10.0 DESCRIPTION OF SITE DESIGN

The following sections describe the overall design of the CRRRC Site and its facilities. The proposed Site development plan is shown on Figure 10-1. The Design and Operations Report included in this submission package describes the following features in greater detail.

10.1 Site Access, Entrance Facilities and Roads

Primary access to the Site will be provided from Boundary Road. The 30 metre wide access road allowance will accommodate the in-bound, out-bound and queuing lanes, appropriate geometry to accommodate turning at Boundary Road, and roadside drainage. 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.

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), secondary scales along the internal access/exit road to/from the landfill, 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.

10.2 Small Load Drop-Off

A small load drop-off is located north of the administration building. Figure 10-1 shows a maximum number of receiving bunkers.

10.3 C&D Processing Facility

C&D material recycling will be carried out to recover waste materials received from construction and demolition projects. The proposed C&D processing facility will be housed in a building with a footprint of approximately 13,000 m^2 and will have the capacity to process approximately 50 tonnes per hour of material. The main recovered products from the processing of C&D refuse material will consist of shredded wood, ferrous and non-ferrous metals, mixed aggregate, shingles, cardboard and drywall, and process fines. Recovered materials will be sent to off-Site markets, recovered materials will be re-used on-Site, and rejected materials will be hauled to the on-Site landfill.

10.4 Material Recovery Facility

The Material Recovery Facility (MRF) will process and recover industrial, commercial and institutional (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 per hour of material. The MRF operation will be housed in a building with a footprint of approximately 13,000 m^2. The recovered materials will generally consist of cardboard, paper, glass, plastics, ferrous and non-ferrous metals, wood and other fibres. The recovered materials will be hauled off-Site to end markets and the rejected materials that cannot be diverted will hauled for disposal in the on-Site landfill.

10.5 Organics Processing Facility and Compost Processing and Storage Pad

The organics processing facility will be constructed to remove the organics component from those portions of the IC&I waste stream that contain a sufficient amount of organics. Processing of both the organics contained within the highly variable mixed IC&I waste stream and source separated organics will be carried out within the facility. The organics processing facility will consist of four main components:

- Receiving and storage building and biofilter;
- Primary anaerobic digester cells;
- Secondary digester and collected gas flaring and/or electrical generating facility; and,
- Compost pad.

It is initially proposed that the organics processing facility be constructed and operated at a demonstration scale, as this combination of processes has not been previously approved for full scale operation. In order to provide diversion of organics during this initial period of Site operation, it is proposed to take source-separated organics from IC&I sources and pre-process them (size reduction and removal of physical contaminants via hydraulic squeezing) within the on-Site organics receiving building, and then take the resulting organics slurry by tanker to approved off-Site farm digesters for processing. It is estimated that this initial operation could divert up to 20,000 tonnes per year of organics. This building, which is anticipated to serve for both the shorter term pre-processing and the full scale receiving and storage, will have a footprint area of about 3,000 m^2 and a height of about 12 metres.

Although subject to modification depending on the results of the demonstration scale project, it is anticipated that the BioPower primary reactor digester will consist of contained and covered cells that are excavated to shallow depth below grade and have a height of about 6.5 to 7 metres, and require a land area of about 5 hectares. This sizing is expected to handle about 50,000 tonnes per year of organics.

The secondary reactor building (having dimensions of about 20 by 30 metres, about 10 metres in height) will receive collected liquor from the primary reactor and receiving building where the liquor will be digested anaerobically and converted to biogas consisting primarily of methane and carbon dioxide. The biogas will be sent to an enclosed flare and/or an electrical generation plant where it will be combusted (in combination with collected landfill gas) and the combustion air treated prior to release. In the initial period of Site operation, all collected gas will be flared. If there is enough gas generated and the economics are favourable, an electrical generation plant would be utilized to generate electricity for export to the grid. The compost storage and processing pad, to be used for final curing of the digested product from the organics processing, for aerobic windrow/trapezoidal composting of leaf and yard materials, and wood grinding and chipping, will be paved and is anticipated to require an area of approximately 3.5 hectares. It is also possible that an aerated pile composting process may be utilized on the pad for the digested product or leaf and yard materials, wherein air is introduced to the material to be composted in order to sustain elevated oxygen content within the material and thereby further assist/accelerate the pathogen kill and composting process.

10.6 Petroleum Hydrocarbon Contaminated Soil Treatment

The initial stages of the treatment system for petroleum hydrocarbon (PHC) contaminated soil will be developed as part of the initial Site development. The initial treatment system will consist of two biopile cells connected to a single treatment unit that controls air extraction rate, moisture and nutrients and the biopiles. Nutrient addition is optional because the main purpose of the initial treatment system approach is to aerate the soil to promote volatilization of the lighter PHCs.

The proposed future treatment system consists of six biopiles in addition to the two biopiles to be developed as part of the initial stages of the treatment system, as required based on MOECC treatment requirements of PHC soil. A PHC soil storage building has also been proposed for the future development of the treatment system.

Incoming PHC impacted soil may first require the removal of oversize materials (i.e., concrete, cobbles, boulders), and then storage on a concrete pad until at least one of the biopiles is ready to be filled. The soil stored on the pad will be covered with a woven coated reinforced polyethylene liner (tarp). The PHC impacted soil will be placed in the biopiles up to a maximum total height of 2.5 metres using a loader after being mixed with nutrients (optional) and a bulking agent (wood chips or straw, up to 10% of soil volume). The cell base would be provided with a geomembrane liner to contain the liquid produced from the process. Piping would be provided in the base to both collect liquid and to add and remove air from the soil; an irrigation piping system would be installed at the top of the soil to supply water, to provide amendments and nutrients, and recirculate the collected liquid. A central treatment unit would be provided to regulate and optimize the conditions within the biopile to achieve the pre-treatment or treatment.

10.7 Surplus Soil Management

The surplus soil management area is located in 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 may be temporarily stored until such time that it is required for re-use, will 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 about 5 metres in height. Other undeveloped 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.

10.8 Landfill

The landfill component of the CRRRC will support the diversion operations for a planning period of 30 years. This is based on a five year ramp up of waste receipts to a maximum of 450,000 tonnes per year and achieving an overall diversion rate of 43% to 57%. The total landfill footprint could cover approximately 84 hectares. The landfill base will be excavated 1.5 to 2.5 metres below the existing ground level and will be surrounded with a perimeter containment berm. The perimeter berm will be constructed to about a 3.5 metre height using the excavated soils and/or similar types of imported materials. The perimeter berm will have a top platform width of about 36 metres to provide adequate overall landfill stability, with 7 horizontal: 1 vertical (7H:1V) sideslopes. The berm will also accommodate a perimeter road, header piping for leachate and landfill gas and other service lines, and provide conveyance of runoff to the stormwater management system. An approximately 20 metre wide bench will be provided between the exterior toe of the perimeter berm and adjacent facilities within the buffer, providing both access and working area around the landfill.

To provide adequate stability for the landfill overlying the clay deposit, the landfill design has 14H:1V sideslopes above the perimeter berm up to about elevation 89 m ASL or approximately 12 to 13 metres above ground surface, and then a 20H:1V slope up to a central peak or ridge area. The maximum height of the designed final landfill contours is about 25 metres above existing ground level. This corresponds to an airspace volume of approximately 10,170,000 cubic metres (m^3) for waste and daily cover. An allowance for a one metre thick final soil cover has been provided, although the final soil cover is likely to have a total thickness of 0.75 metres. Final cover construction will take place after filling in a part of the landfill is complete.

For leachate containment, a Site-specific design approach will be 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 (a geosynthetic clay liner or GCL) extending the full height of the berm and down through the surficial silty sand layer or weathered clay zone and keyed into the upper portion of the underlying silty clay. This would cut off the potential pathway for off-Site leachate migration via the berm fill and surficial silty sand layer. 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, which 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 design of the landfill base recognizes that consolidation settlement of the silty clay deposit will occur due to the weight of the waste, and that the largest settlements will be below the central portion of the landfill where the waste thickness is greatest as described in the following section of this report. 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. 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. The layout of the base is shown on Figure 10-2. 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.

The proposed landfill gas management (LFG) system will be designed in accordance with the requirements of O.Reg. 232/98. The approach at the Site recognizes the diversion of IC&I organics from disposal to the extent practical, and as such the anticipated reduction in potential odour emissions associated with decomposition of organics within the landfill. The proposed active LFG collection system will consist of horizontal collector piping installed in two layers within the waste as the waste is placed, and, 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*, 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 clay foundation settlement.

Due to the presence of clay soils beneath and in a large area beyond the Site, the presence of a high groundwater table in the area, and the proposed low permeability barrier through the surficial silty sand layer around the landfill perimeter, the potential for off-Site migration of landfill gas through the subsurface is negligible. In addition, there is a minimum 100 metre wide buffer between the landfill footprint and the Site property boundaries; and there are ditches and drains that would interrupt the movement any landfill gas in the unlikely event that it had migrated away from the landfill through the thin unsaturated zone.

The proposed Site development provides for on-Site buffer lands. A buffer area 125 metres wide would be adjacent to the east side, the east half of the south side, and the northwest corner of the landfill. Around the remainder of the landfill the perimeter buffer would be 100 metres, as per the O.Reg. 232/98.

10.9 Stormwater Management

Design of drainage requirements from the landfill (as required by O.Reg. 232/98) and from the diversion areas was carried out and the proposed stormwater management system is shown on Figure 10-1. 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 total suspended solids removal. The approach also divides up the Site into three drainage areas that are similar in size to the three pre-development drainage area 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.

10.10 Screening Berms

Constructed screening will be required at the northeast and southeast corner areas and along a portion of the west central Site boundary. The constructed earth screening berms would have 3H:1V side slopes, a 2 metre top width and be 2 metres high with trees transplanted on them. In other areas screening could be provided by leaving an adequate width (15 to 20 metres) of existing tree cover around the perimeter of the property. 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.