.

"The Brady Road facility will exemplify Best Practices in the long-term, by means of safe, and environmentally responsible management of recyclable and non-recyclable "waste" materials discarded by citizens of the City of Winnipeg. As such, it will consistently seek:

MAXIMUM REAL-TIME MATERIALS REUSE: Maximum upstream diversion of materials having potential for reuse, repurposing, commoditization or energy recovery.

MAXIMUM FUTURE MATERIALS REUSE: Maximum environmental and economic stewardship in managing, segregating, storing and recovering potentially useful materials for future reuse, energy recovery or commoditization (including delivery to markets), as markets evolve and mature.

MAXIMUM SITE-UTILIZATION EFFICIENCY: Maximum utilization of the landfill's areal footprint and its materials-storage airspace, to effect greatest practical revenue generation on the smallest possible spatial footprint, at the least cost.

MINIMUM ENVIRONMENTAL IMPACT: To achieve the least possible environmental impact through the combination of Best Practice in new cell design, continually improving Standard Operating Procedures, an evolving Emergency Response Plan; and concerted emphasis on upstream waste diversion.

MINIMUM SOCIO-ECONOMIC IMPACT: To protect the maximum possible buffer zone and to minimize visual impact using berming, a three-tiered fencing system, and botanical screening, thereby protecting the widest practical range of future site-management options with the least possible intrusion into the health, safety and quality of life of the landfill's neighbours.

REGIONAL "SINGLE WINDOW" CENTRE OF EXCELLENCE: To serve as the model waste-materials-management facility and repository within the Winnipeg-centred region, providing such services to the region as value-added materials recycling (or storage for future reuse), composting of organic materials (potentially including some biosolids), optimum management of landfill leachate, and minimized buried disposal of non-recyclable materials, such that the option is protected that less efficient and less environmentally protective landfills within the region can be progressively decommissioned.

> *PERPETUAL SITE USE: To be the only integrated waste-materials management facility that the City of Winnipeg will ever need, functioning effectively on a perpetually re-usable land base that fully meets its long-term foreseeable spatial requirements without the need for expansion, because of increasing focus on diversion and systematic and progressive 'landfill mining' and recovery of buried resources.*

From the perspective of disposal, this Vision Statement identified the needs:

- For increased diversion through materials reuse.
- Increased efficiency in how the Brady Road landfill is operated in order to minimize environmental and social impacts.
- Sustained movement toward a future where the Brady Road landfill would operate well into the future as a model waste-management and materials-recovery facility.

This vision is congruent with the desires for greater waste diversion, value recovery, materials reprocessing and even commoditization expressed in an extensive public participation process (Section 6.0; Appendix E).

4.2 MATERIALS-DIVERSION AND RECYCLING

4.2.1 Overview

The City's recycling program includes the single-family blue box, multi-family blue bin and recycling depot programs. These recycling programs are funded by the Solid Waste Utility funds and not through property taxes.

The City first offered its curbside blue box recycling program to single-family dwellings in 1995 and later, in 2001, expanded the program to include multi-family residential buildings (blue recycling bin program). Currently the City operates a single-stream recycling system and collects material on a weekly basis. There is no limit to the amount of residential recyclables that can be placed at the curb for collection.

Currently the City collects the following items in the recycling program:

- Plastic containers imprinted with a recycling triangle on the bottom, including all bottles, pails, tubs, and jugs
- Aluminum drink cans
- Steel (tin) food cans
- Milk and juice cartons

- Juice boxes
- Newspapers and inserts, flyers and junk mail
- Magazines, phone books, household paper, shredded paper and envelopes
- Cardboard egg cartons and paper tubes
- Flattened cardboard, no more than 1 m in any direction, e.g., cereal, tissue, laundry, shoe and packing boxes
- Glass jars and bottles (clear and coloured)

The following items are not accepted in the recycling program:

- Plastic bags, plastic packaging and cellophane
- Household hazardous waste containers, e.g., antifreeze, motor oil, windshield washer fluid, bleach, pesticide or herbicide
- Aluminum foil or foil pie plates
- Foil or foam takeout food containers
- Foam packaging, foam egg cartons or foam meat trays
- Mirrors, window glass or light bulbs
- Drinking glasses, ceramics or cookware

As part of the CIWMP, the City will consider options for expansion of the recycling program to include material such as plastic bags, aluminum foil or foil pie plates and foam packaging.

Small businesses that produce between 0.5 and 3.0 m^3 (1.0 to 4.0 yd^3) of garbage per week and use the City's garbage-collection service are eligible to participate in the curbside recycling collection program. The City provides recycling containers to participating businesses at no charge. Two types of carts are available including:

- Plastic carts – two-wheeled containers, with a 360-litre capacity.
- Metal bins – 2.25-m^3 capacity (2,250 litres). These are as large or larger than garbage cans, and available with wheels and lockable metal lids, if requested.

Once collected, the City's recyclables are taken to the material recycling facility (MRF) owned and operated by Emterra. Emterra processes the recyclables and ships the separated materials

for further processing as outlined in Table 4-1. The depot is described more fully in Section 4.3.1.

Table 4-1: End Uses for Recyclable Materials[1]

Recyclable Item	Destination	End Use
Containers:		
Glass	Brady Road landfill	Road base
#1 plastic bottles (PET)	Western Canada	Plastic bottles and trays, carpet fibre
#2 plastic bottles (HDPE)	Western Canada	Sewage pipe, plastic bottles
#3-#7 plastic containers	Winnipeg and China	Plastic lumber
Milk / juice cartons	Eastern Canada and Midwestern USA	Office paper and tissue paper
Aluminum	Eastern USA	Auto parts, aluminum cans
Steel cans	Selkirk, Manitoba	Steel building products, auto parts
Paper and Cardboard:		
Newspapers, flyers, magazines	Manitoba, Eastern Canada and Western USA	Newspaper
Household paper, phone books	Western Canada, Western USA and China	Household paper, boxboard and paper egg cartons
Boxboard	Western Canada, Western USA and China	Boxboard and paper egg cartons
Cardboard	Western USA	Cardboard

[1] http://winnipeg.ca/waterandwaste/recycle/whatHappens.stm

4.2.2 Program Performance

In 2009, the City collected 34,654 tonnes of recycling from single-family residences and 7,006 tonnes of recycling from multi-family residences.

The Manitoba Product Stewardship Corporation (MPSC) provided approximately $4.7 million in funding support for the recycling program in 2009. Funding responsibility shifted to Multi-

Material Stewardship Manitoba (MMSM) as of April 1, 2010. The funding rate in effect for Winnipeg for the period from April 1, 2010, to December 31, 2010, was $108 per metric tonne[1].

4.2.2.1 Future Commodity Storage and Recovery

It is possible that products which currently have no market (or value) could become valuable in the future. If these commodities could be identified it may be possible to store them until they become valuable. The large land-base at Brady Road could provide storage area for such products.

Another activity which is related to commodity recovery is landfill mining. Landfill mining refers to the excavation and processing of previously deposited wastes. Chief benefits of landfill mining are potential recovery and reuse of materials and reduction of landfill space (http://en.wikipedia.org/wiki/landfill_mining; http://www.www.enviroalternatives.com/landfill.html). Some of the old cells at Brady may have a significant amount of useful/valuable commodities which could be excavated, recovered and marketed.

4.2.3 Materials Burial

The Federation of Canadian Municipalities (2009) defines “zero waste communities: as:

“A…community that has made a long-term commitment to reducing waste through measures such as extended producer responsibility programs, economic instruments to encourage waste reduction, green procurement and product design that includes end-of-life management.”

Although there are many jurisdictions which are promoting “zero waste” the reality is that there will likely always be a need to bury some of the waste collected. This could be related to difficulties in converting the waste to a useable form, excessive cost to process, lack of market/uses or a variety of other factors. These materials will need to be disposed of by burial.

4.3 MATERIALS RECOVERY AND RECYCLING COMPONENTS

4.3.1 Recycling Depot

All of the single-stream recyclable materials currently collected by the City’s program are processed under contract with Emterra at a single-stream MRF. This contract expires in September 2017. Preliminary review of the current MRF operations and the City’s program indicates that:

- About 47,000 tonnes of recyclables are currently collected and processed annually by the City’s program, around 34,500 tonnes from single family blue box collection and other programs including multi-family bin collection and recycling depots. In 2010, the single

[1] MMSM Municipal Recycling Program Registration Guide

family blue box program served approximately 183,000 households, resulting in recycling recovery rates in the order of 200 kg/household. In comparison with other single-stream recycling programs operating in large urban municipalities (for example, single-stream programs in Ontario), this recovery rate falls a little below the average for program performance.

- The MRF was originally designed to process in the order of 35,000 tonnes per year of single-stream material, with the current contract guaranteeing a minimum tonnage from the City's program of 26,000 tonnes per year. In 2010, the facility processed about 47,000 tonnes of material. Based on the current design and storage capacity of the facility, the MRF appears to be near to at its processing capacity limit. It is unlikely that the current MRF could accommodate an increase in recycling capture rates and increased flow of recyclable materials.

- Currently, if there are operational problems at the MRF, such as the failure of the baler in recent years, there are few alternatives for the City to ensure that its materials can be processed and marketed.

- Operationally, there are areas of the current MRF that could likely be improved to increase the quantity and quality of materials sent to market. A key area for improvement is the container line. Improvements in container processing is necessary to improve the quality of the 'glass' stream used for road aggregate at the Brady Road landfill and should increase aluminum recovery.

The City will need additional processing capacity in the near-term. Additional processing capacity could be provided through: changes to the current MRF operations, expansion of the current MRF, or developing a new facility. A viable option would be to develop a new MRF at Brady Road.

For the mid- to longer-term, the City will require capacity to process 70,000 or more tonnes of recyclable materials each year. In the long term, the City could contract out processing and/or develop City-owned capacity. It is likely that the long-term system could include multiple facilities serving the City and potentially include surrounding rural municipalities.

4.3.2 Future On-Site Materials Recovery Facilities

4.3.2.1 Community Resource Recovery Centre

The City currently provides several areas at the Facility for the diversion of various recyclable materials, including leaf and yard waste, scrap metal, automotive batteries, bicycles, tires, propane tanks and appliances (Photos 1-3, 1-4, 1-5).

Under the CIWMP, a Community Resource Recovery Centre (CRRC) will be established at the front end of the Facility (e.g., Photo 1-7). Intended to be a 'full-service' drop-off centre, the

CRRC will allow individuals to separate out all of the materials they generate, including both garbage and divertable materials such as clean wood, metals and shingles. There are plans to establish off-site, satellite CRRCs to increase accessibility to drop-off centres. It is anticipated that each CRRC could divert between 5,000-10,000 tonnes of material each year, adding up to a 3% increase to the residential diversion rate for each CRRC.

Private sector initiatives that divert materials will be encouraged. Companies currently diverting materials, for example, include: Palliser (wood waste), Wood Anchor (Elm wood waste) and Rocky Road Recycling (concrete).

Additional options considered for the mid- to long term include initiatives to:

- Separate and process durable goods like mattresses and furniture to recover textiles, metal and wood.
- Work with the Province and other community partners to enhance programs for recycling in public spaces and at special events.

4.3.2.2 Yard-Waste Management

Leaf and yard waste is currently managed as follows:

- Collection from northwest Winnipeg residents with automated carts on a quarterly basis (twice in the spring and twice in the fall), to reduce waste volume.
- Drop-off to a dedicated disposal area at the Facility.
- Drop-off at one of the ten “Leaf it with Us” depots that are operated in the spring, summer and fall months.

Despite these programs, much of the leaf and yard waste produced by residents ends up in the curbside garbage stream.

In 2009, 4,759 tonnes of leaf and yard waste was collected from all sources. In its first year of operation (2010), the leaf and yard waste collection program offered to northwest Winnipeg residents resulted in the collection of 697.5 tonnes of leaf and yard waste.

In the near-term, the City could expand on its current leaf and yard waste program. At minimum this would expanding the current collection program offered in the northwest of the City to provide four pickups a year across the City. This could divert another 3,000 tonnes or more a year. If this was coupled with a new CRRC, an additional 5,000 tonnes a year could be diverted.

If leaf and yard waste was collected across the City more frequently (biweekly from April to November) and at a permanent drop-off location (e.g., a new CRRC), the City could divert an

additional 20,000 tonnes from disposal every year (adding around 6% to the current residential diversion rate).

Leaf and yard waste material could be processed at an enhanced composting area at Brady Road. This would include installing a larger and more effective composting pad and possibly new equipment. Some revenues could be earned from the sale of the compost.

4.3.2.3 Wood-Waste Management

In December 2010, the City issued two RFPs related to wood: one was a RFP for wood utilization, the other for chipping Christmas trees.

Wood-utilization contractors will provide the following services, including:

- Chipping wood (e.g., Photo 1-6).
- Reusing existing logs for value-added wood products (i.e., flooring).

4.3.2.4 Food-Waste Management

Currently, the City has no pickup or recycling of food waste as part of the waste-management system. The use of home composters is encouraged and composters are offered by the Solid Waste Services Division at a reduced price. It is anticipated that food waste pickup and recycling will be a component of a future phase of the City's waste-management plan.

In the mid- to longer term, the City is planning to implement a Source Separated Organics program, collecting and processing kitchen (food) waste and other materials. This could divert up to 41,000 tonnes or more from disposal each year, adding around 12% to the current residential diversion rate. There would be significant change to the collection program, and a new processing facility would be needed.

4.3.3 Organics Recycling and Commodity Sales

Organic materials like leaf, yard and food waste make up over one-third of the residential waste stream. Other organic materials in residential garbage include compostable paper (e.g., paper towel), pet waste and diapers. Organics are also generated by businesses and institutions in the City. The majority of these organics are landfilled at Brady Road. Plans to recycle some of these materials are being developed and potential for marketing the end products is being explored.

Composting activities at Brady Road will be expanded and improved in future programs. Currently the City composts leaves and yard waste collected in the "Leaf it to Us" program. A new, larger area for composting is currently being developed and the materials composted will be expanded to include food waste and other organic material.

4.4 LANDFILL SITE DESIGN

The Brady Road Resources Management Facility (the Facility) is located south of the Perimeter Highway, between Brady Road and Waverley Street (Figure 4-1; Photo 1-1). The facility is comprised of 790 ha of City-owned land, which includes land allocated to previous and active use and open space, which acts as a buffer and preserves an option for future storage capacity, provides for resources recovery and reprocessing, and creates potential for public recreation.

4.4.1 Landfill Development

Landfill cells are and will continue to be constructed using an area-fill method progressing south from the northwest corner (Photo 1-1; Figure 4-2). The future waste-burial area is illustrated in Figure 4-3.

4.4.2 Landfill Cells

4.4.2.1 Excavation Plan

Based on information reported by KGS Group (2009), the average base-grade elevation of existing Brady Road Landfill operating cells is estimated to be approximately 227 to 228 m above sea level (asl), for an average excavation depth of approximately 5 to 6 m (16 to 20 ft) below prairie level (233 m asl). The slope of excavated side slopes for existing cells is approximately 3H:1V and 2H:1V. Wastes have been deposited to a height varying from approximately 18 to 29 m above prairie level (251 to 262 m asl). Cell bases were graded on a slope to facilitate leachate collection through pipes and manholes, described further in Section 4.4.4. The historical and projected future progression of cell excavation and completion is illustrated in the contours illustrated in Figure 4-4.

At the City's request, Stantec undertook a desktop geotechnical analysis (Stantec, 2011a) to determine the upper and lower bounds of potential future cell excavation depths in consideration of the upward and downward pressures at the clay/till interface. The upper bound of the possible excavation depth was calculated to be 7.6 m, with the lower bound calculated to be 5.4 m. The upper bound was noted as representing an impending failure condition (i.e., factor of safety = 1.0). The City will undertake further analysis to determine the desired excavation depth for all future cells.

Future cells are expected to be excavated to a depth of 6 to 7 m (16 to 20 ft) below ground surface, for an average base-grade elevation of 227 to 228 m asl. Side slopes will be excavated to a slope of approximately 4H:1V (i.e., ~25-30%; Figure 4-5). Wastes are anticipated to be deposited to a height of up to 30 m above prairie level, with the width of the work face or cell at approximately 60 m. The cell base is anticipated to be sloped towards a leachate-collection pipe to be located in the centre of the cell.

THE CITY OF WINNIPEG

WATER AND WASTE DEPARTMENT
SOLID WASTE SERVICES

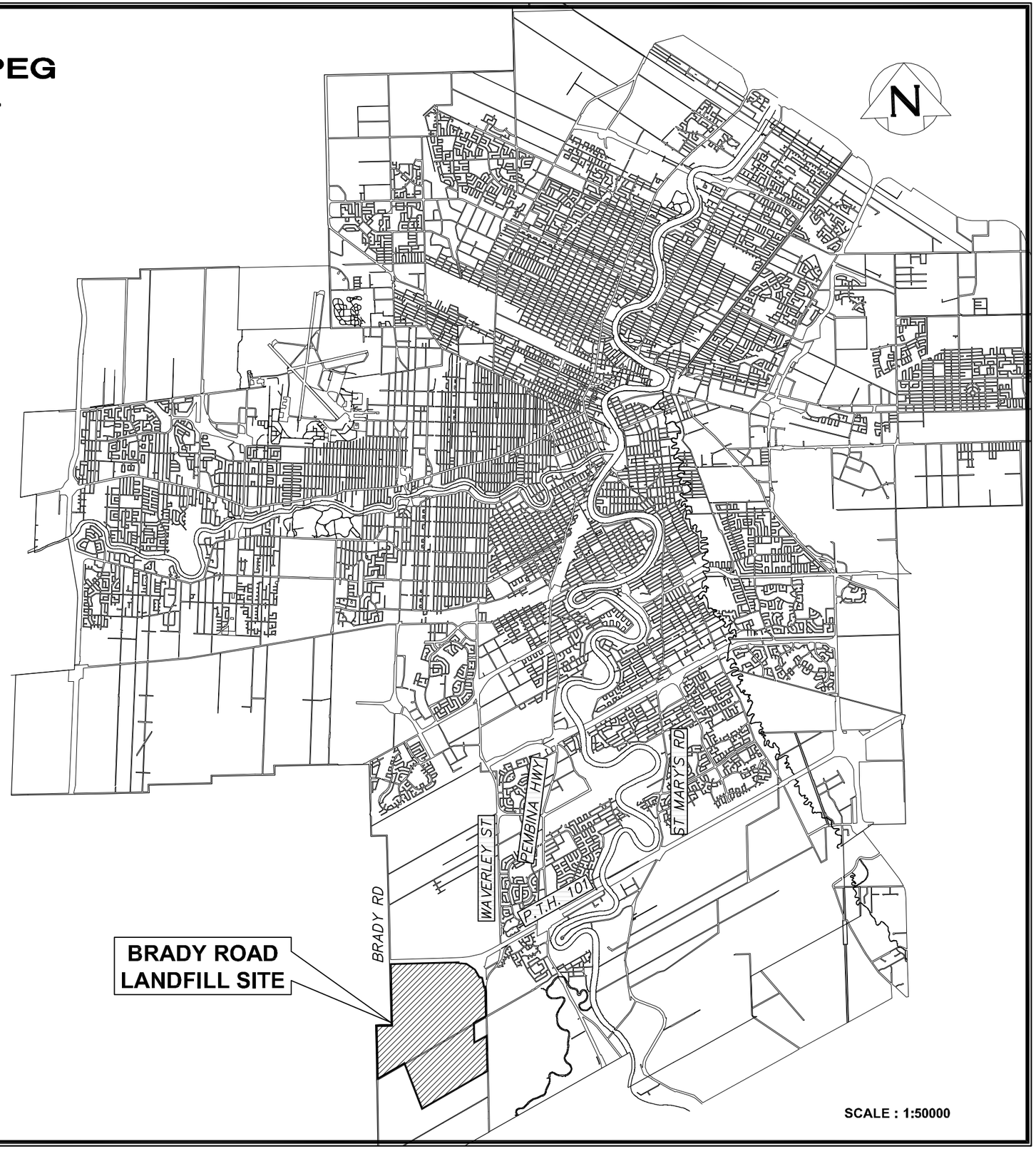
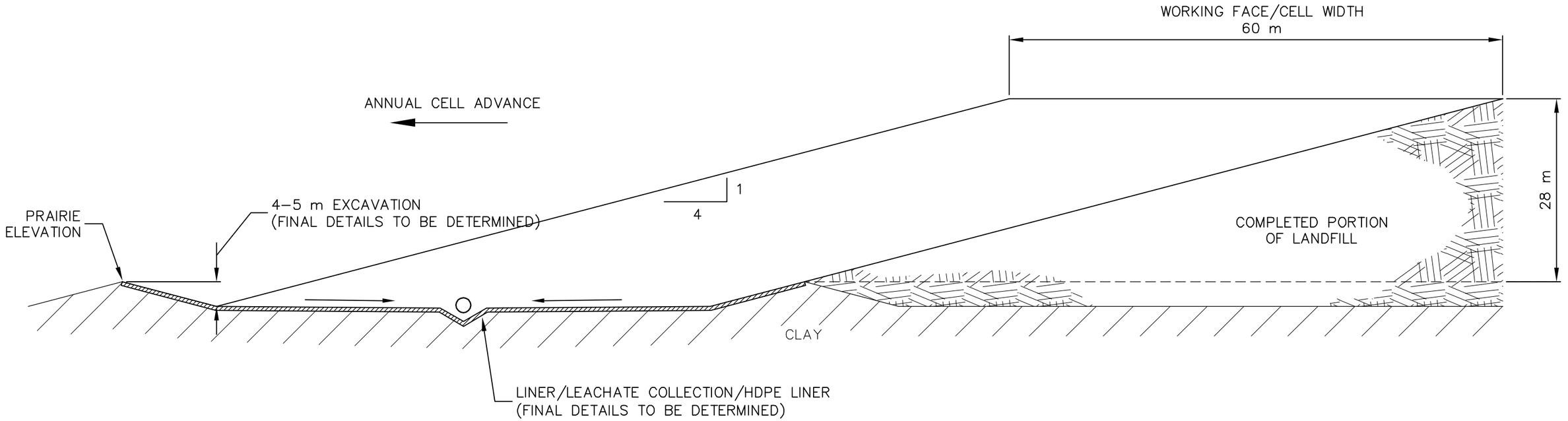
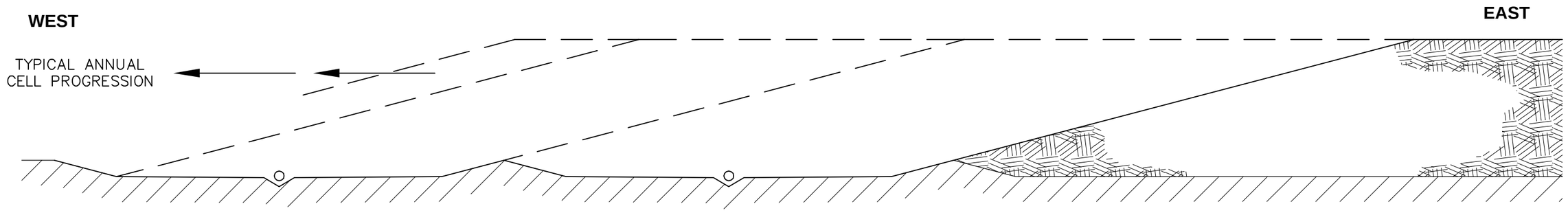


FIGURE 4-1
LOCATION PLAN





THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT
ENGINEERING DIVISION

BRADY ROAD LANDFILL

SHEET 1 OF 1

CITY DRAWING NUMBER

OPERATING CELL CONCEPT

FIGURE 4-2

BRADY ROAD LANDFILL

N

PERIMETER HWY

EXISTING FENCE

MANITOBA HYDRO STATION

EXISTING WEIR

PROPOSED RECREATION AREA

CURRENT GARBAGE BURIAL AREA

POTENTIAL GREEN RESEARCH/BUSINESS AREA

R.M. OF MACDONALD

BRADY RD

TREE SHELTER BELT

EXISTING PUBLIC RECYCLABLES DROP

COMPOSTING AREA

PROPERTY BOUNDARY

WAVERLEY ST

ENTRANCE

CHARETTE ROAD

POTENTIAL SAND RECYCLING AREA

WETLANDS

COMMUNITY RESOURCE RECOVERY CENTER

SCALE BUILDING

OLDER COMPLETED BURIAL AREA

PROPOSED WEIR

POTENTIAL SAND RECYCLING WASHWATER PONDS

CBC TOWERS

OLDER COMPLETED BURIAL AREA

TRANS CANADA PIPELINE EASEMENT

EXISTING FENCE

MANITOBA HYDRO

MANITOBA HYDRO

RUE DES TRAPPISTES

CITY PROPERTY FOR LONG TERM WASTE DIVERSION AND BURIAL USE

THIS DRAWING CONTAINS A 2009 AERIAL PHOTO

LEGEND

PROPOSED SURFACE WATER DRAINAGE SYSTEM

0.0 0.05 0.1 0.2 0.3 0.4 0.5

DISTANCES IN KM

B.M. ELEV.	FIELD BOOK #:		
POSTED TO LBIS			
1		11/11/25	KB
NO.	REVISIONS	DATE	BY

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

BRADY ROAD LANDFILL

MASTERPLAN CONCEPT

SHEET 1 OF 1

CITY DRAWING NUMBER

FIGURE 4-3

PERIMTER HWY

EXISTING FENCE

MANITOBA HYDRO STATION

EXISTING WEIR

N

PROPOSED RECREATION AREA

R.M. OF MACDONALD

BRADY RD

POTENTIAL GREEN RESEARCH/BUSINESS AREA

COMPOSTING AREA

WAVERLEY ST

PROPERTY BOUNDARY

POTENTIAL SAND RECYCLING AREA

WETLANDS

PROPOSED WEIR

ENTRANCE

COMMUNITY RESOURCE RECOVERY CENTER

SCALE BUILDING

CHARETTE RD

OLDER COMPLETED BURIAL AREA

POTENTIAL SAND RECYCLING WASHWATER PONDS

CBC TOWERS

TRANS CANADA PIPELINE EASEMENT

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

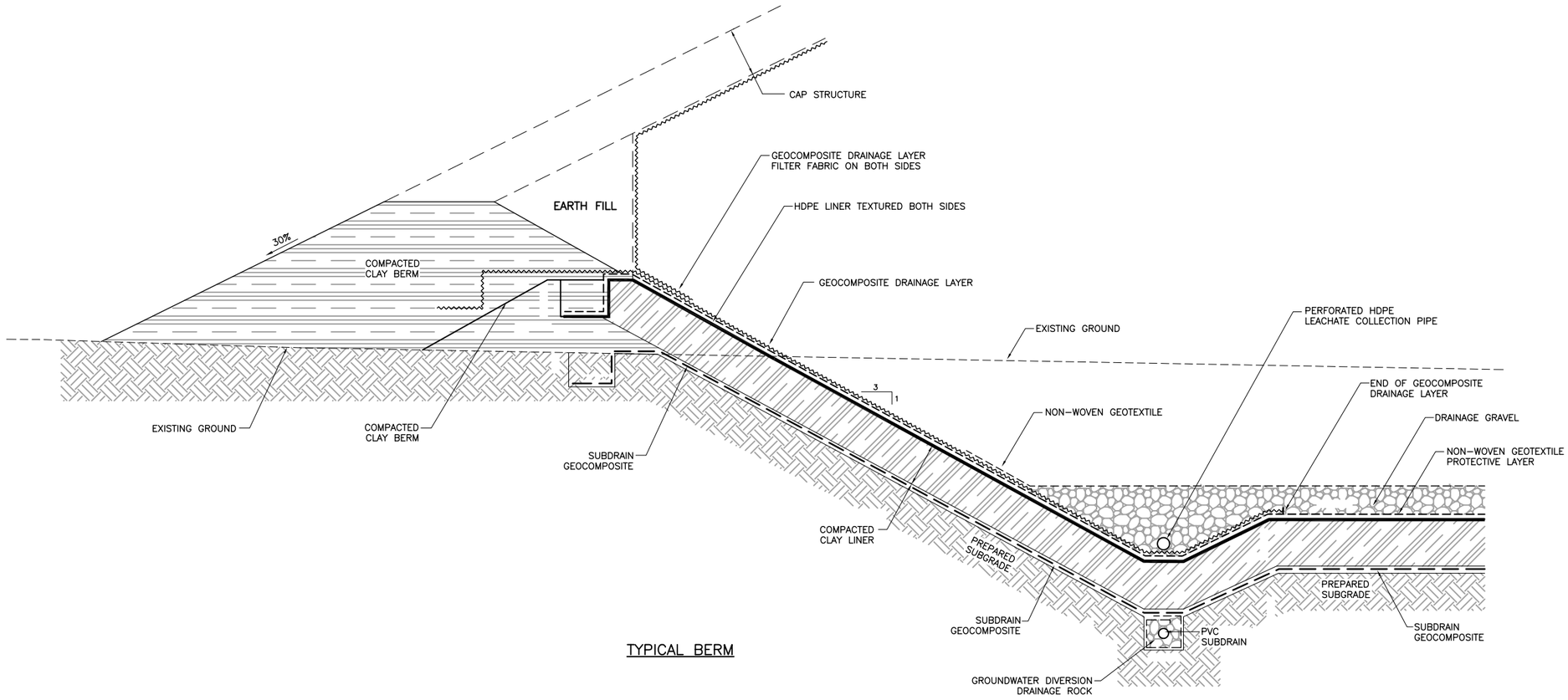
BRADY ROAD LANDFILL

SHEET 1 OF 1

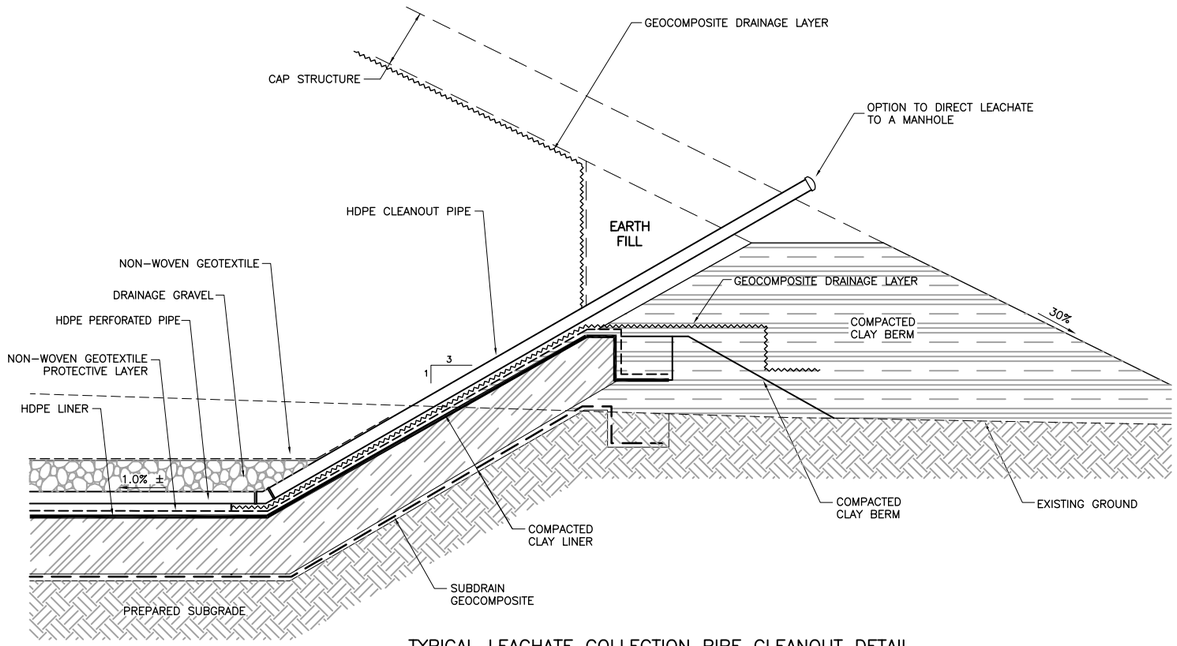
CITY DRAWING NUMBER

CONTOUR DRAWING

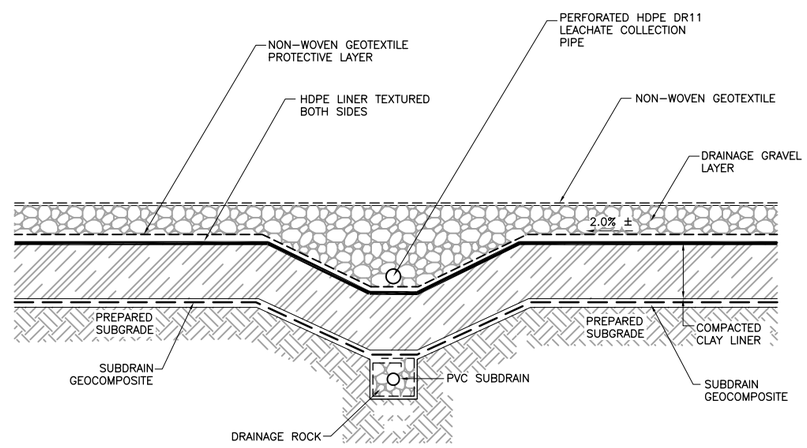
FIGURE 4-4



TYPICAL BERM



TYPICAL LEACHATE COLLECTION PIPE CLEANOUT DETAIL



TYPICAL INTERIOR LEACHATE AND SUBDRAIN

Figure 4-5: Conceptual Landfill Liner Construction for Future City of Winnipeg Landfill Cells

Stantec Consulting Ltd.
200, 325–25th Street S.E.
Calgary AB Canada
T2A 7H8
Tel. 403.716.8000
Fax. 403.716.8039
www.stantec.com

Stantec

Consultants

Legend

Notes

Revision	By	Appd.	YY.MM.DD
A CLIENT REVIEW	DL.D.	D.L.D.	11.11.07

Issued	By	Appd.	YY.MM.DD
File Name:	D.L.D. Dwn.	D.L.D. Chkd.	D.L.D. Dsgn.	11.11.07 YY.MM.DD

Permit-Seal

Project No.	Scale	
11141 0000	AS SHOWN	
Drawing No.	Sheet	Revision
	1 of 1	0

4.4.2.2 Liner

Historically, the Brady Road Landfill has relied on a natural and constructed clay liner for containment. To be consistent with "Best Practices" in western Canada, the clay liner of all new cells developed in future years will be constructed to support the installation of an additional 60-mil high-density polyethylene liner (or equivalent). The liner design of future cells will generally conform to the Standards for Landfills in Alberta (AENV, 2010).

4.4.2.2.1 Clay Base

The clay liner at the Brady Road Landfill site was historically constructed to meet *Waste Disposal Grounds Regulation* requirements for a 1.5-m-thick compacted low-permeability soil. The brown and gray clay layers overlying the silty clay layer blanketing the bedrock were reported (KGS, 2009) to have average hydraulic conductivities of 3.6×10^{-9} and 3.4×10^{-10} m/sec. [relative to values reported two decades earlier for the gray clay layer of 5×10^{-10} m/sec (UMA, 1987)]. The clay that underlies much of the site has the following attributes (KGS, 1991):

Silt and clay content:	*>98% (average)*
Silt content	*8% (average; range is 4-13%)*
Clay content	*90% (average; range is 87-95%)*
Plasticity Index	*>52% (average; range is 38-64%)*
Moisture content	*40-50%*

This liner was progressively constructed in sequential segments as new cells were created by site operations over the years. The liner grade in more recent cells (since c. 1987), was established to facilitate leachate drainage and recovery in a leachate-recovery system.

4.4.2.2.2 Synthetic Liner Material and Properties

The synthetic liner to be installed on all future cells will consist of approximately 60-mil high density polyethylene (HDPE) plastic material or equivalent (Figure 4-5). Liner integrity will be protected following installation by placement of a compacted 1-m-thick layer of waste over progressively prepared liner surfaces.

Construction Quality Assurance Program

Quality assurance of landfill-liner-system installation is imperative, due to potential contaminant migration from faulty seams or liner imperfections and the general inaccessibility of the liner system following installation (Meggyes, 1997). Key components of a construction-quality assurance-program are summarized below. All liner systems will be installed in accordance with manufacturer requirements.

Subgrade Preparation

The subgrade will consist of earthen materials, prepared free of stones, compacted and smoothed by machines to avoid ruts, changes in grade or voids. If the subgrade cannot be prepared free of stones, a thick layer of soil or a non-woven geotextile will be used to cover the subgrade prior to membrane installation. No standing water, mud, snow or excessive moisture will be allowed to be present on the subgrade during liner installation.

Transportation, Handling, Storage and Installation Conditions

Geomembrane liners will be transported, handled and stored to prevent damage, including ensuring they arrive on-site rolled onto a core or folded onto a pallet and are properly covered until immediately before installation. Timing of liner placement, seaming, and QA testing (see below) will be particularly consistent with manufacturer's specification for appropriate range of temperatures.

Geomembrane Seaming and Testing

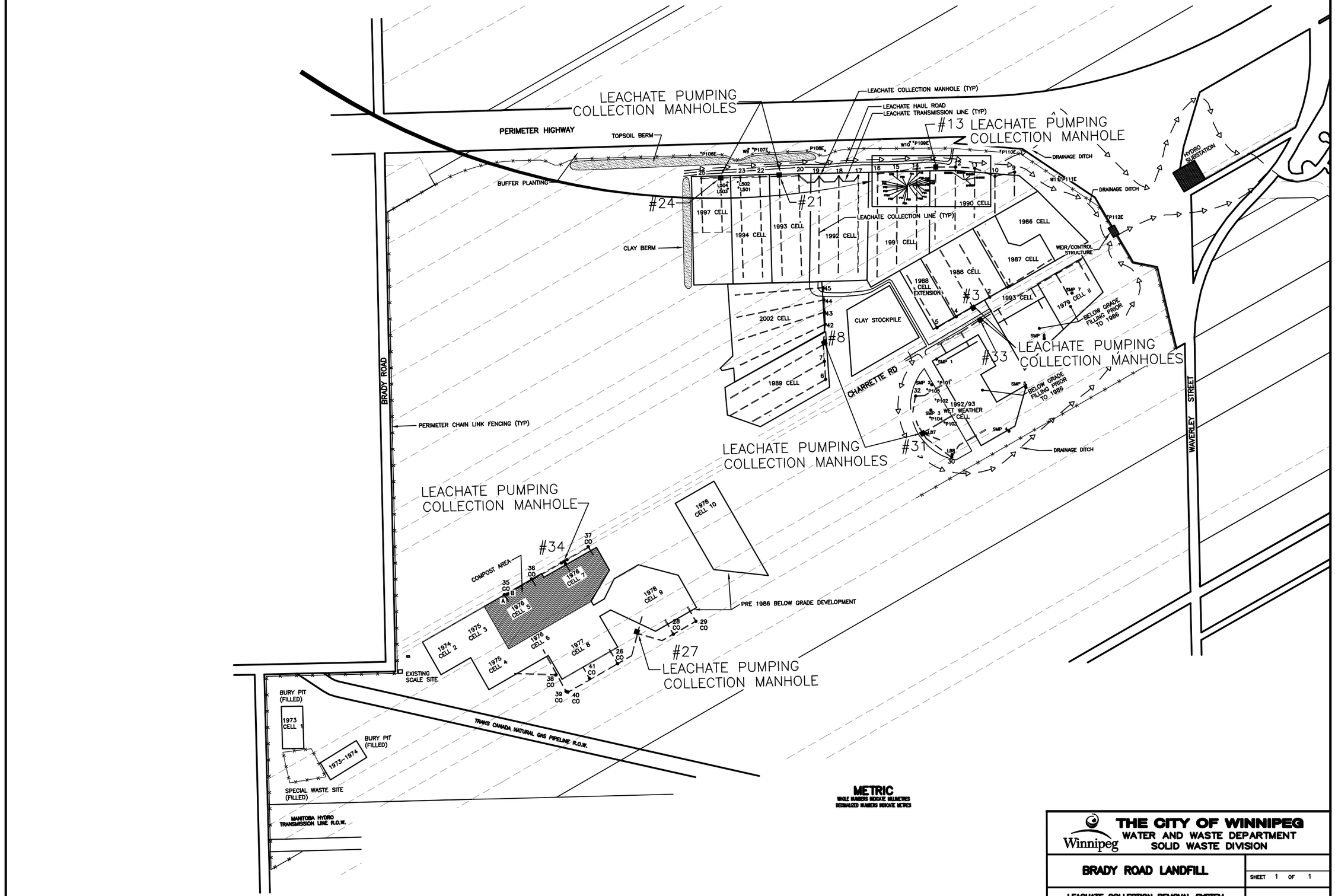
Depending on the material used, the seams will be tested using the air-lance method (in the case of PVC, single-solvent welded seams) or vacuum tested (in the case of HDPE seams). The air-channel test method would also be acceptable. Non-destructive field testing (ASTM D4437) will be undertaken for all seams. Additional destructive testing (ASTM D4437) on random, non-landfill material samples will be undertaken.

4.4.3 Groundwater-Control System

Future cells may be constructed below the seasonal high groundwater table. The City is currently planning on undertaking conceptual and preliminary design work for a liner system in 2012. This design process will, among other things, attend to this consideration. Some preliminary concepts are embodied in Figure 4-4.

4.4.4 Leachate-Collection System

The Brady Road Landfill facility currently collects leachate via a leachate collection and removal system. The existing Brady Road Landfill leachate-collection system consists of perforated pipe conduits installed in trenches containing gravel and slotted pipes driven into the base of existing cells (Figure 4-6). These leachate pipes are sloped (i.e., gravity fed) towards a manhole at the end of each pipe run. The majority of pipe runs and associated manholes are connected together via a leachate pipeline. As of 2003, there were a total of 45 manholes or cleanouts installed at the facility. Pumping of leachate to be hauled for treatment is conducted from one of the nine sump manholes (Nos. 3, 8, 13, 21, 24, 27, 31, 33, 34) located within the facility. Cells created in the following years either include or were retrofitted with a leachate collection system: 1975-78; 1979; 1986-1988; 1989; 1990-1997; 1993; 2002 and on.



METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT
SOLID WASTE DIVISION

BRADY ROAD LANDFILL

SHEET 1 OF 1

LEACHATE COLLECTION REMOVAL SYSTEM

FIGURE 4-6

All future landfill cells will be designed for Best Practice in the design of the leachate-collection systems. Some preliminary concepts are evident in Figure 4-5.

4.4.4.1 Leachate Hauling

Tanker vacuum trucks (30,000 L capacity) are used to haul leachate collected in the sump manholes to the City of Winnipeg North End Water Pollution Control Centre (NEWPCC) located at 2230 Main Street for treatment. Currently, up to six tanker truck loads of leachate are removed from the Brady Road Landfill facility daily for treatment (Park *pers.comm,* 2010). Tanker trucks are weighed (tared) empty upon entering the facility and loaded (gross) upon leaving the facility, for the maintenance of disposal records. The net weight of the tanker is converted to volume using a conversion factor of one (1) tonne (1,000 kg) equals one (1) kilolitre (1,000 L).

4.4.4.2 Leachate Treatment

Leachate removed from the Brady Road Landfill is delivered to the NEWPCC for treatment. Each load of leachate delivered to the NEWPCC is accompanied with a time-dated grab sample, which allows the Centre to monitor the quality of the influent leachate to ensure its treatability by the system. Loads are spaced uniformly to prevent “shock” loading of the system.

In 2002, the NEWPCC received approximately 46,000 KL of leachate from four landfills, approximately 26% or 12,000 KL of which was received from Brady Road Landfill (Manitoba Clean Environment Commission, 2003). A total of 108 chemicals have been identified as being present in the landfill leachate received at the NEWPCC from all sources.

Operations of the NEWPCC, including treatment standards, are governed by *Environment Act* Licence No. 2684 RRR. By-products of the wastewater-treatment process are treated effluent and biosolids. Effluent is treated in accordance with the licensed discharge limits presented in Table 4-2 prior to being discharge to the Red River. The disposal of biosolids has for many years been managed by the City of Winnipeg, in accordance with *Environment Act* Licence No. 1089E RR, including land application through the ‘WinGro Program.’

Biosolids are now being co-deposited with the waste, due to a change in provincial policy regarding the application rates for biosolids to agricultural fields as a soil amendment. The long-standing licensed practice of land spreading of biosolids on selected lands approved for this purpose was ended by the City on December 31, 2010, as the result of new provincial regulations which reduced biosolids application rates to land (and banned winter application). Since 2009, the City has been examining various options for dealing with this material (including composting some of the material at the landfill; Tetr*ES* Consultants, 2009a, b), pending a longer-term solution. Current examinations by the City (jointly with Veolia Water Canada Inc.) include consideration of the greenhouse gas emissions associated with biosolids management options (Stantec, 2011b).

Table 4-2: North End Water Pollution Control Centre (NEWPCC) Treated Effluent Discharge Limits		
Parameter	**Current Licence Limit**	**Future Licence Limit (December 31, 2014)**
Five-day Biochemical Oxygen Demand (BOD_5) / Five –day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	BOD_5 not to exceed 30 mg/L	$CBOD_5$ not to exceed 25 mg/L
Total Suspended Solids (TSS)	Not to exceed 30 mg/L	Not to exceed 30 mg/L
Fecal Coliform	Not to exceed 200 CFU/100 mL*	Not to exceed 200 CFU/100 mL*
Escherichia coli (E.coli)	Not to exceed 200 CFU/100 mL*	Not to exceed 200 CFU/100 mL*
Total Phosphorus (Total P)	Not to exceed 119 kg/day** (30-day rolling average)	Not to exceed 1 mg/L** (30-day rolling average)
Total Nitrogen (Total N)	Less than 838 kg/day removed**	Not to exceed 5 mg/L** (30-day rolling average)
Ammonia Nitrogen Content	-	Not to exceed 2262-29021 kg/24-hour period (any) – dependent on month
CFU – Colony Forming Units * Monthly geometric mean of 1 grab sample collected at equal time intervals on each of a minimum of 3 consecutive days per week **30-day rolling average		

The NEWPCC is required to notify the Director of Manitoba Conservation of any contingency events which may result in non-compliance with the licence (e.g., discharge of raw or partly treated wastewater).

4.4.5 Landfill-Gas-Collection System

4.4.5.1 Relevant Background

Landfills produce landfill gas (LFG) comprised of approximately equal amounts of methane and carbon dioxide, and trace amounts of other compounds. Both methane and carbon dioxide are GHGs; however, methane has a global warming potential 21 times that of carbon dioxide. By burning the methane (CH_4) the resultant products are carbon dioxide (CO_2) and water vapour (H_2O), which reduces its climate-change potential by about 95%.

Manitoba's target for reduction of greenhouse gases (GHG) is to achieve a level of generation that is 6% below 1990 levels by 2012 (Ferguson, 2009). This reduction (in terms of mass) would be equivalent to 3 megatonnes (MT) (i.e., a reduction from 20 MT/yr – 17 MT/yr). Landfills account for 3% of the national GHG emissions. In 2006, Manitoba's GHG emissions were up by 13% (2.4 tonne) relative to 1990 (Ferguson, 2009). Manitoba's GHG emissions from landfills

increased by 37.3% (from 670 kt CO_2 equivalents) to 920 kt CO_2 equivalents between 1990 and 2006. Of the 920 kt, approximately 150 kt CO_2 equivalents (16%) of the landfill emissions can be captured annually from two to three major MB landfills. If this could be achieved, such capture could contribute approximately 5% of the 3 MT reduction target.

Manitoba's *Climate Change and Emissions Reduction Act* (CCERA) was enacted in June 2008. The CCERA sets out the following Landfill-GHG requirements:

- Every owner of a prescribed landfill must submit an assessment of the potential for mitigating emissions that may be generated at the landfill.

- A proposed plan must be submitted for the monitoring, controlling, collecting, or using emissions before they are released into the atmosphere during operation and after closure of the landfill. The proponent's approved plan must be implemented by December 31, 2010.

The plans are key to Manitoba securing concordance with the Western Climate Initiative (WCI) requirement for all facilities emitting 25,000 t/yr of CO_2 equivalents to implement GHG-reduction plans. (The WCI began in February 2007 when the Governors of Arizona, California, New Mexico, Oregon, and Washington committed their respective states to develop a regional target for reducing greenhouse gas emissions, participate in a multi-state registry to track and manage greenhouse gas emissions in the region, and to develop a market-based program to reach the target. The WCI built on existing greenhouse gas reduction efforts in the individual states as well as two existing regional efforts. In 2003, California, Oregon and Washington created the West Coast Global Warming Initiative, and in 2006, Arizona and New Mexico launched the Southwest Climate Change Initiative.) Manitoba became a signatory to the WCI in June 2007.

On December 15, 2009, Manitoba committed to legislation enabling the creation of a cap-and-trade system to reduce greenhouse-gas emissions in Manitoba. Manitoba's cap-and-trade legislation is intended to complement the province's participation in regional climate-change strategies like the Western Climate Initiative and Midwestern Greenhouse Gas Reduction Accord.

As part of the August 2005 work pursuant to the Investigation of Landfill Gas Opportunities study at the Brady Road landfill, an LFG extraction and flaring program was conducted from June 15, 2004, to November 4, 2004. Six LFG extraction wells and 14 gas-pressure probes were installed at the site and monitored. Albeit at a much smaller scale than the proposed project, this trial demonstrated that such a system poses no negative impacts. Furthermore, there are over 400 LFG projects of various types operating in the US (http://www.epa.gov.lmop) and over 40 in Canada that successfully capture and utilize LFG.

4.4.5.2 Landfill Gas Project Details

The City has initiated a project to capture LFG emissions. The project consists of installing a gas-collection system in a completed portion of the landfill and flaring the collected gas on-site

(Figure 4-7). A final clay cap is being placed over the portion of the landfill to be retrofitted for the LFG-collection system to contain landfill gas and minimize air and precipitation infiltration.

The purpose of the program is to reduce LFG emissions to the atmosphere to meet anticipated GHG abatement requirements under *The Climate Change and Emissions Reductions Act*. Reducing LFG emissions will also reduce the emissions of trace compounds in LFG that may cause odour or affect local air quality. The timing for commissioning and startup of operations is planned to fulfill the requirements of *The Climate Change and Emissions Reduction Act*.

The project includes the conventional components for extracting and flaring the LFG. The LFG will be burned in an enclosed flare (i.e., no visible flame; Photo 1-9), which unlike open flame flares, allows for the amount of gas and air entering the flame enclosure to be controlled, making combustion more reliable and efficient. This project does not include alternative or enhanced technologies for altering decomposition within the landfill such as in aerobic biotreatment or bioreactor technologies. Also not included are: the use of the gas on- or off-site to generate electricity or for heating, gas-storage facilities and any transmission lines or pipelines for off-site use of the gas. The direction of the project could change in the future, however, to include such alternatives.

The project will be located within an existing completed portion of the landfill which was in service from 1979 to 2009. The collection system will be extended into additional completed sections of the landfill in the future.

Condensate from condensate traps will be collected and hauled to an approved treatment facility.

The life of this project is estimated at 20 years, not including subsequent additions to the system.

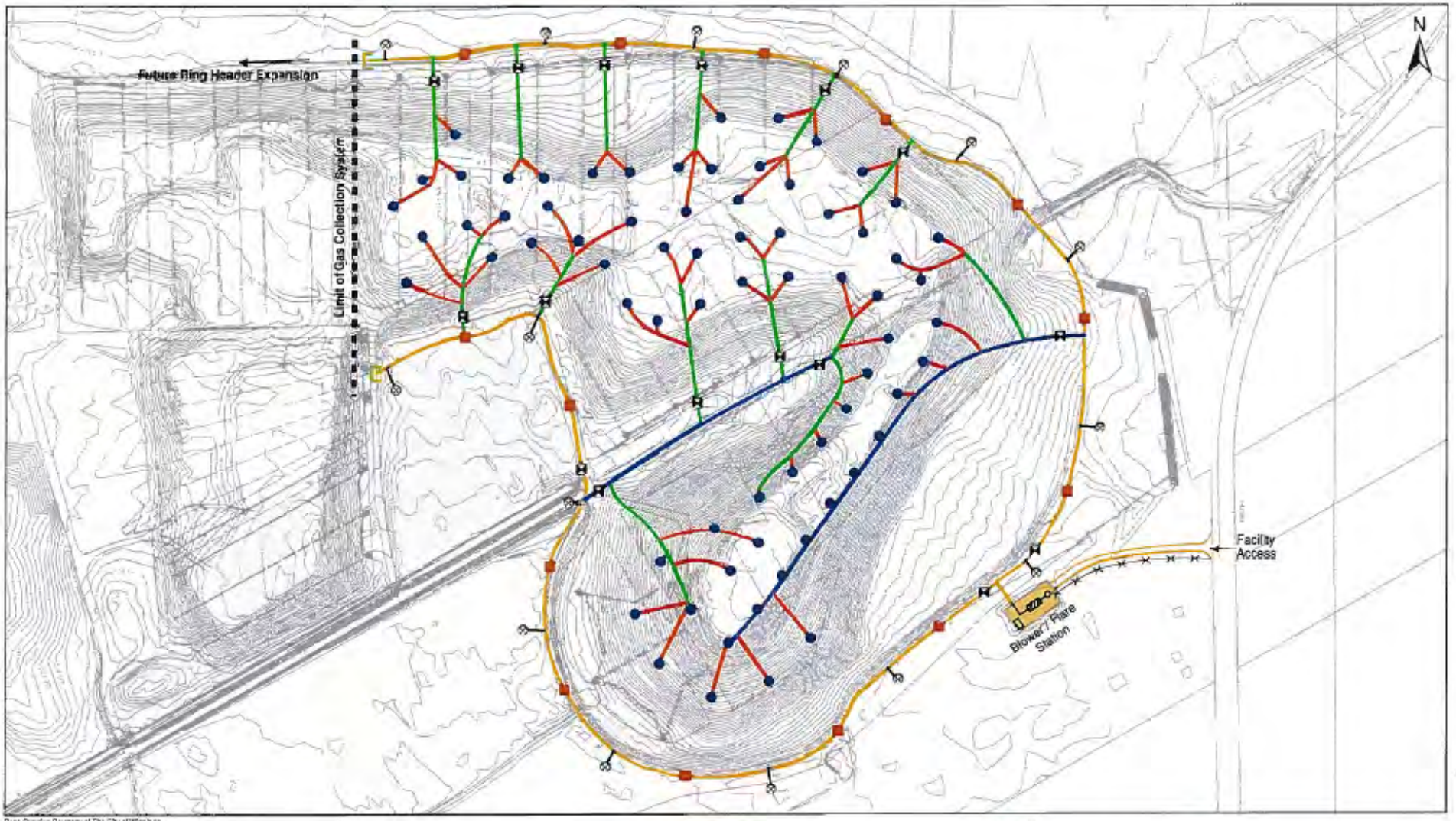
Monitoring of the system will satisfy relevant conditions of Licence No. 2890R.

4.4.6 Cover Material

Placement of daily, intermediate and final cover on deposited waste is necessary to control disease vectors, windblown waste, odours, flies, scavenging and to reduce stormwater infiltration by promoting surface water runoff from the fill area.

Conventional cover material consists of material that has not previously mixed with garbage, rubbish or other solid waste (e.g., soil). Trial uses of alternative daily cover using blown chopped straw are being undertaken. The trial is to evaluate the potential for reducing the volume of soil required while still meeting Class I landfill-cover requirements.

Careful use and conservation of cover soil and topsoil is important in order to minimize the need to access and buy cover soil. Topsoil and subsoil is stripped and stockpiled on-site prior to the



PRELIMINARY

Not To Be Used For Construction

Source: CH2M HILL

Stantec

Brady Road Landfill Site - LFG Collection System Preliminary Conceptual Design

Figure 4-7

lfg_collect

G:_GIS_Project_Folder\111410000_Brady\IDD\Section 4 Figures

construction of roadways and new cells to be used on-site for cover purposes. Every effort is made to divert clean fill that is delivered to the Brady Road Landfill and efficiently stockpile it for future use as cover material.

Material may be required from other borrow sources in the area. Investigation to identify other potential sources of soil is periodically conducted. Landfill mining can be used to recover fill material. This is occurring at the former Cadboro East landfill to assist the developers to decommission the former landfill in preparation for development of the new “Bridgwater” subdivision.

4.5 SITE INFRASTRUCTURE

4.5.1 Site Plan

The current Facility site plan is illustrated in Figure 4-1. The site plan identifies the areas allocated for waste material disposal and/or recovery/recycling. The plan also identifies the location of structures and travel routes within the facility.

Figure 4-1 illustrates the new Master Plan Concept for the future of the facility pursuant to implementation of the CIWMP.

4.5.2 Site Access

Access to Brady Road Landfill is currently gained from a single direct connection off of the north-south Brady Road along the west side of the site. Brady Road links directly from Provincial Trunk Highway (PTH) 100 (or the “Perimeter Highway”) and Rue des Trappistes located approximately 1.6 km (1 mi.) to the north and south, respectively, to Charette Road, the northeast-southwest main internal road within the facility (Figure 1-1).

The current access route to Brady Road Landfill may be subject to change (Figure 1-2) as a result of an Access Management Study currently being undertaken by Manitoba Infrastructure and Transportation to control access points along a portion of the south Perimeter Highway.

4.5.3 Buildings and Weigh Scales

Facility buildings include the Brady Road site office, scale house, equipment storage and maintenance buildings (2) and the compactor shed (Figures 4-8a, 4-8b)

The Brady Road site office consists of the accounting and site-management offices. The scale house is a fully-serviced, self-contained, pre-fabricated building that houses scale operations. The building contains a storage room and watercloset and is serviced with electrical power, local area network, phones, radio and electric heat. Bottled water is used for drinking. A holding tank is provided for sewage pump out.