

Waste Management of Canada Corporation

**West Carleton Environmental Centre –
Biology Best Management Plan**

Report

Waste Management of Canada Corporation

West Carleton Environmental Centre – Biology Best Management Plan

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1. Purpose

The purpose of this report is to describe the Best Management Practices (BMPs) that Waste Management (WM) will employ in order to manage and minimize potential environmental effects to the Natural Environment resulting from the development of the landfill footprint as part of the West Carleton Environmental Centre (WCEC).

2. General/Background Information

The Environmental Assessment (EA) for the WCEC landfill included a detailed assessment of the potential impacts on the existing natural environment conditions. Mitigation measures were identified in order to minimize potential effects on the environment. Recommended mitigation measures and monitoring requirements identified in the Biology Detailed Impact Assessment of the EA (AECOM 2012) are now considered to be commitments that will be addressed and incorporated as part of the West Carleton Environmental Centre landfill development and operation. These were reviewed and accepted by the Minister of the Environment in September 2013.

In addition the same general commitments are discussed in the Environmental Impact Statement (EIS) prepared for the City of Ottawa (AECOM 2014) along with additional or more detailed recommended mitigation measures.

3. Commitments and EA Conditions

All of the EA commitments related to the Natural Environment are shown in Table 1 and those with conditions of approval specified by the Minister of Environment are also indicated.

Table 1. Natural Environment Commitments and EA Conditions

| No. | EA Commitment | EA Condition |
|-----|--|---|
| 1 | Develop a Biology BMP Plan that provides mitigation measures related to vegetation clearing and grubbing activities | |
| 2 | Develop a Biology BMP Plan that provides mitigation measures related to erosion and sediment control to prohibit sediment from entering adjacent water bodies, wetlands and forested areas | |
| 3 | Develop a Biology BMP Plan that provides mitigation measures related to site grading | |
| 4 | Develop a Biology BMP Plan that provides mitigation measures related to edge management | |
| 5 | Develop a plan to address displacement of Bank Swallow colony, | <ol style="list-style-type: none"> 1. The proponent shall develop and implement a Bank Swallow Mitigation, Compensation and Monitoring Plan in consultation with Environment Canada and the Ontario Ministry of Natural Resources prior to the commencement of construction of the undertaking. 2. The Bank Swallow Mitigation, Compensation and Monitoring Plan shall include measures to mitigate impacts of the undertaking on the species, compensate for unavoidable adverse impacts and detail monitoring requirements. |
| 6 | Develop a Compensation and Restoration Plan to offset removals of natural forest in the landfill footprint. | |
| 7 | Develop a Compensation and Restoration Plan to offset removals of wetland in the landfill footprint. | |

Table 1. Natural Environment Commitments and EA Conditions

| No. | EA Commitment | EA Condition |
|-----|---|---|
| 8 | Include in the Environmental Management Plan the following compensation measures identified in the Biology Detailed Impact Assessment: <ul style="list-style-type: none"> • Create or enhance 4 ha of wetland habitat that is suitable for amphibian breeding; • Create or restore forest habitat equal to amount removed; • Create or restore old field habitat where possible; • Establish some natural vegetation between proposed landfill and William Mooney Road. | |
| 9 | Develop a Biology BMP Plan that includes a monitoring program for vegetation and wildlife. | |
| 10 | Contact OMNR should species at risk (e.g., Eastern Meadowlark and Barn Swallow) be encountered on-site and adhere to applicable permits, acts, and guidelines in detailed design and construction. | 3. The proponent shall conduct on-site surveys to determine the presence of Barn Swallow habitat on-site in consultation with the Ontario Ministry of Natural Resources. 4. Should Barn Swallow habitat be present, the proponent shall comply with the requirements of the <i>Endangered Species Act, 2007</i> . 5. The proponent shall conduct on-site surveys to determine the presence of Flooded Jellyskin habitat on-site in consultation with the Ontario Ministry of Natural Resources prior to the commencement of construction of the undertaking. 6. Should the presence of Flooded Jellyskin habitat be present, the proponent shall comply with the requirements of the <i>Endangered Species Act, 2007</i> . |
| 11 | Approval Requirements: Tree clearing should adhere to applicable City of Ottawa By-Laws or approval requirements. A Wildlife Scientific Collectors Permit is required through MNR to capture, contain and release amphibians from one site to another, if required. No other approvals or permits are identified as required, assuming that the <i>Endangered Species Act</i> does not apply. | |

4. Mitigation Measures

Mitigation measures are recommended to minimize or compensate for environmental impacts that are predicted to result from the landfill expansion. The following table provides a summary of recommended mitigation measures as they relate to the commitments in Table 1. Note that the numbers in the first column in Table 2 relate directly to the corresponding number in Table 1. The mitigation measures of some of these potential effects are described in greater detail in the attachments as indicated.

Table 2. Natural Environment Mitigation Measures

| No. | EA Commitment | Mitigation Activity | Timing of Activity |
|-----|---|---|--|
| 1 | Vegetation clearing and grubbing | <ul style="list-style-type: none"> • Identify plant material for possible salvage, mark and dig out, if feasible; • Install temporary tree protection fencing at the edge of clearing limits; • Restrict tree removal to the working area; and, • Ensure beneficial use for trees that are removed (lumber, firewood or woodchips), wherever possible. See Further Details in Attachment A | <ul style="list-style-type: none"> • Prior to vegetation clearing • Prior to and during vegetation clearing • Avoid cutting in breeding bird season (April 15 to July 31) |
| 2 | Erosion and sediment control | <ul style="list-style-type: none"> • Install sediment fences along edge of construction area; • Minimize area and duration of exposed soil; and, • Retain existing vegetation, where feasible. See Further Details in Attachment B | <ul style="list-style-type: none"> • Prior to site grading and maintained until construction is completed or vegetation cover is established on exposed ground. |

Table 2. Natural Environment Mitigation Measures

| No. | EA Commitment | Mitigation Activity | Timing of Activity |
|-----|--|---|---|
| 3 | Site grading | <ul style="list-style-type: none"> Minimize overall grade changes; and; Create gentle slopes, where possible. See Further Details in Attachment C | <ul style="list-style-type: none"> Prior to and during site grading |
| 4 | Edge management | <ul style="list-style-type: none"> Retain narrow zone where no root grubbing occurs to stimulate suckering of cut trees; Remove hazard trees only along edge; Install edge plantings; and, Control of regenerating invasive plants. See Further Details in Attachment D | <ul style="list-style-type: none"> Prior to and during vegetation clearing Avoid cutting in breeding bird season (April 15 to July 31). |
| 5 | Enhancement of Bank Swallow Colony | <ul style="list-style-type: none"> Retain existing Bank Swallow habitat; Remove fill, as necessary, from base of bank; Install protective fencing around the bank swallow habitat; and, Consult with MNR and Environment Canada, as necessary. See Further Details in Attachment E | <ul style="list-style-type: none"> Fill at base of bank should be removed before bank swallow nesting and breeding season Follow precautionary measures prior to and during ongoing operation of landfill |
| 6 | Compensation Restoration Plan to offset removals of natural forest | <ul style="list-style-type: none"> Delineate 9.5 ha of forest compensation area; Salvage shrub and saplings from forest to be removed, if possible; and, Establish vegetation between landfill and William Mooney Road. See Further Details in Attachment F | <ul style="list-style-type: none"> Plant salvage needs to occur prior to forest removal Plantings best in spring but can be done in autumn |
| 7 | Compensation Restoration Plan to offset removal of wetland | <ul style="list-style-type: none"> Delineate 4.0 ha of wetland habitat that is suitable for amphibian breeding and foraging; Salvage plants from wetlands to be removed, if possible; and, Salvage amphibians from wetlands to be removed, if possible. See Further Details in Attachment G | <ul style="list-style-type: none"> Plant and amphibian salvage needs to occur prior to wetland removal Wetland work should occur in dry periods when water levels are lowest |

5. Monitoring Requirements

The purpose of monitoring is to document the ongoing activities and conditions related to the proposed mitigation measures and any residual effects on the natural environment, so that corrective actions can be prescribed as needed. This addresses Commitment 9 as listed in Table 1. Monitoring provides a means of confirming that restoration is proceeding as expected or that the desired results are not being achieved and therefore corrective action is needed. Table 3 outlines the monitoring requirements associated with the corresponding commitments outlined in Table 1 in terms of methodology, timing and frequency. Proposed monitoring is described in greater detail in the attachments as indicated.

Table 3. Natural Environment Monitoring Requirements

| No. | EA Commitment | Monitoring Activity | Timing & Frequency of Activity |
|-----|----------------------------------|---|--|
| 1 | Vegetation Clearing and Grubbing | <ul style="list-style-type: none"> Survey to identify plants suitable for salvage and transplanting. | <ul style="list-style-type: none"> Prior to vegetation clearing |
| 2 | Erosion and Sediment Control | <ul style="list-style-type: none"> Inspect sediment fences. Conduct repairs or maintenance as required Details in Attachment B | <ul style="list-style-type: none"> Monitor sediment fences monthly and following major storm events |
| 4 | Edge Management | <ul style="list-style-type: none"> Inspect condition of new forest edge prior to planting Inspect survival of edge plantings Survey new forest edge for colonization by invasive plants Details in Attachment D | <ul style="list-style-type: none"> After vegetation clearing along edge Inspect survival of edge plantings in growing season for 2 years Invasive monitoring done each year early in growing season for 3 years |
| 5 | Bank Swallow colony | <ul style="list-style-type: none"> Document condition of the bank after fill removal. Monitor number of active nests and condition of bank Details in Attachment E | <ul style="list-style-type: none"> Prior to breeding season Monitor nests during breeding season in June for 3 years after start of landfill expansion |

Table 3. Natural Environment Monitoring Requirements

| No. | EA Commitment | Monitoring Activity | Timing & Frequency of Activity |
|-----|---|--|---|
| 6 | Forest Compensation | <ul style="list-style-type: none"> Monitor survival of planted material in compensation area. Monitor if colonization by invasive plants is occurring Details in Attachment F | <ul style="list-style-type: none"> Confirm planting meets desired results soon after completion Plants monitored in growing season for 3 years after planting Invasive plant monitoring done at the same times |
| 7 | Wetland Compensation and enhancement | <ul style="list-style-type: none"> Monitor survival of planted material. Monitor if colonization by invasive plants is occurring Monitor amphibians through calling counts Details in Attachment G | <ul style="list-style-type: none"> Monitor physical, plant survival and invasive plant growth at end of 1st growing season, then early and late in growing season for next two years Monitor amphibians one year following completion of wetland restoration, twice between April and June |

6. Other Commitments

Note that not all commitments identified in Table 1 have been included in Tables 2 and 3. Some of these commitments have already been addressed or overlap with some of the other commitments. For example there is no monitoring included for the Site Grading (Commitment 3) because once the grading has been completed there is no further monitoring required.

Commitment 8 relates to compensation of wetland or woodland and therefore is mostly addressed within Commitments 6 and 7. The commitment to create some field habitat where possible has not been addressed above. Virtually all available area on-site that is not being used for landfill operations will be used for either forest compensation or wetland restoration, and therefore there is no surplus area where old field can be created. Old field is an early successional community largely dominated by non-native grasses, and a mix of native and non-native forbs. Since there was no commitment to a specific area, the low significance of the community and given the site limitations, there will not be any old field habitat specifically created but it will develop on its own in small patches beside roadways and around the Stormwater ponds.

Commitment 9 is a general comment about monitoring vegetation and wildlife which is addressed in Commitments 1, 4, 5 and 7 on Table 3.

With respect to Species at Risk (Commitment 10), surveys were conducted by AECOM in September 2013 to determine if nesting Barn Swallows or Flooded Jellyskin are present on-site. Neither were found and MNR Species at Risk Biologist was notified with the survey results on November 11, 2013. The MNR responded on December 2, 2013 confirming that they were satisfied with the survey results. During monitoring if any other Endangered or Threatened Species are encountered on-site MNR will be contacted to determine appropriate action.

7. Contingency Activities

It is possible that habitat restoration or mitigation activities are not as successful as expected that could result from unforeseen issues. Table 4 identifies where contingency activities could be required.

Table 4. Natural Environment Contingency Activities

| No. | EA Commitment | Monitoring Observation | Contingency Activity | Timing of Activity |
|-----|---|--|--|---|
| 2 | Erosion and Sediment Control | Sediment escapes into natural feature | <ul style="list-style-type: none"> • Removal of sediments from feature • Prompt repair of, and improvement to, sediment fences | <ul style="list-style-type: none"> • More frequent monitoring if warranted |
| 4 | Edge Management | New forest edge overtaken by invasive plants | <ul style="list-style-type: none"> • Consider application of herbicide or other control measures | <ul style="list-style-type: none"> • Continue monitoring conditions over longer time period |
| 5 | Bank Swallow colony | Bank Swallows abandon colony | <ul style="list-style-type: none"> • Assess probable causes of abandonment • Collaboration with MNR and Environment Canada • Consider plan to rebuild bank or create conditions for Bank Swallow colony at another location | <ul style="list-style-type: none"> • Continue monitoring conditions over longer time period • Monitor site of other Bank Swallow colony |
| 6 | Forest Compensation | Significant dieback of planted material | <ul style="list-style-type: none"> • Assess probable causes of plant die-off • Implement corrective measure if possible and replanted | <ul style="list-style-type: none"> • Measure survival of planted material |
| 7 | Wetland Compensation and enhancement | Poor survival of wetland plants | <ul style="list-style-type: none"> • Assess causes for poor survival such as hydrology, soils, etc. • Make physical changes to wetland as warranted to improve. • Consider planting different plant species | <ul style="list-style-type: none"> • Continue monitoring conditions over longer time period |

8. References

AECOM, 2012:

Environmental Assessment for a New Landfill Footprint at the West Carleton Environmental Centre: Biology (Aquatic and Terrestrial) Detailed Impact Assessment. Prepared for Waste Management of Canada Corporation.

AECOM, 2014:

Environmental Impact Statement for the West Carleton Environmental Centre Landfill Expansion. Prepared for Waste Management of Canada Corporation.

Attachment A

Clearing and Grubbing

Attachment A. Clearing and Grubbing

Mitigation measures will be applied during clearing and grubbing activities to minimize the impact to retained vegetation. Examples of measures that should be applied where applicable include:

- a) Prior to clearing, the area to be cleared should be examined by an ecologist or arborist to identify plant material for possible salvage that can be used in forest compensation plantings (see Attachment F) and wetland creation (see Attachment G). Considerations for determining if plant salvage is feasible include: species, size that is transplantable and accessibility for removal.
- b) Vegetated areas bordering the working area will be protected with temporary tree protection and sediment fencing as determined in the final grading plan (further details in Attachment D). Equipment, storage of materials, and other construction activities will not be permitted in these zones.
- c) Tree removal will be restricted to the working area. Vegetation removals associated with clearing, site access and staging will occur outside the key breeding bird period identified by Environment Canada for migratory birds (typically April 21 to July 31 for this area) to ensure compliance with the *Migratory Birds Convention Act, 1994* (MBCA).
- d) If works must be conducted during the breeding bird season, a nest survey will need to be conducted by a qualified avian biologist prior to commencement of works to identify and locate active nests of species covered by the MBCA. Clearing cannot occur where active nests are found until the birds have left the nest.
- e) Trees will be felled in a manner that avoids damaging other standing vegetation and trees will be felled away from any watercourse where it is safe to do so.
- f) Cut woody material will be utilized where possible for lumber, firewood or woodchips. Where possible, cut branches may be piled into brush piles for wildlife habitat. Wood chip material may also be used in the edge plantings (at the identified edge management and landscape areas).
- g) Forest topsoil that can be re-spread within 12 months of initial storage will be used wherever practical and feasible at forest edge planting sites and stormwater management facility margins.

Attachment B

Sediment and Erosion Control

Attachment B. Sediment and Erosion Control

Mitigation measures will be used for erosion and sediment control to prohibit sediment from entering adjacent water bodies, wetlands and forested areas. The primary principles associated with erosion and sediment control (ESC) protection measures are to a) minimize soil mobilization; b) minimize the duration of soil exposure; c) retain existing vegetation where feasible; d) keep runoff velocities low; and, e) trap sediment as close to the source as possible.

The following list summarizes the basic principles and performance guidelines that will be employed during the development of detailed design and contract documents and drawings.

- a) Erosion and sediment control fencing will be installed prior to construction and maintained within their effective limits throughout the construction and until the restoration of disturbed vegetation, rock revetments or similar are successfully completed.
- b) Erosion and sediment control structures will be designed, installed, maintained, and removed according to *Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites (1987)*.
- c) Earth stockpiles shall be enclosed with appropriate sediment and erosion control fencing.
- d) Runoff from material stockpiles or site de-watering will be filtered through an appropriate device (temporary settling facility, filter bag, etc.) before release.
- e) Sediment control structures will be regularly inspected, particularly after storm events, and repaired as required. The structures will be cleaned out when accumulated sediment reaches half the design height.

Attachment C

Site Grading

Attachment C. Site Grading

Mitigation measures will be used during grading to minimize the overall grading footprint and keep slopes to a minimum. The primary principles associated with grading mitigation measures are similar to those described above for clearing/grubbing and sediment and erosion control.

- a) The design completed in subsequent design phases will ensure that drainage from any unstabilized surface is captured and adequately filtered prior to discharge to natural areas, including receiving drainage features.
- b) Erosion and sediment control measures will be designed and then installed on site prior to any grading.
- c) In dust sensitive areas, dust suppression methods (water, calcium chloride or other as appropriate) will be used as required to control off-site migration of particulates.
- d) Adhere to permits, acts and guidelines: Dust suppressant license required from MOE for use of registered dust suppressants other than water.

Attachment D

Forest Edge Management Strategy

Attachment D. Forest Edge Management Strategy

Edge management measures will be implemented to protect newly created forest edges where the adjacent retained habitat is large enough to warrant this measure. These measures will mitigate effects of increased sun, wind and change in humidity and shade at a newly opened forest edge to protect the overall forest area that will be retained. .

Key edge management principles that will be followed during development and operation of the landfill are as follows:

- a) Temporary vegetation protection fencing will be installed at the edge of the clearing limits where the edge of a forest community is removed prior to any tree cutting (see Attachment A).
- b) Trees along 5 m out from the newly created edge will have the trunks flush cut slightly above ground level (not grubbed) to stimulate suckering regeneration that will help fortify the new edge. No materials or equipment should be stored within this area.
- c) Wood chip material will be applied in the edge plantings (at the identified edge management areas) that will be developed during subsequent design phases. This material will help retain soil moisture and prevent weed spread.
- d) Removal of hazard trees will be undertaken along the new edge as required to maintain safety.
- e) Part way through the first growing season, the edge should be inspected by an ecologist for regeneration of invasive plants. These should be cut and applied with herbicides by a licensed applicator in the growing season.
- f) Buffer plantings of native tree and shrub species will be installed in the 5 m regeneration edge, and in the next 5 m where the understorey is bare. Plantings need not be dense as there is anticipated to be much suckering.
- g) The forest edge should be monitored early in the second growing season (mid-May to mid-June) to examine survival of invasive plants as well as planted materials and the existing trees along edge. Corrective action should be recommended as appropriate, if there is significant die off (>75%) of planted material or aggressive regeneration of invasive plants.
- h) If corrective management is required, an early autumn monitoring event should occur. Otherwise it should occur again early in the third growing season.

Monitoring and Corrective Management

Monitoring is part and parcel of the edge management plan and therefore is incorporated above. To assess tree survival along the new forest edge as well as survival of the edge plantings and rate of natural regeneration. Once the plants are well established, the required management is expected to be minimal.

Attachment E

Enhancement of Bank Swallow
Nesting Colony

Attachment E. Enhancement of Bank Swallow Nesting Colony

A plan for mitigation and monitoring plan for Bank Swallows has been developed in consultation with Environment Canada (Canadian Wildlife Service) and the Ontario Ministry of Natural Resources.

The earthen bank currently used by nesting Bank Swallows can be retained within the landfill plan. Although it is in close proximity to the proposed landfill, maintaining the existing site is a better option than attempting to create another nesting site because of the uncertainty that a new site would actually be colonized by the birds. The existing bank obviously has the right characteristics since the swallows have been using it for a number of years.

If removed, the cliff face needs to be excavated outside of the breeding season (late April to late July) when no nesting birds are present. Active bird nests are protected under the Migratory Birds Convention Act.

Some grading below the bank face occurred in 2013 as part of the MNR's required closure plan of the former gravel pit. The upper portion of the bank where the nest holes are present was not disturbed however, but soil has been placed partway up the slope such that the nest holes may no longer be secure from ground predators. Some of this fill needs to be removed such that the nest holes are not accessible from predators.

The following recommendations have been made in an effort to protect the active colony

- a) The lower portion of the bank where the Bank Swallow colony occurs needs to be exposed. Fill that has been placed at the base needs to be excavated and removed such that the steep, nearly vertical bank should be at least 3 m high. The fill needs to be excavated carefully so that the bank with the nest holes does not collapse. This work should be done after frost is out of ground but before early May when the birds return from migration.
- b) Heavy construction work should avoid the immediate vicinity of the nesting bluff during the breeding season (May 1 to July 31).
- c) Since the bank face needs to remain steep in order to continue providing a suitable nesting site, some periodic excavation at the base of the bank may be required. The physical structure of the bank should be examined each year in early spring to ensure that it is still suitable for the swallows. Excavation work, if necessary, should be done in the spring before the birds have returned from migration.
- d) The area above and below the bank should be clearly marked and cordoned off to ensure that equipment and personnel keep a sufficient distance from the colony to minimize disturbance to the birds.
- e) The colony should be monitored during the breeding season in June during year of construction and the two following years to determine the number of active nesting pairs, as a gauge of success.

Attachment F

Forest Compensation Planting

Attachment F. Forest Compensation Planting

This forest compensation plan addresses the requirement to compensate for forest that is proposed to be removed for the landfill expansion. A total of approximately 9.0 ha of Significant Woodland will be removed and therefore this amount of area needs to be replaced with appropriate plantings. A detailed planting plan which prescribes appropriate species, size and spacing is being prepared.

Site of Planted Forest

The forest compensation will occur in three areas as indicated on Table 1 and shown on **Figures 1a and 1b**. This includes an 80 m wide band along the east side of William Mooney Road that will provide a visual screen. Plantings of native trees and shrubs are proposed in the east portion of the site and among the cultural woodland along Carp Road (East side Interplanting Area). Here plantings will occur in the gaps between existing vegetation.

Table 1. Forest Compensation Areas

| Compensation Area | Area to be Planted |
|------------------------------|--------------------|
| Northwest | 5.5 ha |
| South of Existing Landfill | 2.8 ha |
| East side Interplanting Area | 0.8 ha |
| TOTAL | 9.1 ha |

Steps of Forest Compensation

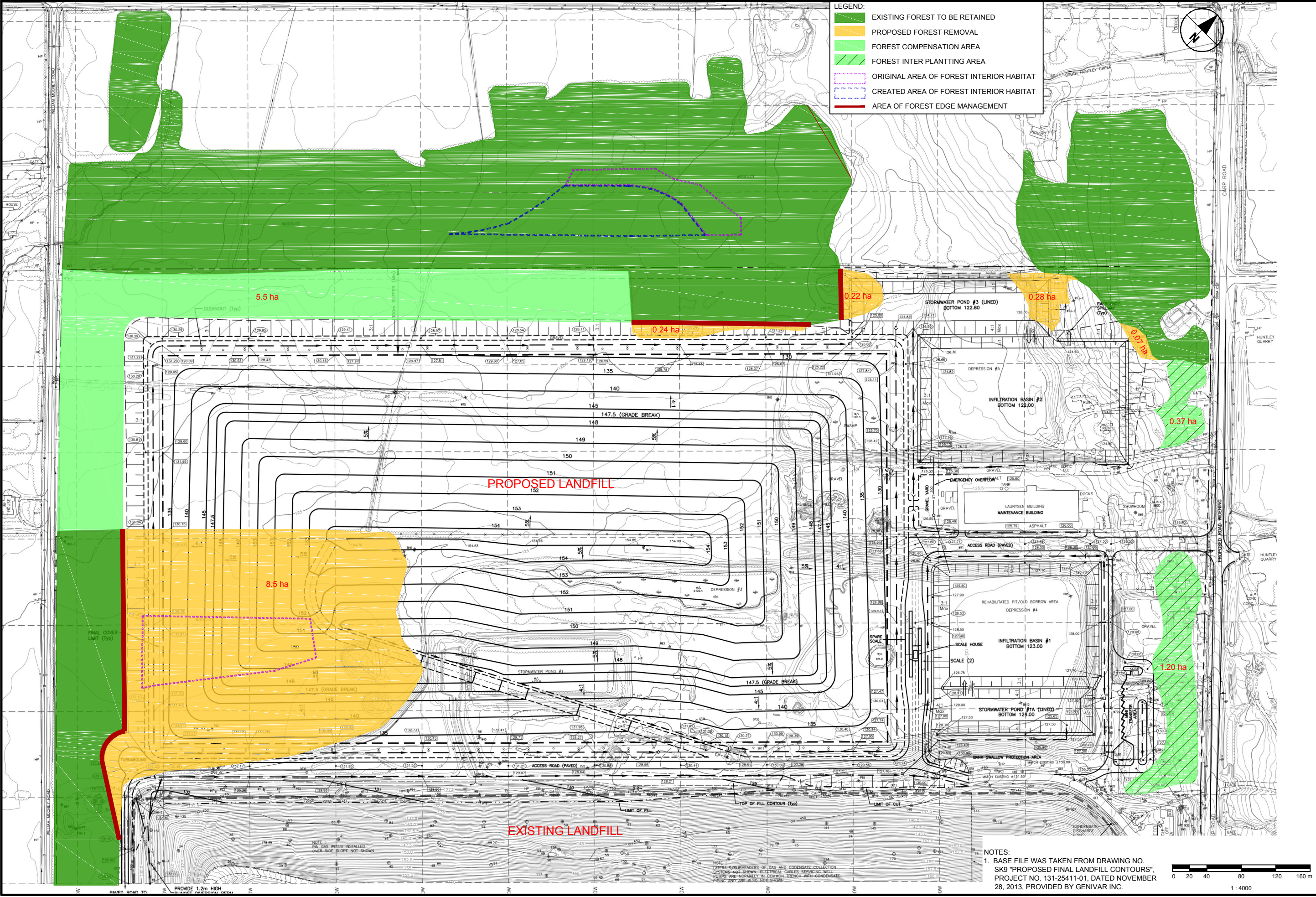
- a) The forest compensation area should be clearly delineated and signed to keep it off limits to construction vehicles and equipment
- b) The forest area scheduled for removal shall be examined to identify plant material that can be salvaged and transplanted to the forest compensation area. Planting material could consist of shrubs, saplings and ground flora. Deciduous or mixed forest stands are likely to contain more salvageable forest ground flora as well as shrubs or saplings, than dense coniferous forest. Areas should be marked to remove plants, or to lift soil that can be moved with seed bank intact. The feasibility of salvage will need to be assessed for suitability of plant material and practicality of moving them.
- c) Because of the abundance of the highly invasive Glossy Buckthorn in the forest that will be removed, soil should only be moved if the buckthorn is absent or at least scarce. Otherwise a great seed source of buckthorn may be inadvertently transplanted to the compensation area.
- d) A detailed planting plan should be developed for the forest compensation area with some flexibility to incorporate salvaged material. A mix of the following tree species is recommended that reflects local forest composition:
 - White Cedar
 - Paper Birch
 - Red Oak
 - American Basswood
 - White Pine
 - Sugar Maple
 - Black Cherry
 - Trembling Aspen
 - Balsam Fir
 - Red Maple
 - Ironwood
- e) Suitable shrubs include: Gray Dogwood, Alternate-leaved Dogwood, Choke Cherry, Nannyberry, Prickly-ash, Bush Honeysuckle and Staghorn Sumac.

- f) Plantings should be made in scattered clusters consisting of a mix of several tree and shrub species with some gaps between where some natural regeneration can occur. The clusters should be variable in composition to promote diversity. Plantings should not have uniform even spacing as this does not mimic nature.
- g) Because of the number of trees required whips or small saplings should be planted as bare root stock in spring before they have leafed out, or in the autumn. Plants should be watered immediately after planting, then two weeks later and then once per month over the summer of the first growing season.
- h) Tree stakes are not necessary and should not be used. Small tree guards or bark wrap should be placed on the trees to prevent rodent damage but these need to be removed two years after planting.

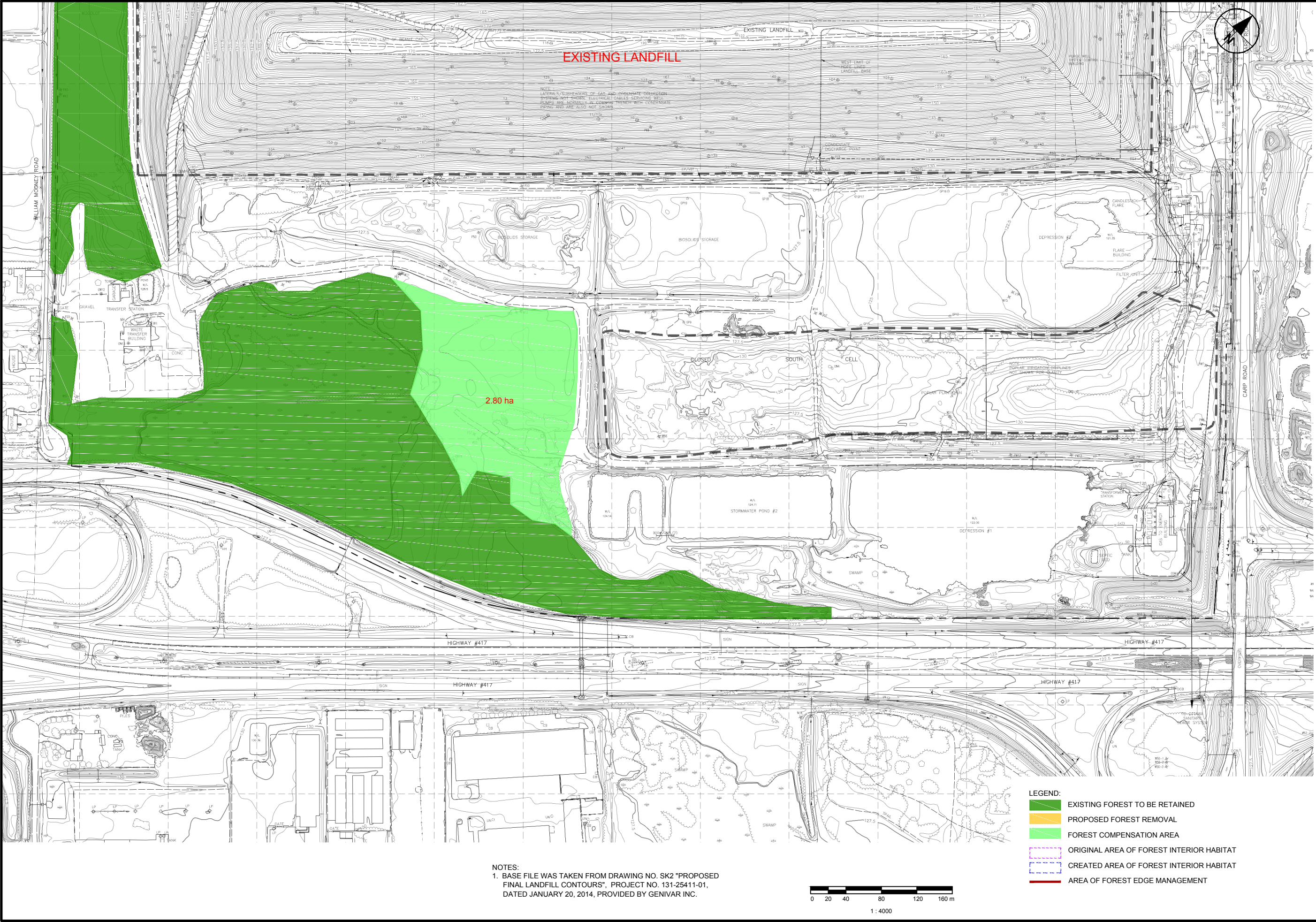
Monitoring and Corrective Management

Monitoring is conducted to assess success of the compensation planting and management involves taking steps as necessary to ensure that the planted material achieves good survival. Once the plants are well established, the required management is expected to be minimal unless unforeseen situations arise, in particular a die off of plantings.

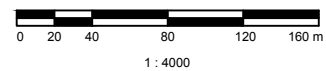
- a) Plant survival and growth should be monitored by assessing the percent survival. Ideally plants will be planted in spring and first monitored in late summer. If woody plants have less than 75% survival, then those plants should be replaced that autumn or in the following spring. As some mortality is likely, greater than 75% survival is considered success.
- b) Plant survival and growth should be monitored again near the end of the second and third growing seasons. Again plants should be replaced in autumn or spring if less than 75% survival is achieved.
- c) Natural regeneration should also be documented particularly to determine if aggressive non-native plants are colonizing. The extent of woody non-native plant establishment should be assessed to determine if corrective action is needed.
- d) If required removal of non-native woody plants should be done. Hand digging may be effective if the invading plants are small and limited in distribution, and should be done on monitoring visits if feasible. The application of herbicides by a licensed pesticide applicator may be required if non-native woody plants are establishing rapidly. While complete eradication of buckthorns may not be feasible, they should be controlled for the first three years.



NOTES:
1. BASE FILE WAS TAKEN FROM DRAWING NO. SK9 'PROPOSED FINAL LANDFILL CONTOURS', PROJECT NO. 131-25411-01, DATED NOVEMBER 28, 2013, PROVIDED BY GENIVAR INC.



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 1. BASE FILE WAS TAKEN FROM DRAWING NO. SK2 "PROPOSED FINAL LANDFILL CONTOURS", PROJECT NO. 131-25411-01, DATED JANUARY 20, 2014, PROVIDED BY GENIVAR INC.



- LEGEND:**
- EXISTING FOREST TO BE RETAINED
 - PROPOSED FOREST REMOVAL
 - FOREST COMPENSATION AREA
 - ORIGINAL AREA OF FOREST INTERIOR HABITAT
 - CREATED AREA OF FOREST INTERIOR HABITAT
 - AREA OF FOREST EDGE MANAGEMENT

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Attachment G

Details of Wetland
Compensation and
Enhancement

Attachment G. Details of Wetland Compensation and Enhancement

The EA report (AECOM, 2012) recommended that a Wetland Compensation and Restoration Plan be developed to create or enhance 4 ha of wetland habitat suitable for amphibian breeding near the proposed landfill footprint. The purpose is to compensate for the area of wetland that would be removed through the development of the landfill. The compensation wetland is proposed within the area of stormwater ponds south of the existing landfill.

Currently the wetland compensation plan shown on **Figure 2** is conceptual since more detailed investigations of conditions at the site are required. The results may result in some refinements to this plan.

Detailed Assessment of Enhancement Site

Additional site specific information about the ponds is required in order to determine a functional wetland compensation since these ponds were not considered at the time of EA report, in particular:

- a) bathymetry of ponds to determine depth and steepness of edge;
- b) mapping of extent and composition of marsh vegetation along shoreline of the ponds;
- c) assess abundance and types of invasive plants present to determine if they are likely to spread and dominate in the enhanced wetland;
- d) description of submerged vegetation within the ponds;
- e) description of soil types and moisture regime on lands surrounding ponds, and within ponds;
- f) determine if there are issues of soil contamination on lands surrounding ponds where excavation may occur;
- g) acquire some understanding of hydrology feeding the ponds, such as inflow, outflow and seasonal water level fluctuations;
- h) identify any logistical constraints to enhancing wetland habitat at this location;
- i) the wetlands that will be removed on the landfill footprint should be investigated for opportunities to salvage suitable plant material that can be used in the enhancement wetland.

Steps in Wetland Compensation and Enhancement

- a) Draw up detailed plan showing the limits of the existing wetland, shoreline areas to be contoured, excavated areas and where plantings are to occur.
- b) Determine if any permits are required for (e.g., conservation authority or MOE) and if so, go through steps of the application.
- c) Ideally, the physical excavation in the wetland should be completed in late summer or early autumn when the water levels are lowest. Planting of woody plants can be done in the autumn or early spring, both planting and seeding of herbaceous or graminoid wetland plants should occur in the spring.
- d) Wetland enhancement will require excavation to contour the steep slopes of the two smaller ponds to make the shoreline slopes more gradual which will allow for a wider area of emergent marsh. Steep sided ponds allow minimal marsh development along shorelines and therefore support few wetland species. Contouring will result in a slight expansion of the pond rim or making part of the pond bottom shallower, or both. The central area of the pond should remain at its current depth.

- e) Wetland creation will require shallow excavation to create a depression in a wider area around the ponds. Presumably this would occur around the south and southwest sides of the ponds in area that is currently disturbed cultural meadow. The excavation will need to dig into the shallow or seasonal groundwater table. If soil is excessively sand and gravelly, then some importation of topsoil may be required.
- f) A native meadow marsh seed mix shall be spread onto the shallow depression area where meadow marsh vegetation is to be established.
- g) Thicket swamp shall be established by planting suitable mix of wetland shrubs in clumps within excavated depression. Suitable species may include: Pussy Willow, Sandbar Willow, Bebb's Willow, Shining Willow, Slender Willow, Red-osier Dogwood, Nannyberry, Meadowsweet and Winterberry. Salvaged plant material should be used if feasible.
- h) Establishing emergent marsh along the contoured pond shoreline will involve planting of appropriate shoreline wetland plants that may include sedges, bulrushes, Broad-leaved Arrowhead, Mud-plantain and Swamp Milkweed. Salvaged plant material should be used if feasible.
- i) The submerged aquatic plants in ponds are typically dominated by Stoneworts and little else. If this is the case, several species of submerged plants should be planted which may include: Hornwort, Bladderwort, Elodea, pondweeds, Yellow Waterlily and White Waterlily.
- j) When wetlands are being removed, frogs and tadpoles and potentially fish should be salvaged and moved to the enhanced wetland area. This may be difficult to accomplish unless the water in the ponded wetlands are pumped down thereby concentrating the amphibians and making them easy to collect. Ideally amphibian salvage should occur in late summer or early autumn when water level is the lowest. Apart from Green Frogs, the other amphibians do not permanently live in the wetland, but breed in ponds in spring, then spend most of the summer in forest, field and thicket habitat. Their tadpoles have a three month larval period, where it takes over a year for Green Frog larvae to develop. Therefore if the wetlands are removed in midsummer to autumn, it would primarily be Green Frog adults and larvae that need to be moved.

Monitoring

Monitoring is important to document success of the enhancement effort or to determine if any corrective management is required. Planted plant survival, changing species composition, rate of succession, or any changes in physical environment (e.g., erosion) will be monitored by a qualified ecologist for a period of three years after the wetland is enhanced.

Monitoring should document the following:

1. Physical characteristics such as water levels, presence of erosion, evidence of flooding, water flow;
2. Condition and distribution of vegetation including survivorship of planted and seeded material, as well as natural establishment of wetland plants and succession;
3. Colonization by invasive plant species;
4. Amphibian breeding activities;
5. Presence of water birds including Canada Geese;
6. Incidental observation of other wetland wildlife including birds, mammals, reptiles, dragonflies;
7. Setup of Photographic monitoring stations. Photographs should be taken in standard directions at wide angle to record physical conditions, plant growth and any changing conditions; and
8. A determination if any corrective management is required.

Monitoring should occur at the following time periods:

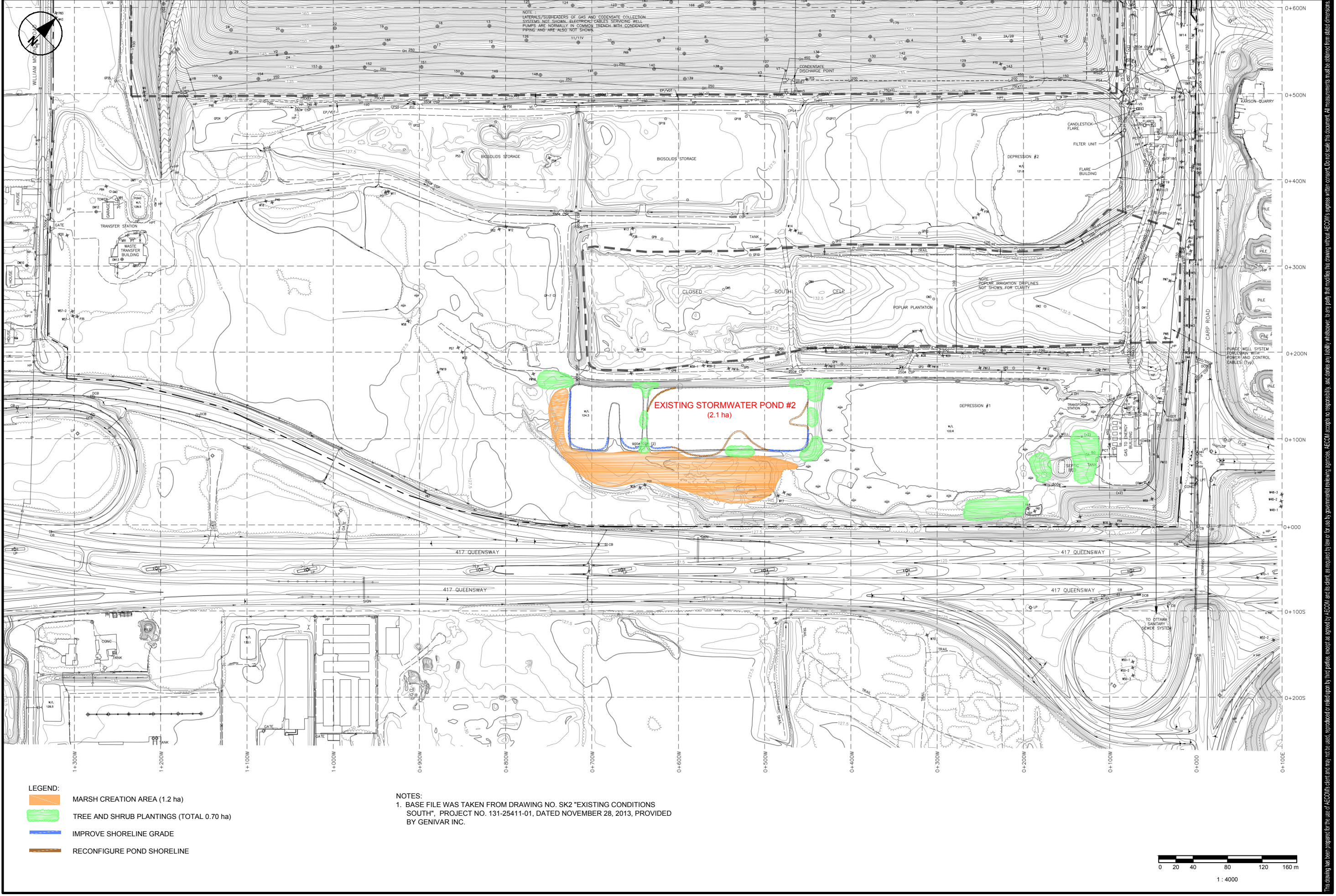
- a) Nocturnal amphibian surveys should be conducted on three visits in April, May and June to document the full suite of species on the first and third years following wetland enhancement. Monitoring should occur at each pond location. During nocturnal surveys weather conditions, species, numbers and calling locations within the ponds should be recorded.
- b) Early in the growing season (late May / early June) for three years following wetland enhancement to document characteristics described above.
- c) Late in the growing season (August / early September) for three years following wetland enhancement to document characteristics described above.
- d) Photographic stations should be setup around the wetland perimeters and marked with metal stakes. Photos should be taken at the same locations, focal length and direction during all vegetation surveys to be comparable.

Corrective Management

Corrective management may be prescribed as necessary to ensure that the wetland enhancement is achieving the desired results. Once the wetland plants are well established, the required management should be minimal unless unforeseen situations arise. Management will coincide with the regular monitoring that will occur after wetland enhancements have been implemented. Monitoring will determine where and if corrective actions are needed to meet the performance objectives.

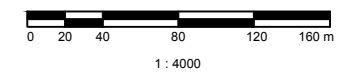
- a) Through plant survival monitoring if woody plants have less than 75% survival, then those plants should be replaced. If there is significant die-off of emergent or submergent plants then these should be replaced or substituted with another species, since that species may not be suitable to the conditions on site
- b) Large numbers of Canada Geese have been noted at some ponds on the landfill and present a challenge to restoration since they may graze all of the emergent plants as they are becoming established. While it will be very difficult to exclude them completely, planting tall shrubs and trees near shore of ponds will make shoreline less attractive to geese.
- c) There is a risk that the wetland may be colonized by aggressive non-native plants. The establishment of wetland plants will need to be monitored and corrective action to eliminate or at least control these species may be required. This could include hand digging or the application of non-persistent herbicides.

Where wetland improvements are not occurring as planned, appropriate corrective management will be recommended and Waste Management will be contacted to authorize or implement the necessary activities. Results of monitoring and other components of the wetland compensation as implemented will be summarized in annual reports.



- LEGEND:**
- MARS CREATION AREA (1.2 ha)
 - TREE AND SHRUB PLANTINGS (TOTAL 0.70 ha)
 - IMPROVE SHORELINE GRADE
 - RECONFIGURE POND SHORELINE

NOTES:
 1. BASE FILE WAS TAKEN FROM DRAWING NO. SK2 "EXISTING CONDITIONS SOUTH", PROJECT NO. 131-25411-01, DATED NOVEMBER 28, 2013, PROVIDED BY GENIVAR INC.



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