CITY OF TEMISKAMING SHORES
NEW WASTE MANAGEMENT CAPACITY
ENVIRONMENTAL ASSESSMENT STUDY REPORT
TECHNICAL SUPPORT DOCUMENT:

NOISE

Submitted to:

City of Temiskaming Shores
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Submitted by:

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February 2015

TY910491

FOREWORD

As of January 1, 2015, we have changed our company name from AMEC Environment & Infrastructure, a Division of AMEC Americas Limited to Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler). This reflects the combination of our parent company, AMEC plc, and Foster Wheeler AG. This name change is administrative in nature and we assure you that we will continue to maintain the current resources, contracts or other existing services you have with Amec Foster Wheeler. We will continue to provide the same quality of services and the same dedicated team of consultants, project managers, engineers and scientists. Our focus remains on delivering projects safely and successfully for you. You can find more information on Amec Foster Wheeler at www.amecfw.com.

EXECUTIVE SUMMARY

The City of Temiskaming Shores was formed in January 2004 through the amalgamation of the towns of Haileybury and New Liskeard and Township of Dymond into a single tier municipality. The City has two existing landfill sites: the New Liskeard Landfill (formerly the Town of New Liskeard Landfill) and the Haileybury Landfill (formerly the Town of Haileybury Landfill).

The New Liskeard Landfill, located approximately 3 kilometres west of the former Town of New Liskeard off of Rockley Road, has been used for landfilling since 1916 (Earth Tech, 2008). The Haileybury Landfill, located approximately 9 km southwest of the former Town of Haileybury off of Highway 11 along Dump Road, has been in operation since 1975 (Earth Tech, 2008).

Prior to amalgamation, the New Liskeard Landfill received waste only from the former Town of New Liskeard, while the Haileybury Landfill received waste from the former Town of Haileybury, the former Town of Dymond, the Town of Cobalt, and from residents of Firstbrooke and Lorrain Townships (Earth Tech, 2008). The New Liskeard Landfill reached its approved landfill capacity in June 2009, and is currently no longer accepting waste. Currently, the Haileybury Landfill accepts landfill waste from the City of Temiskaming Shores and the Town of Cobalt.

Based on waste generation projections (AMEC, 2010), the Haileybury Landfill is expected to reach its approved landfill capacity by mid-2016. As such, the City's draft Solid Waste Management Master Plan (WMMP) identified the provision of additional landfill capacity to facilitate long-term waste disposal as the second key objective in establishing a sustainable solid waste management program for the City of Temiskaming Shores (Earth Tech, 2009). Through the EA process, the City evaluated different ways to manage waste and ultimately selected landfilling. Subsequently, the City evaluated different methods (locations) for managing waste through landfilling. The selected preferred alternative is the expansion of the New Liskeard Landfill (the Project).

Amec Foster Wheeler has completed a study of the potential noise effects of the Project as a Technical Support Document (TSD) in support of the Environmental Assessment (EA). The Noise Assessment requires the identification of significant noise sources at the site and noise-sensitive receptors in the area. Five representative points of reception surrounding the waste management site, within the Site-Vicinity Study area, have been identified and considered for this TSD. All five of the representative points of reception are residential dwellings.

The Ontario Ministry of the Environment and Climate Change (MOECC) guideline "Noise Guidelines for Landfill Sites (draft) Oct 1998" was used to establish the criteria for this assessment. Noise levels have been assessed using A-weighted noise levels (dBA), which are typically used to assess noise impacts on human beings. A-weighting approximates the frequency response which is typical of human hearing and allows for single number (dBA), rather than spectral, comparison and assessment. Noise effects have been assessed over a time period of one hour, using the energy equivalent noise level (L_{eq}) as required by the applicable MOECC

guidelines. Noise levels are modelled for the daytime period (07:00 – 19:00) only since the landfill operation is not expected to extend over the evening or night-time periods.

The proposed landfill expansion will spread over five waste disposal cells. For the purpose of this noise impact assessment, it is assumed that the construction of the proposed landfill expansion will begin from the south end of the site at Cell 1. The Project will progress sequentially from Cell 1 through Cell 5 (i.e., south to north). The activities associated with the landfill site are expected to occur over a period of 45 years and they are mainly divided into four phases for this assessment: construction of Cell 1 base and associated perimeter roads and drainage ditches (Phase 1); landfilling of active cells (1 through 5) coupled with development of Cells 2 through 5 and progressive closure of Cells 1 through 4 (Phase 2); closure of Cell 5 and final capping and cover (Phase 3); and post-closure (Phase 4). The post-closure phase is considered as insignificant for this assessment as there are no major activities expected during this phase, other than monitoring activities.

Noise effects have been predicted at the representative receptor locations for Phase 1 through 3. A noise prediction model, a computerized implementation (CadnaA) of the ISO 9613-2 outdoor noise propagation algorithm, was used for this assessment. The predicted noise levels for all phases of the Project were assessed against the applicable MOECC guidelines limits. Project daytime noise levels at the receptor locations are expected to be below the MOECC noise criterion limit of 55 dBA. However, despite meeting the MOECC noise criterion, noise levels may be audible at the receptors within close proximity of the Project such as POR01 and POR02. Since the noise predictions indicate that the MOECC criterion will be met at all representative receptors, no additional mitigation is required for the Project.

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GLOSSARY AND ABBREVIATIONS

Amec Foster Wheeler	Amec Foster Wheeler Environment & Infrastructure
dBA	A-weighted Decibel sound level
CAZ	Contaminant Attenuation Zone
City	City of Temiskaming Shores
EA	Environmental Assessment
ha	hectare
km	kilometres
km/hr	kilometre per hour
L_{eq}	energy equivalent noise level
m	metre
MOECC	Ministry of the Environment and Climate Change
POR	Point of Reception
the Project	expansion of the New Liskeard Landfill
Site	Preferred Alternative (expansion of New Liskeard Landfill)
SSA	Site Study Area
TSD	technical support document
WMMP	Waste Management Master Plan

1.0 INTRODUCTION AND PROJECT OVERVIEW

The City of Temiskaming Shores was formed in January 2004 through the amalgamation of the towns of Haileybury and New Liskeard and Township of Dymond into a single tier municipality. The City has two existing landfill sites: the New Liskeard Landfill (formerly the Town of New Liskeard Landfill) and the Haileybury Landfill (formerly the Town of Haileybury Landfill). The locations of these landfills are identified on Figure 1.1.

The New Liskeard Landfill, located approximately 3 kilometres (km) west of the former Town of New Liskeard off of Rockley Road, has been used for landfilling since 1916 (Earth Tech, 2008). The Haileybury Landfill, located approximately 9 km southwest of the former Town of Haileybury off of Highway 11 along Dump Road, has been in operation since 1975 (Earth Tech, 2008).

Prior to amalgamation, the New Liskeard Landfill received waste only from the former Town of New Liskeard, while the Haileybury Landfill received waste from the former Town of Haileybury, the former Town of Dymond, the Town of Cobalt, and from residents of Firstbrooke and Lorrain Townships (Earth Tech, 2008). The New Liskeard Landfill reached its approved landfill capacity in June 2009, and is currently no longer accepting waste. Currently, the Haileybury Landfill accepts landfill waste from the City of Temiskaming Shores and the Town of Cobalt.

Based on waste generation projections (AMEC, 2010), the Haileybury Landfill is expected to reach its approved landfill capacity by mid-2016. As such, the City's draft Solid Waste Management Master Plan (WMMP) identified the provision of additional landfill capacity to facilitate long-term waste disposal as the second key objective in establishing a sustainable solid waste management program for the City of Temiskaming Shores (Earth Tech, 2009). Through the environmental assessment (EA) process, the City evaluated different ways to manage waste and ultimately selected landfilling. Subsequently, the City evaluated different methods (locations) for managing waste through landfilling. The selected preferred alternative is the expansion of the New Liskeard Landfill (the Project).

The New Liskeard Landfill is situated approximately 1 km west of Highway 11 along the north side of Rockley Road in Dymond Township. The legal description of the landfill property is the west half of Lot 5, Concession 2 of the former Town of New Liskeard (MOECC, 2007). This site is located approximately 3 km west of the former Town of New Liskeard, as shown on Figure 1.1.

The total property area is 32 hectares (ha), of which approximately 5 ha have been landfilled. The Project property access is from the south gate located along Rockley Road. A series of granular haul roads have been constructed on the site, one running from the gate adjacent to the west property boundary, one running south and east of the landfill and one running over the capped landfill area towards the most recent active disposal area.

A detailed history of landfilling activities is provided in the Feasibility Study (AMEC, 2010).

This Technical Support Document (TSD) has been prepared by Amec Foster Wheeler and is one of a series of technical reports which support the EA for the Project.

1.1 Overview of the Project

The major proposed Project components are those typical to the operation of a municipal non-hazardous solid waste landfill, and they are listed below:

- Waste haul trucks travelling along site/haul roads to working face;
- Deposition of waste materials, compaction, bulldozing, and grading activities at the working face;
- Stockpiling of clean cover materials, with loading of daily cover material into haul trucks and transport to the working face; and
- Facility support activities, with vehicular traffic from small vehicles or pick-up trucks.

The Project is expected to start once the landfill capacity at the Haileybury Landfill site is reached.

The sequential development of the proposed landfill expansion is outlined below:

- Phase 1 Construction (Year 1) - construction of Cell 1 base and associated perimeter access roads/drainage ditches;
- Phase 2 Operation (Year 2 through 20) - landfilling of active cells (1 through 5) coupled with development of cells 2 through 5, and progressive closure of cells (1 through 4). The activity location will change as the Project progresses sequentially from Cell 1 through Cell 5. Therefore, five operation scenarios are assessed for Phase 2;
- Phase 3 Closure (Years 20 to 21) - closure of Cell 5 and final capping and cover; and
- Phase 4 Post-closure (Years 21 to 45) - post-closure monitoring.

For the purpose of this noise impact assessment, it is assumed that the construction of the proposed landfill expansion will begin from the south end of the site at Cell 1. The Project will progress in four phases sequentially from Cell 1 through Cell 5 (i.e., south to north). The first three phases of the Project are considered to be significant as there are many activities occurring during these phases. However, the post-closure stage (Phase 4) is considered as insignificant, from a noise perspective, as there are no major activities expected during this phase, other than the post-closure monitoring.

The activities associated with Phase 1 are construction of Cell 1 base and associated perimeter access roads/drainage ditches. The activities (i.e., noise sources) will move from cell to cell as the Project progresses during Phase 2 and they overlap between construction, operation and closure stages of the Project. Therefore, five operation scenarios are assessed for this phase (Phase 2a through 2e). Each of these scenarios involves landfilling of an active cell, compacting

and bulldozing at the active cell, excavation of the next cell and transporting clean cover material to the working face of the active cell. The activities overlap between construction, operation and closure stages of the Project in Phase 2. Phase 3 is closure of cell 5 and final capping and covering. The Project layout along with the cells are shown in Figure 1.2.

1.2 Noise

Noise effects are expected during the construction, operation and closure stages of the Project. The prediction of noise effects consists of first identifying significant noise sources and receptors, estimating the noise source emissions, calculating the noise level propagated to each receptor from each noise source and combining the noise level contributions from all sources at each receptor.

Project noise levels were predicted using the A-weighted noise scale (dBA) which is the noise level that best reflects how people hear noise. For reference, Table 1.1 (Harris, 1997) provides a list of noise levels in dBA for the corresponding activities. These represent average noise levels, and could vary based on the situation and proximity to the activity.

Table 1.1: Noise Level Reference, Common Activities

Activities	Noise Level (dBA)	Apparent Loudness
Jet plane takeoff	130	Deafening
Thunder, artillery, elevated train, factory	110	Very Loud
Noisy office, average street noise, radio/TV	70	Loud
Average home/office, conversation, quiet radio/TV	50	Moderate
Quiet home/office, quiet conversation	30	Faint
Rustle of leaves	10	Very Faint

Source: Harris (1997)

A glossary of commonly used noise terminology can be found in Appendix A.

2.0 METHODOLOGY

2.1 Spatial Boundaries

2.1.1 Site Study Area

The Site Study Area encompasses the most immediate area of the Project. It corresponds to the direct footprint of the onsite Project components. The Site Study Area covers a total area of approximately 30 ha that encompasses the physical location of all activities associated with the landfill, including the access roads, site entrance, and the waste disposal cells.

2.1.2 Site-Vicinity Study Area

The Site-Vicinity Study Area generally corresponds to the area in the vicinity of the Project where the potential noise effects of the Project are expected to occur, and can be predicted or measured with a reasonable degree of accuracy. For the noise assessment, the Site-Vicinity Study Area is defined as an area that extends approximately 1 km from the main Project noise sources (Figure 2.1).

2.1.3 Extended Study Area

The Extended Study Area for the noise assessment is defined as an area that extends approximately 5 km from the main Project noise sources, as shown in Figure 2.1. It is not expected that the noise effects of the Project would be measurable, audible and/or perceptible beyond the Extended Study Area.

2.2 Temporal Boundaries

The temporal boundaries of the study will span all phases of the Project, including the construction, operation and closure stages. Initial construction will begin with preparation of Cell 1, and waste receiving is projected to start in 2020. Subsequent construction of landfill cells will occur concurrent with landfilling of the active cell, with the closure of the completed cell.

2.3 Selection of Effects Assessment Indicators

The effects assessment indicators selected for the noise assessment and the rationale for selection of these indicators is presented in Table 2.1.

Table 2.1: Effects Assessment Indicators Selected for Noise and Vibration

Effect Assessment Indicator	Rationale for Selection
Daytime Noise Level	Project activities will occur during daytime. Noise created by these activities has the potential to affect nearby receptor locations.

2.4 Noise Effects Prediction Methodology

Amec Foster Wheeler has completed an assessment of the potential noise effects of this proposed Project in accordance with the applicable Ministry of the Environment and Climate Change (MOECC) noise assessment criteria.

A computer noise prediction modelling package (CadnaA), developed by DataKustik GmbH and accepted by the MOECC for use in Ontario, was used to predict noise levels for this Project. The model algorithms are based on the ISO 9613 standard (ISO, 1996a; ISO 1996b). The model accounts for many factors when calculating the resultant noise level at a receptor including, but not necessarily limited to, the following:

- Source sound levels;
- Source directivity;
- Distance attenuation;
- Source-receptor geometry including heights and elevations;
- Barrier effects of builds and surrounding topography;
- Ground and air (atmospheric) attenuation; and
- Meteorological effects on noise propagation.

Noise source emissions are most generally characterized by the sources' associated octave band sound power spectrum. Other parameters including building dimensions, frequency of operation, hours of operation, and enclosure attenuation ratings also define the nature of noise emissions.

The ISO 9613 prediction method is typically conservative, with respect to the effect of meteorological conditions, as it assumes that all receptors are downwind from the noise source or that a moderate ground based temperature inversion exists.

Noise levels have been predicted and assessed over an averaging time period of one hour, using the energy equivalent noise level (L_{eq}) as required by the applicable MOECC guidelines. Noise levels were modelled exclusively for the daytime period (07:00 – 19:00) as the Project activities are expected during daytime only. The predictable worst-case site noise impact (e.g., all equipment operating simultaneously) with onsite truck hauling was modelled and assessed.

2.5 Sensitive Receptors

For the purpose of this assessment, five representative points of reception (POR) surrounding the Project have been identified within the Site-vicinity Study Area. It is expected that, due to the effects of distance attenuation, the sound levels at locations farther away from the site than the selected receptors will be lower. The PORs that have been identified and considered in this assessment are listed in Table 2.2 and they are shown in Figure 2.2.

Table 2.2: Sensitive Receptors

Receptor Description	Receptor ID	UTM X-Coordinate	UTM Y-Coordinate
House on East (North side of Rockley Road)	POR01	597,255	5,262,533
House on South (South side of Rockley Road)	POR02	597,122	5,262,388
House on East (884048 Hwy 65)	POR03	597,796	5,263,141
House on Northeast (884114 Hwy 65)	POR04	597,338	5,263,591
House on North (on Petes Dam Road)	POR05	596,798	5,264,013

Note: UTM Reference System WGS 17T.

The receptor height considered for all PORs is at 4.5 metres (m) above grade as this represents the worst-impacted location for all of the receptors (i.e., the highest window level for a two-storey house).

2.6 Applicable Criteria

The MOECC “Noise Guidelines for Landfill Sites (draft) Oct 1998” is applicable to the the Project site. The guideline stipulates a daytime (7:00 am and 7:00 pm) noise criterion of 55 dBA and a nighttime (7:00 pm and 7:00 am) noise criterion of 45 dBA at receptor locations. These sound exposure limits apply to all receptors, in any worst-case hour of operation at the landfill. The limits provided in the MOECC guideline can be superseded and replaced with the existing background sound levels. To use of the existing background levels, as the sound level limits, the proponent is required to establish that the existing background levels are consistently higher, than the MOECC sound level limits, due to other activities in the area such as road traffic and/or other industries.

Background sound level measurements were not completed for this project and thus the MOECC sound level limits were used for assessment. The landfill is expected to operate during daytime hours (07:00 – 19:00) and therefore was assessed with the daytime criterion of 55 dBA.

2.7 Noise Sources

Noise is generated from a variety of activities occurring at the Project site. These activities include construction of the Cell 1 base and associated perimeter access roads/drainage ditches (Phase 1); deposition and compaction of waste materials, bulldozing, and grading activities at the working face of the active cell along with excavating, loading and transporting of clean cover materials to the working face of the active cell from future cells (Phase 2); and closure of Cell 5 and final capping (Phase 3). The post-closure stage of the Project (Phase 4) is considered as insignificant, from a noise perspective, as there are no major activities during this phase, other than the post-closure monitoring.

The activities and noise sources will move from cell to cell as the Project progresses during Phase 2 and they overlap between construction, operation and closure stages of the Project. Therefore, five operation scenarios are assessed for this phase (Phase 2a through 2e).

For the purpose of this noise impact assessment, it is assumed that the construction of the proposed landfill expansion will begin from the south end of the site (Cell 1). The Project is expected to progress sequentially from Cell 1 through Cell 5 (i.e., south to north). Noise sources considered for each phase are listed in Table 2.3 along with their corresponding sound power levels.

Table 2.3: Noise Source Summary

Noise Source Description	Source ID	Sound Power Level (dBA)	Sound Characteristics	Noise Control
Waste Compactor	C	108	Steady	None
Dozer	D	109	Steady	None
Loader	L	107	Steady	None
Excavator	E	106	Steady	None
Articulated Truck Route – Cover Material	TR1	113	Steady	None
Waste Haul Truck Route	TR2	113	Steady	None

Note: [1] Sound power levels taken from DEFRA construction equipment database.

Noise source locations for various phases of the Project are shown in Figures 2.3 through 2.9. To model predictable worst-case, it was assumed that the noise sources operate continuous and simultaneous.

3.0 PREDICTION OF EFFECTS

Project noise levels were modelled at all five of the representative noise receptors for each of the various phases of the Project. The major noise sources at the site include heavy equipment such as compactors, dozers, excavators and loaders, and on-site truck traffic. The activities and noise sources are expected to move from cell to cell as the Project progresses. The prediction of effects for Phase 2 was completed for five operational scenarios as the activities move sequentially from Cell 1 through Cell 5 (i.e., south to north). No noise mitigation is proposed or considered for this noise impact assessment.

The equipment (i.e., noise sources) distribution for various phases are shown in Figures 2.3 through 2.9. Noise levels were modelled using Cadna/A to determine the predicted noise level at each point of reception listed in Table 2.2. A worst case one-hour L_{eq} noise level, in dBA, was predicted at all of the representative receptors which was based on the predictable worst-case (i.e., all equipment operating simultaneously in any phase) and was predicted for each of the various phases of the Project.

The atmospheric conditions used in the model were 10 degrees Celsius and 70% relative humidity. A ground absorption coefficient of 0.7 was used in the noise model. Two round trips were considered for the truck routes in any one hour period and a truck speed of 20 kilometres per hour (km/hr) was considered in the assessment. Conservatively, no operational duty cycles and therefore all sources were considered to operate simultaneously.

Noise effects have been assessed over a time period of one hour, using the energy equivalent noise level (L_{eq}) as required by the applicable MOECC guidelines. Noise levels are modelled and assessed for the daytime period (07:00 – 19:00) as the landfill operations are not expected to extend over the evening and night-time periods.

The predicted daytime Project noise levels for various phases of the Project are presented in Table 3.1 and the noise contours are presented in Figures 3.1 through 3.7.

Table 3.1: Daytime Project Noise Levels at Sensitive Receptors

Receptor ID	Predicted Sound Level (dBA)						
	Phase 1	Phase 2a	Phase 2b	Phase 2c	Phase 2d	Phase 2e	Phase 3
POR01	46	50	48	47	44	42	42
POR02	48	50	49	47	44	42	39
POR03	31	36	35	36	36	34	33
POR04	31	35	36	37	38	37	35
POR05	28	35	37	38	39	38	36

Daytime operational noise levels at the receptor locations are predicted to be below the MOECC noise criteria limit of 55 dBA. However, they may be audible at receptors in close proximity of the Project (e.g., POR01 and POR02). The post-closure stage of the Project (Phase 4) is considered as insignificant, from a noise perspective, as there are no major activities expected during this phase, other than the post-closure monitoring.

4.0 CONCLUSIONS

Amec Foster Wheeler has completed a study of the potential noise effects of the Project as a TSD in support of the EA. The noise impact assessment considers significant noise activities at the Project site, noise sensitive receptors within the Site-vicinity Study Area, and the MOECC Noise Guidelines for Landfills.

For the purpose of this noise impact assessment, it is assumed that the construction of the proposed landfill expansion will begin from the south end of the site at Cell 1. The Project life is about 45 years and the Project is expected to progress in four phases sequentially from Cell 1 through Cell 5 (i.e., south to north): construction of Cell 1 base and associated perimeter roads and drainage ditches (Phase 1); landfilling of active cells (1 through 5) coupled with development of Cells 2 through 5 and progressive closure of Cells 1 through 4 (Phase 2); closure of Cell 5 and final capping and cover (Phase 3); and post-closure (Phase 4).

Noise levels are assessed for the daytime period (07:00 – 19:00) as the activities at the site are expected during daytime only. The Project sound levels at the modelled receptor locations for Phase 1 through 3 are expected to meet the applicable MOECC criteria limit for landfills. However, they may be audible at receptors at close proximity of the Project (e.g., POR01 and POR02). The post-closure phase of the Project (Phase 4) is considered as insignificant, from a noise perspective, for this assessment as there are no major activities expected during this phase, other than monitoring activities. No additional noise mitigation is required for the Project.

5.0 CLOSING

This TSD was prepared for the City of Temiskaming Shores for specific purpose addressed herein. The quality of information, conclusions and estimates contained herein is consistent with the level of effort involved in Amec Foster Wheeler's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources, and iii) the assumptions, conditions and qualifications set forth in the report. This TSD is intended to be used by the City of Temiskaming Shores only, subject to the terms and conditions of its contract with Amec Foster Wheeler. Any other use of, or reliance on, this report by a third party other than those expressly noted in this report is at that party's sole risk. This TSD has been prepared in accordance with generally accepted engineering practice. No other warranty, expressed or implied, is made.

Written by: Mohammed Salim, P. Eng., Senior Environmental Noise Lead
Amec Foster Wheeler Environment & Infrastructure

Signature: _____ Date: August 23, 2016

Reviewed by: Buddy Ledger, P. Eng., Senior Acoustics Engineer
Amec Foster Wheeler Environment & Infrastructure

Signature: _____ Date: August 23, 2016

6.0 REFERENCES

AMEC Earth & Environmental. 2010. Feasibility Study for Development of a Long-Term Landfill Disposal Strategy.

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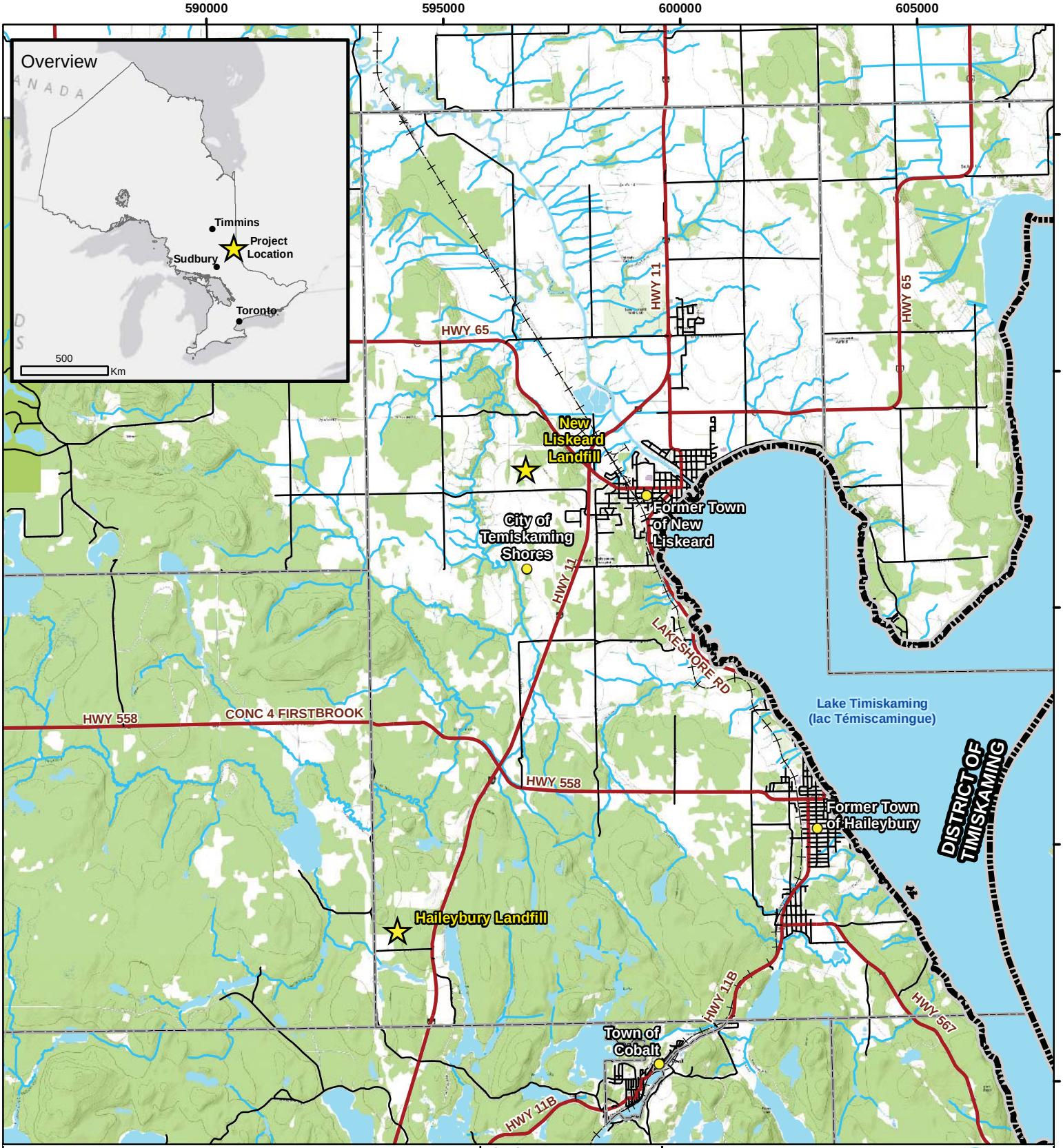
FIGURES



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LEGEND

- Landfill Locations
- Regional Communities
- Upper Tier Municipality Boundary
- Lower Tier Municipality Boundary
- Highway / Major Roads
- Local Roads
- Railway
- Watercourse
- Waterbody
- Wooded Area

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Temiskaming Shores

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TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

General Site Location

Datum & Projection: NAD 1983 UTM Zone 17N

0 2 4 6 8 Kilometres

N W E S

PROJECT N°:TY910491 | **FIGURE: 1.1**

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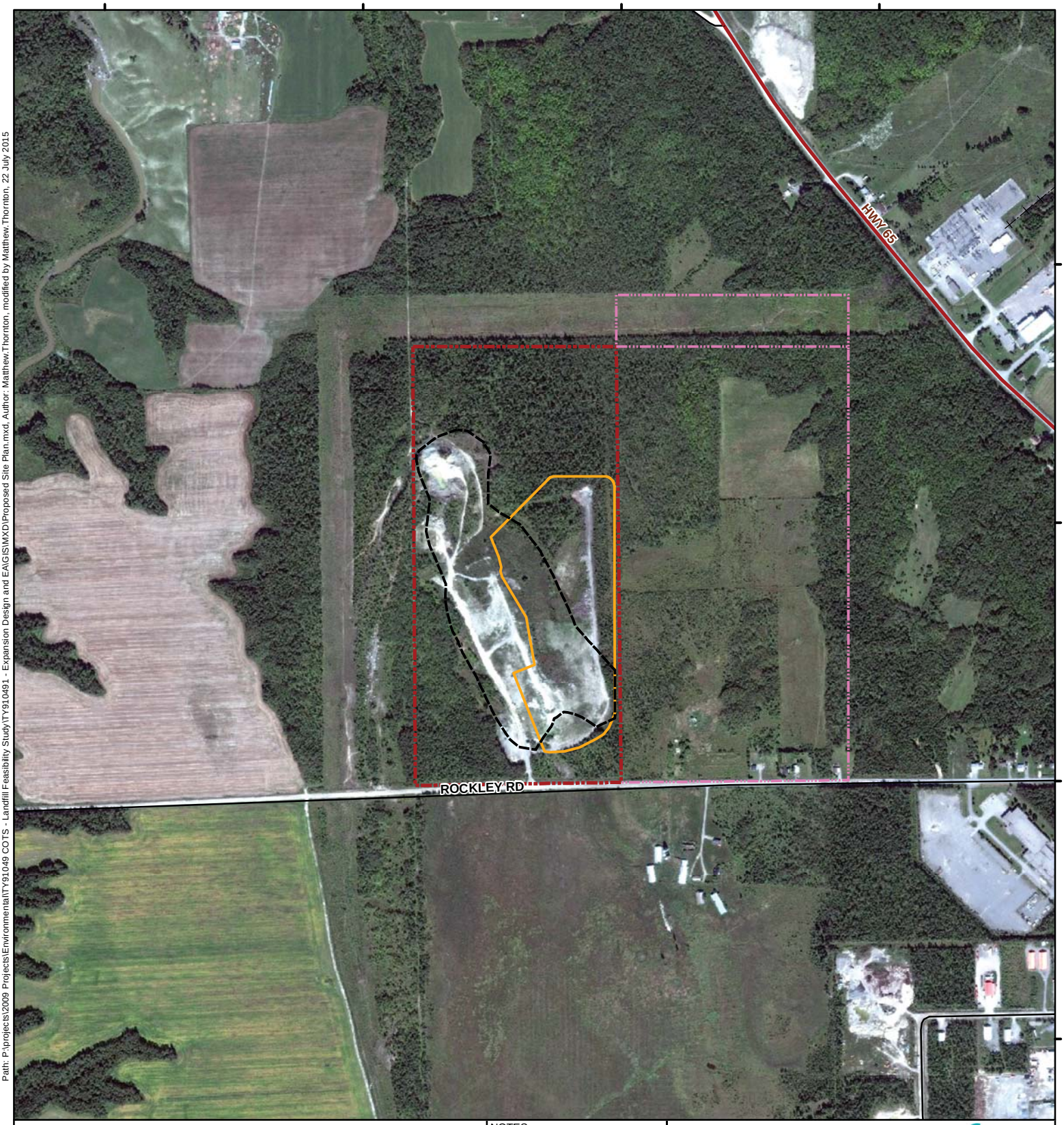

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LEGEND

- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)
- Highway / Major Roads
- Local Roads
- Railway

0 0.25 0.5 0.75 1 Kilometres

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

N W E S

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NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Proposed Site Plan

PROJECT N^{o}:TY910491	**FIGURE: 1.2**
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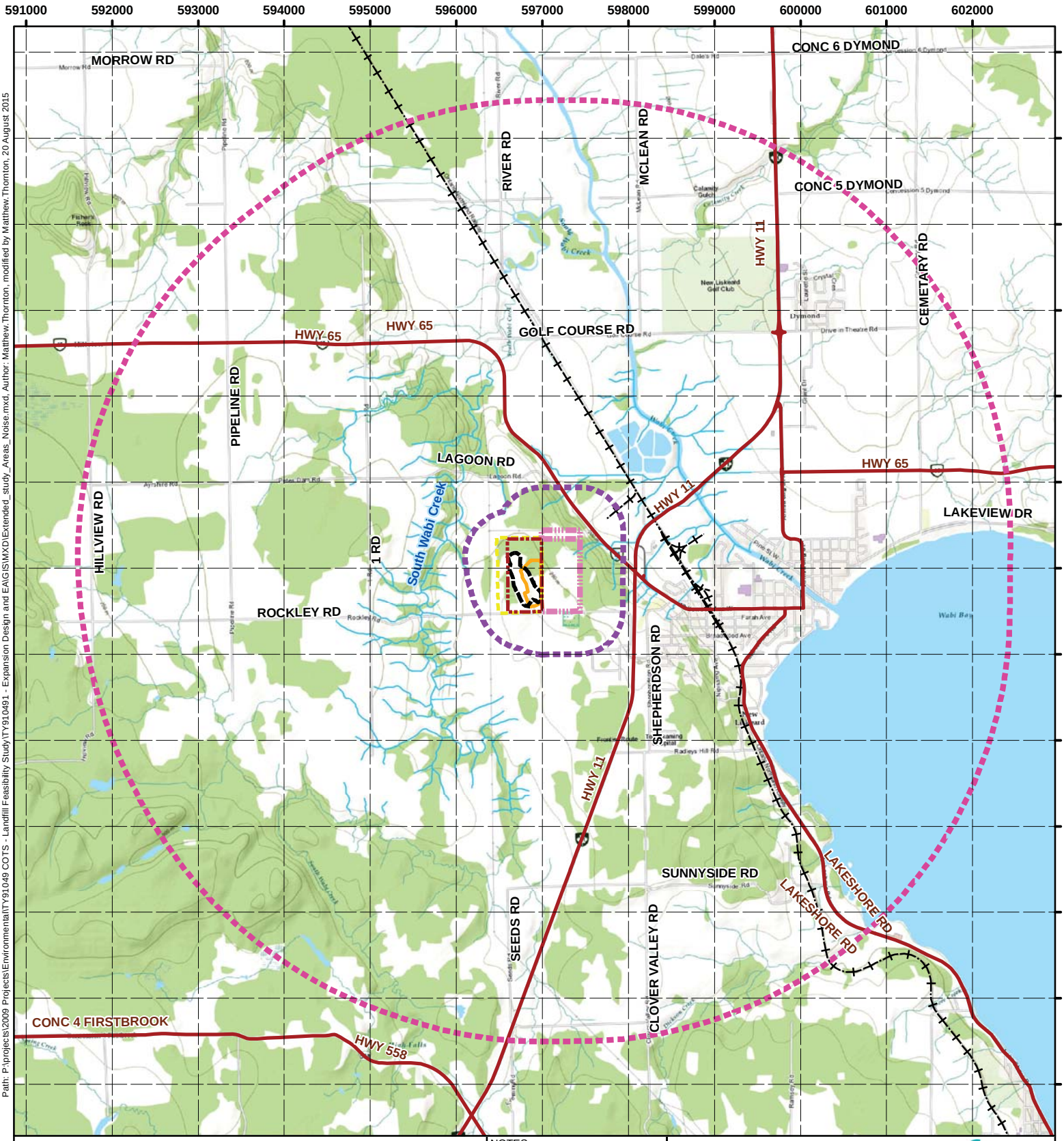

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LEGEND

- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)
- Extended Study Area
- Noise Study Area (5 km Buffer)
- Site Vicinity (500 m Buffer)
- Highway / Major Roads
- Railway
- Permanent Watercourse
- Wetland

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
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Temiskaming Shores

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TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Project Study Areas

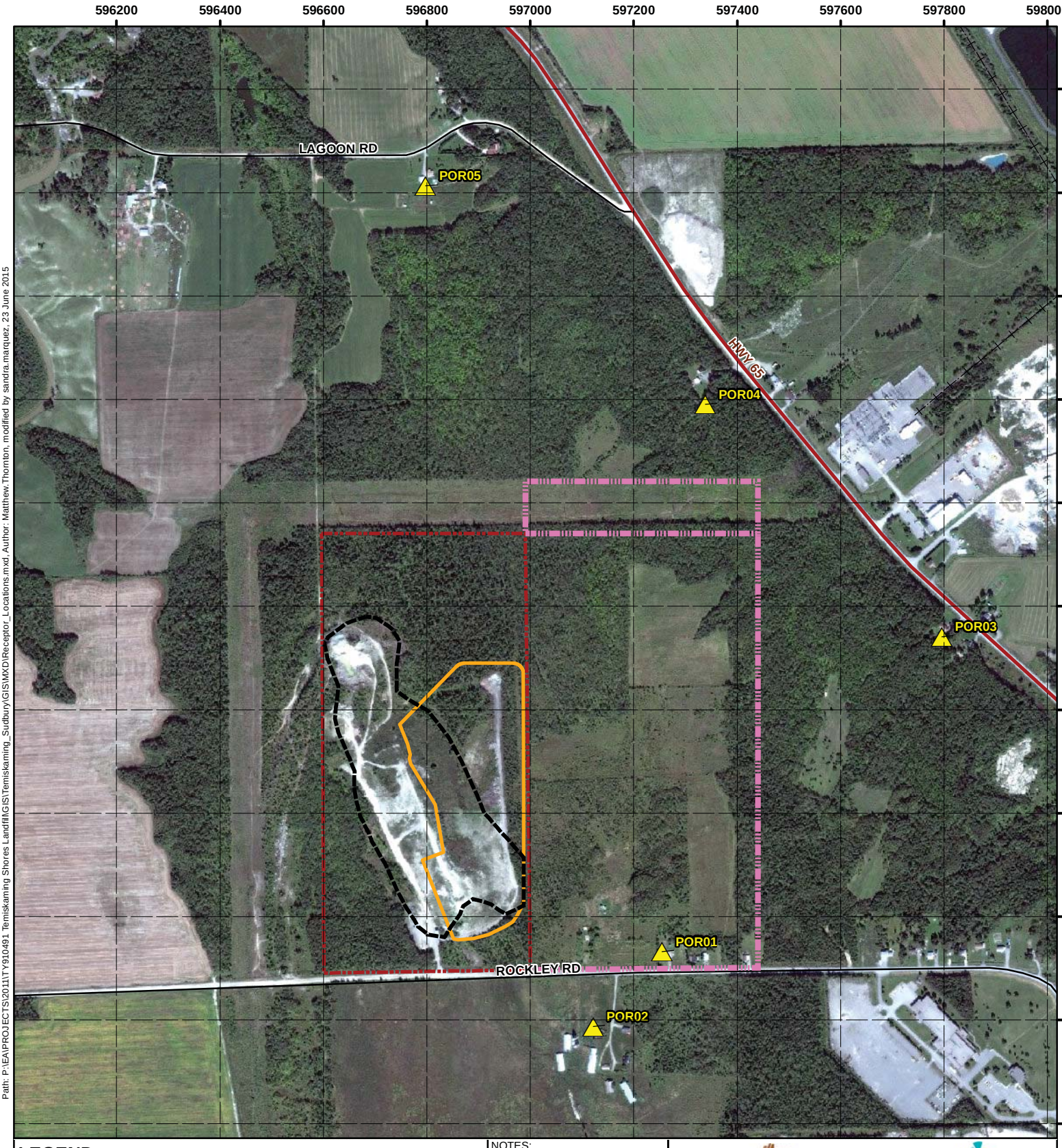
Datum & Projection: NAD 1983 UTM Zone 17N

0 1.5 3 4.5 6 Kilometres

N W E S

PROJECT N°:TY910491 | **FIGURE: 2.1**

SCALE: 1:60,000 | DATE: August 2015



Path: P:\EA\PROJECTS\2011\TY910491 Temiskaming Shores Landfill\GIS\Temiskaming_Sudbury\GIS\MXD\Receptor_Locations.mxd, Author: Matthew.Thornton, modified by sandra.marquez, 23 June 2015

LEGEND

- Receptor (labelled with ID)
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

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TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Points of Reception Locations

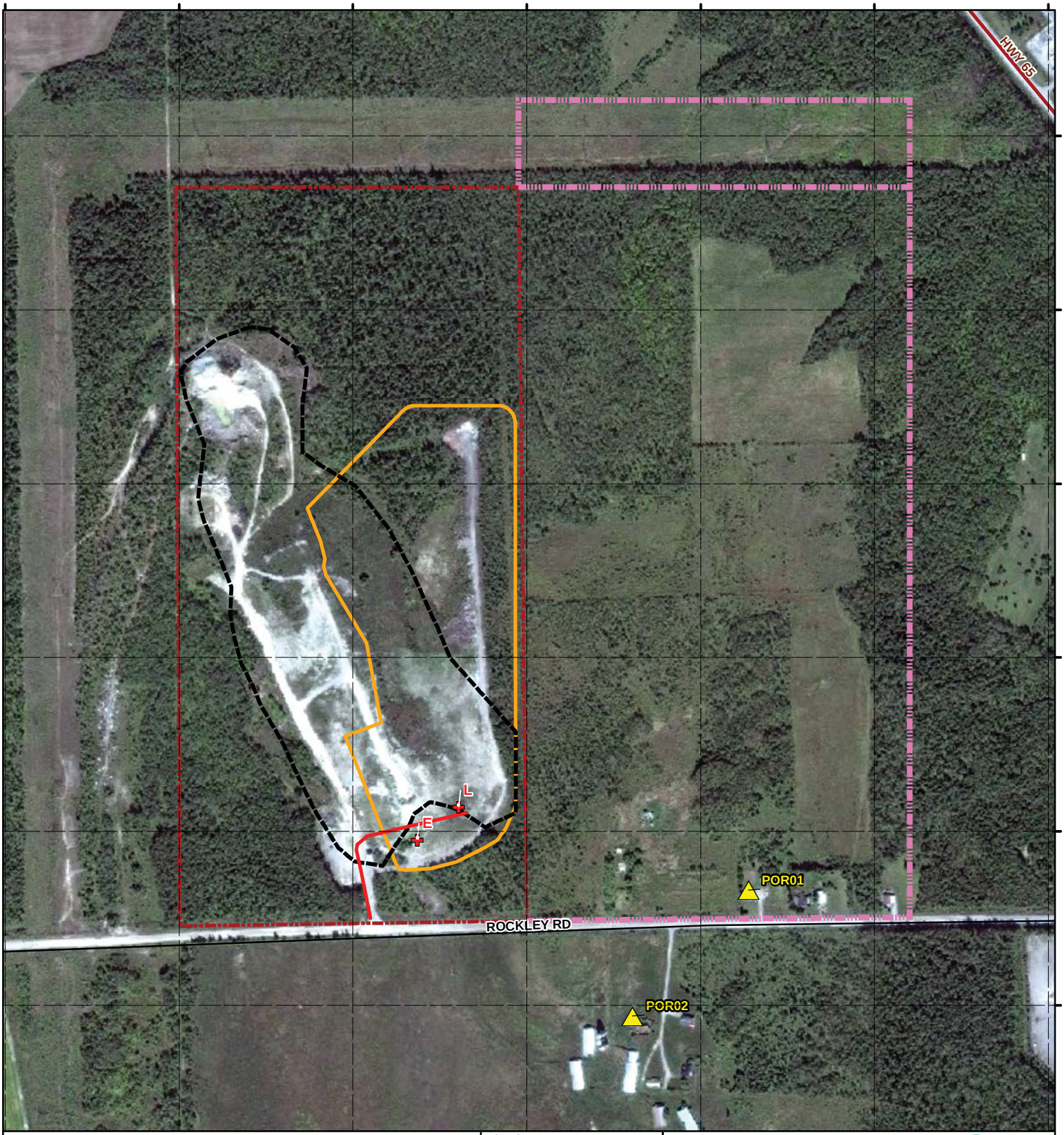
Datum & Projection: NAD 1983 UTM Zone 17N

0 0.2 0.4 0.6 0.8 1 Kilometers

N W E S

PROJECT N°:TY910491 | **FIGURE: 2.2**

SCALE: 1:10,000 | DATE: August 2015



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LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

0 100 200 300 400 500 Meters

N W E S

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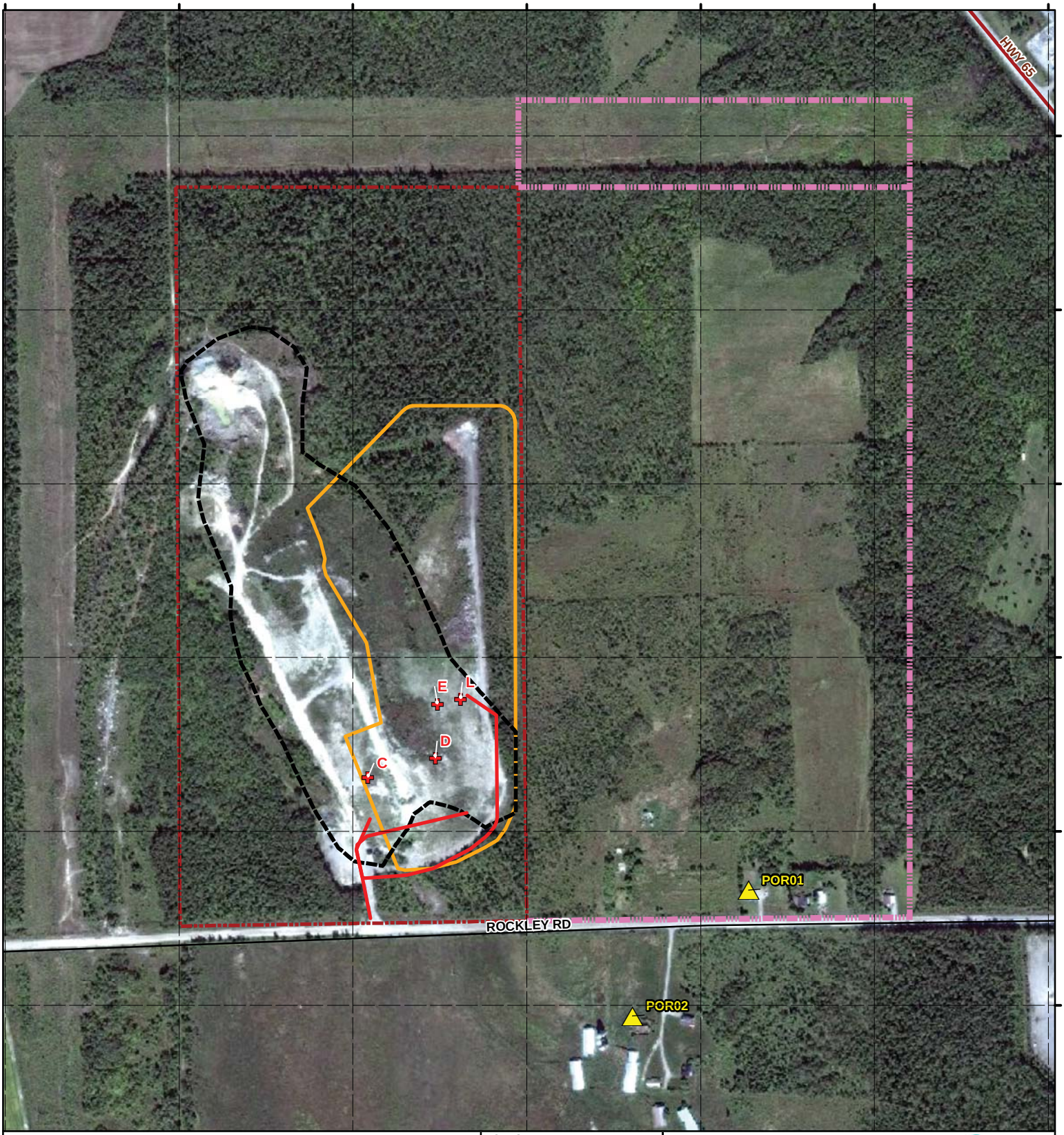
Significant Noise Source Location (Phase 1)

PROJECT N^{o}:TY910491	**FIGURE: 2.3**
SCALE: 1:6,000	DATE: September 2015



Path: P:\projects\2009 Projects\Environmental\TY91049 COTS - Landfill Feasibility Study\TY910491 - Expansion Design and EA\GIS\MXD\Significant_Noise_Source_Phase_2a.mxd, Author: Matthew.Thornton, modified by Matthew.Thornton, 10 September 2015

LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

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TECHNICAL SUPPORT DOCUMENT: NOISE
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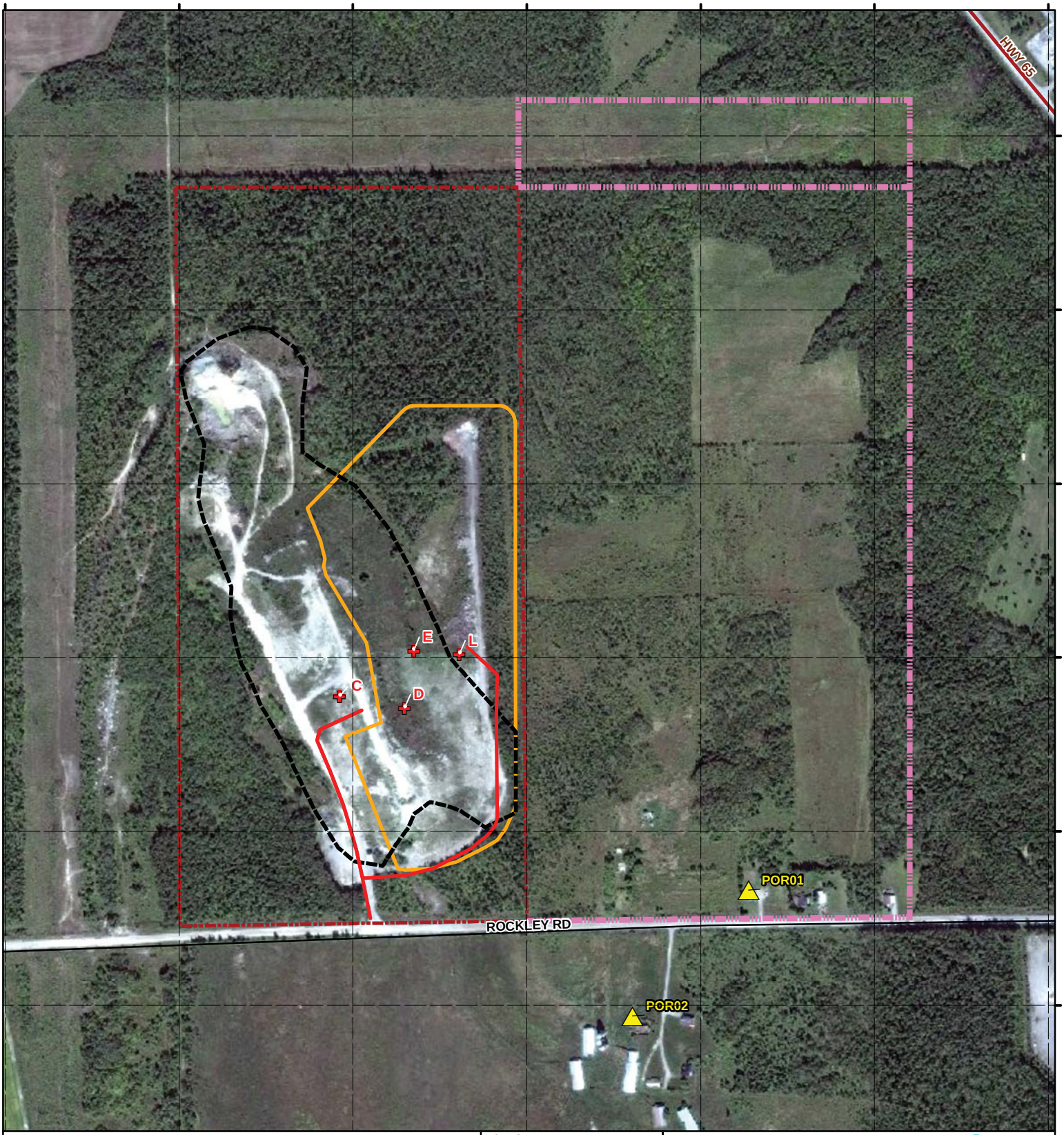
Significant Noise Source Location (Phase 2a)

Datum & Projection: NAD 1983 UTM Zone 17N

0 100 200 300 400 500 Meters

N W E S

PROJECT N°:TY910491	**FIGURE: 2.4**
SCALE: 1:6,000	DATE: September 2015



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LEGEND

- Receptor (labelled with ID)
- Point_Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

0 100 200 300 400 500 Meters

N W E S

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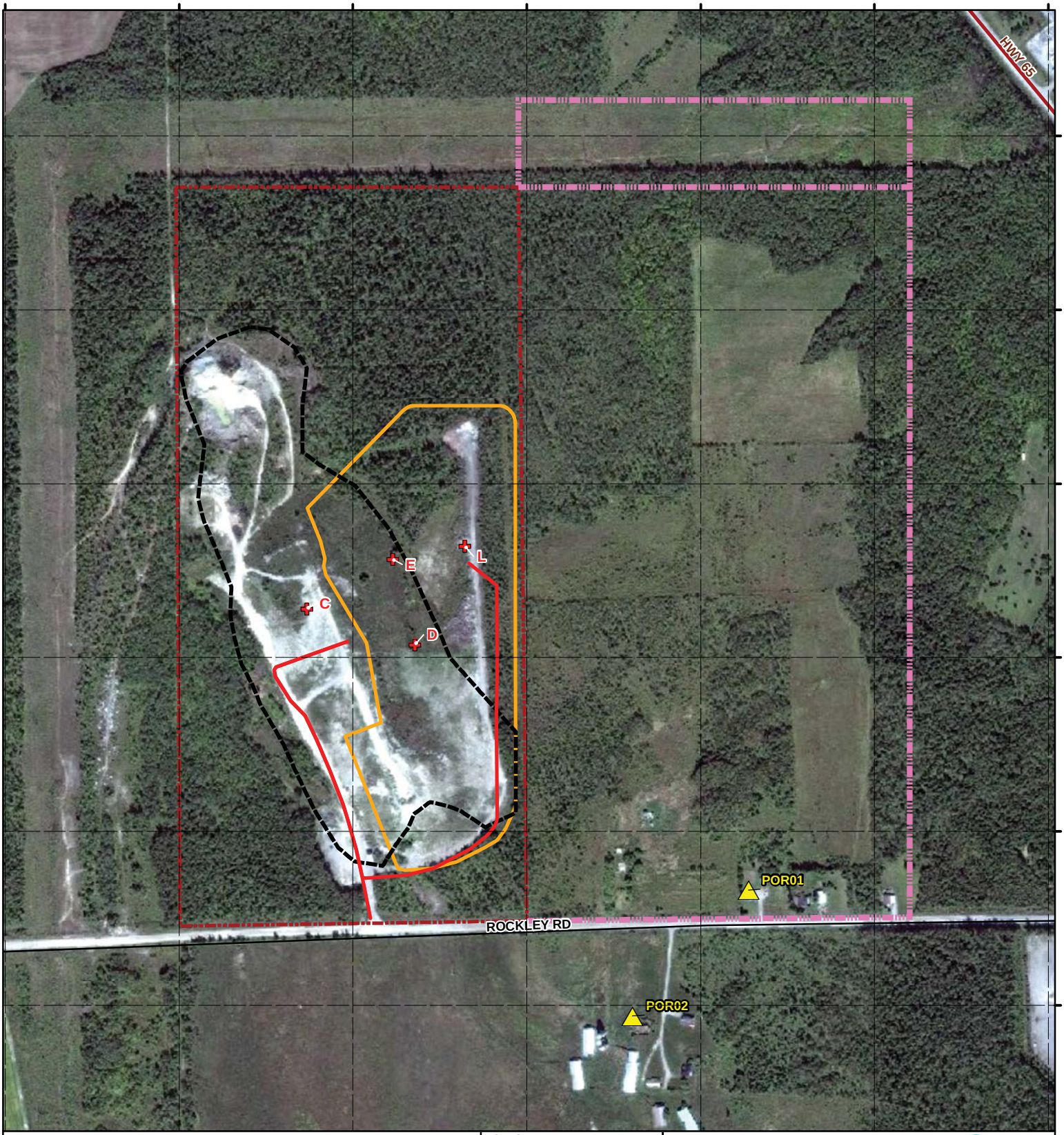
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Significant Noise Source Location (Phase 2b)

PROJECT N^{o}:TY910491	**FIGURE: 2.5**
SCALE: 1:6,000	DATE: August 2015



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LEGEND

- Receptor (labelled with ID)
- Point_Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

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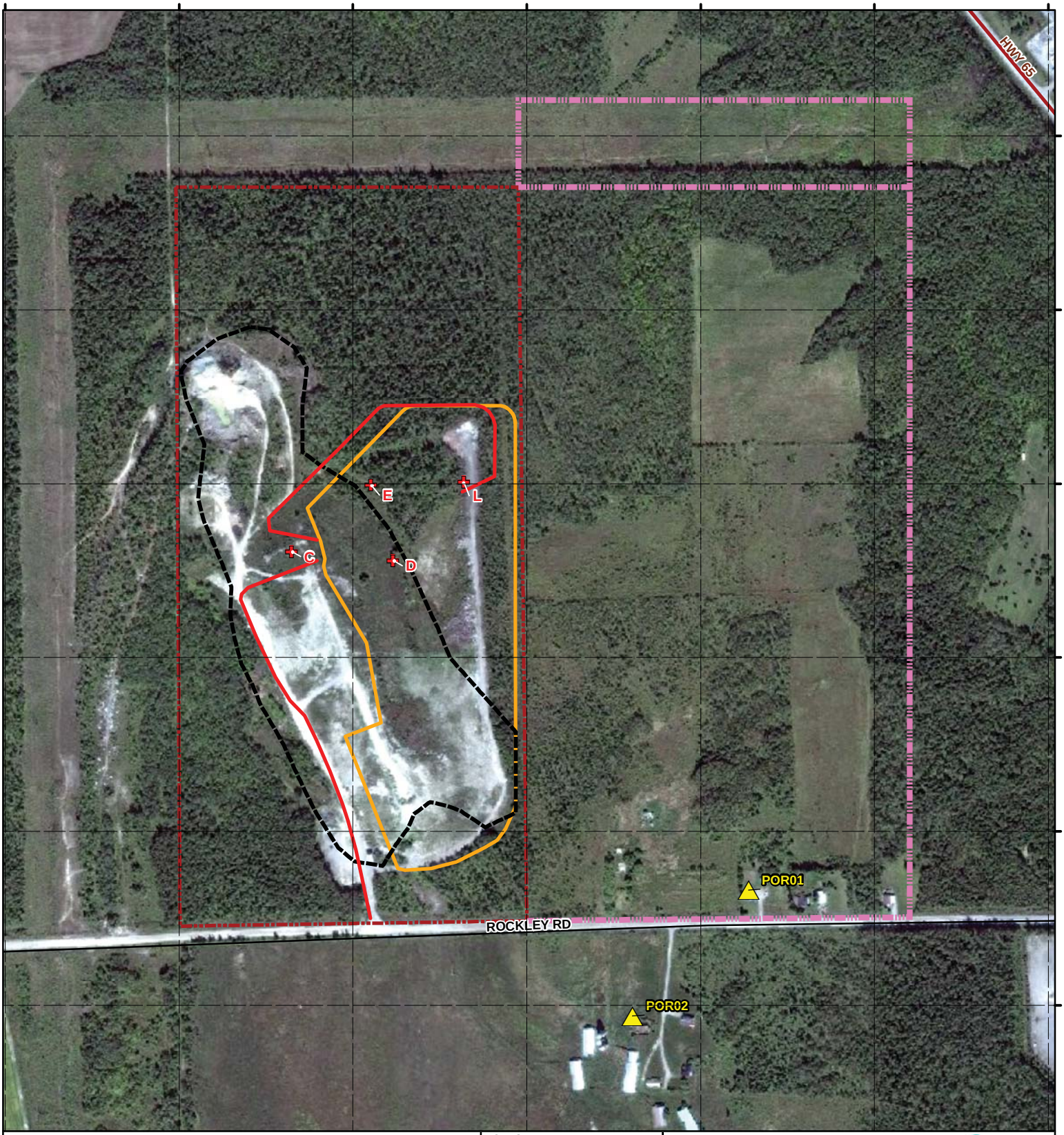
TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Significant Noise Source Location (Phase 2c)

PROJECT N°:TY910491	**FIGURE: 2.6**
SCALE: 1:6,000	DATE: August 2015



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LEGEND

- Receptor (labelled with ID)
- Point_Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

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TECHNICAL SUPPORT DOCUMENT: NOISE
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TEMISKAMNG SHORES ONTARIO

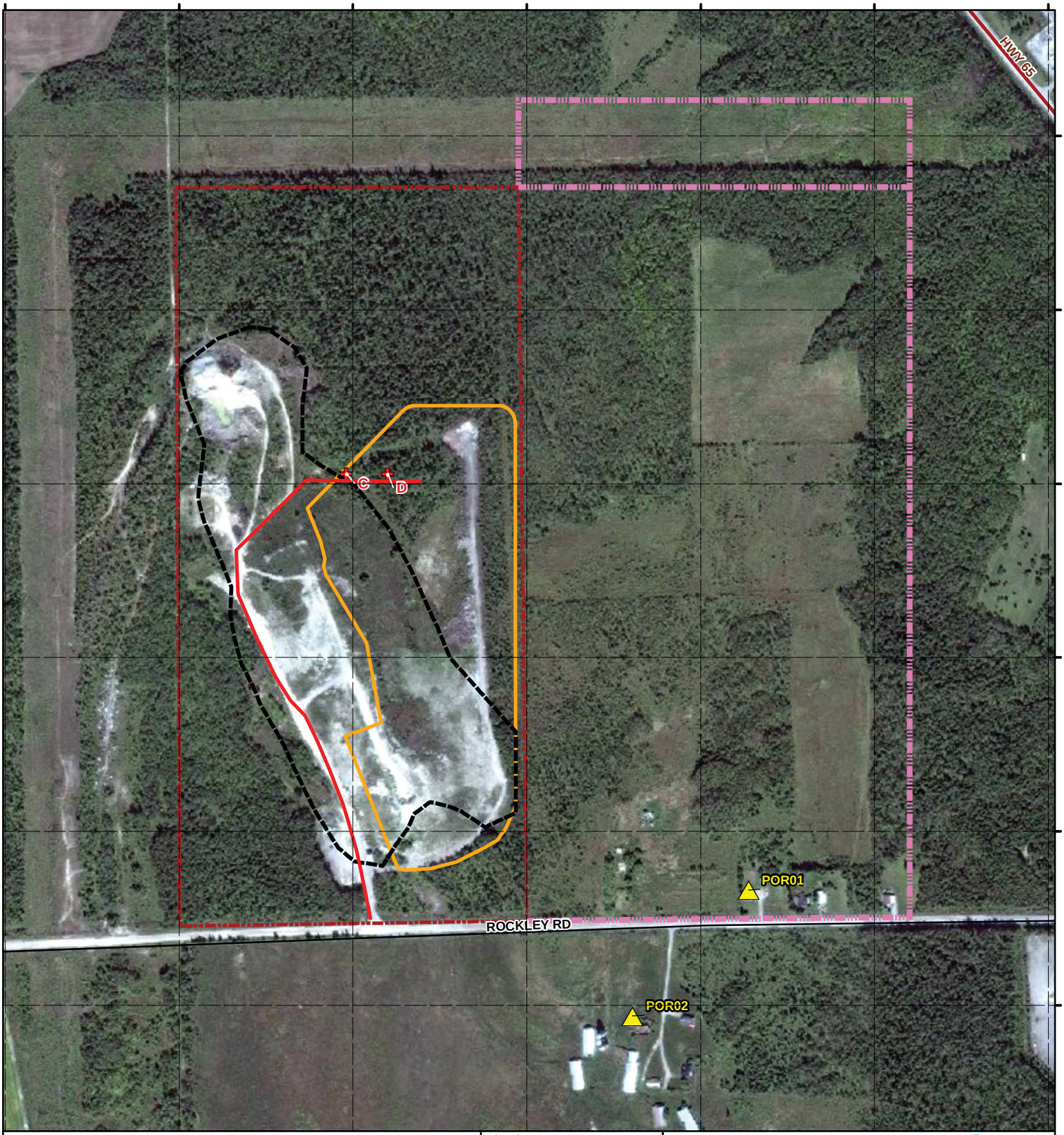
Significant Noise Source Location (Phase 2d)

Datum & Projection: NAD 1983 UTM Zone 17N

0 100 200 300 400 500 Meters

N W E S

PROJECT N°:TY910491	**FIGURE: 2.7**
SCALE: 1:6,000	DATE: August 2015



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LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

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TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

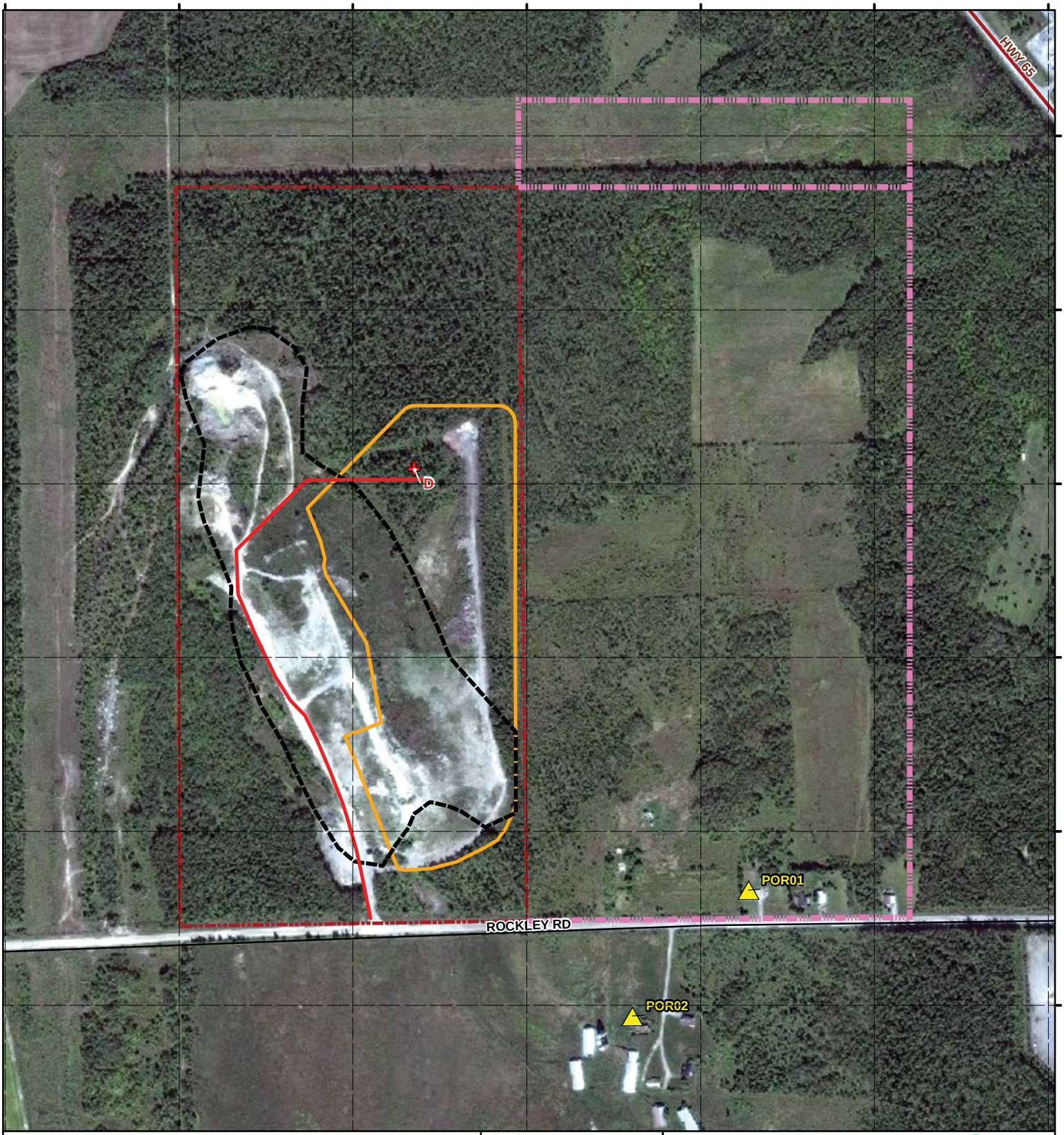
Significant Noise Source Location (Phase 2e)

Datum & Projection: NAD 1983 UTM Zone 17N

0 100 200 300 400 500 Meters

N W E S

PROJECT N°:TY910491	**FIGURE: 2.8**
SCALE: 1:6,000	DATE: September 2015



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LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

0 100 200 300 400 500 Meters

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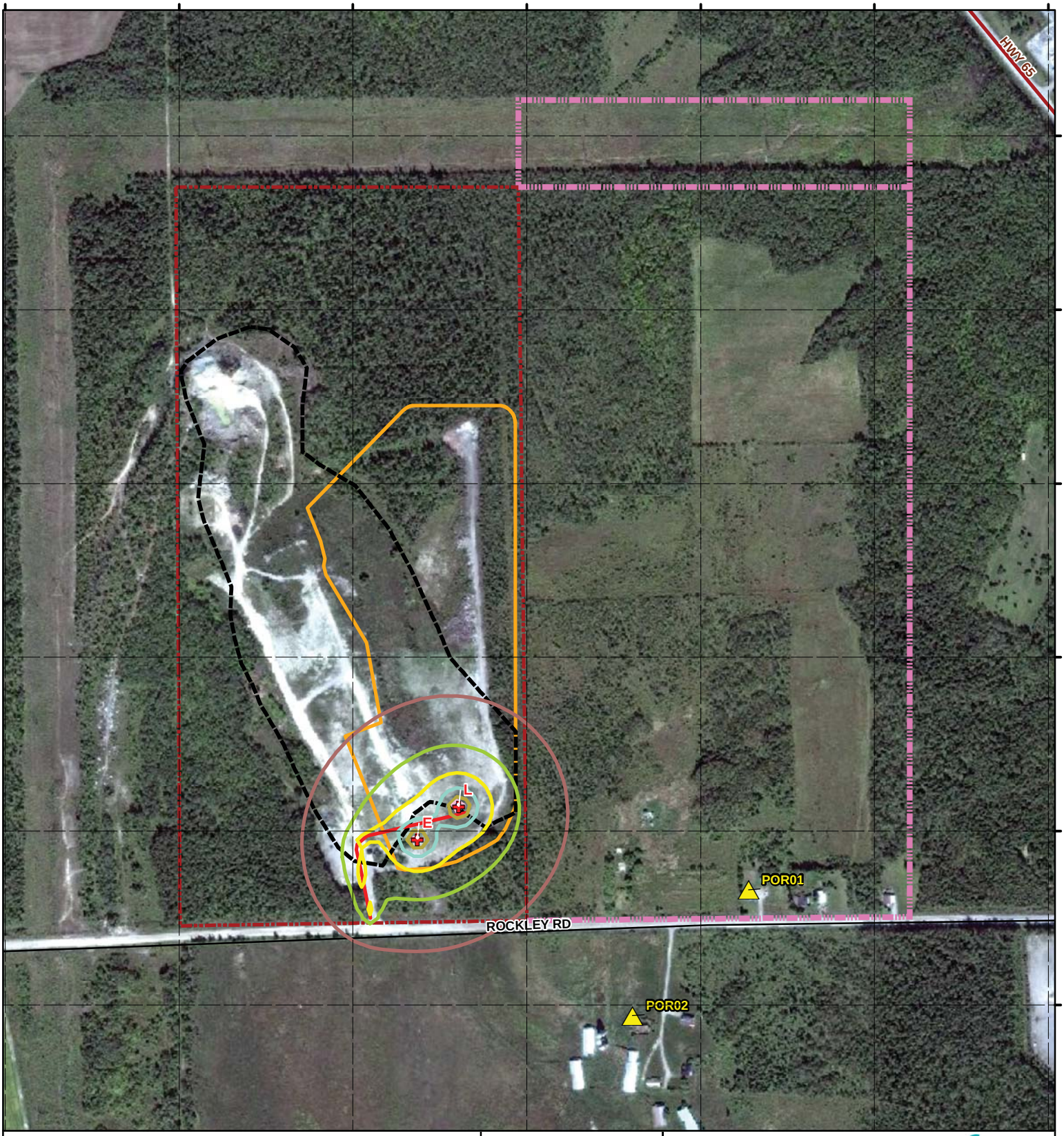
TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Significant Noise Source Location (Phase 3)

PROJECT N^{o}:TY910491	**FIGURE: 2.9**
SCALE: 1:6,000	DATE: September 2015



Path: P:\projects\2009 Projects\Environmental\TY910491 COTS - Landfill Feasibility Study\TY910491 - Expansion Design and EA\GIS\MXD\Daytime_Noise_Phase_1.mxd, Author: Matthew.Thornton, modified by Matthew.Thornton, 09 September 2015

LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

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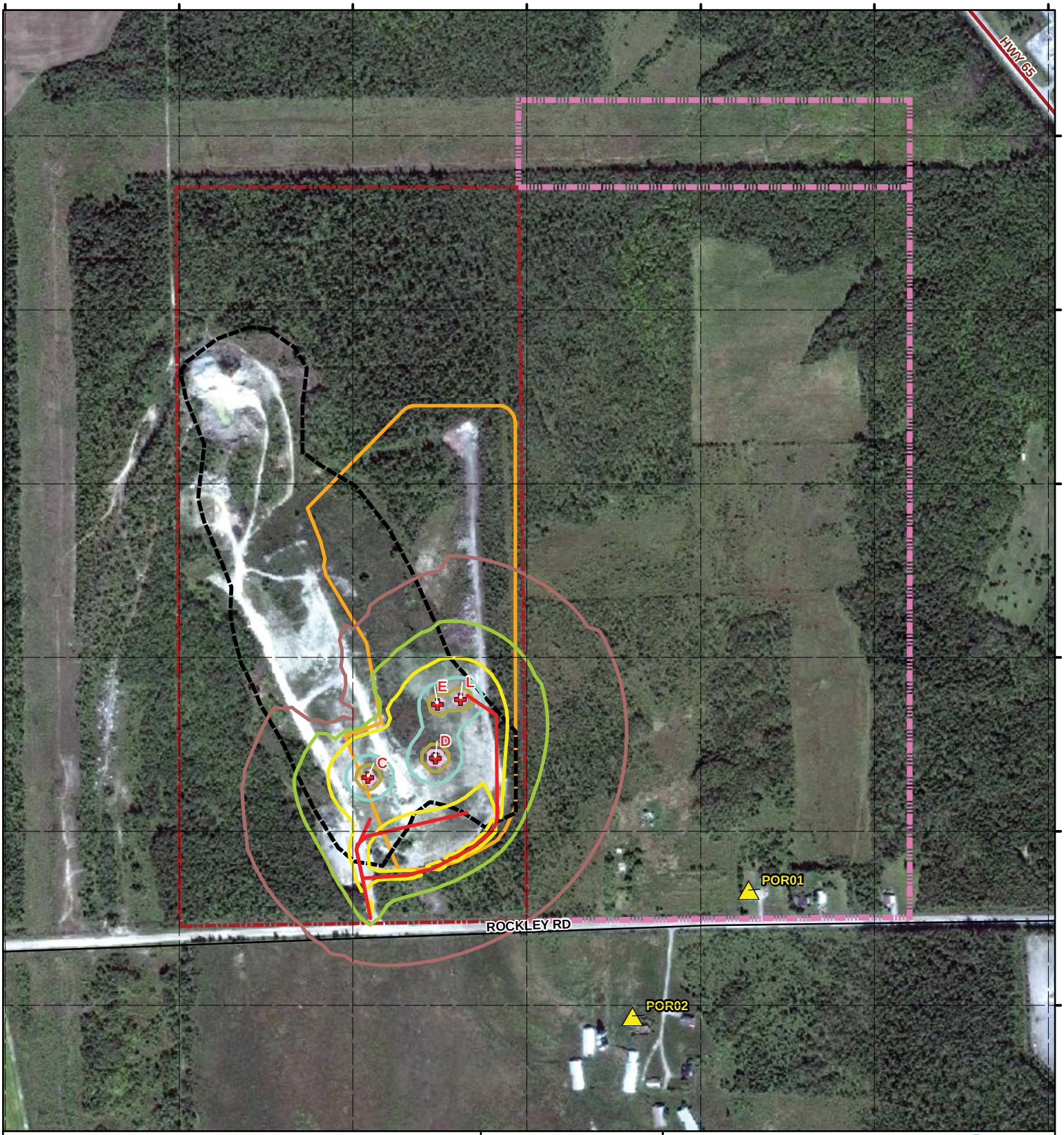
TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Daytime Noise Contours (Phase 1)

PROJECT N°:TY910491	**FIGURE: 3.1**
SCALE: 1:6,000	DATE: September 2015



Path: P:\projects\2009 Projects\Environmental\TY910491 COTS - Landfill Feasibility Study\TY910491 - Expansion Design and EA\GIS\MXD\Daytime_Noise_Phase_2a.mxd, Author: Matthew.Thornton, modified by Matthew.Thornton, 10 September 2015

LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

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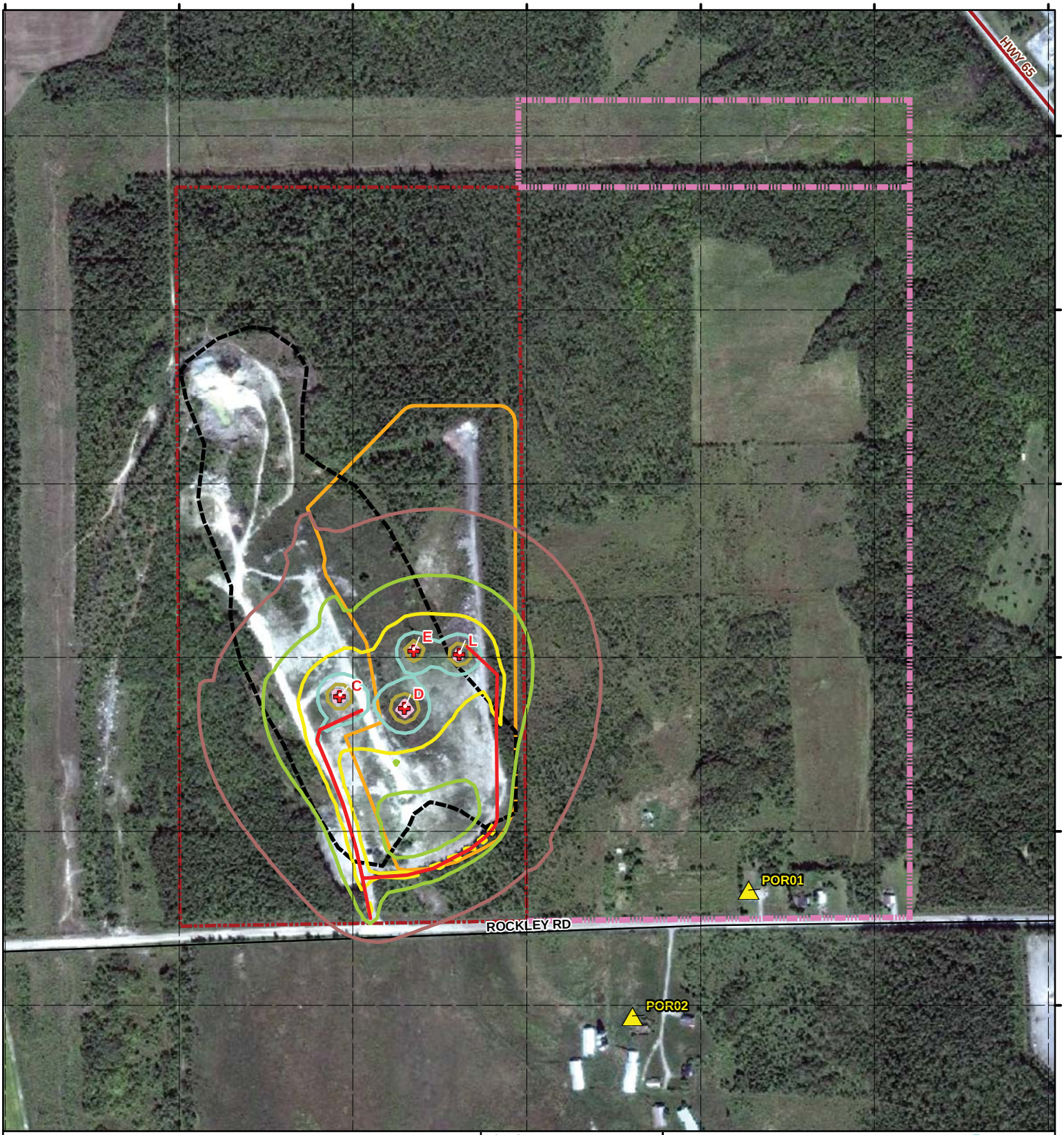
TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Daytime Noise Contours (Phase 2a)

PROJECT N^{o}:TY910491	**FIGURE: 3.2**
SCALE: 1:6,000	DATE: September 2015



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LEGEND

- Receptor (labelled with ID)
- Point_Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

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NEW WASTE MANAGEMENT CAPACITY
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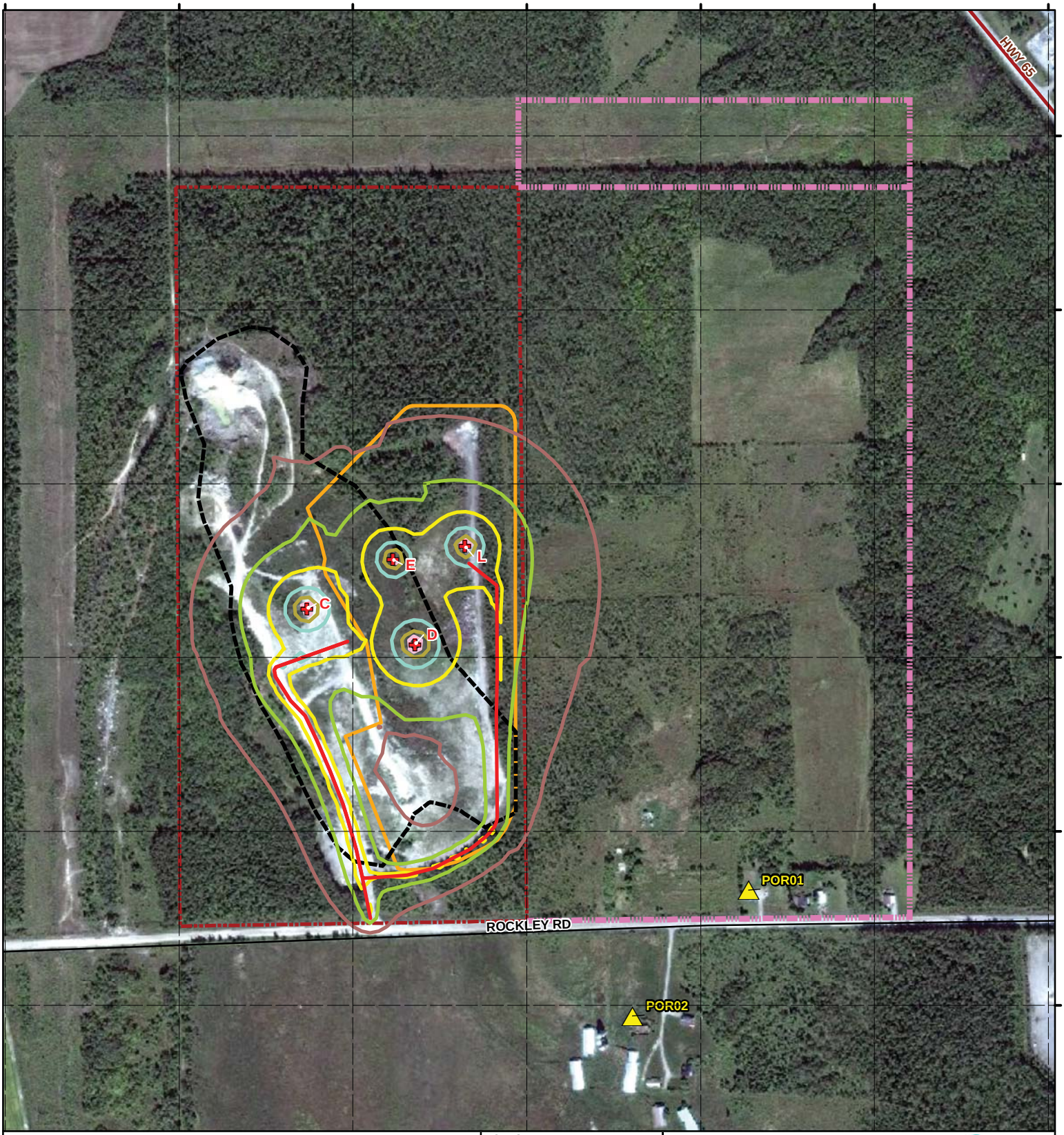
Daytime Noise Contours (Phase 2b)

PROJECT N°:TY910491	**FIGURE: 3.3**
SCALE: 1:6,000	DATE: August 2015



Path: P:\projects\2009 Projects\Environmental\TY91049 COTS - Landfill Feasibility Study\TY910491 - Expansion Design and EA\GIS\MXD\Daytime_Noise_Phase_2c.mxd, Author: Matthew.Thornton, modified by Matthew.Thornton, 30 June 2015

LEGEND

- Receptor (labelled with ID)
- Point_Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

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Daytime Noise Contours (Phase 2c)

PROJECT N°:TY910491	**FIGURE: 3.4**
SCALE: 1:6,000	DATE: August 2015

Path: P:\projects\2009 Projects\Environmental\TY91049 COTS - Landfill Feasibility Study\TY910491 - Expansion Design and EA\GIS\MXD\Daytime_Noise_Phase_2d.mxd, Author: Matthew.Thornton, modified by Matthew.Thornton, 19 August 2015

LEGEND

- Receptor (labelled with ID)
- Point_Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

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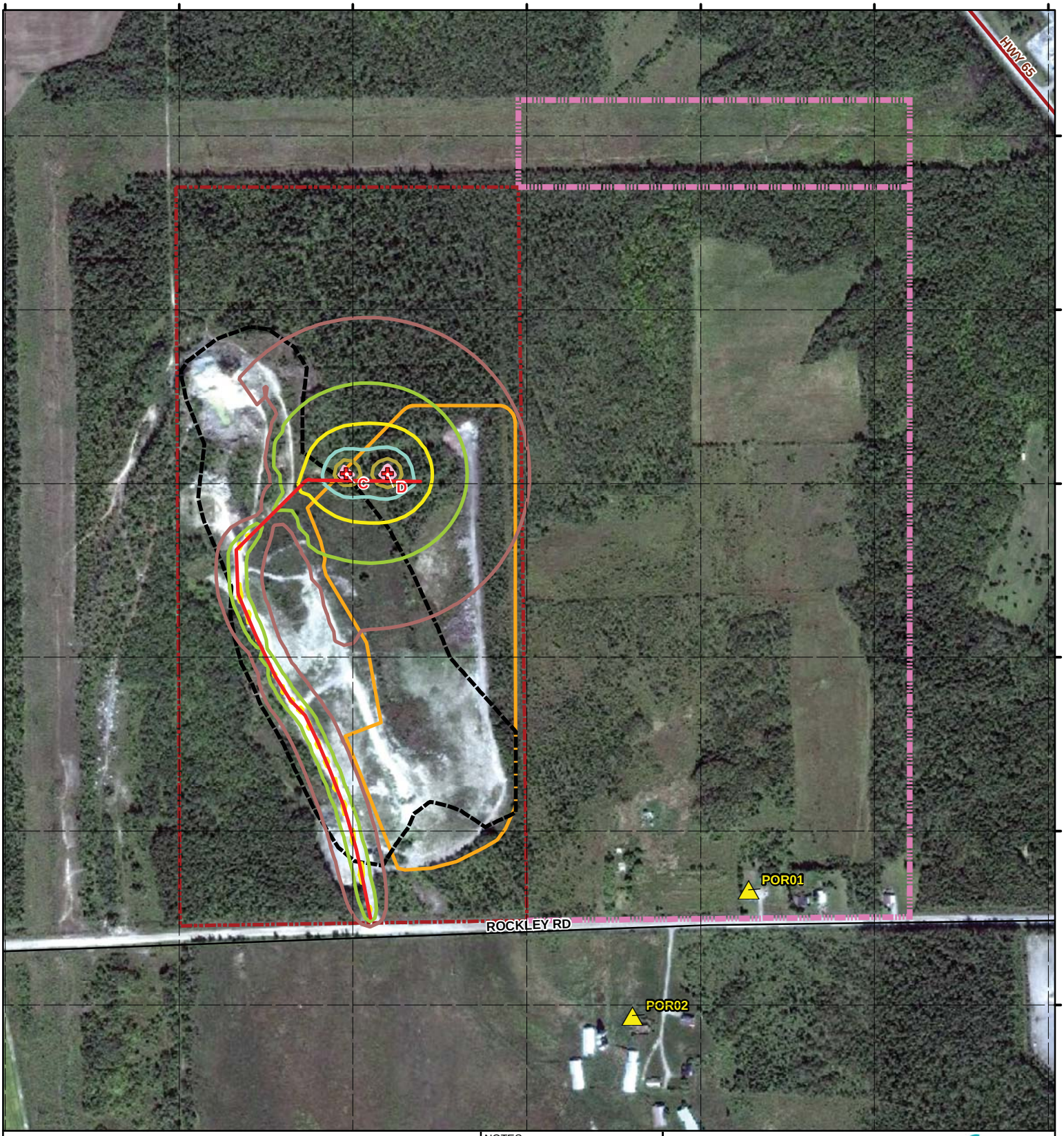
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Daytime Noise Contours (Phase 2d)

PROJECT N°:TY910491	**FIGURE: 3.5**
SCALE: 1:6,000	DATE: August 2015



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LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

N W E S

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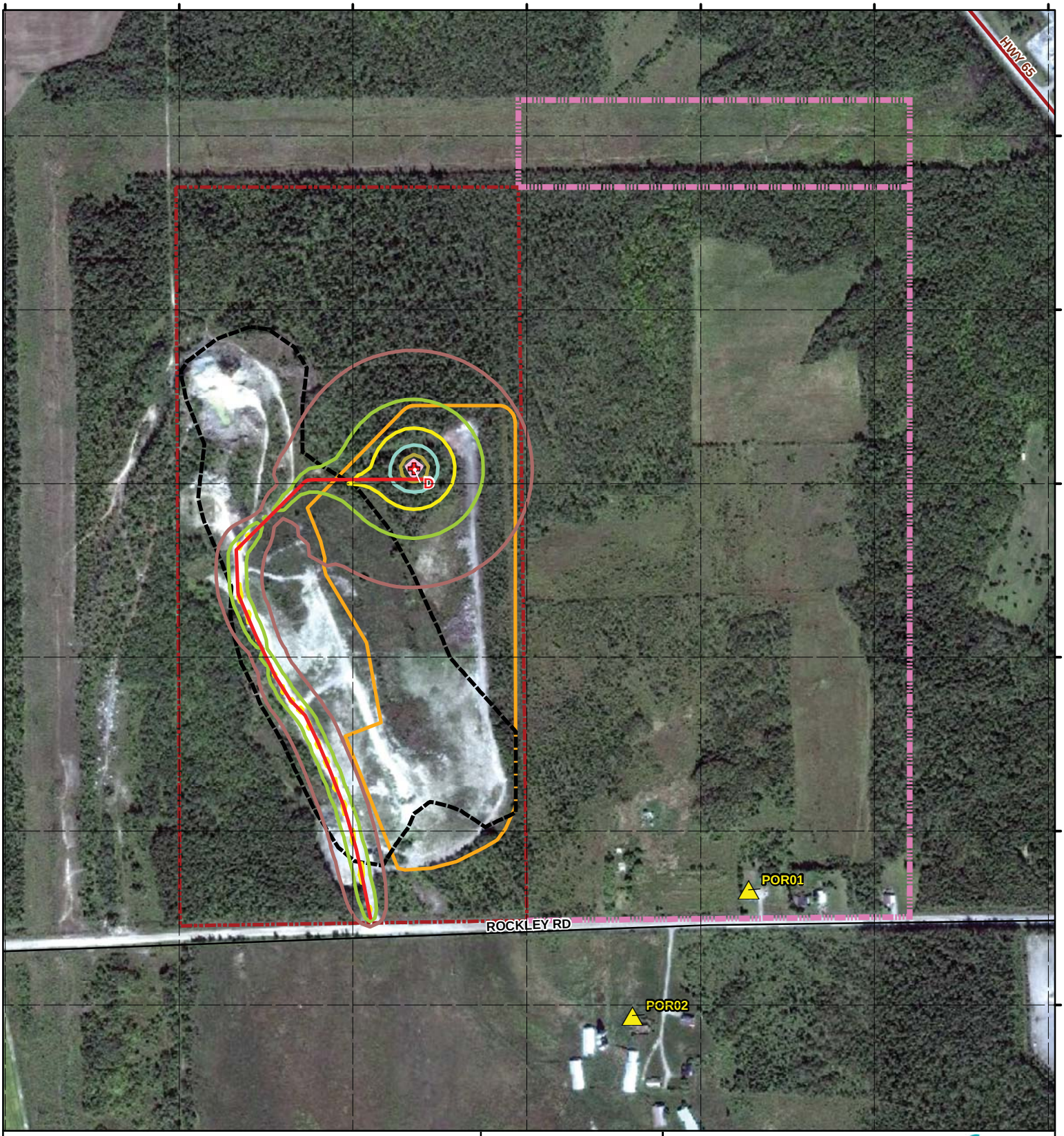
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Daytime Noise Contours (Phase 2e)

PROJECT N°:TY910491	**FIGURE: 3.6**
SCALE: 1:6,000	DATE: September 2015



Path: P:\projects\2009 Projects\Environmental\TY910491 COTS - Landfill Feasibility Study\TY910491 - Expansion Design and EA\GIS\MXD\Daytime_Noise_Phase_3.mxd, Author: Matthew.Thornton, modified by Matthew.Thornton, 10 September 2015

LEGEND

- Receptor (labelled with ID)
- Point Source
- Line Source
- Property Boundary
- Contaminant Attenuation Zone
- Highway / Major Roads
- Local Roads
- Approximate Domestic Solid Boundary
- Site (Proposed Landfill Expansion Area)

Daytime Operations dBA Contours

- >=55
- >=60
- >=65
- >=70
- >=75
- >=80
- >=85

0 100 200 300 400 500 Meters

NOTES:
- Background image extracted from ESRI World Topo Map.
- All base data on this map was extracted form Land Information
- Geonames extracted from Geobase.

Datum & Projection: NAD 1983 UTM Zone 17N

N W E S

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TECHNICAL SUPPORT DOCUMENT: NOISE
NEW WASTE MANAGEMENT CAPACITY
TEMISKAMNG SHORES ONTARIO

Daytime Noise Contours (Phase 3)

PROJECT N^{o}:TY910491	**FIGURE: 3.7**
SCALE: 1:6,000	DATE: September 2015

APPENDIX A

GLOSSARY OF COMMONLY USED NOISE TERMINOLOGY

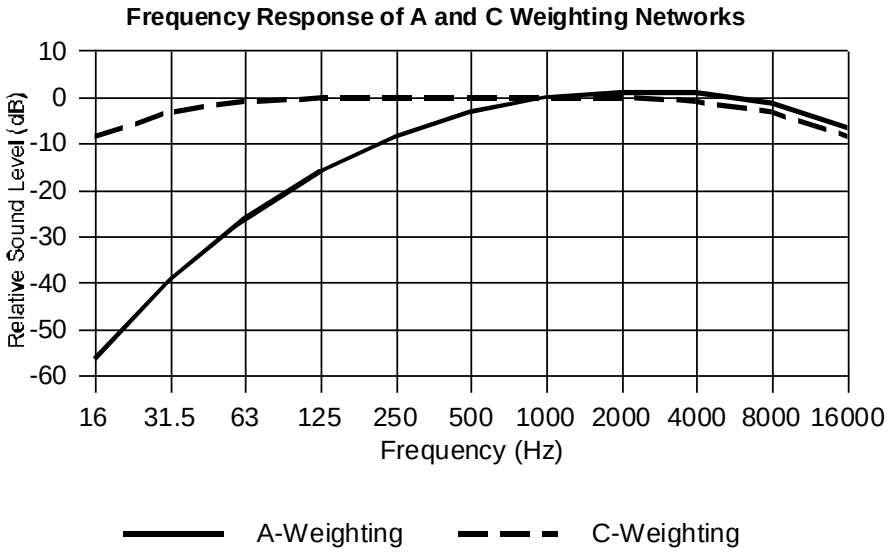
APPENDIX A: GLOSSARY OF COMMONLY USED NOISE TERMINOLOGY

Ambient or Background Noise: The ambient noise from all sources other than the sound of interest (i.e. sound other than that being measured). Under most MOE guidelines, aircraft overflights and train noise, due to their transient nature, are normally excluded from measurements of background noise.

Attenuation: The reduction of sound intensity by various means (e.g., air, humidity, porous materials, etc.).

dB - Decibel: The logarithmic units associated with sound pressure level, sound power level, or acceleration level. See sound pressure level, for example.

dBA - Decibel, A-Weighted: The logarithmic units associated with a sound pressure level, where the sound pressure signal has been filtered using a frequency weighting that mimics the response of the human ear to quiet sound levels. The resultant sound pressure level is therefore representative of the subjective response of the human ear. A-weighted sound pressure levels are denoted by the suffix 'A' (ie. dBA), and the term pressure is normally omitted from the description (i.e., sound level or noise level).



dBC - Decibel, C-Weighted: The logarithmic units associated with a sound pressure level, where the sound pressure signal has been filtered using a frequency weighting that mimics the response of the human ear to loud sound levels. C-weighted sound pressure levels are denoted by the suffix 'C' (ie. dBC). C-weighted levels are often used in low-frequency noise analysis, as the filtering effect is nearly flat at lower frequencies.

dBL or dBLin - Decibel, Linear: The logarithmic units associated with a sound pressure level, where the sound pressure signal is unfiltered, and represents the full spectrum of incoming noise.

Calibrator (Acoustical): A device which produces a known sound pressure on the microphone of a sound level measurement system, and is used to adjust the system to standard specifications.

Directivity Factor (Q) (also, **Directional** or **Directionality Factor):** A factor mathematically related to Directivity Index, used in calculating propagated sound levels to account for the effect of reflecting surfaces near to the source. For example, for a source in free space where the sound is radiating spherically, Q = 1. For a source located on or very near to a surface (such as the ground, a wall, rooftop, etc.), where the sound is radiating hemispherically, Q = 2. This accounts for the additional sound energy reflecting off the surface, and translates into a +3 dB add.

Energy Equivalent Sound Level (L_{eq}): An energy-average sound level taken over a specified period of time. It represents the average sound pressure encountered for the period. The time period is often added as a suffix to the label (e.g., $L_{eq}(24)$ for the 24-hour equivalent sound level). L_{eq} is usually A-weighted. An L_{eq} value expressed in dBA is a good, single value descriptor of the annoyance of noise.

Exceedance Noise Level (L_N): The noise level exceeded N% of the time. It is a statistical measure of the noise level. For highly varying sounds, the L_{90} represents the background noise level, L_{50} represents the median or typical noise level, and L_{10} represents the short term peak noise levels, such as those due to occasional traffic or a barking dog.

Far Field: Describes a region in free space where the sound pressure level from a source obeys the inverse-square law (the sound pressure level decreases 6 dB with each doubling of distance from the source). Also, in this region the sound particle velocity is in phase with the sound pressure. Closer to the source where these two conditions do not hold constitutes the “near field” region.

Free Sound Field (Free Field): A sound field in which the effects of obstacles or boundaries on sound propagated in that field are negligible.

Frequency: The number of times per second that the sine wave of sound or of a vibrating object repeats itself, now expressed in hertz (Hz), formerly in cycles per second (cps).

Hertz (Hz): Unit of measurement of frequency, numerically equal to cycles per second.

Human Perception of Sound: The human perception of noise impact is an important consideration in qualifying the noise effects caused by projects. The following table presents a general guideline.

Increase in Noise Level (dB)	Perception
3 or less	insignificant due to imperceptibility
4 to 5	just-noticeable difference
6 to 9	marginally significant
10 or more	significant, perceived as a doubling of sound exposure

Impact Sound: The sound produced by the collision of two solid objects, e.g., footsteps, dropped objects, etc., on an interior surface (wall, floor, or ceiling) of a building. Typical industrial sources include punch presses, forging hammers, etc.

Impulsive Noise: a) Single or multiple sound pressure peak(s) (with either a rise time less than 200 milliseconds or total duration less than 200 milliseconds) spaced at least by 500 millisecond pauses, b) A sharp sound pressure peak occurring in a short interval of time.

Infrasonic: Sounds of a frequency lower than 20 hertz.

Insertion Loss (IL): The arithmetic difference between the sound level from a source before and after the installation of a noise mitigation measure, at the same location. Insertion loss is typically presented as a positive number, i.e., the post-mitigation sound level is lower than the pre-mitigation level. Insertion loss is expressed in dB and is usually specified per 1/1 octave band, per 1/3 octave band, or overall.

Low Frequency Noise (LFN): Noise in the low frequency range, from infrasonic sounds (<20 Hz) up to 250 Hz.

Masking: a) The process by which the threshold of audibility for a sound is raised by the presence of another (masking) sound, or b) The amount by which the threshold of audibility of a sound is raised by the presence of another (masking) sound.

Near Field: The sound field very near to a source, where sound pressure does not obey the inverse-square law and the particle velocity is not in phase with the sound pressure.

Noise: Unwanted sound.

Noise Level: Same as Sound Level, except applied to unwanted sounds.

Peak Sound Pressure Level: Same as Sound Pressure Level except that peak (not peak-to-peak) sound pressure values are used in place of RMS pressures.

Quasi-Steady Impulsive Noise: Noise composed of a series of short, discrete events, characterized by rapid rise times, but with less than 0.5 seconds elapsing between events.

RMS Sound Pressure: The square-root of the mean-squared pressure of a sound (usually the result of an RMS detector on a microphone signal).

Reverberant Field: The region in a room where the reflected sound dominates, as opposed to the region close to the noise source where the direct sound dominates.

Sound: a dynamic (fluctuating) pressure.

Sound Exposure Level (SEL): An L_{eq} referenced to a one second duration. Also known as the Single Event Level. It is a measure of the cumulative noise exposure for a single event. It provides a measure of the accumulation of sound energy over the duration of the event.

Sound Intensity: The sound energy flow through a unit area in a unit time.

Sound Level Meter: An instrument comprised of a microphone, amplifier, output meter, and frequency-weighting networks which is used for the measurement of noise and sound levels.

Sound Pressure Level (SPL): The logarithmic ratio of the RMS sound pressure to the sound pressure at the threshold of hearing. The sound pressure level is defined by equation (1) where P is the RMS pressure due to a sound and P_0 is the reference pressure. P_0 is usually taken as 2.0×10^{-5} Pascals.

(1) $\text{SPL (dB)} = 20 \log(P_{RMS}/P_0)$

Sound Power Level (PWL): The logarithmic ratio of the instantaneous sound power (energy) of a noise source to that of an international standard reference power. The sound power level is defined by equation (2) where W is the sound power of the source in watts, and W_0 is the reference power of 10^{-12} watts.

(2) $\text{PWL (dB)} = 10 \log(W/W_0)$

Interrelationships between sound pressure level (SPL) and sound power level (PWL) depend on the location and type of source.

Spectrum: The description of a sound wave's resolution into its components of frequency and amplitude.

Speed (Velocity) of Sound in Air: 344 m/s (1128 ft/s) at 70°F (21°C) in air at sea level.

Threshold of Audibility (Threshold of Detectability): The minimum sound pressure level at which a person can hear a specified frequency of sound over a specified number of trials.