
SECTION 5.0

SECTION 5.0 ENVIRONMENTAL IMPACT ASSESSMENT

The purpose of this Environmental Impact Assessment (EIA) is to identify and describe any potential impacts that may occur as a result of the construction and operation of the proposed expansion of the City of Brandon's IWWTF or the operationally improved Maple Leaf Pork pretreatment plant. This assessment follows the general direction indicated in Manitoba Conservation's "Advice For The Preparation of An Environmental Act Proposal and Environmental Assessment for an Alteration to the City of Brandon's Industrial Wastewater Facility" prepared by Manitoba Conservation, which was issued on June 10th, 2002. The original Maple Leaf Pork plant project proposal underwent review by representatives of the Canadian Environmental Assessment Agency. The outcome, received April 6th, 1998, was that no environmental assessment would be required under the federal jurisdiction of the Canadian Environmental Assessment Act. It is our present understanding that the Canadian Environmental Assessment Agency will have a member on the Manitoba Conservation review team that considers this application.

Information on the environmental component of the study was collected from published information, maps and telephone interviews with government personnel in various regulatory agencies. This was supplemented with air photo interpretation and field reconnaissance in the early summer of 2002.

Potential environmental impacts were identified by superimposing project elements of the expansion of the IWWTF and operationally improved pretreatment plant onto existing natural conditions and applying standard mitigative measures. An underlying assumption of this method is that the plant will be constructed and operated with due care for safety and environmental matters, using current and practical engineering practices. Wherever possible, major upsets and deviations from normal construction or operating conditions have been taken into account in the EIA.

Table 5.1: Explanation of Terms Used in Impact Assessment

Project Phase:	Refers to the phase of the project as either construction or operation of the expanded IWWTF or operational improvements to the pretreatment plant.
Potential Impact:	Classification of the type of impacts anticipated during a specific project phase.
Magnitude of Impact:	Refers to the percentage of population or resource that may be affected by an impact from activities associated with the construction or operation of the proposed Maple Leaf improved pretreatment plant or the expanded IWWTF. Where possible, the population or resource base has been defined in quantitative or ordinal terms (e.g., hectares of soil types, units of habitat). Impact magnitude has been classified as either less than (<) 1%, 1 to 10%, or greater than (>) 10% of the population, or resource base. If there was insufficient information available to quantify the percent impacted, the change was identified only as an increase or decrease in the population or resource.
	Where the magnitude of an impact has been defined as <1%, the impact is virtually immeasurable and represents a non-significant change from background in the population or resource (negligible).
Direction of Impact:	Refers to whether an impact to a population or a resource is considered to have a positive, negative or neutral effect.
Duration of Impact:	Refers to the time it takes a population or resource to recover from the impact. If quantitative information was lacking, duration was identified as short-term (<1 year), moderate term (1 to 10 years) and long term (>10 years).
Frequency of Impact:	Refers to the number of times an activity occurs over the construction or operation phase, and is identified as once, rare, intermittent, or continuous.
Scope of Impact:	Refers to the geographical area potentially affected by the impact and was rated as local, or regional, or provincial. Where possible, quantitative estimates of the surface area affected by the impact were provided.
Degree of Reversibility:	Refers to the extent an adverse effect is reversible or irreversible over a 10-year period.
Residual Impact:	A subjective estimate of the residual impact remaining after employing mitigation measures in reducing the magnitude and/or the duration of the identified impacts on the environment.

Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Degree of Reversibility of Impact
Negligible	Positive	Short term (< 1 year)	Once or Rare	Local	Reversible
Low (<1%)	Negative	Moderate (1 to 10 years)	Intermittent	Regional	Irreversible
Moderate (1 to 10%)	Neutral	Long term (>10 years)	Continuous	Provincial	
High (>10%)					

The following subsections address the various components of the environment, which are anticipated to be impacted by the proposed construction and/or operating activities. Tables 5.5

and 5.6 at the end of this Section, provide a brief summary of the anticipated potential impacts and mitigative measures for the construction phase of the project. The potential impacts on specific environmental parameters are described in terms of relative or absolute significance, where possible. Impacts are defined as negligible, low, moderate or high according to terms in Table 5.1: Explanation of Terms Used in Impact Assessment. The mitigation measures shown in Tables 5.5 and 5.6 are also further explained under the subsections of Section 6, Mitigative Measures.

5.1 RISK ANALYSIS AND PUBLIC HEALTH CONCEPTS

Risk and risk analysis terms used in this impact assessment will follow the definitions as given by Cohrssen and Covello (1989) as follows:

1. RISK: the likelihood of suffering harm from a hazard.
2. RISK AGENT: a chemical substance, biological organism, radioactive material or other potentially hazardous substance or activity.
3. HAZARD: a substance or action that can cause harm.
4. RISK ANALYSIS: methods of risk assessment: e.g., hazard identification, risk assessment, significance of risk and risk communication.
5. HAZARD IDENTIFICATION: the first step in risk analysis is to determine whether a risk agent, under plausible circumstances, causes harm to human health or the environment.
6. RISK ASSESSMENT: the second step of risk analysis; the technical assessment of the severity and likelihood of harm to human health or the environment occurring from exposure to a risk agent. Includes the following three steps:
 - a) Source/release assessment: estimates the amounts, frequencies and location of the introduction, release or escape of risk agents (e.g., toxic chemicals) from specific sources.
 - b) Exposure assessment: provides quantitative data on individuals, populations or ecosystems that are, or may be, exposed to a risk agent, the concentrations of a risk agent and the duration and other characteristics of exposure.
 - c) Dose-response assessment.
7. RISK CHARACTERIZATION: integrates the results of the previous steps into a risk statement that includes one or more quantitative estimates of the risk, including attendant uncertainty.
8. RISK ESTIMATE: an estimate of the likelihood, or statistical probability, that harm will occur as a result of exposure to a risk agent.
9. RISK MANAGEMENT: the process involved in the determination of what action to take to reduce or eliminate a risk; includes design and implementation of policies and strategies resulting from the decision-making process. Also includes social, economic and political input.
10. RISK PERCEPTION: reflects how individuals perceive the risk(s) associated with exposure to the risk agent. All people perceive risks differently, depending upon the

nature of the risk and their individual experiences. Many factors may influence risk perception.

A “health effect” refers to a certain health consequence. Bernard and Lauwerys (1986) defined “biological effect” as a “biochemical, functional or structural change resulting from reaction of an organism to exposure”. An adverse biological effect is the result of a negative impact on biological function or structure. Adverse biological effects can be reversible, as in the case of the return to normal vision following blurred vision or eye irritation. These effects may also be irreversible as in the case of irreparable tissue damage (e.g., emphysema induced by excessive cigarette smoking).

During the construction and operation phases of the City of Brandon’s expanded IWWTF and the Maple Leaf pretreatment plant, appropriate workplace health and safety procedures; and, protocols will be followed by all construction and operation workers in accordance with the Manitoba Workplace Safety and Health Act. For example, the construction contractor will have an accredited safety and health officer on site during the construction phase.

5.2 POTENTIAL HEALTH EFFECTS ASSOCIATED WITH THE EXPANDED IWWTF EMISSIONS OR PRETREATMENT EMISSIONS

Potential health effects associated expanded IWWTF emissions are anticipated to stem primarily from odours and/or emissions from the expanded IWWTF. Emission rates from the pretreatment plant will not change; they will only be of a longer duration. Potential health effects from pork processing plants including their waste treatment facilities are not a significant concern in any of the jurisdictions where large pork processing plants presently exist. As part of the original pork plant EIS study and again recently Earth Tech (Canada) Inc. contacted a number of provincial and state Environmental Agencies as well as the U.S. EPA (Table 5.2) for emissions data from pork processing facilities similar to that existing and proposed at Brandon. The typical response was that they do not have any data on pork plant emissions because pork processing plant emissions have not generally been a concern. This is further substantiated by the fact that no odour complaints have been received in the three years of operation of the Maple Leaf Pork processing plant and neighbours canvassed within a three-kilometer radius of the plant expressed the general view that Maple Leaf has been a good neighbour. Preliminary air quality data (1999, 2000 and 2001) collected by the Province of Manitoba also does not show significant change in Brandon’s air quality since the pork plant began operations (August 1999).

**Table 5.2: Contacts at Provincial, State and Federal Agencies
With Respect to Air Emissions from Pork Processing Plants**

Agency	Contact	Phone Number or E-mail Address	Response
Air Quality Division Lincoln, Nebraska	Bret Anderson Shelly Katerly Joanne Principato Brian McManus Lenee Hancock	402-471-6412 402-471-2189 402-471-2189 402-471-2186 402-471-2186	No data. No data. No data. No data. No data.
Allan Mills, Computer Work	Allan Mills	402-752-8144	No data.
Alpine Geophysics Crested Butte Colorado		970-349-6118	No data.
Department of Environmental Quality, Nebraska	Dan Eddinger Keith Sandell Randy Griffin Brad Anderson	402-471-3413 402-471-3413 402-471-3413 402-471-6412	No data. No data. No data. No data.
Division of Air Quality, North Carolina	James Roller Dr. Bill Cure Dr. Bob Wotton	919-715-0665 919-733-1806 919-733-1815	No data. No data. No data.
Duke University Medical Centre, Durham, N.C.	Susan Shiffman	919-660-5657	No data. Dust control important.
Health & Natural Resources, Department of Environment, Raleigh, N.C.	Information	919-571-4100	No data.
Iowa Natural Resources	Chin-Ta Tsai Dennis Thielien	515-242-6494 515-242-5131	No data. No data.
Minnesota Pollution Control Agency	Dr. Gregory Pratt Denis Becker Eric Kilburg Denise Leezer	651-296-7664 612-297-7364 612-269-8643 651-296-6576	No data. No data. No data. No data.
Missouri Department of Natural Resources	Don Froniing Diane Chojnacki Celeste Koon Mike Sudholdt	573-751-4817 573-751-4817 573-526-3363 573-751-4817	No data. No data. No data. No data.
M.O.E.E., Toronto	Carl Slater	905-521-7731	No data. Would accept monitoring.
Oklahoma Department of Environmental Quality	Monroe McKissic Pat Frisbey Scott Thomas	405-782-8146 405-702-4141 495-271-5220	No data. No data. No data.
Premium Standard Foods, Princeton, Missouri	Brian Paulsen	660-748-7316	No data. If a concern it would relate to H ₂ S, NO _x , CO ₂ or PM10.
R.V. Anderson & Associates, Toronto	Peter Takaoka	416-497-8600	No data. Odours main concern.
Schrieber Engineering, Jefferson City, Mo.	Chris Schrieber	573-761-3230	No data.
U.S. EPA	Dr. Brian K. Gullet	Bgullett@engineer.aeel.epa.gov	No data or experience with pork processing plants.

From discussions with the above individuals, we have concluded that there are no known significant air pollution/health concerns or risks associated with large pork processing plants. Otherwise, jurisdictions with large pork processing operations would have either experienced problems and have collected such data; or, at least known the source of health problems stemming from air emissions from such operations.

Should air emissions from the City of Brandon's expanded IWWTF plant be identified as the cause for complaints or of health problems, the City of Brandon has committed to Manitoba Conservation to investigate such problems and to undertake appropriate mitigative action.

5.3 AIR QUALITY IMPACTS

5.3.1 Construction

During the construction phase of the expanded IWWTF, certain air quality impacts may occur. These impacts will be minimized and mitigated to the maximum practicable extent in an effort to minimize the impact on the environment and the existing pork processing plant from construction activities. Typical construction air quality impacts relate to vehicle and heavy equipment exhaust, as well as dust generation during travel, excavation and grading work; and, odours from construction processes and materials. Construction equipment will be maintained in good working order so as to minimize emissions and if necessary, water sprinkling will be used to minimize dust emissions. Dust control is extremely important on site for product quality control within the pork processing plant. Normal odours and emissions associated with painting, asphalt pavement, roofing, adhesives and waterproofing chemicals, etc. will also be produced. Impacts from all of these activities are anticipated to be short-term, local impacts of negligible to low magnitude. In addition, predominant winds out of the west nearly half the time will carry dust and emissions primarily to the east where the closest permanent inhabitant is more than 3 km (2 mile) from the plant site. Although both the impacts are of negligible to low magnitude, each can be further mitigated: emissions by keeping the construction equipment in good working order and dust can be suppressed by sprinkling the ground with water or other approved treatment.

5.3.2 Operation Air Emission Sources

During operation of the expanded IWWTF, air emissions are anticipated to be from the following sources: odours and/or emissions from the IWWTF or operationally improved pretreatment plant.

Odours and/or emissions from the operationally improved pretreatment plant itself are anticipated to be minimal. Any odours and/or emissions from the pretreatment buildings will exhaust through wall or roof vents located in all areas of the pretreatment building. Odours from grease bearing and non-grease bearing streams, DAF bottom solids, centrifuge solids and

finished grease in the pretreatment building will be minimal because of the relatively fast removal by covered trucks. New cleaning procedures recently implemented in the existing pretreatment building will help reduce odours within. Odours from the pretreatment building will be fully dispersed at the property line as experienced at other large pork processing facilities. Emissions from these exhaust fans are primarily moisture and steam.

The primary additional emissions from the expanded IWWTF other than odours will be nitrogen gas from the denitrification process of the Zenon system. Nitrogen gas makes up over 75% of air by weight and over 78% by volume. The volumes of nitrogen gas released from the denitrification processes at the expanded IWWTF would be an inconsequential amount compared to the surrounding air mass. Additional odours from the Zenon system are anticipated to be minor, since the Zenon system is essentially a “closed” system. All the tanks are covered and any sludge generated is pumped back to the covered existing anaerobic lagoon. Some additional odours may be noticed when the anaerobic cell is being cleaned of biosolids; however, this operation is also largely a “closed” system because the sludge is pumped into tanker trucks for disposal off-site. This latter source of odour would occur only intermittently on an annual or semi-annual basis and would be a minor impact, short-term, local and reversible.

Emissions from flaring and/or utilizing methane gas from the biogas system will be reduced after the introduction of the second-shift because less biogas will be produced. Up to 9,000 m³/day of biogas was the production rate estimated from the first shift in 1998; for the second-shift this comparable volume of biogas has dropped to 2,935 m³/day. The need for a large carbon source in the Zenon system requires all of the second-shift BOD carbon source plus additional from the existing biological system resulting in less biogas being generated. Therefore, the potential for impacts from biogas has dropped by about one-third with the introduction of the second shift expanded IWWTF.

None of the emissions sources above have been quantified since no comparable data is available. Because no input data has been found relevant to emissions from pork processing facilities, it has been agreed by Manitoba Conservation (Personal Communication – Mr. Larry Strachan, P.Eng.) that no modeling is required.

5.3.3 Meteorology

Principle station data collected at the Brandon Airport from 1971 to 2000 indicated a mean annual temperature of 1.9°C and 472.0 mm of precipitation. Wind data from 1958 to 1982 was compiled to produce wind roses for an annual average (Figure 2.9), an average winter (November to April) season (Figure 2.10) and an average summer (May to October) season (Figure 2.11). During most of the year (46.5% of the time), the winds in Brandon blow from the northwest, west; or, southwest with speeds averaging over 18 km/h (11.2 mph). In the

summer wind rose, the average wind speed is 16.9 km/h (10.5 mph); and in the winter the average wind speed is 13.9 km/h (8.6 mph).

5.3.4 Background Concentrations of Air Quality Parameters

Data on ambient air quality parameters are available from two (2) monitoring stations in Brandon, located adjacent to 18th Street (University of Brandon; 1104 Princess Avenue (Monitoring Station 9201)) and to the east at 17th Street East (Assiniboia Community College; (Monitoring Station 5131)). Data is given for a wide range of parameters and is available from 1990 through 2001 (Personal Communication - Jean Van Dusen, Air Quality Specialist, Manitoba Conservation.). Data for years prior to 1990 are also available.

Present data being reported for Brandon consists of: Nitrogen Dioxide (NO₂); Nitric Oxide (NO); Nitrogen Oxides (NO_x); Oxidants Ozone (O₃); Ammonia (NH₃); Total Suspended Particulate (TSP); Lead (Pb); and, Sulphates (SO₄). Available one-hour and 24-hour data are presented in Table 5.3.

Table 5.3: Ambient Air Quality Data for Brandon, Manitoba

Parameter	1990	1991	1992	1993	1994	1995	1996
NO₂ (pphm)	28.5 1-hr 6.4 24-hr	29.2 1-hr 7.8 24-hr	N/A 1-hr N/A 24-hr	24.8 1-hr 10.1 24-hr	34.9 1-hr 5.6 24-hr	13.0 1-hr 3.8 24-hr	8.0 1-hr 4.9 24-hr
NO (pphm)	15.7 1-hr 7.4 24-hr	14.4 1-hr 4.6 24-hr	9.9 1-hr 4.2 24-hr	46.4 1-hr 4.9 24-hr	27.4 1-hr 8.4 24-hr	9.3 1-hr 2.6 24-hr	N/A 1-hr N/A 24-hr
NO_x (pphm)	31.0 1-hr 8.7 24-hr	25.3 1-hr 5.9 24-hr	N/A 1-hr N/A 24-hr	74.7 1-hr 16.4 24-hr	35.6 1-hr 10.3 24-hr	16.4 1-hr 5.3 24-hr	N/A 1-hr N/A 24-hr
O₃ (pphm)	6.1 1-hr 4.6 24-hr	5.4 1-hr 4.3 24-hr	5.3 1-hr 4.4 24-hr	5.0 1-hr 3.7 24-hr	5.9 1-hr 4.7 24-hr	7.4 1-hr 4.9 24-hr	7.8 1-hr 5.7 24-hr
NH₃ (ppm)	7.7 1-hr 2.7 24-hr	4.3 1-hr 1.2 24-hr	5.2 1-hr 1.2 24-hr	4.1 1-hr 0.8 24-hr	3.6 1-hr 0.4 24-hr	4.0 1-hr 0.8 24-hr	4.9 1-hr 1.0 (24-hr
TSP Max 24-hr (ug/m³)	181 (5131) 115 (9201)	88 (5131) 92 (9201)	85 (5131) 133 (9201)	N/A (5131) 94 (9201)	N/A (5131) 96 (9201)	N/A (5131) 96 (9201)	N/A (5131) 138 (9201)
Pb Max 24-hr (ug/m³)	0.03 (5131) 0.04 (9201)	0.04 (5131) 0.07 (9201)	0.03 (5131) 0.04 (9201)	N/A (5131) 0.04 (9201)	N/A (5131) 0.03 (9201)	N/A (5131) 0.04 (9201)	N/A (5131) 0.04 (9201)
SO₄ Max 24-hr (ug/m³)	4.24 (5131) 4.63 (9201)	4.24 (5131) 4.63 (9201)	3.65 (5131) 5.37 (9201)	N/A (5131) 4.76 (9201)	N/A (5131) 4.09 (9201)	N/A (5131) 4.12 (9201)	N/A (5131) 6.17 (9201)

- Note:
1. pphm denotes parts per hundred million.
 2. (5131) denotes location as Brandon, Assiniboine Community College.
 3. (9201) denotes location as Brandon, 1104 Princess Street.

5.3.5 Air Quality Impacts Due To Expanded IWWTF

Air quality impacts due to the City of Brandon's expanded IWWTF are anticipated to be minimal because by far the largest amount of gas emitted to the atmosphere will be nitrogen gas. In addition, this statement is based on the fact that in other jurisdictions where large

waste water treatment facilities serving large pork processing plants exist, air quality monitoring has not been required or undertaken. This indicates that emissions from such plants are not a significant concern. The existing monitoring stations, particularly the one near the Assiniboine Community College; (Monitoring Station 5131 is located about 3 km west of the City of Brandon IWWTF site) and analysis of available Station data (1999, 2000 and 2001) indicate no significant impacts on air quality occurred during the initial operation of the IWWTF and the Pork Processing plant. The City of Brandon and Maple Leaf Pork are committed to undertaking emissions testing should Manitoba Conservation require it in the future.

5.3.6 Greenhouse Gases

Minor amounts of greenhouse gases may be emitted from the IWWTF from the vents on the pretreatment building due to the additional length of operation of the second shift and from the operation vehicles and traffic.

All reasonable measures have been taken during design to limit the amount of greenhouse gas emissions from the overall project. During the operation of the pork processing plant, greenhouse gas emissions are limited through recovery of methane gas from the anaerobic digester and using it beneficially in a hot water heater; or, by flaring when not required for heating purposes. A Biogas Conditioning System was incorporated into the design to bring the biogas to a higher quality, so that it will burn at a higher efficiency. The hot water heater which was installed at the pork plant is of a Low Emissions (L.E.) type and is kept in good working order, so as to maintain a high burning efficiency on natural gas and to minimize the emission of greenhouse gases. As indicated earlier, less methane will be generated from the proposed second shift wastewater treatment than from the original first shift, since the expanded IWWTF will produce less methane.

Potential for greenhouse gases from the expanded IWWTF are anticipated to be minor; the majority of gases released will be nitrogen from the denitrification processes.

Minor sources of greenhouse gases may be emitted from the vents on the pretreatment buildings, and operation vehicles and traffic. Vents from the pretreatment buildings are anticipated to emit only relatively minor quantities of greenhouse gases. Greenhouse gases from operation vehicles will be minimized by ensuring properly maintained vehicles and machinery are used on the site.

During construction activities greenhouse gas emissions typical of construction diesel vehicle exhausts will be generated with the most prominent including CO, CO₂, NO_x, and gaseous unburned hydrocarbons (HC). Carbon monoxide in diesel exhaust appears low enough not to require specific controls, while NO_x emissions tend to equal or exceed those of comparable

spark-ignition engines, but can be reduced by exhaust-gas recirculation. The incremental impacts of the construction are anticipated to be of low magnitude over the short term of the construction phase of the project.

5.3.7 Noise

Other than traffic noise, noise impacts are anticipated to be greatest during the construction phase, since during the operation phase most noise-generating activities will occur indoors. The equipment building as part of the Zenon system will house all the motors and pumps that will produce additional noise during the operations phase. Silencers will be installed on blower intakes and exhausts that together with the fans being housed in an enclosed building will limit exterior noise. Noise at the eastern property boundary (the closest) is anticipated to be insignificant to minor.

During construction, noise impacts are likely to be as a result of the operation of construction equipment, from vehicle back-up “beepers”, compressors and other equipment. Pile driving is unlikely as none was used in the original construction.

Construction noise will be generated mainly from cranes and other heavy equipment operating on a sporadic basis. Air operated equipment will be used extensively; however, these noise levels will be relatively low. Noise impacts will be local, short term, and of low magnitude. In addition, population in the area is sparse.

No monitoring of noise during construction is anticipated. Complaints from residents are not anticipated largely because there are so few residents (approximately six (6) occupied residences and thirteen (13) businesses exist within a 3 km (2 mile) radius of the proposed site); and, the surrounding area is largely industrial. Another advantage of this construction site is the relatively large buffer zone (240 m; or, 800 ft) to the property boundary.

Noise during the operation phase is not anticipated to be significant. Except for traffic, all activities take place inside enclosed areas so resulting external noise will be minimal. No noise complaints have been registered to date as a result of one-shift operation.

5.4 POTENTIAL HUMAN HEALTH RISKS

5.4.1 Potential Impacts of Air Emissions

The potential for human health risks from air emissions associated with the expanded IWWTF is minimal. Air emissions are not a significant concern at other similar facilities associated with pork processing facilities throughout North America as evidenced by the fact that no jurisdiction at present could be located that even monitors air emissions from such plants or their waste treatment systems.

During construction, air emissions originating from heavy equipment and dust generated from travel and excavation activities may be irritable to nearby residents who may suffer from respiratory problems. The probability of this happening is considered to be very low because of the sparse population and prevailing winds. These intermittent, local impacts are not anticipated to present a significant hazard to human health.

During the original pork plant construction project when aggregate crushing was operating on the N ¼ Sec. 16 Twp. 10 Rge. 18 WPM, 24-hours a day, the closest neighbours Carmen Denbow and James Terhune, expressed some concern about noise at night, but agreed to let the crushing operation proceed 24-hours a day when they learned it would be completed in a few days. Should aggregate crushing take place on the IWWTF site for expansion, the hours of operation will be coordinated with Denbow and Terhune.

5.5 SURFACE WATER IMPACTS

5.5.1 General

Some ponds exist on the northwest corner of the property and a retention basin has been constructed just east of the centre of the property. There are no streams or other open water near the expanded IWWTF or pretreatment plant; however, new ditch work will be undertaken as part of Maple Leaf Pork's alterations to accommodate the second shift and a large drainage ditch exists immediately north of the pretreatment site. Care will be taken to keep pollutants out of the ditches; however, should an unforeseen accident occur that pollutes a ditch, a downstream barrier will be constructed and the spill will be cleaned up immediately. No pollutants can be released directly into surface waters from the proposed construction activities. However, overland flow provides a potential for erosion, particularly of disturbed and denuded areas; and, there is potential for increased runoff from the site due to increased roof areas, compaction of surface materials and vegetation removal. These areas will yield more surface water runoff than occurs presently under more natural conditions.

Other than potential for short-term erosion and the potential to affect the quantity and distribution of runoff, there is also the possibility of contaminant transport from fuel and other chemical spills on the site eventually being transported to the Assiniboine River. Aside from these, no other significant surface water impacts are anticipated. Potential impacts on surface water are considered to be local, moderate term and of low magnitude. Erosion impacts are mitigable by the use of silt fences; additional runoff will be controlled by a storage pond; and, spills would be contained by emergency diking or the use of berms, followed by immediate clean-up.

Following construction of the expanded IWWTF plant, the disturbed areas of the site will be seeded with a natural 50:50 mix still to be selected and vegetation or other soil re-enforcement

methods will limit erosion/sedimentation impacts on surface waters from ditches and runoff events.

There will be no discharge of contaminants (other than from treated effluent to the Assiniboine River as described in the following section) into the surface water drainage system as part of the normal operations of the expanded IWWTF or pretreatment plant. Any accidental spills associated with the operation will be investigated and managed in accordance with the plant's Spills Response Plan. In the event that the investigation indicates impact to surface water, then appropriate mitigative measures will be taken.

5.5.2 Assiniboine River

Information presented in this section has been gathered as a result of the Assiniboine River Monitoring Study, a multi-year study conducted by Earth Tech (Canada) Inc. and North/South Consultants Inc. on behalf of the City of Brandon. The purpose of the study is to monitor the effects of wastewater discharge from the IWWTF, in conjunction with other discharges in the vicinity of Brandon (i.e., the Brandon Municipal WWTF and the Simplot Canada Ltd. fertilizer plant), on water quality in the reach of the Assiniboine River between the cities of Brandon and Portage la Prairie. Water quality models, using QUAL2E (USEPA), are being developed to assist in the interpretation of observed results and to predict water quality under a variety of conditions.

The study considered three major issues:

Ammonia

Considerable attention has been directed towards studying the effects of ammonia because, at high concentrations, ammonia may be toxic to aquatic life. Guidelines for ammonia are contained in the MWQSOGs and vary with temperature and pH.

Ammonia nitrogen is an intermediate in the conversion of organic nitrogen to nitrates (via nitrites). The main sources of ammonia to surface waters are from the decay of organic nitrogen, excretion from aquatic organisms, inputs from point and non-point sources (e.g., effluents, runoff from agricultural land), and release from sediments (under some circumstances). Ammonia is taken up by plants and algae, and is broken down (in a process known as nitrification) to nitrites and nitrates by nitrifying bacteria. During winter, ammonia levels sometimes approach a mass balance as low temperature limits the activity of nitrifying bacteria, algae, and plants.

Oxygen

Dissolved oxygen is essential for the survival of most aquatic life and is one of the basic parameters used to assess aquatic ecosystem integrity. The amount of oxygen that can be dissolved in water varies with temperature: colder water holds more oxygen than warmer water.

Important factors affecting oxygen concentrations in winter include:

- the use of oxygen by organisms in both the water column and sediments due to the breakdown of organic materials as well as the conversion of ammonia to nitrate;
- the relative input of oxygen from tributaries and groundwater (studies suggest that groundwater inputs to the Assinboine River may contain very little oxygen) ; and
- the occurrence of re-aeration (during winter, this process can be severely restricted by ice cover).

The same processes affect oxygen levels in summer. However, the activity of photosynthetic organisms adds complexity, as these organisms produce oxygen during the day and consume it at night, potentially resulting in large swings in oxygen concentrations over a 24-hour period.

The MWQSOGs specify both chronic and acute objectives depending on water temperature and the presence of sensitive life stages/species of fish. Analysis of effects during the open water season (Cooley et al. 2001b) considered chronic and acute objectives of 6 mg/L and 5 mg/L, respectively. Work conducted for the winter period used the site-specific objective of 5 mg/L recommended by Gurney (1991) as the basis for comparison (Cooley et al. 2001a).

Nitrogen and Phosphorus Enrichment

The third major issue is nitrogen and phosphorus leading to the proliferation of algae (in particular phytoplankton).

Algal growth in riverine environments is determined by the interaction of numerous factors including:

- light availability, which depends on depth and turbidity, as well as light intensity and the hours of sunlight per day. It should be noted that optimum light levels vary among species;

- water temperature, as growth is usually more rapid in warmer water until an upper maximum is reached, though, as with light, there are differences among species;
- flow, in relation to water residence time which determines the time for potential growth as well as the inputs from upstream lakes;
- substratum type, for attached algae (dense mats of algae in riverine environments generally form only on rocky substrata); and
- nutrient availability, as overall algal biomass is usually limited by either or both of the major nutrients: nitrogen and phosphorus. Certain types of bluegreen algae can obtain nitrogen by fixing atmospheric nitrogen; therefore, phosphorus may be the limiting nutrient. Diatoms may be limited by silica, required for their growth. It should be noted, however, that nutrients only are limiting if other growing conditions are suitable. Results of studies completed to date suggest that in the study area nitrogen is the more likely limiting nutrient when nutrient limitation does occur.

Fecal coliform bacteria and protozoan parasites were initially a component of the study, but sampling conducted during the first year of operation indicated generally low levels of fecal coliform and protozoan parasites in the IWWTF effluent; sampling after that time was conducted as a component of the routine effluent monitoring. The expanded IWWTF system will be equipped and operated to ensure that this continues to be the case.

Water sampling began in February 1999, with an intensive sampling program focused on assessing effects related to the input of ammonia and wastes exerting an oxygen demand on the water under ice-cover. Sampling continued with a spring (May 1999) and summer/fall (June, July, August, and September 1999) open-water program. These studies documented the condition of the river prior to the operation of the IWWTF. The facility began operating in September 1999; however, discharges during the September 1999 study were minimal. Production and corresponding effluent discharge at the Maple Leaf plant increased after commissioning in September 1999, reaching near one-shift capacity by early 2002. Water quality in the Assiniboine River was examined through intensive monitoring in November 1999 at the time of ice formation, and in February, May, and June, 2000. Intensive monitoring originally scheduled for summer and fall 2000 was deferred due to high river discharge; however, monitoring at limited sites continued through September 2000. Low river discharge in spring and summer 2002 provided an opportunity to continue monitoring and modeling exercises under low-flow conditions; intensive water-quality monitoring took place in June, July, and August 2002.

Samples were collected from 14 sites located on the Assiniboine River between Brandon and Portage la Prairie. The timing of sample collection along the study reach was staggered to permit sampling of approximately the same parcel of river water as it moved downstream of Brandon. Water samples were analyzed for a suite of parameters, including ammonia, nitrate/nitrite, total Kjeldahl nitrogen, total phosphorus, phosphate, dissolved oxygen, and chlorophyll a. Additional analyses involved measurements of phytoplankton, periphyton, light, and sediment oxygen demand at selected sites and times. Results are reported in Cooley et al. (2001a, 2001b), Schneider-Vieira et al. (1999, 2000), Toews and Schneider-Vieira (2000), and Toews et al. (1999, 2000, 2001, 2002). To date, a calibrated water quality model has been produced for winter conditions (Cooley et al. 2001a), but summer conditions have been more difficult to model. Data have been analysed in terms of total nutrient loads, nitrogen: phosphorus ratios and other parameters to assess growing conditions for algae in the river (Cooley et al 2001b). A complete summer of data gathered under low flow conditions occurred in 2002; these data have been reported (Toews 2002) but analysis is currently underway and will be presented in a forthcoming report (Cooley et al. 2003a).

The following discussion describes the major conclusions with respect to the effect of effluent inputs from the IWWTF on water quality in the Assiniboine River based on analyses for the winter and open water season completed to date (Cooley et al. 2001a, 2001b). Analyses for winter conditions were based on effluents observed in February 2000 and full one shift projections as indicated in the 1998 design criteria that were available at the time of the report preparation in February 2001. The assessment for winter conditions will be updated to reflect the current two-shift projections in a forthcoming report (Cooley et al. 2003b). Analyses for the open water season are based on observed data and analyses for the summers of 1999 and early 2000, supplemented by data collected during the summer of 2002. As discussed in Cooley et al. (2001b), it has not been possible to develop a calibrated water quality model for the open water season to date, possibly due to the role of periphyton in nutrient dynamics (this algal group is not included in the QUAL2E model). Complete analysis of the 2002 data, and interpretation of the effects of projected one shift nutrient loading, will be provided in a forthcoming report (Cooley et al. 2003 a).

5.5.2.1 Winter Conditions

Ammonia

The major sources of ammonia in the reach of the Assiniboine River between the City of Brandon and the Portage Water Reservoir are the City of Brandon Municipal WWTF, the municipal drainage ditch that receives discharge from the Simplot Canada fertilizer plant and Manitoba Hydro's Brandon Thermal Generating Station ash lagoon, and the City of Brandon's existing IWWTF.

During the February 2000 study, ammonia inputs at Brandon increased ammonia levels in the river, tripling background levels at the downstream end of the mixing zone. The fully mixed ammonia concentration, however, was well below the MWQSOGs. Ammonia concentrations then gradually declined, reaching levels approximately 1.6 times values upstream of Brandon by the lower end of the study reach. This decline appeared to be the result of dilution by groundwater, as well as breakdown of ammonia by nitrifying bacteria (nitrification).

The scenarios as presented in Cooley et al. (2001a) indicated that ammonia concentrations would not be expected to exceed MWQSOGs downstream of the mixing zone even under low river discharge (i.e., $7Q_{10}$) and relatively high effluent loads (i.e., Simplot Canada licence limits; IWWTF 1998 design criteria; Brandon Municipal WWTF effluent loads measured in February 2000). Typical projected values of the 2-shift operation are below the 1998 single shift projections examined in Cooley et al.(2001a). The effect of projected inputs on ammonia concentrations in the river, as well as an analysis of the assimilative capacity in relation to future inputs from the City of Brandon's municipal facility, will be provided in Cooley et al. (2003b).

Oxygen

Oxygen concentrations in many northern rivers decline during the winter months under ice cover, as little or no oxygen enters the system, oxygen is consumed by biological activity (though at a low rate), and surface waters are diluted by anoxic/hypoxic groundwater (e.g., Whitfield and McNaughton 1986). The situation is exacerbated in eutrophic waters, where oxygen demand in both the sediments and water column is elevated by inputs of organic matter.

The major sources of oxygen demand (i.e., carbonaceous biochemical oxygen demand (CBOD) and ammonia) entering the river during winter between the City of Brandon and the Portage Water Reservoir are the City of Brandon's Municipal WWTF, the municipal drainage ditch that receives discharge from the Simplot Canada fertilizer plant and Manitoba Hydro's Brandon Thermal Generating Station ash lagoon, and the City of Brandon's IWWTF. It should be noted that the Assiniboine River upstream of effluent inputs near Brandon may contain a large load of CBOD (during the February 2000 study the CBOD load in the river was 10-20 times larger than the load in the effluents). As could be expected, background concentrations of oxygen in the Assiniboine River entering Brandon are well below saturation and show evidence of considerable oxygen uptake upstream (e.g., 7.5 mg/L or 53% saturation during the February 2000 study).

Other important factors affecting oxygen levels during winter include:

- Open water and re-aeration play a critical role in determining the oxygen concentration and profile in the river. The extent of open water is expected to vary widely both between and within years, as it is closely related to air temperature, as well as hydraulics (i.e., water velocity, discharge, and depth).
- Incoming groundwater dilutes the dissolved oxygen in the Assiniboine River. The effect of this dilution would be greater under low river discharge (e.g., $7Q_{10}$) as groundwater inputs are believed to remain relatively constant. Under low river discharge, groundwater inputs comprise a greater fraction of overall river discharge, thus exerting a relatively greater effect on water quality.
- Under low river discharge, sediment oxygen demand and other oxygen-consuming processes exert a greater effect on oxygen depletion than under 'average' flows (i.e., there is more time for rate-dependent processes to consume oxygen in a given distance).
- The Souris River may supply oxygen to the Assiniboine River. This occurrence, however, will depend upon the water quality and the discharge of the Souris River, as well as conditions in the Assiniboine River itself.

Predictive model simulations (Cooley et al., 2001a) for the ice-cover season indicate that oxygen levels would often decline to well below 5 mg/L, under conditions when there is little re-aeration throughout the study area (it should be noted that in February 2000 considerable re-aeration was observed; however, it is expected that under extremely cold prolonged conditions much of the river would freeze and re-aeration downstream of the effluent inputs would be minimal).

Predictive simulations for the ice-cover season also indicate that oxygen depletion may be severe enough that concentrations may drop measurably below 5 mg/L in the absence of effluent discharges. Effluent discharges may actually supply oxygen to the river at the point of input by maintaining areas of open water where re-aeration is increased; however, the ultimate effect of effluents is a function of the oxygen consumed by oxygen-consuming substances present in the effluents (i.e., BOD loads and rates of aerobic processes), as well as re-aeration in the plumes and the oxygen load contributed by the effluent, in conjunction with river discharge (i.e., dilution of effluents and river travel times). A very rough estimate (as presented in Cooley et al., 2001a) of the potential effect of effluent inputs at Brandon (using Simplot licence limits, 1998 single shift design criteria for the WWTF, and effluent loads from the Brandon Municipal WWTF measured in February 2000) on oxygen levels in the Portage Reservoir at March $7Q_{10}$ flows ($9.11 \text{ m}^3/\text{s}$) is a net decline of 2.21 mg/L (of which the modeled IWWTF accounted for 8%, at loads approximating 1998 design criteria). The proposed

effluent quality for the IWWTF expansion has a lower BOD load than analysed previously; results of the updated analysis will be presented in Cooley et al. (2003b).

5.5.2.2 Open Water

Under high flow conditions, as occurred during the summer of 1999, the effects of existing effluent inputs at Brandon were masked by high background concentrations of nutrients in the river. The large volume of river water also served to dilute inputs (e.g., BOD), and biological processes in the river under these conditions are generally not sufficient to cause a measurable change (e.g., oxygen levels were not measurably changed by the decay of BOD or Sediment Oxygen Demand (SOD)).

Given the above, the following observations, based primarily on information gathered during low flow conditions in May and June 2000, summarize our current understanding of conditions in the Assiniboine River during the growing season:

Ammonia

During the summer of 1999, ammonia loads from the City of Brandon's Municipal WWTF effluents were rapidly diluted in the Assiniboine River due to atypically high river discharges. Ammonia concentrations in the summer of 1999 in the river upstream of the influence of effluents and discharges ranged from 0.01 to 0.07 mg/L. In all months sampled in 1999, ammonia concentrations increased within the mixing zone, to a maximum of approximately 0.20 mg/L, but were diluted or reduced to near upstream levels approximately 35 km downstream (near Treesbank) of the municipal lagoon outfalls.

Similarly, under low flow conditions in May and June 2000 and through the summer in 2002, effluent inputs increased ammonia concentrations, but levels dropped rapidly to near background concentrations by the end of the combined source mixing zone (including all of the considered sources in the Brandon area). Examination of mass balances in 2000 suggests that this decline is due in part to biological processes (uptake by attached algae and/or breakdown by bacteria) (Cooley et al. 2001b).

The discharge of ammonia from the existing IWWTF during the studies was generally low (usually less than 1 kg/d) and was a small fraction of inputs from other sources; the projected typical loading is marginally higher (approximately 2.4 kg/day) but still falls within the range of observed values. For comparison, the load of ammonia discharged from the City of Brandon's Municipal WWTF in May and June 2000 was 16.1 kg/day and 148 kg/day, respectively, and ranged from 64 to 465 kg/day in 2002. The load of ammonia discharged from the municipal drainage ditch that receives discharge from the Simplot Canada Ltd. fertilizer plant and the Manitoba Hydro ash lagoon was 113 kg/day and 134 kg/day in May and June 2000, respectively, and from 24 to 198 kg/day in June 2002.

Oxygen

Concentrations of DO measured in the Assiniboine River from Brandon to the reservoir at Portage la Prairie during high flow conditions from May through September 1999 were high and varied little along the river; there was no evidence of marked changes (increases or decreases) to DO concentrations as a result of biological activity.

Under low flow conditions in 2000 and 2002, most daytime measurements of oxygen indicated high values, and levels actually increased through the mixing zone. These elevated values were related to the presence of periphyton (Cooley et al. 2001b). Several individual measurements obtained during the July 2002 intensive monitoring period fell below the chronic objective (7-day average) of 6 mg/L, and DO concentrations at two sites fell below the acute objective of 5 mg/L.

High algal productivity associated with nutrient enrichment may lead to wide DO fluctuations in response to oxygen production by photosynthesis in the day and oxygen consumption by respiration at night. Early-morning dissolved oxygen concentrations measured at Treesbank declined well below 5 mg/L during mid summer low flow measurements (Toews, 2002).

The projected typical effluent from the expanded IWWTF will input 35 kg/day BOD (it should be noted that this value is somewhat higher than observed during the 2002 studies but these latter values may have been atypically low due to the time of week that the samples were collected). An estimate of the potential increase in the effects to oxygen will be provided in Cooley et al. (2003a).

Nutrients and Algae

During high flow conditions in 1999, high background concentration and loads of nitrogen and phosphorus generally masked the effects of nutrient inputs at Brandon.

Under the lower flow conditions in the spring of 2000, phosphorus and nitrogen inputs at Brandon increased the nutrient load of the Assiniboine River. The load of phosphorus released from the IWWTF in May 2000 was almost as high as the background load in the Assiniboine River, as measured just upstream of the Hydro weir (sampling site 2) (50 vs 59 kg/day, respectively). Conversely, nitrogen loads in the IWWTF effluent were much lower in May and June 2000 relative to upstream loads carried in the river (i.e., 195 vs. 1135 kg/day in June 2000, respectively; Cooley et al. 2001b). During the sampling periods in June, July, and August 2002, the City of Brandon Municipal and IWWTFs increased the total phosphorus load carried by the Assiniboine River at Brandon by 147%, 117%, and 142%, respectively (Toews 2002). The combined discharge of the effluents from both the City of Brandon Municipal and IWWTF, the drainage ditch that receives discharge from the Simplot Canada

Ltd. fertilizer plant and the Manitoba Hydro ash lagoon, increased the total nitrogen load in the Assiniboine River at Brandon by 88 to 160% during the June sampling period, 89% during the July sampling period, and 100% in the late August sampling period (Toews 2002).

The projected effluent loading for the expanded IWWTF represents a comparable, or marginally lower, phosphorus load and approximately half of the nitrogen load compared to that observed during studies in the summer 2002.

The analysis of the relationship between phytoplankton and attached algae and nutrient levels in the river is on-going; final results will be presented in Cooley et al. 2003a. Analysis will include comparison among the three years when algal data was collected: high flow conditions in 1999, and low flow conditions in May and June 2000 and June to September in 2002 (it should be noted that nutrient loading from the IWWTF was different between 2000 and 2002). Under high flow conditions, the growth of phytoplankton is limited by turbid water and low water residence times. However, even under low flow conditions, blooms of phytoplankton are episodic, reflecting the complex interaction of many factors affecting growth. The growth of periphyton during all the low flow years was abundant. Under low flow conditions, nutrient concentrations and nitrogen to phosphorus ratios indicated that algal growth in the river was nitrogen-limited upstream of Brandon, that nutrient inputs in Brandon resulted in no nutrient limitation until Treesbank, after which nitrogen limitation again occurred. July 2002 was the exception in that concentrations of nitrate/nitrite were high in water entering Brandon, and nitrogen limiting conditions did not occur until the PTH #5 bridge (the site in the Portage Reservoir also was not nutrient-limited during this sampling period).

5.6 SUBSURFACE IMPACTS

5.6.1 Groundwater

During the minimal site leveling, grading, construction of drainage works; and, construction of the expanded IWWTF and the relatively minor changes at the pretreatment plant, the greatest groundwater concern stems primarily from the activity of refueling construction vehicles on site. The existence of an extensive aquifer beneath the site, which could become polluted if a major spill occurred, necessitates that this potential impact not be considered lightly. Because of the coarse soils over most of the site, any spill of more than a few litres (one gallon) would quickly infiltrate to the ground water table. This moderate potential impact has a local scope of influence; however, the source is anticipated to be intermittent.

Since 1998, extensive investigation of existing ground water quality at the site has been undertaken to identify ground water impacts associated with past and surrounding land uses. A monitoring program has been designed to detect unexpected leakage into the ground water system from any of the plant or process facilities, and from surrounding land uses. In the event that an adverse impact to groundwater quality is noted, as a result of plant or process

operations, then further investigation will be undertaken to determine the source and nature of contamination. Appropriate mitigative measures would then be undertaken to ensure there are no adverse off-site impacts with respect to ground water quality.

The existing ground water monitoring program incorporates monitoring the City of Brandon IWWTF. The reader is referred to the Terraprobe (1998) ground water report for details of the ground water monitoring program and to their subsequent reports provided at least annually.

Some impact to the ground water monitoring program could occur due to the intentional or unintentional loss of monitoring wells due to construction equipment. Loss of wells has already occurred over the five-year monitoring program to date and disturbed wells have been routinely replaced using proper well decommissioning techniques. Any required wells disturbed during construction will be replaced prior to the next monitoring event.

5.6.2 SOILS

Increased potential for erosion in the short term is the main soil impact associated with land leveling and construction. Construction activities will take place on previously disturbed non-agricultural land (about 40 ha (90 acres)). The soil is only suitable for low quality pasture or hay lands due to its coarse texture and rapid drainage. The area of construction for the improved pretreatment plant and the expanded IWWT has already been disturbed by the original construction of the pork processing plant and the original IWWTF. However, in areas of new construction all topsoil will again be stripped and stockpiled for future use in site landscaping; and, the remainder of the soils will be used according to a normal cut and fill operation. Pockets of silt and/or other weaker soils will be excavated and the soil transferred to appropriate fill areas to be replaced with better construction materials. The whole construction area, and particularly where soils have been replaced, will be backfilled and proof-rolled to improve their density and other engineering characteristics.

There is also the potential for soil contamination through spills in the refueling area and the possibility of mechanical breakdown of construction or yard equipment, which may result in liquid releases. Impacts from any spills of fuels or lubricants on soils are anticipated to be local, potentially long-term, but low magnitude. Because of a commitment to fast clean-up of spills, we believe this potentially long-term impact can be reduced to short-term potential.

Under normal operating conditions, there will be no discharge of contaminants from the improved pretreatment plant or the expanded IWWTF process into the soil other than sludge that will be handled by the existing City of Brandon's Biosolids Management Program described later in this report. Both facilities have been designed for complete containment of effluent with no release to the soil on site. For example, the equalization basin will have a double liner.

Therefore, under normal operating circumstances there will be little or no potential for contamination of the soil. As indicated earlier there will be land application of biosolids.

5.7 TERRESTRIAL IMPACTS

5.7.1 Wildlife

Construction related impacts to wildlife are expected to be limited. Most wildlife species already present in the area surrounding the plant have likely adjusted to the ambient noise and activity disturbances of the area. The construction disturbances themselves are expected to be limited to the local area. Original site preparation resulted in the loss of about 40 ha (99 acres) of hayfield; however, a portion of this area in the southeast corner of the site was cut for hay in 2002. During construction of the improved pretreatment plant and the expanded IWWTF and its infrastructure, noise, activity and night lighting may cause temporary habitat alienation in adjacent areas. Car and truck traffic to and from the worksite by construction staff may peak at about 30 to 50 vehicles per day. This represents an increase of 5% or less over the current average annual daily traffic volume of 1,980 vehicles per day (personal communication, University of Manitoba Transport Information Group).

Construction traffic for the expanded IWWTF will be less than the 100 vehicles per day to the City of Brandon site. This construction traffic will be a minor, local, short-term, intermittent impact that is reversible. Construction traffic will be much less than traffic created by the second shift that is already licenced. The higher level of traffic during two-shift operation resulted in our original prediction that deer collisions on Richmond Avenue and Highway 110 near the site could increase to four (4) to eight (8) per year, about the same as Highway 10 on the north side of Brandon. It appears this prediction has been substantiated, since a recent (July 2002) telephone call to the Brandon Police Department indicated there has been a noticeable increase in deer kills on Richmond Avenue since Maple Leaf start-up. (Personal Communication – Kelly Pettinger, Animal Control Office, Brandon Police Service). He also indicated there are normally between 50 to 70 deer kills within the City of Brandon annually, with many occurring between October and the end of December.

5.7.2 Vegetation

Original construction activities have resulted in the removal of approximately 40 ha (99 acres) of hay field on the City of Brandon/Maple Leaf site. Construction of the expanded IWWTF will not increase this disturbed area, since all proposed activities will occur within the original construction site. Some vegetation has re-established since the original construction, but most of it is sparse and mostly of weedy variety. Native vegetation in the existing gravel pit and aspen stand will not be disturbed. Although there is a potential for accidental spills of fuel or chemicals to cause injury to adjacent vegetation, the likelihood is remote.

No significant negative impacts on vegetation are anticipated during the operations stage of this project, since all of the new facilities are on the same site as the original construction.

5.7.3 Current Land Uses

Until the time of the original construction (1998-1999), the site had been used primarily for agricultural purposes. Prior to its acquisition by the City of Brandon for the purposes of accommodating the proposed Maple Leaf Foods Pork's processing plant, the land was used and owned by Simplot for fertigation; that is, disposal of effluent containing plant nutrients suitable for fertilization through an irrigation system. Major adjoining land uses include the Simplot fertilizer plant (industrial) located about 2.5 km (1.5 mile) to the west; gravel pits to the north with the Assiniboine River 0.5 km (0.3 mile) beyond to the north; Nexen Chemicals 1.25 km (0.8 mile) to the east southeast; and, farmland with a east-west rail line to the south. A C.P.R.-C.N.R. transfer track borders the western edge of the property. Two small auto wrecking firms (Harvest Salvage and East End Auto Wreckers) are located across Richmond Avenue to the south towards the west end of the site; and, Wesman Salvage north of the site, and Shur-Grow (Cominco Fertilizers) and Simplot own bulk sites located also to the north near the northwest corner of the proposed site. All the other land immediately adjacent to and surrounding the Maple Leaf and City of Brandon sites are currently used as either gravel pits or farmland. A schematic diagram of adjacent properties is shown in Figure 5.1.

The subject property was originally designated "Heavy Industrial" in the Brandon and Area Planning District Development Plan, By-law No. 9/84; and, it is classified as "M3" Heavy Industrial District, according to the City of Brandon Zoning By-law No. 5128. Under the "M3" Heavy Industrial District designation meat processing and packaging of meat processing is a permitted use (Personal Communication - Beth Sanders, MCIP, District Planner/Development Officer). The designations have since changed and "M3" has become "MH" meaning Industrial Heavy Zone; and, "AMR" has become "DR" meaning Development Reserve. It is intended that land currently designated "DR" will become "MH" sometime in the future. Surrounding land to the North is currently designated "DR", to the South "MH" at Richmond and "DR" beyond, to the east land is designated "MH" (Personal Communication - Beth Sanders, MCIP, District Planner/Development Officer). Figure 2.4 shows the existing zoning of properties neighbouring the Maple Leaf Pork and City of Brandon sites.

5.8 EMPLOYMENT AND INCOME

5.8.1 Construction

During construction the peak labour force at the expanded IWWTF is anticipated to reach about 30 to 40 workers. Initially, there will be a few workers involved in the site grading. Once the minor site work is completed, the work force will gradually increase once the foundation work begins for the tanks and the equipment building, to be followed by the

building erection. The work force will generally increase week by week until the expanded IWWTF is completed. The work force will also vary from week to week depending what construction activities are being carried out at any specific time.

The estimated construction labour by month is given in Table 5.4: Estimated Construction Labour Force by Month. It shows the average number of workers to be about between 30 and 40 over a nearly 12-month construction period.

The objective will be to have the equipment building exterior completed by November 2003 so that work can continue on the fully enclosed interior of the building during the winter months. In addition, most or all of the earth moving for the equalization basin and the foundation work for tanks would be completed early in the schedule. A preliminary schedule has been included as Figure 5.2.

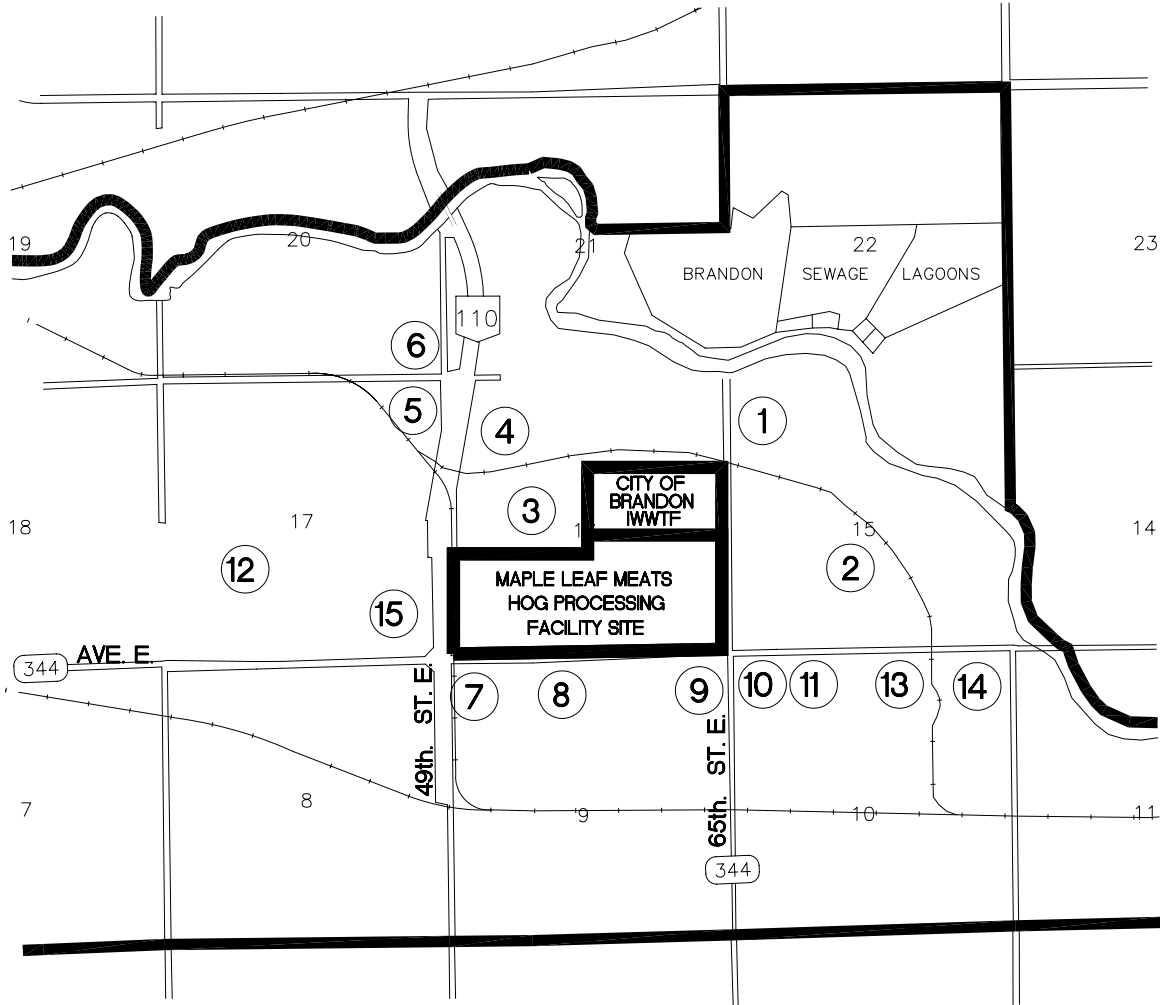
Table 5.4: Estimated Construction Labour Force by Month

Month/Year	Estimated Number of Workers on Site
September, 2003	5
October, 2003	10
November, 2003	20
December, 2003	25
January, 2004	30
February, 2004	30
March, 2004	35
April, 2004	35
May, 2004	30
June, 2004	20
July, 2004	20
August, 2004	10
September, 2004	10

During the original Maple Leaf Pork plant construction, the peak day labour was predicted to reach 500 whereas the actual labour force peaked at 390. Ninety-nine percent (99%) of the original construction labour force was reportedly from Manitoba. This indicates the impact of 30 to 40 construction personnel (about 10% of the original overall site construction workforce) for the expansion of the IWWTF in Brandon will be minimal.

5.8.2 Operations

During two-shift operation, no more than about five (5) people will be employed at the IWWTF. There are currently two employees at the site.



LEGEND

- | | |
|-------------------------------------|---|
| ① J. Terhune, C. Denbow - Residents | ⑨ Abandoned Farmhouse |
| ② Westco | ⑩ Paul's Hauling (Anhydrous Ammonia) |
| ③ Cominco Fertilizers | ⑪ Burned Down House |
| ④ Wesman Salvage | ⑫ Simplot Land |
| ⑤ Bradley Sand and Gravel (Yard) | ⑬ Western Cooperative Fertilizer Plant (Westco) |
| ⑥ Bradley Sand and Gravel (Office) | ⑭ Nexen Chemical Plant |
| ⑦ Harvest Salvage | ⑮ Simplot Millennium Park |
| ⑧ East End Auto Wreckers | |

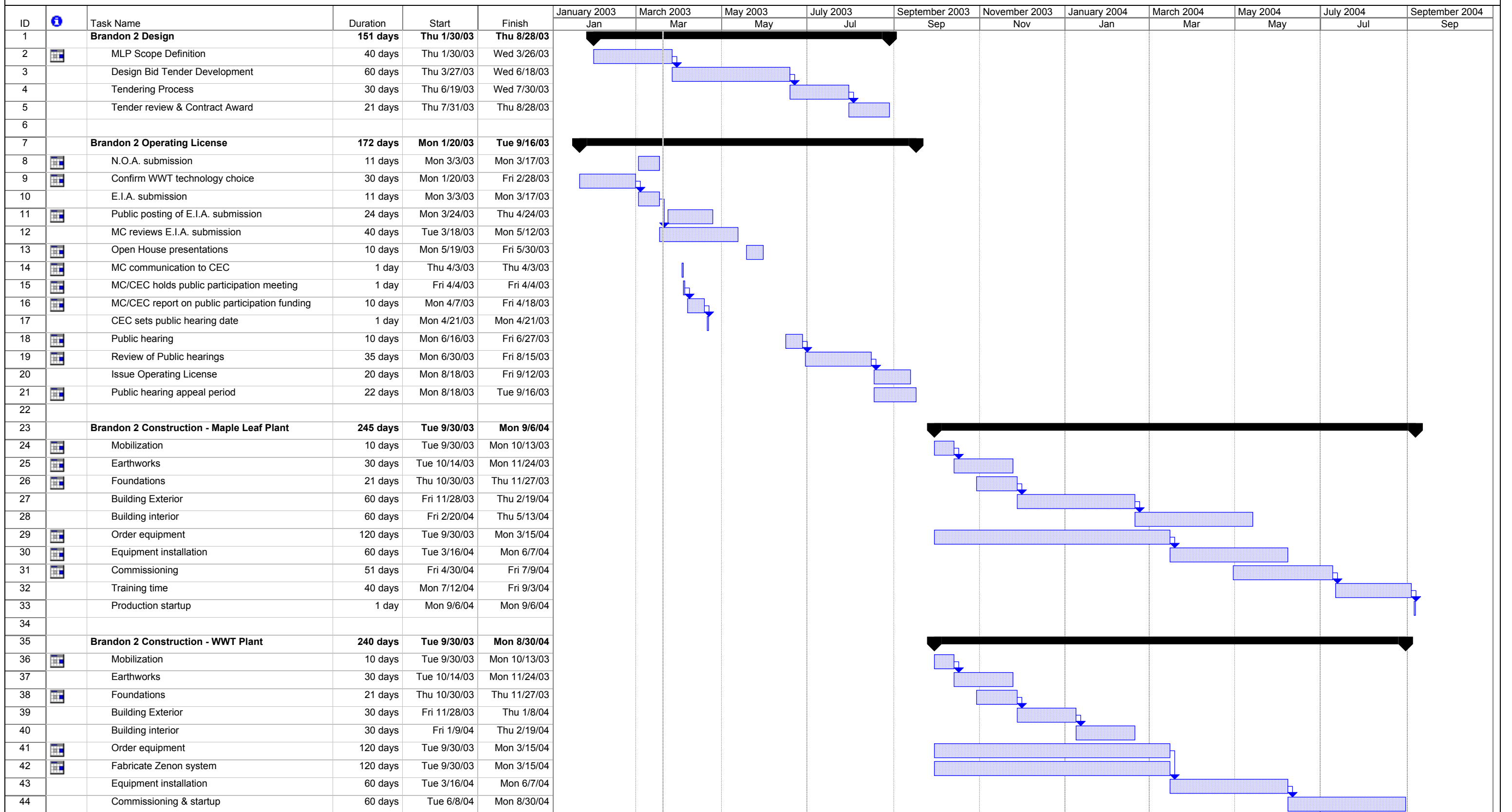


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drawn CB	project no. 57730	
checked SJB	drawing no.	rev.
approved KMA	5.1	



Schematic Drawing of Properties Adjacent to
The City of Brandon Expanded IWWTF

Figure 5.2: Preliminary Construction Schedule



Project: Brandon2Construction.rev6wit
Date: Thu 3/20/03

Task: [Blue hatched bar] Progress [Black bar] Summary [Grey bar] External Tasks [Green arrow] Deadline

Split: [Dotted line] Milestone [Black diamond] Project Summary [Grey diamond] External Milestone

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5.8.3 Direct Employment

Most, if not all, of the expanded IWWTF construction related jobs will be of a temporary nature. Project Management personnel and labourers will likely be employed for the longest duration, which is anticipated to be fewer than 12 months. Trades people will come and go depending upon specific tasks and skills required at various stages of construction. The typical duration of employment of the various trades people will likely be in the order of two (2) to four (4) week periods, although this will vary from trade to trade and person to person.

With an average work force of about 28 people over a 12 month period at an estimated average hourly rate of \$28.00/hour (Personal Communication - Mr. Dave Martin (956-7425), Exec. Sec., Manitoba Building and Construction Trades Council), the direct employment benefits can be estimated at about \$1.6 M. The impact of this employment will be positive, short term, and largely local to regional in extent.

5.8.4 Indirect and Induced Employment

During the construction period, indirect and induced employment has been estimated by the Manitoba Bureau of Statistics to provide about 20 person-years of work. This effort would generate approximately \$1.1 Million in indirect and induced employment.

5.8.5 Local Purchasing Policy

To the extent possible in a competitive market, products or services will be purchased firstly in Brandon; secondly, in Manitoba; and, thirdly, in Canada. No direct preference will be given to local firms and suppliers during bidding processes; however, all other things being equal, local firms normally would be selected over non-local firms for construction and material supply contracts and sub-contracts.

5.8.6 Overall Benefit

The overall benefit to the surrounding community from the construction activities of the expanded IWWTF will be most easily realized in the direct, indirect and induced employment generated for construction workers, truck drivers and the like. With a peak construction person estimate of approximately 40 workers on the site and an estimated construction time of just under one year there will be a very significant economic benefit from the construction alone. The Manitoba Bureau of Statistics has estimated total direct, indirect and induced employment to generate 48 person-years of work. Wages alone paid to construction workers will be in the order of \$1.6 Million and other indirect and induced employment is estimated to generate another \$1.1 Million, for a total economic benefit from employment alone of about \$2.7 Million. The overall benefit of construction is considered to have a moderate magnitude

of impact, to be of short duration, and regional in scope, since the bulk of workers are most likely to come from within a one (1) hour travel radius of Brandon or Winnipeg.

5.9 POPULATION

The construction of the expanded IWWTF will not have a significant impact on the local population numbers. A peak of 40 construction persons is estimated to be approximately 0.20% of the Brandon workforce and 0.08% of the workforce of the Brandon region. Close to 400 construction workers on the original Maple Leaf site and up to 800 workers on the Simplot plant expansion a few years previous were recently accommodated by the City of Brandon without significant negative impacts on the community.

5.10 COMMUNITY PROFILE

5.10.1 Background

As the construction phase of the IWWTF project is not expected to significantly affect the population or the overall employment in the community, it is also not expected to significantly affect the community profile.

5.10.2 Community Profile

The impact of the City of Brandon's expanded IWWTF will have a positive impact on the City of Brandon in our view in that it facilitates the beginning of the second shift at Maple Leaf Pork. Whereas enrollment in public schools and the University had been declining in recent years prior to Maple Leaf Pork, a growth in population for the City of Brandon has or will reverse several of these negative trends. Some services such as medical, number of social workers, fire, roads, daily water consumption and solid waste disposal may have to be expanded in the future, but many of these impacts would be considered positive by residents of a city the size of Brandon. Most of these services have had excess capacity in the City of Brandon; however, not sufficient to accommodate all anticipated growth. However, the City of Brandon have a very capable staff whose foresight and planning skills combined with the excellent communication developed over the initial few year with Maple Leaf Pork will ensure that City of Brandon residents will realize significant benefits from the overall project.

5.10.3 Knowledge of and Attitudes Towards The Project

The City of Brandon and Maple Leaf Foods Inc.'s environmental consultants have twice visited all known private residents within three (3) km of the site building to elicit concerns and supply general information regarding the plant. The first visit was carried out in early 1999 and the second visit was completed in the early summer of 2002. Maple Leaf Pork initially operated a Hot Line where general information could be obtained or complaints could

be registered. Out of over 1,000 calls to the Maple Leaf Hot Line and the BEDB, only one was close to a complaint – a concern expressed about the downstream water quality of the Assiniboine River. The Hot Line was eventually discontinued because the number of calls eventually diminished to an insignificant number. The City of Brandon and Maple Leaf Pork also have periodically issued press releases and will continue to conduct public information sessions to keep the public informed and elicit comments from the general public. Examples of public information and feedback are included in Section 11.0 of this report. Additional Open Houses are planned for early to mid May 2003.

During the operations of the one-shift phase of the project, media coverage has regularly kept the public informed about the Maple Leaf Pork processing plant to a large degree. Maple Leaf Pork and the City of Brandon will continue to issue press releases at milestone dates of the development; for example, when the new expanded IWWTF begin operations and when the plant reaches full one- and two-shift capacity. In addition, as plant workers from the Brandon area return daily to their communities, knowledge of the project will continue to increase and attitudes towards the project will develop.

We recently (October 2002) contacted four towns surrounding the City of Brandon to solicit whether or not they have noticed impacts on their towns from Maple Leaf Pork's activities in Brandon that would include the expanded IWWTF. The towns contacted included Alexander, Carberry, Rivers; and, Wawanesa. Carberry was represented by municipal officials. Mr. Jim Madder, Chief Administrative Officer, R.M. of Whitehead and Mr. Brent McMillan, Chief Administrative Officer, both indicated that the impact on their communities has been minimal, but positive. Both indicated a couple of people from their community work at Maple Leaf Pork; and, Maple Leaf has created some economic stimulation in the Carberry area. Mayor Roy Stevenson of Rivers indicated that although in the last year the Town has lost their hotel to fire, lost their bank, lost their elevators (an estimated 40 to 50 jobs in total); and, the Town of Rivers gained two (2) people in the last census. The Mayor credited Maple Leaf Pork activity in Brandon in total for preventing major economic impact from these losses. He estimated that there are somewhere between 15 and 20 people from Rivers and surrounding area employed at Maple Leaf Pork in Brandon. Wawanesa indicated Maple Leaf has definitely been a benefit to their town (Personal Communication – L. Plett, Town Administrative Officer). All four towns recognized the benefits of this transferred income into their communities; and, none of the town representatives could identify any negative impacts on their community.

We predicted in the application for the operations phase of the overall project, that Brandon and surrounding communities would view Maple Leaf Pork as a positive addition to their community. Our latest interviews with residents within a 3 km radius of the plant and a few

Mayors and representatives of surrounding towns in general have certainly confirmed this prediction.

5.10.4 Conclusions

The construction phase of the expanded IWWTF is not anticipated to significantly affect the profile of the community. The City of Brandon has accommodated other large construction workforces in the past on construction projects associated with Westco, Simplot; and, the original Maple Leaf Pork plant without significant problems. It is expected that this would also be the case for the construction phase of this project. A recent check with The City of Brandon officials indicates the construction and one-shift operation phase of the original plant has not changed the community profile significantly; however, it is apparent there has been an increase in traffic over the past few years (Personal Communication-Ian Christiansen). This opinion has been confirmed through discussion with other local people.

5.11 SOCIOECONOMIC IMPACT

5.11.1 Community Support

During the construction and operation of the expanded wastewater plant, the City of Brandon anticipates little public curiosity largely because a major facility currently occupies the site. Neighbours within a 3 km radius of the site have all been visited by a representative of the City of Brandon/Maple Leaf Pork, and it was found that the project has been positively accepted by virtually all neighbours.

The City of Brandon is traditionally supportive of community life and activities. It owns and operates a community parks and recreation program; is a regional service center for the region (Westman); and, it is a funding partner with the Province of Manitoba in the Keystone Centre.

5.11.2 Employment Impact

It is anticipated that a labour force of between 30 and 40 people will be employed at the site during the construction of this over \$10.0 Million expanded IWWTF. The employment impact from this proposed development construction is anticipated to be positive and regional, relatively short-term (less than 1 year), will occur only once and will be irreversible.

5.12 TRANSPORTATION

Traffic from the construction of the IWWTF will be fewer than 100 vehicles per day. The only area where this might be noticeable is 65th Street East that borders the construction site to the east. Only one residence (Denbow and Terhune) is served by this rural road, which is further north from Richmond Avenue than the site. Therefore, other than for Denbow and

Terhune, the increase in traffic is anticipated to be insignificant. This traffic impact will be local, short-term; and, reversible.

5.13 HERITAGE IMPACTS

An archaeological impact assessment was conducted on the site by qualified archaeological consultants, Quaternary Consultants Limited prior to the original construction on the site. The assessment indicated one (1) archaeological site located on the property. Intensive examination at this location found no associated features, such as tipi rings and, shovel testing indicated no buried soil zones.

As a result of the Heritage Resource Impact Assessment conducted under the terms of Heritage Permit A1-98, issued by Historic Resources Branch, Manitoba Culture, Heritage and Citizenship, Quaternary Consultants Limited recommended that there are no further archaeological concerns and that construction can be allowed to proceed without impact to heritage resources.

5.14 IMPACTS ON LOCAL LAND USE PLANNING PROGRAM

The impact of the City of Brandon's expanded IWWTF construction phase on the local land use planning program is anticipated to be minimal. The city has absorbed construction workforces of much larger size previously with no difficulties. Otherwise, the plant is situated in an area already designated and utilized for industry, with Simplot, Manitoba Hydro Steam Generating Facility; and, Nexen Chemicals all present in the immediate area.

Overall, we do not anticipate the impact of the construction on the local land use planning program to be significant.

5.15 SUMMARY OF ENVIRONMENTAL IMPACTS

The following Table 5.5: Summary of Environmental Impacts (Construction) and Table 5.6: Summary of Environmental Impacts (Operation) summarize the impacts for the relevant construction and operation activities, respectively.

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Table 5.5: Summary of Environmental Impacts (Construction)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
Air Emissions	Construction	Construction Vehicle Exhaust	Negligible	Negative	Short Term	Continuous during working hours	Local	Vehicles to be well maintained	Irreversible	Normal construction equipment emissions
		Airborne Dust and Particulates	Low	Negative	Short Term	Intermittent	Local	Earthwork to be limited to building site as much as possible; Non-toxic dust control measures will be taken if necessary	Reversible	Minimum airborne dust and particles
		Odours	Low	Negative	Short Term	Intermittent	Local	Large buffer zone to property line (240 m; or 800 feet)	Reversible	Odours dispersed naturally
Greenhouse Gasses	Construction	Construction Vehicle Exhaust	Low to Negligible	Negative	Short Term	Continuous during working hours	Provincial	Vehicles to be well maintained	Irreversible	Minimization of GHG emissions
Noise	Construction	Back-up Beepers	Negligible	Neutral	Short Term	Intermittent	Local	None, safety issue	Reversible	Minor annoyances in sparsely populated areas
		Machinery Noise	Low	Negative	Short Term	Continuous during working hours	Local	Vehicles to be well maintained and operate only during appropriate hours	Reversible	
		Pile Driving Equipment	Low	Negative	Short Term	Intermittent during working hours	Local	Restrict hours of use to appropriate times	Reversible	
Human Health	Construction	Construction worker health/safety	Low	Negative	Short Term	Continuous during working hours	Local	Manitoba Workplace Safety and Health regulations to be followed	Reversible	Minimize health/safety impacts
		Particulate emissions(dust) affecting humans	Low	Negative	Short Term	Intermittent	Local	Non-toxic dust control measures will be undertaken if necessary. Affected workers can be removed from the influence of excessive dust or use PPE.	Reversible	Minimize dust etc. on work site

Table 5.5: Summary of Environmental Impacts (Construction) (Cont'd.)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
Surface Water	Construction	Sediment deposition via runoff	Low	Negative	Moderate	Intermittent	Local	Silt fences will be placed in ditches. Pond is in place upstream of river.	Reversible	Sediment in runoff is intercepted
		Chemical spills to ditches	Low	Negative	Moderate	Intermittent	Local	Storm water to be monitored, if necessary, during construction for comparison to existing levels. Check dams will be constructed if necessary. Holding ponds upstream of river.	Reversible	Nil, clean-up activities would be employed to remove contaminants
Assiniboine River	Construction	Water quality In Assiniboine River	Negligible	Negative	Short Term	Once	Local	Monitoring surface water before it leaves site	Reversible	Nil
Groundwater	Construction	Chemical/Fuel spills on the site	Moderate	Negative	Moderate	Rare	Local	Chemicals and Fuels stored and used in a designated area of the site with low permeability and berms to the greatest extent possible	Reversible	Nil, clean-up activities would be employed to remove contaminants
		Chemical/Fuel spills in ditches	Moderate	Negative	Moderate	Rare	Local	Immediate Clean-up measures will be undertaken	Reversible	Nil, clean-up activities would be employed to remove contaminants
Soils	Construction	Chemical/fuel spills on the site	Low	Negative	Long term	Rare	Local	Chemicals and Fuels stored and used in a designated area of the site with low permeability and berms to the greatest extent possible	Reversible	Nil, clean-up activities would be employed to remove contaminants
		Disturbance of previously disturbed area due to surface preparation	Low	Negligible	Long Term	Once	Local	Confine activities to project area, salvage topsoil materials suitable for reclamation, and re-vegetate to prevent erosion	Reversible	Nil

Table 5.5: Summary of Environmental Impacts (Construction) (Cont'd.)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
Wildlife	Construction	Habitat reduction	Low	Negative	Long Term	Continuous	Local	Areas of disturbance will be minimized to the extent possible.	Irreversible	Minimal habitat reduction
		Habitat alienation in adjacent areas due to noise and light disturbance	Low	Negative	Short Term	Continuous	Local	Confine activity to project area. Additional habitat available nearby.	Reversible	Nil
		Deer mortality due to vehicle collisions	Negligible	Negative	Moderate	Intermittent	Local	Awareness training and encourage personnel to obey speed limits on access roads	Reversible	Small increase in number of kills in short term
Vegetation	Construction	Vegetation reduction through site grubbing and levelling	Low	Negative	Moderate	Continuous	Local	Earthwork limited to building site as much as possible. Topsoil stock-piled for use in landscaping.	Reversible	Minimal reduction in vegetation in short term
		Fuel/chemical spills causing injury to vegetation	Negligible	Negative	Short Term	Rare	Local	Employee training and awareness programs and contingency plans	Reversible	Minimal vegetation injury
Overall Economic Impact	Construction	Direct and indirect employment	Low	Positive	Moderate	Continuous	Regional	No mitigation necessary	Irreversible	Economic gain to region
Transportation	Construction	Increase in immediate site traffic	Low	Negative	Short term	Continuous	Regional	On site vehicle storage will be provided; i.e. no vehicles parked on public roads.	Reversible	Normal inconvenience for local traffic with turning vehicles
		Increase in accident rate	Low	Negative	Short Term	Intermittent	Regional	Ample rest area parking available at existing truck stops.	Reversible	Factors leading to fatigue and accidents will be reduced

Table 5.5: Summary of Environmental Impacts (Construction) (Cont'd.)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
Heritage Impacts	Construction	Disturbance or demolition of heritage resources	Negligible	Negative	Short Term	Once	Local	The site was inspected by a qualified consultant so that items/areas of significance could be addressed.	Reversible	Nil, no significant heritage resources were encountered on the site.
Ozone Depleting Substances	Construction	Propellant emissions	Negligible	Negative	Short Term	Intermittent	Provincial	Use alternative products	Irreversible	Negligible
		Refrigerant emissions	Low	Negative	Long Term	Intermittent	Provincial	Refrigerants to be serviced and recovered by qualified personnel according to regulations.	Irreversible	Minimal to no impact on ozone layer via refrigerant releases
Waste Generation and Disposal	Construction	Disposal of construction wastes	Low	Negative	Short Term	Continuous	Local	Wastes generated through the construction process will be gathered and periodically hauled to the local landfill.	Reversible	Construction wastes properly disposed of in a safe manner
		Disposal of hazardous wastes, solvents, etc.	Low	Negative	Moderate	Intermittent	Regional	Hazardous wastes generated on the site such as solvents, etc. will be properly stored, transported, and disposed of according to regulations.	Reversible	Hazardous wastes disposed of properly. Minimal human health risks

Table 5.6: Summary of Environmental Impacts (Operation)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
Air Emissions	Operation	Vehicle Exhaust	Negligible	Negative	Long Term	Intermittent during working hours	Local	Vehicles to be well maintained	Irreversible	Normal yard equipment emissions
	Operation	Airborne Dust and Particulate	Low	Negative	Long Term	Intermittent	Local	Non-toxic dust control measures will be undertaken, if necessary. Pavement in future.	Reversible	Minimum air-borne dust and particles. Dust not tolerable near food processing plant.
	Operation	Odours/Stack Emissions	Low to Medium	Negative	Long Term	Intermittent	Local	Large buffer zone to property line (more than 240 m or 800 feet to nearest resident)	Reversible	Odours dispersed naturally otherwise not a concern
Greenhouse Gasses	Operation	Climate Change	Low to Negligible	Negative	Long Term	Continuous during working hours	Provincial	L.E. Equipment to be used and well maintained	Irreversible	Minimization of GHG emissions
Noise	Operation	Back-up Beepers	Negligible	Neutral	Short Term	Intermittent	Local	None, safety issue	Reversible	Minor annoyances in sparsely populated areas
	Operation	Machinery Noise	Low	Neutral	Short Term	Intermittent	Local	Interior machinery; well maintained. Hearing protection provided to workers, as required	Reversible	Muffled noise from within equipment building .
	Operation	Traffic	Low	Negative	Short Term	Intermittent	Local	Traffic control and keep site equipment in good working order	Reversible	If any, only impacts one residence.
Human Health	Operation	Worker Health/Safety	Low	Negative	Short Term	Intermittent during working hours	Local	Manitoba Workplace Safety and Health regulations to be followed. Safety Officer and Nurse on staff	Reversible	Minimize health/safety impacts

Table 5.6: Summary of Environmental Impacts (Operation) (Cont'd.)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
	Operation	Particulate Emissions (Dust) Affecting Humans	Low	Negative	Short Term	Intermittent	Local	Use of water and non-toxic dust control measures will be undertaken if necessary	Reversible	Minimize dust, etc. on work site
	Operation	Personal Injury	Low, Medium, or High	Negative	Short or Long Term	Intermittent	Local	Nurse on site; emergency response team	Reversible	Persistent or chronic injuries
	Operation	Ammonia Leak	Medium to High	Negative	Short Term	Rare	Local	Equipment maintenance; leak detection, alarm system, back-up power, emergency response plan in place	Reversible	None when totally dispersed
Surface Water	Operation	Sediment deposition via runoff	Low	Negative	Short Term	Intermittent	Local	Site and ditches will be vegetated, where practical. Storm ponds located upstream of river.	Reversible	Sediment in runoff is intercepted
	Operation	Chemical spills to ditches	Low	Negative	Moderate	Rare	Local	Check dams will be constructed if necessary. Proper chemical storage and handling procedures to be practiced.	Reversible	Nil, clean-up activities would be employed to remove contaminants
Assiniboine River	Operation (Winter)	Ammonia may be toxic to aquatic life	Assiniboine River Impact Assessment Will Be Provided by May 15, 2003							
	Operation (Winter)	Oxygen Depletion								
	Operation (Winter)	TN and TP enrichment; algae growth								
	Operation (Winter)	Protozoa and Coliform								
	Operation (Open Water)	Ammonia may be toxic to aquatic life								
	Operation (Open Water)	Oxygen Depletion								
	Operation (Open Water)	TN and TP enrichment; algae growth								

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Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
	Operation (Open Water)	Protozoa and Coliform								
Groundwater	Operation	Chemical/fuel spills on the site	Moderate	Negative	Moderate	Rare	Local	Secondary containment; adhere to codes	Reversible	Nil, clean-up activities would be employed to remove contaminants
	Operation	Chemical/fuel spills in ditches	Moderate	Negative	Moderate	Rare	Local	Immediate clean-up measures will be undertaken	Reversible	Nil, clean-up activities would be employed to remove contaminants

Table 5.6: Summary of Environmental Impacts (Operation) (Cont'd.)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
	Operation	Equalization basin leakage	Moderate	Negative	Moderate	Rare	Local	Containment and contaminated water directed to anaerobic lagoon of IWWTF. Groundwater monitoring program in place.	Reversible	Nil, clean-up activities would be employed to remove contaminants
Soils	Operation	Chemical/Fuel Spills on the Site	Low	Negative	Moderate	Intermittent	Local	Secondary containment and adhere to Codes	Reversible	Nil, clean-up activities would be employed to remove contaminants
	Operation	Oil Drips from Vehicles	Low	Negative	Long Term	Intermittent	Local	Visual monitoring and removal of contaminated soil, if necessary	Reversible	Nil
Wildlife	Operation	Habitat Alienation in Adjacent Areas Due to Noise and Light Disturbance	Low	Negative	Long Term	Continuous	Local	Confine activity to project area. Site is already used for heavy industrial activity, remaining wildlife have adapted.	Reversible	Nil
	Operation	Deer Mortality Due to Vehicle Collisions	Low	Negative	Long Term	Intermittent	Local	Awareness training and encourage personnel to obey speed limits on access roads.	Reversible	Small increase in number of kills in long term
Vegetation	Operation	Native Vegetation Allowed on Remainder of Site	Moderate	Positive	Long Term	Continuous	Local	Allow native vegetation to grow on undisturbed portions of the site. Disturbed site is re-established grass land from previous construction.	Reversible	Increase in acreage of native vegetation
	Operation	Fuel/Chemical Spills Causing Injury to Vegetation	Negligible	Negative	Short Term	Intermittent	Local	Employee training and awareness programs and contingency plans. Proper storage and handling procedures.	Reversible	Minimal vegetation injury

Table 5.6: Summary of Environmental Impacts (Operation) (Cont'd.)

Classification of Potential Impact	Project Phase	Potential Impact	Magnitude of Impact	Direction of Impact	Duration of Impact	Frequency of Impact	Scope of Impact	Mitigative Measures	Degree of Reversibility	Residual Impact
Overall Economic Impact	Operation	Direct and Indirect Employment	Negligible	Positive	Long Term	Continuous	Local	No mitigation necessary	Reversible	Economic gain to region
Transportation	Operation	Increase in Site-Bound Traffic	Negligible	Negative	Long Term	Continuous	Local	Offset peak hours; improved roadways to site; turning lanes.	Reversible	Normal inconvenience for local traffic; more traffic
	Operation	Increase in Accident Rate	Low	Negative	Long Term	Intermittent	Local	Improved traffic control for higher capacity	Reversible	Factors leading to congestion reduced
Ozone Depleting Substances	Operation	Propellant Emissions	Negligible	Negative	Long Term	Intermittent	Provincial	Use alternative products	Irreversible	Negligible
Solid Waste Generation and Disposal	Operation	Disposal of Operational Wastes	Low	Negative	Short Term	Continuous	Local	Wastes generated through the operation process will be gathered and periodically hauled to the local landfill	Reversible	Operational wastes properly disposed of in a safe manner
	Operation	Biosolids disposal on agricultural land	High	Positive	Long Term	Intermittent	Local	Biosolids Management Plan, with land application according to Environment Act Licence	Reversible	Negative potential impact turned into positive resource