5.0 SITE DESIGN

As discussed in the Geology, Hydrogeology & Geotechnical Report (Volume III), a geotechnical analysis of landfill stability was completed to assess the geometrical requirements of this landform, including its interaction with the required stormwater ponds, Simpson Drain, leachate management and other Site features. The proposed Site Development Plan provided in this section takes the geotechnical analysis into consideration.

5.1 Site Access, Entrance Facilities and Roads

Primary access to the CRRRC will be provided from Boundary Road, as indicated on Figure 6. The Site entrance is located as far north as possible along Boundary Road, as this will minimize travel distance for Site-related traffic on Boundary Road between Highway 417 and the access location, and also adequately separate the access location from the intersections of Boundary Road with Mitch Owens Road and Devine Road further to the south. The road from the primary Site entrance consists of a 450 metre long two way main road to the in-bound scale, the provision of a separate single out-bound lane to an out-bound scale, and a separate 400 metre long truck queuing lane. All queuing of waiting Site traffic will be on-Site and there will be no backup of incoming traffic onto Boundary Road. The 30 metre wide access road allowance will accommodate entrance and exit lanes, an area to ensure that truck queuing will take place off Boundary Road, appropriate geometry to accommodate turning at Boundary Road, and roadside drainage. At the east end of this primary access road it enters the main part of the CRRRC property. A secondary Site access/exit will be provided at the northern end of Frontier Road for infrequent use by vehicles associated with Site operations, maintenance or emergency. Temporary haul roads will be constructed within the landfill footprint to provide access for vehicles to the active phase of the landfill.

The primary in-bound and out-bound weigh scales will have associated scale houses. A secondary weigh scale and associated scale house is proposed for the access/exit road to/from the landfill to weigh material to be disposed of in the landfill.

The administration building located just north of the primary access road will have an approximate footprint of 200 square metres (m^2). The administration building will house office functions for the CRRRC. Staff and visitor access to the building will be provided via a separate lane off the main access road prior to the in-bound scales. A paved parking and apron area will be provided around the administration building.

Ancillary facilities at the CRRRC include a maintenance garage (and associated employee parking lot) and a truck tire wash located along the exit road from the landfill.

All on-Site roads north of the Simpson Drain are paved, with the exception of the road running along the east side of the Site connecting the landfill to the maintenance garage; this road will remain gravel surfaced for use by equipment associated with landfill operations such as compactors, dozers, etc. The layout of facilities and roads has been designed to maximize “drive-through” methods of moving equipment on-Site to reduce the use of back-up beepers.

A small load drop-off area is located north of the administration building. Vehicles will enter the Site over the in-bound scales and proceed to this facility to drop off their material in the appropriate bunker, and then exit the Site. A separate road is provided for on-Site trucks to access the containers within the bunkers. The roadways associated with this facility will be paved.

5.2 Buffers

The width of the buffer area adjacent to the east side, the east half of the south side, and the northwest corner of the landfill is 125 m. Around the remainder of the landfill the perimeter buffer would be 100 m, as per O.Reg. 232/98 (MOE, 1998a).

5.3 Visual and Noise Screening

Screening will be provided by leaving an adequate width (15 to 20 m) of existing tree cover around the perimeter of the property where possible. Constructed screening consisting of earth berms 2 to 3 m high with trees transplanted on them will be required at the northeast and southeast corner areas and along a portion of the west central Site boundary. It is noted that a portion of the constructed screening proposed at the northeast corner could be replaced by transplanting trees in the gap in the existing tree line at the north end of the Frontier Road cul-de-sac; this would also effectively screen the view of the Site for persons travelling along Highway 417.

During the planning of the proposed CRRRC Project, ways to avoid or reduce potential negative effects from Site noise and enhance positive effects were identified. These will be incorporated into the CRRRC operating practices. The following design and operating considerations for controlling noise were assumed in the noise assessment:

- Constructed screening features (berms) will be located along the edge of the property at the proposed locations shown on Figure 6.
- Working face or noise screening berms will be located as shown on Figure 8 to shield existing receptor locations from equipment operating in the active cell. Noise screening berms will be required for areas within Phases 6, 7 and 8 of the landfill to break the line of sight between the equipment in the active cell and the most sensitive PORs. The following berm heights are recommended:
  - For Phase 6 of the landfill, equipment operating within 30 m of the southwest corner of the phase boundary should be screened by a berm with a minimum height of 2.5 m.
  - For Phase 7 of the landfill, equipment operating within 30 m of the southwest corner of the phase boundary should be screened by a berm with a minimum height of 3 m. Equipment operating between 30 m and 60 m of the southwest corner of the phase boundary should be screened by a berm with a minimum height of 2.5 m.
  - For Phase 8 of the landfill, equipment operating within 30 m of the southwest corner of the phase boundary should be screened by a berm with a minimum height of 2.5 m.
- Constructed noise screening berms will also be required for vacant lot receptors if a noise sensitive building is developed on those lands. Details are provided in TSD #2.
- "Drive-through" methods of moving equipment on-Site will be maximized to reduce the use of back-up beepers, and there will be speed limit control for traffic on-Site.
- Between 0600 and 0700 hours motorized equipment will only be idling, full operation will occur between 0700 and 1900 hours (i.e., daytime hours).
- Between 1900 and 2300 hours (i.e. evening hours) operations are limited to activities indoors within the MRF and C&D processing facility.

Complete phases may provide shielding for some PORs for operations occurring in adjacent cells. In addition, all motorized equipment will be kept in good repair and be fitted with standard operational exhaust mufflers.

5.4 Stormwater Management

The design of drainage requirements for the CRRRC is shown on Figure 6. The full Stormwater Management System Design Report is provided in Appendix A. The approach to system design is to closely match post-development flows to pre-development flows by providing the required retention time in on-Site ponds, and by doing so also provide an Enhanced level of TSS removal (MOE, 2003). The approach also divides up the Site into three drainage areas that are similar in size to the three pre-development drainage areas leading to the three surface water discharge locations from the Site. The three discharge locations, which all flow eastward and enter Shaw's Creek, are to the Regimbald Municipal Drain to the northeast, to the Simpson Municipal Drain in the central portion, and in the southern portion to the Wilson-Johnston Municipal Drain via an existing ditch. The system consists of Site grading, ditching and culverts leading to five linear stormwater ponds or pairs of ponds; one of the five ponds will receive stormwater drainage from a portion of the diversion areas to provide a large fire pond (as per the building code) to provide water for firefighting purposes, if required. Oil-water separators will be used in the vehicle maintenance garage and reversed slope outlet pipes will be used for stormwater management ponds that receive drainage from vehicle parking areas. Also, it is envisioned that the tire wash station will be a recirculating system with a solids interceptor.

5.5 Construction and Demolition Processing Facility

The C&D processing facility will recover waste materials received from C&D projects. The proposed C&D processing facility will have the capacity to process approximately 50 tonnes/hour of material. It is proposed that the C&D facility accept a maximum of 800 tonnes per day and 199,680 tonnes per year for processing. The main recovered products from the processing of C&D material will consist of shredded wood, ferrous and non-ferrous metals, mixed aggregate, shingles, cardboard and drywall. Storage of unprocessed C&D material will be limited to 2,200 tonnes.

The C&D processing facility will be housed in a building with a footprint of approximately 13,000 square metres. The C&D building will house mechanical processing equipment used for crushing, screening, air and magnetic separation, and shredding. Manual sorting of materials will also take place inside the building. The C&D processing facility will be heated by heat recovered from the flare/generator or a biogas boiler or via a backup fuel oil heating system, and will have a dust collection system that will discharge through a bag house and cyclone with the air vented through the roof.

Incoming trucks will enter the building from the south side and unload onto the building floor. The eastern and southern parts of the building will be mostly open space for receiving and other processing operations, such as chipping of recovered wood. C&D waste materials, which are typically received at the Site in roll off bins, would be segregated initially according to their main material components (mostly concrete, mostly wood (clean or dirty), mostly asphalt, etc.), which can then be further sorted for appropriate processing. For example, metal is recovered directly, wood is often chipped or shredded and sent to the compost processing and storage area, asphalt is ground for re-use; and concrete is crushed. Materials that cannot be recovered will go to disposal. The building will also be set up to load trucks with recovered materials to be sent to off-Site markets, recovered materials to be re-used on-Site, and/or rejected and residual materials to be hauled to the on-Site landfill component.

Detailed information about the design and operation of the C&D processing facility is provided in Appendix D.

5.6 Materials Recovery Facility

The MRF will process and recover IC&I materials, and is designed to handle both mixed materials and source separated loads. The proposed MRF will have the capacity to process approximately 50 tonnes/hour of material. It is proposed that the MRF accept a maximum of 800 tonnes per day and 199,680 tonnes per year for processing. The recovered materials will generally consist of cardboard, paper, glass, plastics, ferrous and non-ferrous metals, wood and other fibres.

The MRF operation will be housed in a building with a footprint of approximately 13,000 m^2. The MRF will be heated by heat recovered from the flare/generator or a biogas boiler or via a backup fuel oil heating system, and will have a dust collection system that will discharge through a bag house and cyclone with the air vented through the roof. Storage of unprocessed material at the MRF will be limited to 850 tonnes.

Incoming vehicles containing materials destined for the MRF will enter the MRF building along the west part of the south side of the building and unload onto the floor. Clean (source separated) loads will be kept separate from mixed loads. These incoming materials will be loaded into a system of processing equipment that includes both mechanical recovery and manual sorting of materials. The recovered materials will be baled and stored, and then loaded onto trucks along the eastern part of the south side of the building and hauled off-Site to end markets. Rejected and residual materials will be loaded onto trucks within the east end of the building and hauled for disposal in the on-Site landfill.

Detailed information about the design and operation of the MRF is provided in Appendix E.

5.7 Organics Processing Facility

The organics processing facility will be constructed to divert the organics component from those portions of the IC&I waste stream that contain a sufficient amount of organics, as well as source-separated organics. It is proposed that the following will be accepted at the organics processing facility: A maximum of 50,000 tonnes of organic waste (mixed IC&I and source separated organics) destined for the primary reactor at full operation including a maximum of 20,000 tonnes per year (out of the total of 50,000 tonnes per year) of source separated organics for pre-processing before being transported to off-Site farm based or other approved commercial AD processing. The organics processing facility will consist of a receiving and storage building, pre-processing operations, primary anaerobic digester reactors, and a secondary digester. The facility will be heated by heat recovered from the flare/generator or a biogas boiler or via a backup fuel oil heating system.

The proposed BioPower process for anaerobic digestion of mixed organics from IC&I sources uses well known biological treatment processes, however this combination of processes has not been previously approved for full scale operation in Ontario. In accordance with MOECC preference for new technology, it is initially proposed to construct and operate an on-Site demonstration scale BioPower facility. Pre-processing of source-separated organics to create an organics slurry for off-Site anaerobic digesters will occur on-Site in the building established for the receipt and storage of organics. Should this operation prove successful and there be continued interest/demand from off-Site anaerobic digesters, Taggart Miller may elect to continue it for source-separated organics while operating the BioPower facility for organic streams for which that technology is more appropriate. This building, which is anticipated to serve for both the shorter term pre-processing and the full scale receiving and storage, has been assumed to have a footprint area of approximately 3,000 m^2.

The demonstration scale facility will be located within the Site area proposed for organics processing. The purpose of the demonstration scale project is to: confirm the effectiveness of the BioPower technology in treating organic waste; provide information to enhance and optimize the BioPower technology; and refine process design and operating parameters for operation on a full-scale commercial basis for implementation at the CRRRC Site.

The demonstration will be performed by constructing and operating a facility that parallels and incorporates all of the processes and facilities associated with the BioPower technology, and the anticipated full-scale facility. These facilities will subsequently be expanded as required and incorporated into the full-scale plant following successful completion of the demonstration phase, depending on the results of the demonstration phase and market demand.

The principal facilities to be used in the course of the demonstration (and subsequently in the full-scale operations) are:

- Organics processing building;
- Biofilter for treatment of air from the organics processing building;
- Primary anaerobic digestion reactor;
- Secondary anaerobic digester/reactor;
- Negative pressure extraction system for generated decomposition by-products;
- Flare;
- Equipment for blending organic materials, transportation and placement of blended material in primary reactor, installation of cover system, excavation and transportation of digested product, processing of digested product, curing of digested product, refurbishment of primary reactor for re-use; and,
- Monitoring and analytical equipment.

It is intended that the demonstration facility be sized to accommodate up to 4,000 tonnes of organic waste per calendar month, not to exceed 23,400 tonnes per year. The demonstration will be performed for a minimum of one complete treatment cycle (filling primary reactor, anaerobic treatment of organics in primary reactor and liquor in secondary reactor, aerobic stabilization of material in primary reactor, emptying of primary reactor, screening and further processing/curing of digested product, and analysis of compost quality). For planning purposes, it is anticipated that the demonstration will operate for a period of 24 to 36 months. Key operational parameters within the primary and secondary digesters will be monitored. Data will be analyzed and used to adjust operating conditions and processes as appropriate. The monitoring program may be adjusted in response to ongoing data review and analysis. The character of compost produced by the BioPower process will be monitored in accordance with MOECC compost guidelines (MOE, 2012a). As the demonstration progresses, data will be gathered and the performance assessed from three perspectives: environmental, operational and economic. The runoff from the curing of digested product will be collected in a dedicated cell of a stormwater management pond. As the quality of runoff from the curing digested product is not yet known, this data will also be obtained during the demonstration process. Potential uses of the runoff from the curing of digested product will be determined based on the water quality data collected during the demonstration process. Part V EPA approval will be sought for conversion of the system to full-scale commercial operation. The precise full-scale system requirements will be specified in the Part V application. Operationally, the transition from demonstration to full-scale is expected to be seamless, since the demonstration system will be fully incorporated into the commercial plant.

Detailed information about the design and operation of the organics processing facility is provided in Appendix F.

5.8 Compost Processing and Storage Area

The compost processing and storage area will occupy an area of approximately 3.5 hectares and will have a paved surface. The following activities will be carried out on the pad: 1) leaf and yard materials received will be ground, initially aerobically composted in a static pile, and transferred to open windrows/trapezoidal piles for composting and curing; 2) received clean wood will be ground and processed into chips; 3) the digested product from organics processing will be cured in windrows/trapezoidal piles; 4) these products will be screened and stored for subsequent use on- or off-Site; and 5) residual materials will be transferred for recovery or disposal. If it is found that the quality of the digested product requires further composting, consideration will be given to aerated pile composting to evaluate alternative processes during or after the demonstration-scale period. Runoff from the compost processing and storage area will be directed to the same stormwater management pond as discussed in Section 5.7.

Detailed information about the design and operation of the compost processing and storage area is provided in Appendix G.

5.9 Petroleum Hydrocarbon (PHC) Contaminated Soil Treatment

The PHC contaminated soil treatment area will accept soils contaminated with PHC products. It is proposed that the Site will accept up to 25,000 tonnes of PHC contaminated soil per year. The facility will initially consist of one or two biopile cells connected to a single treatment unit that controls air extraction rate, moisture and nutrients and the biopiles; future stages of the facility may include up to eight biopile cells. Treated PHC contaminated soil may be used on-Site or provided for off-Site use if there is market demand and its quality meets the applicable regulatory guideline. The initial treatment system approach will be to aerate the soil to promote volatilization of the lighter PHCs, where required, prior to use as daily cover in the landfill component of the CRRRC to prevent off-Site odour impacts. Any PHC impacted soil that is not treated will be used as daily cover material in the on-Site landfill.

Detailed information about the design and operation of the PHC contaminated soil treatment area is provided in Appendix H.

5.10 Surplus Soil Management

The surplus soil management area is located at the west central portion of the Site area north of the Simpson Drain. The ongoing operation in this area, as well as other areas of the Site where surplus uncontaminated soil (or rock) received from construction projects may be temporarily stored until such time that it is required for re-use, will basically consist of the dumping and dozing of incoming soil into a stockpile(s), and removal of this soil for re-use on-Site. Uncontaminated soil is comprised of native (undisturbed) earth materials (from undeveloped land) or native earth materials/fill materials that are unimpacted by development or human activity, or altered earth/fill material whose quality meets the applicable table in O. Reg. 153/04 (MOE, 2004). It is anticipated that the temporary stockpiles could be up to approximately 5 m in height. Other underdeveloped areas of the Site could also be used for this purpose to suit Site operations. The operational details of surplus uncontaminated soil management will change frequently depending on the quantities and types of materials that are available to be brought to the Site, and the Site requirements for materials for construction and operational purposes.

In addition to PHC contaminated soils, the CRRRC will also receive other types of non-hazardous contaminated soil (or rock). Contaminated soil, with the exception of PHC contaminated soil directed to treatment, will be managed within the landfill, either as waste or re-used as daily cover.

5.11 Landfill Component

The on-Site landfill component will accept residual and waste materials; for additional detail, refer to Appendix I, Section 2.0.

The total landfill footprint has been assumed to be approximately 84 hectares. The landfill base will be excavated 1.5 to 2.5 m below existing ground level and will be surrounded by a perimeter berm. The perimeter berm will screen the landfill and ensure landfill stability and will accommodate a perimeter road, header piping for leachate and LFG and other service lines, and provide conveyance of runoff to the stormwater management system.

The presence of the clay deposit beneath this Site requires the landfill to have relatively flat sideslopes, in order that the landfill has adequate stability. The landfill design has 14H:1V sideslopes above the perimeter berm up to approximately elevation 89 m asl or 12 to 13 m above ground level, and then a 20H:1V slope up to a central peak or ridge area. The maximum design height of the final landfill contours is approximately 25 m above ground level. This corresponds to an airspace volume of approximately 10,170,000 m^3 for waste and daily cover. The design of the leachate containment and leachate collection system will meet the requirements of O.Reg. 232/98 (MOE, 1998a), within the context of the Site-specific geological and hydrogeological setting, as follows:

- For leachate containment, a Site-specific design approach has been followed. The natural low permeability silty clay deposit will provide the low permeability bottom liner for the landfill. The perimeter berm will incorporate a constructed low permeability hydraulic barrier (GCL) extending the full height of the berm and down through the surficial silty sand layer or weathered clay zone and keyed into the underlying upper silty clay. This would cut off the potential pathway for off-Site leachate migration via the berm fill and surficial silty sand layer; and,

- The design of the landfill base recognizes that consolidation settlement of the silty clay deposit will occur and that the largest settlements will be below the central portion of the landfill where the waste thickness is greatest. As such, the landfill base will be shaped to provide drainage of leachate from the perimeter of the landfill towards the centre; the leachate will be conveyed through a system of perforated and non-perforated leachate piping and a granular drainage blanket. Leachate sumps (manholes) will be provided within the landfill; they will be located at the lowest points of the base grading, both when constructed initially and allowing for the longer term consolidation of the clay as the waste is placed. The leachate collection system design will accommodate the expected settlement of the subgrade. As the settlement of the clay occurs, the slope of the base and piping will increase from that originally constructed, thereby enhancing the transmission of leachate to the interior leachate sumps. Leachate removal from each sump will be by means of submersible pumps and via piping to a forcemain that will convey the collected leachate for treatment (as described in Section 5.12). Cleanout access for inspection and flushing/cleaning of the leachate collection piping system will be provided, both from the exterior of the landfill and by cleanouts provided from within the landfill.

A leachate detection and secondary containment system (LDSCS) will be positioned beneath the perimeter berm on the hydraulically downgradient (eastern) side of the landfill. The LDSCS, will be a granular filled trench completed in the surficial silty sand layer, will allow for the monitoring of the performance of the landfill's leachate containment system (the natural clay deposit, the LCS, and perimeter berm with the GCL) and provide secondary containment in the unlikely event that leachate enters the surficial silty sand layer outside of the landfill footprint.

The proposed LFG management system will be designed in accordance with the requirements of O.Reg. 232/98 (MOE, 1998a). Given the contemplated diversion of IC&I organics from disposal to the extent practical, LFG and odour associated with decomposition of organics within the landfill will be reduced. The proposed LFG management system is an active collection system consisting of horizontal collector piping installed in two layers within the waste as the waste is placed, header piping around the landfill perimeter and extending to the condensate management facilities, a vacuum extraction plant and an enclosed flare. The proposed LFG collection system will conform to the most recent version of B149.6-11 Code for Digester Gas and Landfill Gas Installations (CSA, 2011), which has been adopted by the Technical Safety and Standards Authority for use in Ontario as of December 2012. The LFG collection system will also be designed for the predicted subgrade settlement.

Detailed information about the design and operation of the on-Site landfill component is provided in Appendix I.

5.12 Leachate Pre-treatment Facility

Leachate is produced when precipitation (rainfall and/or snowmelt) percolates downward through waste and dissolves contaminants present in the refuse. The leachate will be captured at the bottom of the landfill within the granular drainage blanket and directed to a leachate collection pipe network. These pipes will direct the leachate to a system of maintenance holes where it will be pumped out of the landfill for treatment. In addition, this leachate pre-treatment facility will treat excess liquor from the on-Site organics processing facility. A full leachate management plan is provided in Appendix J and is summarized in this section.

It is proposed that leachate be pre-treated on-Site. It is currently anticipated that the leachate will be pre-treated as required to comply with the requirements of the City of Ottawa as set out in the required discharge agreement between the City of Ottawa and Taggart Miller, and then transported to the City of Ottawa sewage treatment plant (ROPEC) for final treatment and discharge.

The leachate pre-treatment facility consists of an equalization tank, leachate storage pond or tank(s), liquor storage tank, boilers and heat exchangers, Sequencing Batch Reactor (SBR) system, effluent storage ponds or tanks, truck filling station and sludge management system. It will pre-treat leachate from the landfill, condensate from the LFG collection system and liquor from the on-Site organics processing facility.

Leachate from the landfill will be pumped to the equalization tank. In periods of high leachate generation, excess leachate would be directed to the leachate storage pond or tank(s) where it will be temporarily held until process capacity becomes available. The liquor will be stored in a separate storage tank.

At the start of the treatment process, the leachate is blended with the liquor and, if necessary, heated by a boiler system to optimize biological treatment processes. The liquid then goes to the SBR system which consists of three stages: the leachate/liquor is mixed with the previously accumulated sludge in an anaerobic digestion tank. The solids remain in the tank and the liquid portion overflows into one of up to three holding/pre-treatment tanks where it will be aerated and dosed in sequential batches to one of up to six digestion tanks.

In the leachate digestion tanks, the liquid will be further aerated in cycles; in off cycles, the solid particles are allowed to settle to the bottom followed by decanting of the clarified supernatant to a mixing tank. Chemicals are added at the mixing tank and mixed with a mechanical mixer before discharge to a clarifier. The chemicals facilitate coagulation for metal precipitation and are added as required to meet the Sewer Use By-law (City of Ottawa, 2003) limits. If required, the pH of the clarified liquid will be adjusted back to the range required by the municipal by-law before being directed to the treated effluent ponds or tanks.

The sludge from both the bottom of the clarifier and the bottom of the sludge digestion tank will be pumped into a sludge storage tank. There, a liquid polymer will be added to the sludge to facilitate efficient dewatering. The sludge will then be dewatered using tube filters placed on a concrete pad. Each tube has a porous fabric made of a specifically engineered dewatering textile. As sludge is pumped into the tube, water filters out through the fabric and is collected and sent back to the leachate storage pond or tank(s) to re-enter the treatment cycle. The dewatered solids will be disposed of at the on-Site landfill.

It is currently anticipated that the pre-treated liquid effluent stored in the effluent storage ponds or tanks will be hauled by tanker truck to the City of Ottawa's municipal wastewater treatment plant for further treatment and discharge.

5.13 Flare and Power Generation Area

The flare and power generation area will consist of three main components: a gas extraction plant, a flare, and possibly a utilization facility. The facility will accept and process both biogas from the organics processing facility and LFG from the landfill. The layout of the flare and power generation area is shown on Figure 9.

5.13.1 Extraction Plant

A gas extraction plant will provide a vacuum to both the LFG collection system located within the landfill, and the organics processing facility, and would convey the LFG/biogas to the flare, and to the utilization facility or an on-Site heating application. The extraction plant will be located in the northeast portion of the Site near the secondary digester within the organics processing facility area, outside of the approved waste footprint. The main components of the extraction plant will be one or more centrifugal blowers, LFG treatment facilities, monitoring instrumentation and controls, and an air compressor.

5.13.1.1 Centrifugal Blower

One or more centrifugal blowers will be installed in the extraction plant. The blower(s) will be used to create a vacuum of some 15 to 25 inches water column at each horizontal collector connected to the LFG collection system, and will convey the LFG to the flare. A separate blower system may be used to provide a vacuum to the organics processing facility.

The blower(s) will be equipped with a direct-drive motor and a variable frequency drive to provide suitable control at low flow rates. The blower(s) and associated motor and controls will meet the requirements of CSA B149.6-11 (CSA, 2011). The blower(s) will be connected to a programmable logic controller (PLC) and to an external manually operated emergency shut-down device in accordance with CSA B149.6-11.

5.13.1.2 LFG Treatment Facilities

A condensate knockout will remove most water droplets and mist as well as dirt from the LFG. The resultant liquid condensate will be disposed of into the leachate treatment system. Additional LFG treatment may be warranted in the event that a utilization facility is developed.

5.13.1.3 Monitoring Instrumentation and Controls

Automated control and monitoring within the extraction plant will be conducted via a PLC computer. The PLC will control the blower(s), flare and automatic shut-off valves, with input from various sensors including the gas concentration instrumentation. A datalogger will store data from the flare, blower and other instrumentation.

A flow meter will provide flow measurement for a range of LFG flow rates.

A methane and oxygen gas analyzer system will continuously measure and display concentrations of methane and oxygen in the LFG. Due to instrumentation limitations and the length of the connection line with the LFG pipe, there will be a time lag in response of the instrument to actual LFG concentrations in the pipe.

A pressure sensor will be installed to measure the LFG pressure generated immediately downstream of the blowers. A second pressure sensor will be located upstream of the condensate knockout.

A safety shut-off valve will be installed upstream of the blower and a check valve and second safety shut-off valve will be installed downstream of the blower as required by CSA B149.6-11 (CSA, 2011). Safety shut-off valves are actuated valves that can be shut off by the PLC.

5.13.1.4 Air Compressor

An air compressor will be located at the extraction plant and will be used to supply compressed air to condensate trap pump(s), safety shut-off valves, and the LFG instrumentation sampling system.

5.13.2 Flare

An enclosed flare will be located in the northeast portion of the Site near the extraction plant and secondary digester.

The enclosed flare will have a capacity of some 2,000 to 2,500 standard cubic feet per minute (scfm) of LFG at 50% methane plus possibly additional capacity for biogas from the organics processing facility. A flare turn-down ratio of 4:1 is anticipated. An enclosed flare is specified because of its high hydrocarbon destruction efficiency and its flame will not be visible. The flare is estimated to have a diameter of approximately 3 m and a height of approximately 12 m. The enclosed flare will have a destruction efficiency of total organic compounds of approximately 99%. The temperature of the flare will be controlled by thermocouples at various heights inside the flare. An ultraviolet flame sensor, connected to the PLC, will enable the blower to be shut down if the flame extinguishes. The enclosed flare will meet the requirements of CSA B149.6-11 (CSA, 2011).

A flame arrestor (intended to reduce the flame temperature in the event of a flash-back) and a thermal valve (intended to shut in the event of a slow burn-back), both required by CSA B149.6-11 (CSA, 2011), will be located upstream of the enclosed flare. The header pipe leading from the extraction plant to the flare will be supported appropriately with pipe supports. The enclosed flare will be surrounded by a fence in accordance with CSA B149.6-11.

Two smaller flares (instead of one larger one) may be used for combustion if it is decided to combust biogas from the organics processing facility and that from the landfill in separate flares. The general location of the two flares would be at the same as that currently selected for the single flare.

5.13.3 Utilization Facility

A utilization facility may be installed in the future to generate electricity and/or heat or to upgrade the gas to natural gas pipeline quality. A future utilization facility would be located in the northeast portion of the Site near the flare and would accept both LFG from the LFG collection system and biogas from the organics processing facility. The flare would be retained to provide a method of destroying the LFG if the LFG utilization facility is unavailable for any reason.