REVISED REPORT ON MINIMUM DISTANCE SEPARATION (MDS I) FOR NON-AGRICULTURAL DEVELOPMENT LOCATED IN CLAREMONT, PICKERING, IN THE REGIONAL MUNICIPALITY OF DURHAM

Prepared for:
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July 26, 2021

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SUMMARY

AgPlan was retained by Claremont Developments Inc. in April 2018 to complete a Minimum Distance Separation (MDS) agricultural study for the subject site located at 5113 Old Brock Road .

Subsequently in 2020, a Local Planning Appeal Tribunal (LPAT) hearing occurred, and a Hearing Decision was rendered, August 27, 2020. The LPAT Decision confirmed the application of the Clergy principle to the appeals of the rezoning and subdivision applications. Applying the Clergy principle results in the application of the municipal planning policy regime of 1990/91. The policy history, description and opinion are described by Malone Given Parsons (2021), which notes as follows:

> *As a result of the Tribunal's determination that the Clergy principle applies to Claremont Developments Inc.'s appeals of the zoning by-law amendment and plan of subdivision applications, the applicable municipal planning policy documents to evaluate the applications are the Region of Durham Official Plan (June 5, 1991) and the Claremont Development Plan, 1991 (Edition 3).*
>
> *In accordance with the above municipal planning policy documents, the entirety of the subject lands (i.e., both Phase I Residential and Phase II Residential) were within the Claremont Hamlet boundary, which constitutes a settlement area. Consequently, for the purposes of evaluation the zoning by-law amendment and plan of subdivision applications, as revised, the entirety of the subject lands are to be treated as being within a settlement area*.

Based on the decision that the subject lands are within a settlement area as well as statistical analysis of livestock and manure reduction, this report concludes:

1. As the subject site is designated for non-agricultural development based on 1990/91 municipal planning documents, MDS I does not apply.

2. Regardless, if the MDS I setback distances were to apply, there are no potential MDS conflicts associated with the proposed Claremont development and there is sufficient distance available to allow for the expansion of an existing cattle operation or for new horse operations within the MDS study area without conflict with MDS.

3. The analyses of trends in livestock production, nutrient units, and nutrient units multiplied by odour factor indicate that the probability of conflict due to manure odours is diminishing within Pickering (which is the most precise scale of information available for these statistics).

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TABLE OF CONTENTS

Summary i

1.0 Study Objectives 1
1.1 Introduction 1
1.2 Description of the Proposed Claremont Development 2
1.3 Policy Background 4

2.0 Findings 4
2.1 MDS Not Required 4
2.2 MDS I Calculations 11
2.2.1 Methods 4
2.2.2 Calculations 7
2.3 Livestock Production Context 9

3.0 Conclusion 17

4.0 References 18

List of Appendices

Appendix 1 MDS I and MDS II Calculation Discussion 21

List of Tables

Table 1 MDS I Calculation and Assumptions Summary 8
Table 1-1 MDS (2017) in Metres Based on Two Manure Handling Systems Relative to Different Numbers of Cattle + Calves 26
Table 1-2 MDS (2017) in Metres Based on One Manure Handling System (V3) Relative to Different Numbers of Cattle + Calves 27
Table 1-3 MDS (2017) in Metres Based on Two Manure Handling Systems Relative to Different Numbers of Feeder Pigs 28
Table 1-4 MDS (2017) in Metres Based on Two Manure Handling Systems Relative to Different Numbers of Broiler Chickens 29
Table 1-5 MDS (2017) in Metres Based on Two Manure Handling Systems Relative to Different Numbers of Broiler Chickens 30
Table 1-6 MDS II (2017) in Metres Based on Two Manure Handling Systems Relative to Number of Broiler Chickens (Type A Land Use) 31

List of Figures

Figure 1 Total Nutrient Units in Durham Region and Pickering 1981 - 2016 11
Figure 2 Total Nutrient Units Times Odour Factor in Durham and Pickering 1981 - 2016 11
Figure 3 Nutrient Units per Census Farm in Durham and Pickering 1981 - 2016 12

Figure 4 Total Nutrient Units per Census Farm Hectare in Durham and Pickering 1981 - 2016 12
Figure 5 Pickering Total Nutrient Units as a Proportion of Total Nutrient Units in Durham Region 1981- 2016 13
Figure 6 Number of Farms Reporting Manure in Durham Region and Pickering 1991 - 2016 13
Figure 7 Proportion of Total Census Farms Reporting Manure in Durham Region and Pickering 1991 - 2016 14
Figure 8 Nutrient Units for Livestock Reported on Census Farms in Durham 2016 14
Figure 9 Nutrient Units for Livestock Reported on Census Farms in Pickering 2016 15
Figure 10 Nutrient Units Times Odour Factor for Livestock Reported on Census Farms in Durham 2016 15
Figure 11 Nutrient Units Times Odour Factor for Livestock Reported on Census Farms in Pickering 2016 16
Figure 12 Average Number of Animals per Census Farm Reporting in Pickering for Two Livestock Categories -Cattle and Calves as well as Horses and Ponies 1981 - 2016 16
Figure 13 Number of Livestock Reported in Durham OMAFRA Data 2004 - 2020 With Lines of Best Fit 17
Figure 1-1 MDS (2017) in Metres (Including Lines of Best Fit) Based on Two Manure Handling Systems Relative to Different Numbers of Cattle + Calves 32
Figure 1-2 MDS (2017) in Metres (Including Lines of Best Fit) Based on One Manure Handling System (V3) Relative to Different Numbers of Cattle + Calves 33
Figure 1-3 MDS (2017) in Metres (Including Lines of Best Fit) Based on Two Manure Handling System Relative to Different Numbers of Cattle + Calves (Land Use “A” & “B”) 34
Figure 1-4 MDS (2017) in Metres (Including Lines of Best Fit) Based on Two Manure Handling Systems Relative to Different Numbers of Feeder Pigs 35
Figure 1-5 MDS (2017) in Metres (Including Lines of Best Fit) Based on Two Manure Handling Systems Relative to Different Numbers of Broiler Chickens 36
Figure 1-6 MDS II (2017) in Metres (Including Lines of Best Fit) Based on Two Manure Handling Systems Relative to Different Numbers of Broiler Chickens (Type A Land Use) 37
Figure 1-7 MDS II (2017) in Metres (Including Bar Graphs and Lines of Best Fit) Based on Two Manure Handling Systems Relative to Different Numbers of Broiler Chickens (Type A Land Use) 38

List of Schedules/Maps

Map 1 Site Location 2
Map 2 Draft Plan of Subdivision 3
Map 3 MDS Study Area 19
Map 4 MDS Arcs Map 20

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1.0 STUDY OBJECTIVES

1.1 INTRODUCTION

AgPlan Limited was retained by Claremont Developments Inc. in April 2018 to complete an agricultural study to:

- Calculate as necessary, Minimum Distance Separation (MDS I) for barn(s) located within a 1.5 km study area of lands proposed for non-agricultural development of the property known as 5113 Old Brock Rd. in Claremont, located in Pickering within the Regional Municipality of Durham (Map 1 - additional map detail can be seen on Maps 2, 3 and 4).

AgPlan produced a report, dated May 22, 2018, having the title *Report on Minimum Distance Separation (MDS I) for Proposed Non-Agricultural Development Located in Claremont, Pickering, in the Regional Municipality of Durham*. Subsequently, a Local Planning Appeal Tribunal (LPAT) Hearing (2020) occurred. The Hearing Decision was rendered August 27, 2020, after AgPlan produced its MDS report (2018) related to the development of the subject site.

The LPAT Decision confirmed the application of the *Clergy* principle to the appeals of the rezoning and subdivision applications in Claremont. Acceptance of the *Clergy* principle results in the application of the municipal planning policy regime of 1990/91. Policy history, description, and opinion is described by Malone Given Parsons (2021).

> *As a result of the Tribunal's determination that the Clergy principle applies to Claremont Developments Inc.'s appeals of the zoning by-law amendment and plan of subdivision applications, the applicable municipal planning policy documents to evaluate the applications are the Region of Durham Official Plan (June 5, 1991) and the Claremont Development Plan, 1991 (Edition 3).*
>
> *In accordance with the above municipal planning policy documents, the entirety of the subject lands (i.e., both the Phase 1 and Phase 2 lands) are within the Claremont Hamlet boundary, which constitutes a settlement area. Consequently, for the purposes of evaluating the zoning by-law amendment and plan of subdivision applications, as revised, the entirety of the subject lands are to be treated as being within a settlement area.*

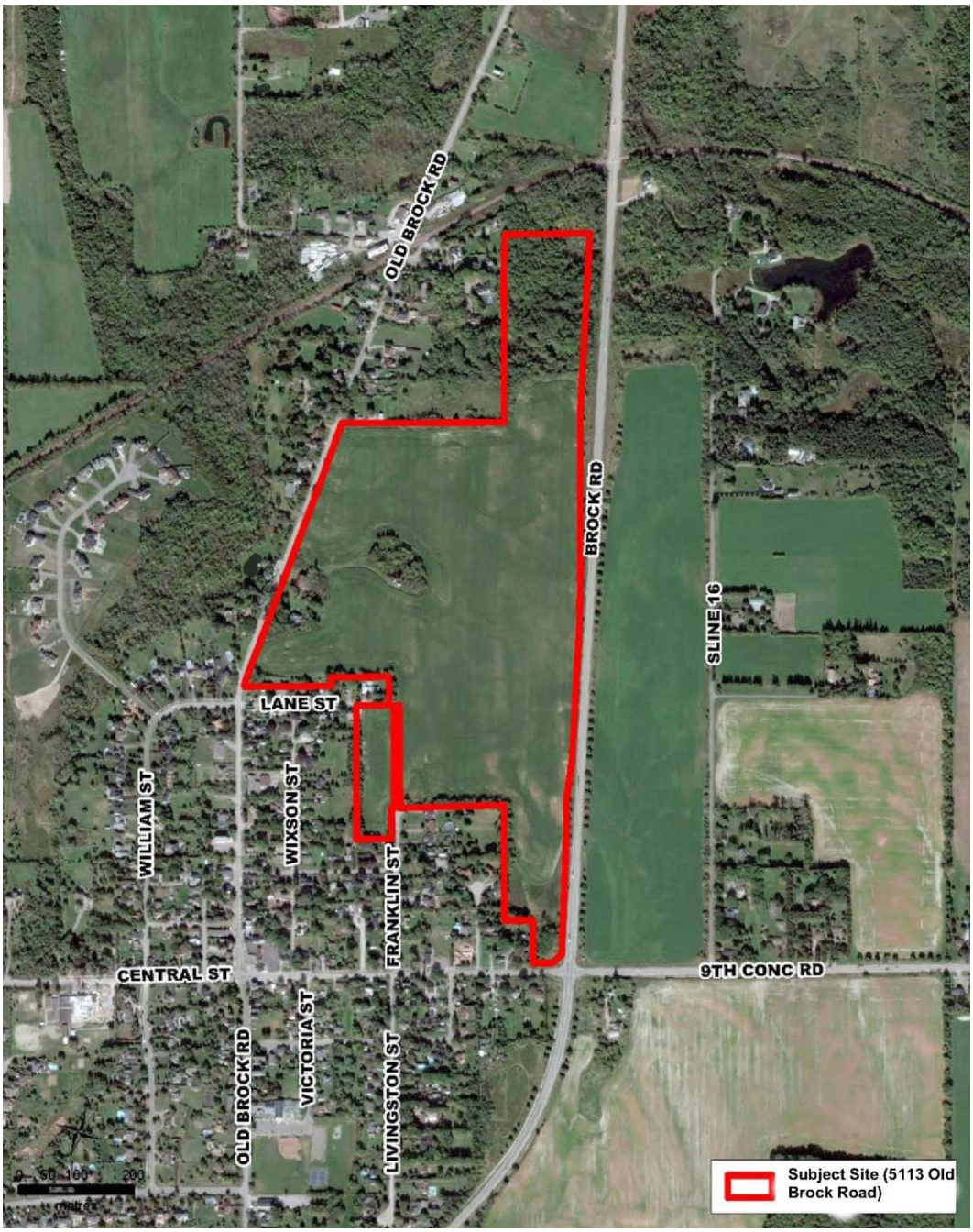
Based on the decision that the subject lands are within a settlement area, this report updates the original AgPlan report (2018). Therefore, Section 2.1 under "Findings" now states that MDS I is not required based on Guideline #36 of the MDS Document (2017). Regardless, MDS I calculations have been retained within this report in Section 2.2.

Three matters qualify the contents of this report as follows:

- When information provided by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) is mentioned within this report, OMAFRA is cited regardless of whether the information was originally provided by OMAF (Ontario Ministry of Agriculture and Food), or by OMAFRA (Ontario Ministry of Agriculture Food, and Rural Affairs).

- The words “site”, “property”, and “subject lands”, have been used synonymously.
- The contents of this agricultural report may be modified by the author following external reviews.

MAP 1 SITE LOCATION (source: Malone Given Parsons Planning Opinion Report, 2021)

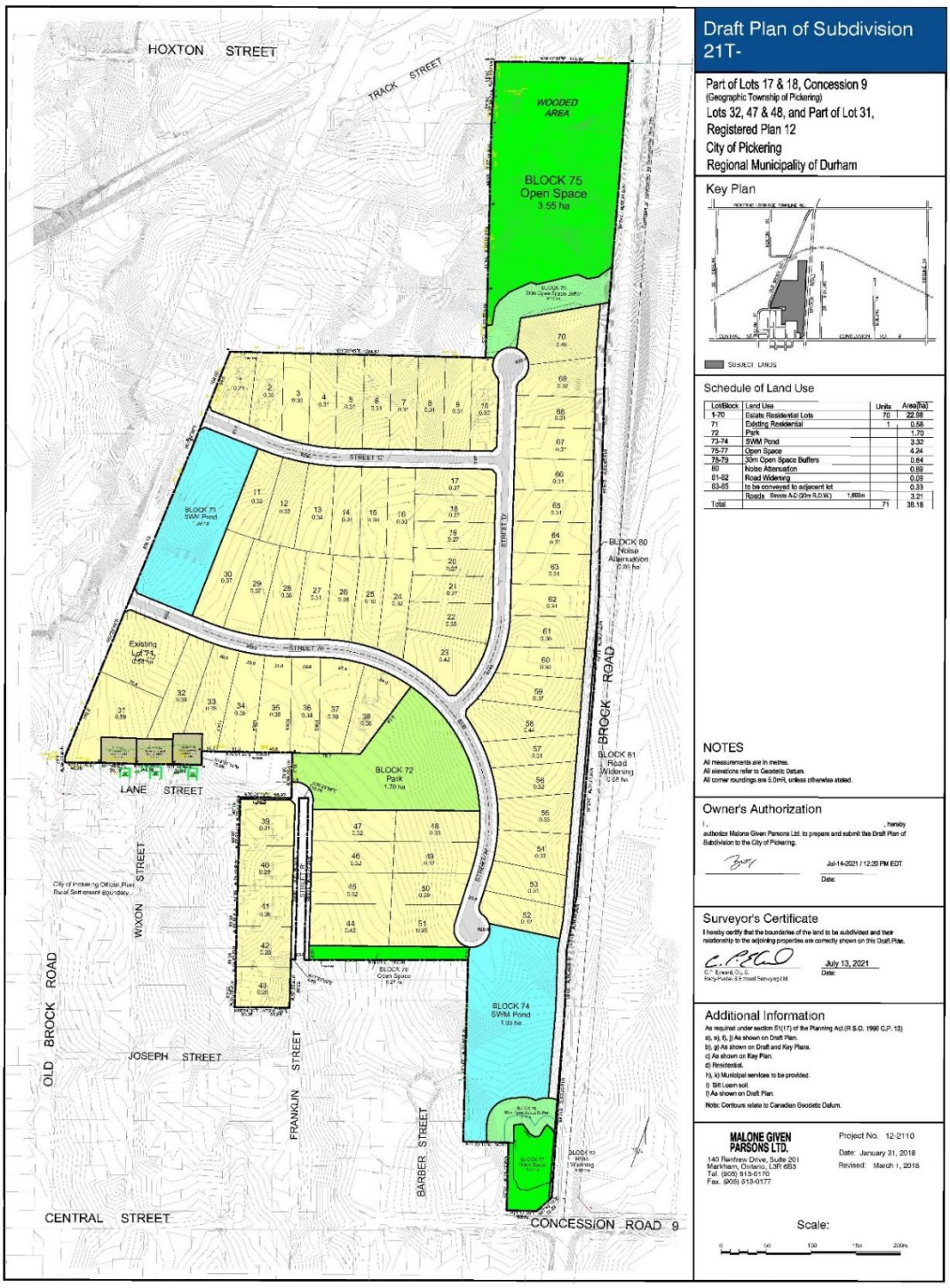


1.2 DESCRIPTION OF THE PROPOSED CLAREMONT DEVELOPMENT

A portion of the subject property is proposed to be developed as a residential subdivision (a non-agricultural use). The Draft Plan of Subdivision proposes 71 residential lots for single detached residential units on 38.18 hectares of land within the Hamlet of

Claremont. The development will also include two storm water management ponds, apartment block, and open space/EP block, and a noise buffer block for noise mitigation from Brock Road (Map 2).

MAP 2 DRAFT PLAN OF SUBDIVISION (source: Malone Given Parsons Planning Opinion Report, 2021)



1.3 POLICY BACKGROUND

A full description of the policies affecting the proposed development in Claremont is outlined in the Malone Given Parsons (MGP) *Planning Opinion Report* (2021). Because Policies and Guidelines have changed since the time of the original development application in 1990, the author of this MDS report has applied a conservative analysis using present day MDS guidelines and standards.

2.0 FINDINGS

2.1 MDS NOT REQUIRED

The entirety of the subject site is within the Claremont Hamlet Settlement Area and MDS I does not apply to the Claremont subdivision as described by Guideline #36 of the MDS Document (2017) (quoted below).

> ***#36. Non-Application of MDS Within Settlement Areas***
> *MDS I setbacks are not required for proposed land use changes (e.g., consents, rezonings, redesignations, etc.) within approved settlement areas, as it is generally understood that the long-term use of the land is intended to be for non-agricultural purposes.*

Regardless, if the setback distances based on the application of the MDS Document (2017) were applied, then findings described in the next section of this report support the conclusion that there are no MDS I conflicts with the subject site based on an examination of, and MDS I calculations for, the study area 1.5 km from the boundary of the subject site.

2.2 MDS I CALCULATIONS

2.2.1 Methods

The findings, described in the section following this one, are based on published literature, which is listed in the references section, aerial photo interpretation and visual observations from the roadside. Some additional description of methods may be included within subsections of the “findings” within this report. Limitations associated with the methods and findings include the following:

- The use of statistics from Statistics Canada and the Ontario Ministry of Agriculture and Food, Ministry of Rural Affairs is subject to the limitations of the surveys completed by these government groups.
- Visual observations are limited by distance and screening caused by changes in topography and/or the presence of tree cover.
- The use of past conditions to project/estimate future conditions is subject to the extrapolation of existing measurements and is subject to the general limitations associated with extrapolation (as outlined in many statistics texts).
- The scale at which information is available. For example, the agricultural census information, at its most detailed, is available at the Census Consolidated Subdivision (CCS) level which tends to correspond with sub-tier municipalities or township boundaries. As well, when there are relatively few census farms providing data, that data are subject to suppression for reasons of confidentiality.

The calculation of MDS I requires some interpretation based on factors such as:

- the MDS calculation method in force at the time the calculation is made;
- type and intensity of new land-use proposed (type “A” or type “B” land use);
- whether to increase the size of the MDS study area when large livestock operations are observed nearby outside of the 1.5 km limit;
- number and kind of animals producing manure;
- manure handling system;
- barn and manure storage placement;
- what constitutes a “livestock facility” (barn) intended for livestock use;
- whether a livestock facility is structurally sound enough to allow for the housing of livestock;
- maximum tillable area;
- maximum livestock facility housing capacity given an allowance for feed bins, feed preparation areas, field shade shelters, livestock assembly areas, livestock loading chutes, machinery sheds, milking centres, offices, riding arenas, silos and/or washrooms; and,
- the presence, location, and size of existing non-agricultural development adjacent or near to the proposed new non-agricultural development.

With respect to the work completed related to the subject property, an additional assumption was made:

- Several methods are available for obtaining information about livestock kind and number and these methods include farmer interviews. However, the MDS document (2017) also suggests that the information obtained through interviews needs to be checked concerning whether the interview information is reasonable. In order to restrict MDS calculations to a single step/calculation and to avoid any problems associated with biosecurity on farms, livestock numbers were based on barn area measurements used as input to the OMAFRA MDS software to obtain maximum barn housing capacity. In this way, MDS distances have been maximized and are conservative.

Biosecurity is defined by OMAFRA (2016) as follows:

> *Biosecurity at the farm level can be defined as the management practices enabling producers to prevent the movement of disease-causing agents onto and off of agricultural operations. This includes environmental contamination. Biosecurity therefore involves many aspects of farm management, such as disease control and prevention (e.g., closed herd, vaccinations), nutrient management and visitor control. Although controlling and limiting the movement of livestock is recognised as the most important biosecurity measure for most diseases, many important hazards can be carried on contaminated clothing, boots, equipment, and vehicles.*

The work completed for MDS followed a specific sequence:

1. Obtain aerial photographs for the lands surrounding the proposed non-agricultural development area of sufficient size for the 1.5 km study area.

2. Plot a 1.5 km study area boundary from the boundary of the proposed development area (Map 3).
3. Complete field work and aerial photo interpretation to identify structurally sound livestock barns or buildings capable of housing livestock, livestock type, manure handling system and plot the results on the aerial photography.
4. Assign a number to each barn identified by field work.
5. Obtain and map areas of non-agricultural use based on one, or a combination of all of, farm tax rating, designation and/or zoning, as well as by properties equal to or less than 2 ha and/or having less than or equal to 2 ha of tillable land.
6. Identify those barns where MDS calculations are not necessary after application of Guideline 12.
7. Using the Agricultural Information Atlas measure
    - the area of land on the property having a barn or barns, and
    - the area of barns.
8. Complete additional photo interpretation of the photography provided as part of the Agricultural Information Atlas.
9. Input land area and barn(s) area as necessary into the OMAFRA MDS (*AgriSuite*) software to calculate MDS.
10. Summarize MDS assumptions and results in tabular form (Table 1).
11. Map MDS arcs (Map 4).

The MDS study area, identified on Map 3, has been generated using GIS and/or CAD software and provides a study area larger than 1.5 km for all points measured from the boundary of the proposed development area. The study area size is therefore conservative because it includes more land than is necessary given the wording of the MDS Document (2017).

MDS Guideline #12 (2017) states that:

> *A reduced MDS I setback may be permitted provided there are four, or more, non-agricultural uses, residential uses and/or dwellings closer to the subject livestock facility than the proposed development or dwellings and those four or more non-agricultural uses, residential uses and/or dwellings are:*
> • *located within the intervening area (120° field of view shown in Figure 4 in Section 7 of this MDS Document) between the closest part of the proposed development or dwelling and the nearest livestock facility or anaerobic digester;*
> • *located on separate lots; and*
> • *of the same or greater sensitivity (i.e., Type A or Type B in accordance with Implementation Guidelines #33 and #34) as the proposed development or dwelling.*
> *If ALL of the above conditions are met, the MDS I setback for the proposed development or dwelling may be reduced such that it is located no closer to the livestock facility or anaerobic digester than the furthest of the four non-agricultural uses, residential uses and/or dwellings*.

The application of Guideline 12 in the *MDS Document* (2017), to identify agricultural areas already potentially affected by non-agricultural uses, required an interpretation of the meaning of the phrase “non-agricultural uses”.

The *MDS Document* (2017) defines a non-agricultural use as:

> *Buildings designed or intended for a purpose other than an agricultural use; as well as land, vacant or otherwise not yet fully developed, which is zoned or designated such that the principal or long-term use is not intended to be an agricultural use, including, but not limited to: commercial, future urban development, industrial, institutional, open space uses, recreational uses, settlement area, urban reserve, etc. However, this does not include agriculture-related uses, on-farm diversified uses and residential uses.*

Subsequently, residential uses are defined in the *MDS Document* (2017) as:

> *Land, vacant or otherwise not yet fully developed, for which the zoning or designation permits dwellings for human habitation as the principal use, including, but not limited to: estate residential, low-density residential, rural residential, etc. However, this does not include dwellings accessory to an agricultural use.*

These two definitions have been interpreted to have several components. For purposes of this MDS analysis and report, the following assumptions about non-agricultural uses were made:

1. all areas designated and/or zoned that do not specify livestock production as an allowed use were assumed to be non-agricultural uses;
2. all agricultural zoning/designations that include uses other than agriculture which are not agriculture-related and/or are not on-farm diversified uses as defined by the PPS (2020) were assumed to be non-agricultural uses;
3. lands found within the existing hamlet settlement area boundaries were assumed to be non-agricultural uses; and
4. land parcels which are less than or equal to 2 ha in size or have less than or equal to 2 ha of tillable area were assumed to be non-agricultural uses. The consideration of tillable area was included in the property size analysis because:
    - there are some properties in linear development adjacent to roads which, based on field observation, are not being used for agriculture,
    - the lands are not likely to be used for agriculture because, for the most part, the lands are forested and would not be captured by the application of the 2 ha “rule”.

2.2.2 Calculations

MDS 1 calculations were completed following the sequence of steps and methods previously described within this report. Not all barns had MDS 1 calculations completed as a result of the application of Guideline 12 (the 4 or more adjacent non-agricultural uses). Specific information on MDS assumptions and results associated with each calculation is summarized in Table 1.

TABLE 1 MDS ASSUMPTIONS AND RESULTS SUMMARY

MDS Barn No.	Livestock	Encroaching Land Use Factor	MDS Guideline 12 Applies	Barn(s) Area (m^2) and in (#) of animals	Manure Handling System	Distance from the Barn and/or Manure pile (metres)
1	Cattle and calves	Type B		1835/395	Solid, outside, no cover, 18 to 30% DM, with uncovered liquid runoff storage	551/562
1 modified	Cattle and calves	Type B		NA/773	Solid, outside, no cover, 18 to 30% DM, with uncovered liquid runoff storage	696/704
2	Cattle and calves	Type B	✓	571/123	Solid, outside, no cover, 18 to 30% DM, with uncovered liquid runoff storage	366/382
3	Horses	Type B	✓	332/11	Solid, outside, no cover, 18 to 30% DM, with uncovered liquid runoff storage	200/220
4	Horses (average per farm)	Type B		NA/23	Solid, outside, no cover, 18 to 30% DM, with uncovered liquid runoff storage	243/262

Much of the proposed Claremont residential development is “shielded” from the requirement to produce MDS because of the existing development within the hamlet itself which results in MDS not being applicable to the north, west, and south, of the proposed development area (following Guideline 12 in the *MDS Document*). To the southeast there is a grouping of four or more adjacent non-residential properties (shown on Map 4) which also affect MDS relative to the Claremont development.

There are only two relatively large livestock operations present that could potentially have conflict. However, the one cattle operation to the north and east (barn number 1 in Table 1) is outside of the 1.5 km study area requirement and the MDS distance can easily be met as shown on Map 4. If all the cattle reported in Pickering in the 2016 Census were placed on this farm, MDS distance could still be met (as summarized in Table 1, barn number 1 modified).

The second cattle farm, located to the southeast of the proposed development, has a barn of the size that would require an MDS I distance of 382 m from the manure pile (as summarized by barn 2 in Table 1 and as shown on Map 4) which just meets the boundary of the four or more non-agricultural uses to the northwest of the barn. Any expansion of the farm operation resulting in new barns on this property would require the application of MDS II and the presence of the four or more non-agricultural uses would mean that the new barn would have to be located further to the south or southeast in order to meet MDS requirements related to the four or more non-agricultural uses. Therefore, there is no MDS conflict with the potential development in Claremont.

There are several horse farms of smaller area within the MDS study area. The largest barn observed in the MDS study area was used to calculate an MDS distance (barn number 3 in Table 1) and this distance, at a maximum of 220 m, is well away from the proposed Claremont development. The distance, between the eastern edge of the Claremont development and the closest residential/small farm properties to the east, is approximately 265 m, enough to allow a barn containing 23 large frame mature horses (the average per farm for census farms reporting horses in 2016) on the closest residential/smaller farm properties. The barn needed to house the 23 horses would need to be 694 m² which is much larger than the barns observed within the study area. The hypothetical barn just described is summarized as barn number 4 in Table 1.

The impact of the subject site on livestock production is mitigated for several reasons:

- farms on all sides of the subject site are separated/buffered by existing urban development, natural heritage system lands and/or roads,
- livestock nutrient units per farm in Pickering have decreased since 1981,
- existing smaller land parcels less than 10 acres (4.047 ha) in the study area can potentially reduce the size of new livestock barns or barn expansions,
- the existing MDS II methodology already requires relatively lower MDS for barn expansions or for new barns associated with an existing barn cluster (after three years with no building permits) relative to MDS I requirements as described in Appendix 1. This provides farmers with the opportunity to expand with less distance separation - a form of mitigation.

2.3 LIVESTOCK PRODUCTION CONTEXT

MDS has as its objective the separation of manure from sensitive uses, such as residential uses, so as to reduce conflict associated with manure odour. The calculation of MDS is based on an existing condition and is therefore limited. Part of the judgement associated with the probability of conflict over time, due to manure odours, is a function of trends in livestock production (number of nutrient units and species of livestock) as well as the kinds of manure storage facilities. Published statistics provide evidence of change over time and, in this analysis, a timeframe of 35 years from 1981 to 2016 has been used. The statistical analyses and the trends observed resulting from the analyses, therefore provide an indication of whether MDS calculated separation distances completed in the future are more, or less, likely to be met.

One way of analysing change over time is to examine the number of farms reporting livestock and the number of different kinds of livestock being produced. However, different animals produce different amounts of manure with varying degrees of unpleasant odour. Therefore, livestock information has been converted to nutrient units (formerly called animal units), a measure of manure production, based on conversion rates provided in the *MDS Document* (2017). Additionally, nutrient units have been multiplied by an odour factor as provided in the *MDS Document* (2017).

Changes in nutrient unit (manure) production can be cross-checked with separate information produced within the census related to farms reporting manure and the area

used for manure application. This analysis is included and supports the trend to fewer farms reporting manure.

The information provided by the agricultural census is provided at different scales - national (Canada), provincial (Ontario), regional (south and west, for example), regional municipality or county (e.g., Durham Region) and sub-tier municipality or township (e.g., Pickering). At the most detailed level, some data are more likely to be suppressed for reasons of confidentiality. No data are available for a portion of Pickering such as the lands immediately around the Hamlet of Claremont. The Pickering data that have been analysed in this study are the most detailed available.

The data analysed provides the following observations:

- the total number of nutrient units produced in Durham Region and Pickering have been decreasing as shown in Figure 1;
- nutrient units multiplied by the odour factor have also been decreasing in Durham and Pickering (Figure 2);
- Figures 1 and 2 also demonstrate that Pickering has a relatively small amount of the total nutrient units and odour factor calculated for the Durham Region;
- nutrient units have been decreasing over time per census farm and census farm hectare (Figures 3 and 4);
- the proportion of the nutrient units produced in Durham Region that can be attributed to Pickering has been decreasing over time, in other words, the importance of Pickering as a contributor to the number of nutrient units in Durham is diminishing (Figure 5);
- number of farms reporting manure in Durham and Pickering has been decreasing but a measure of farms reporting manure proportionate to total census farm number indicates fluctuating levels with no clear trend (Figures 6 and 7);
- Figures 8 through to 11 indicate that the predominant livestock producing nutrient units, as well as nutrient units multiplied by (times) odour factor, varies between the Region of Durham and Pickering;
- of the farms still producing livestock, the average number of livestock per farm have increased for the predominant livestock production of cattle and horses within Pickering (Figure 12);
- because the census data for 2021 will not be published until next year, OMAFRA data, published yearly at the regional scale for a restricted range of livestock, was examined. Figures 13 shows diminishing levels of total cattle and total pigs but relatively constant levels of sheep and lambs from 2004 to 2020.

Much of the data analysed supports the fact that less manure is being produced in Durham and Pickering and the amount produced in Pickering is decreasing more rapidly when compared to Durham as a whole. On the other hand, the fact that cattle as well as horses have a higher number of animals per farm over time in Pickering has been used as a rationale for maximizing MDS arcs relative to the subject site in Claremont.

FIGURE 1

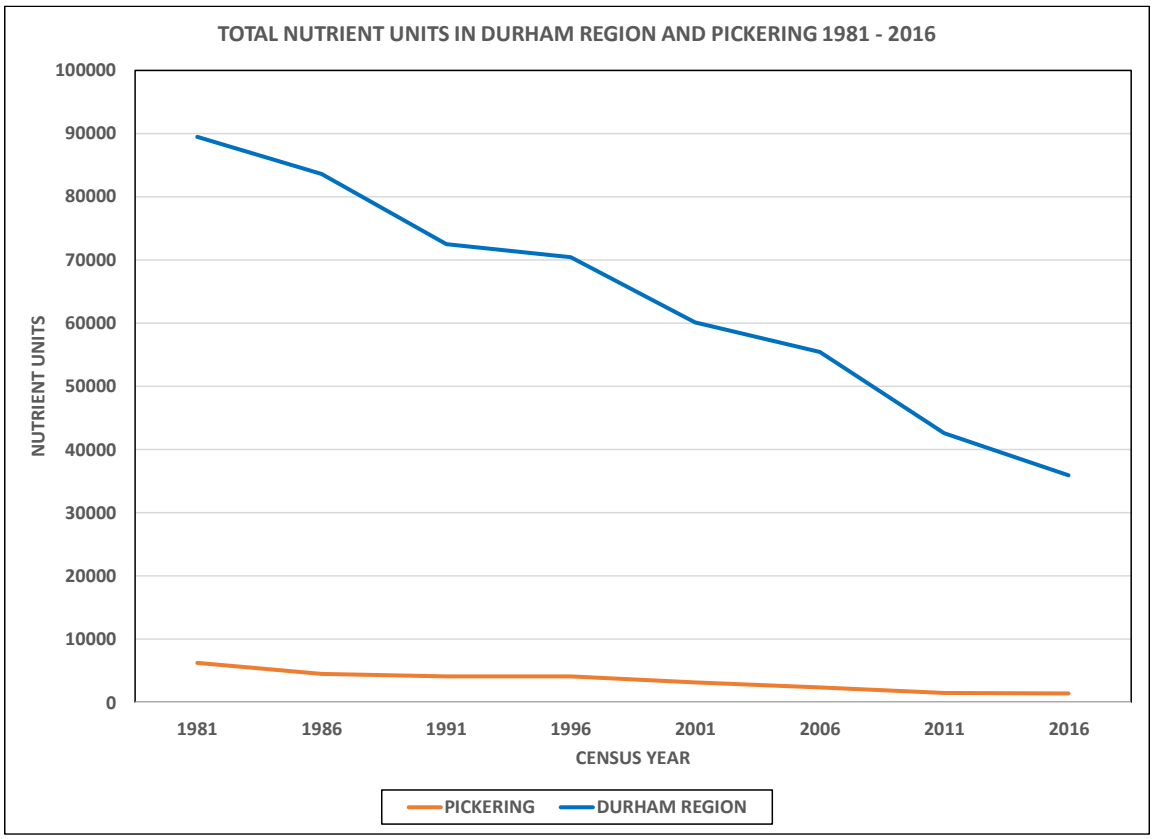


FIGURE 2

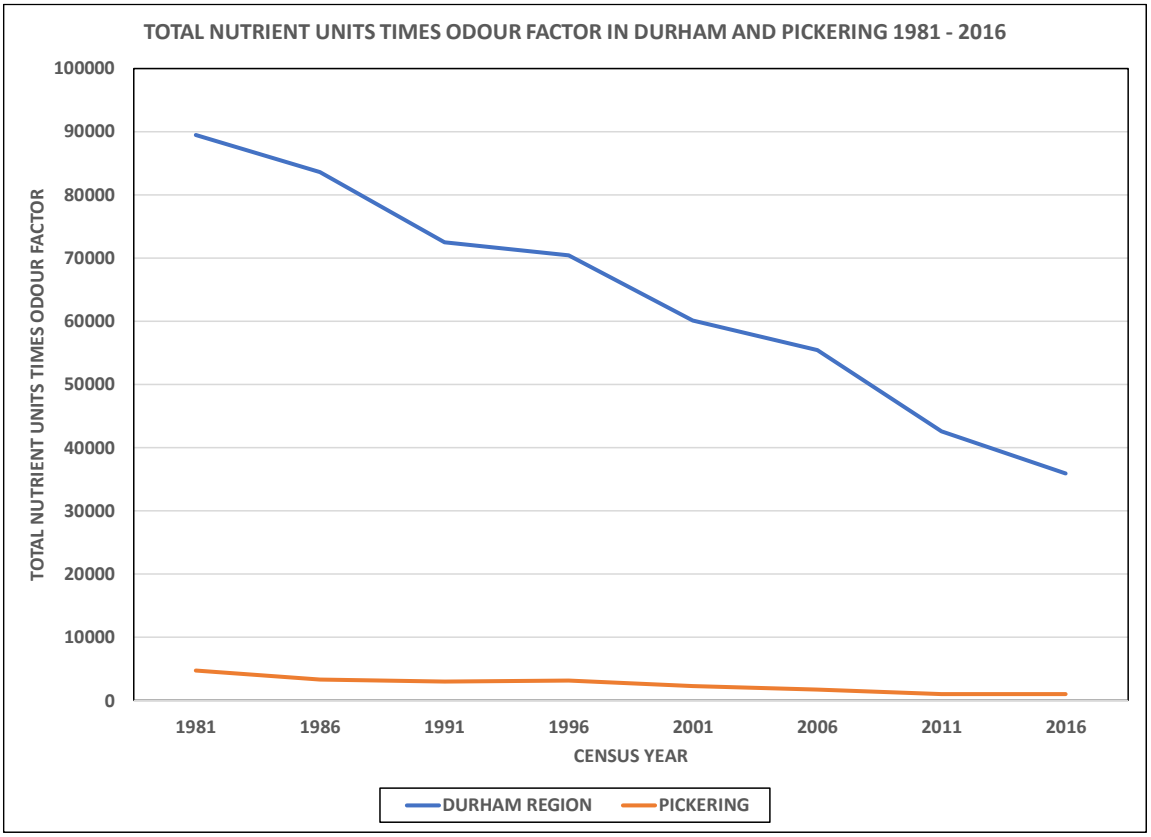


FIGURE 3

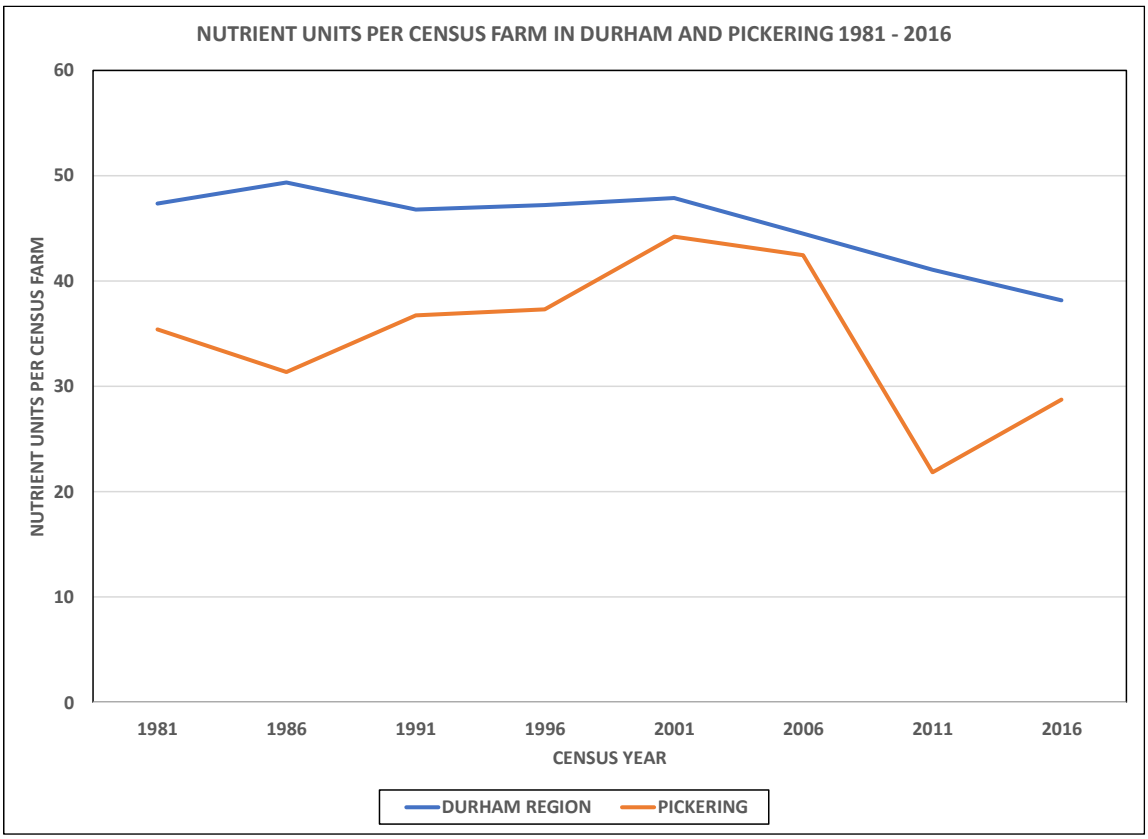


FIGURE 4

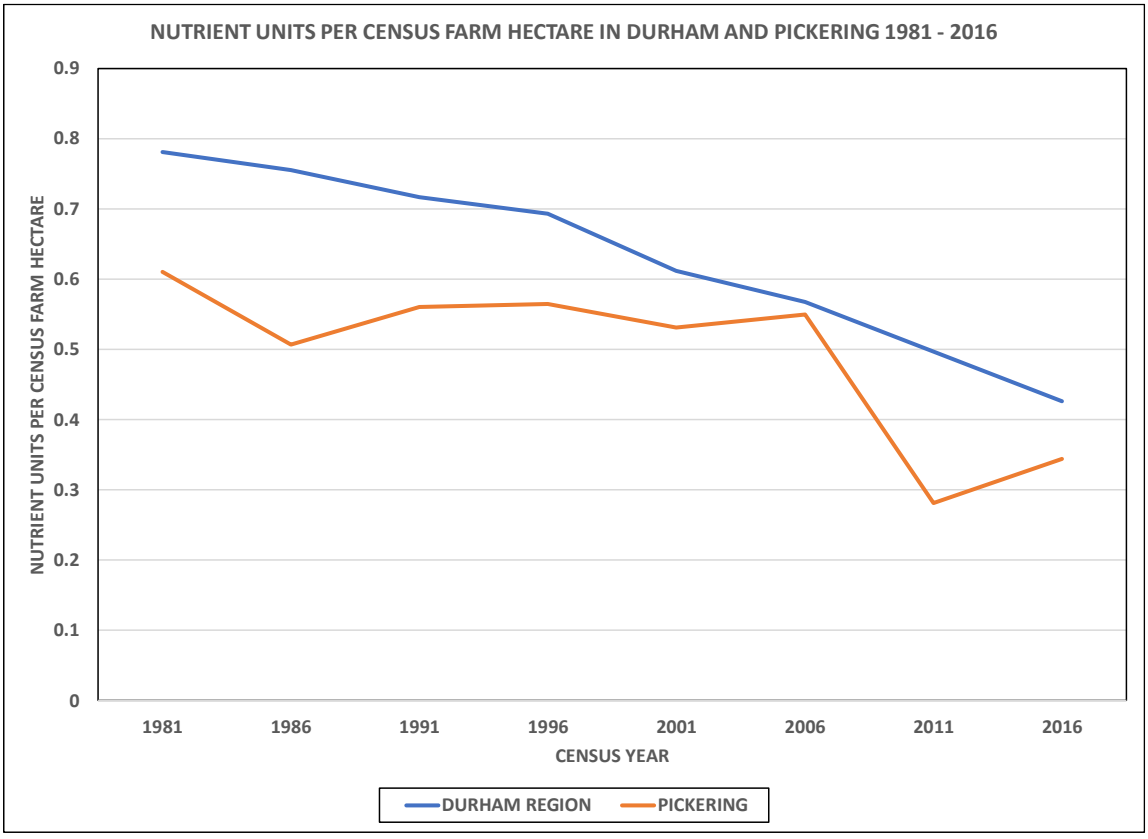


FIGURE 5

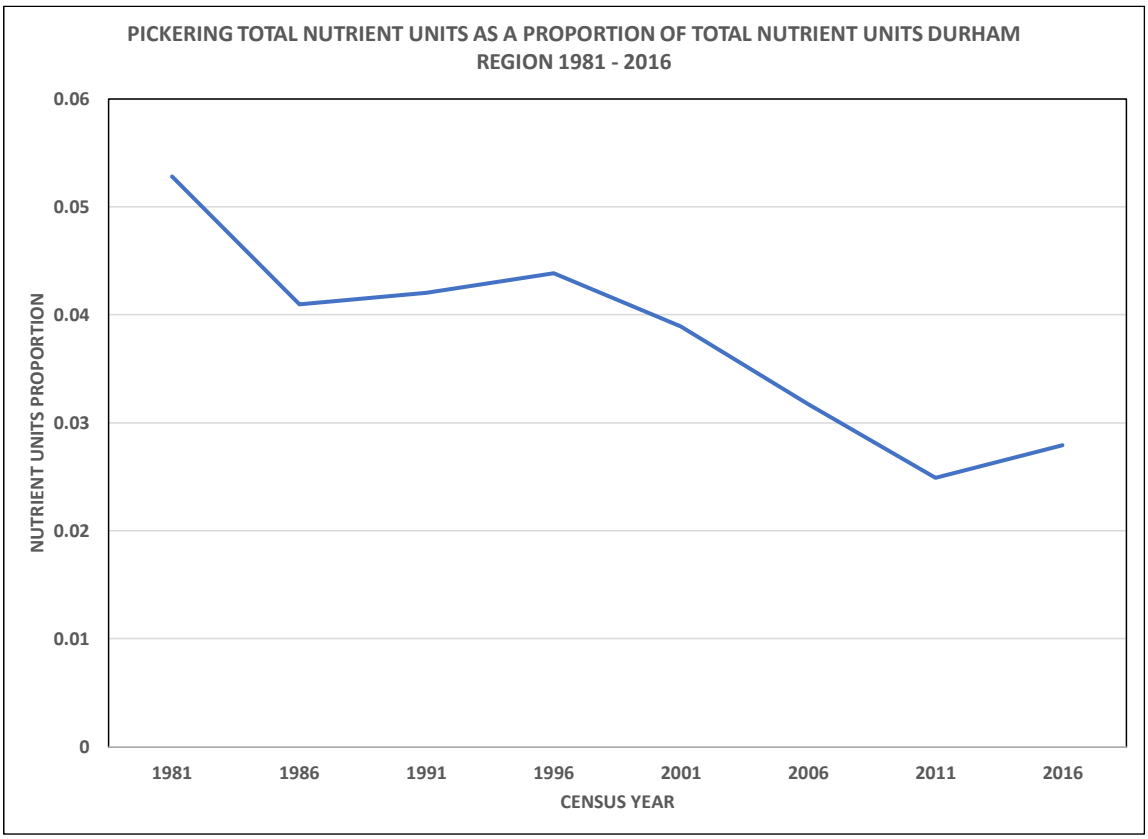


FIGURE 6

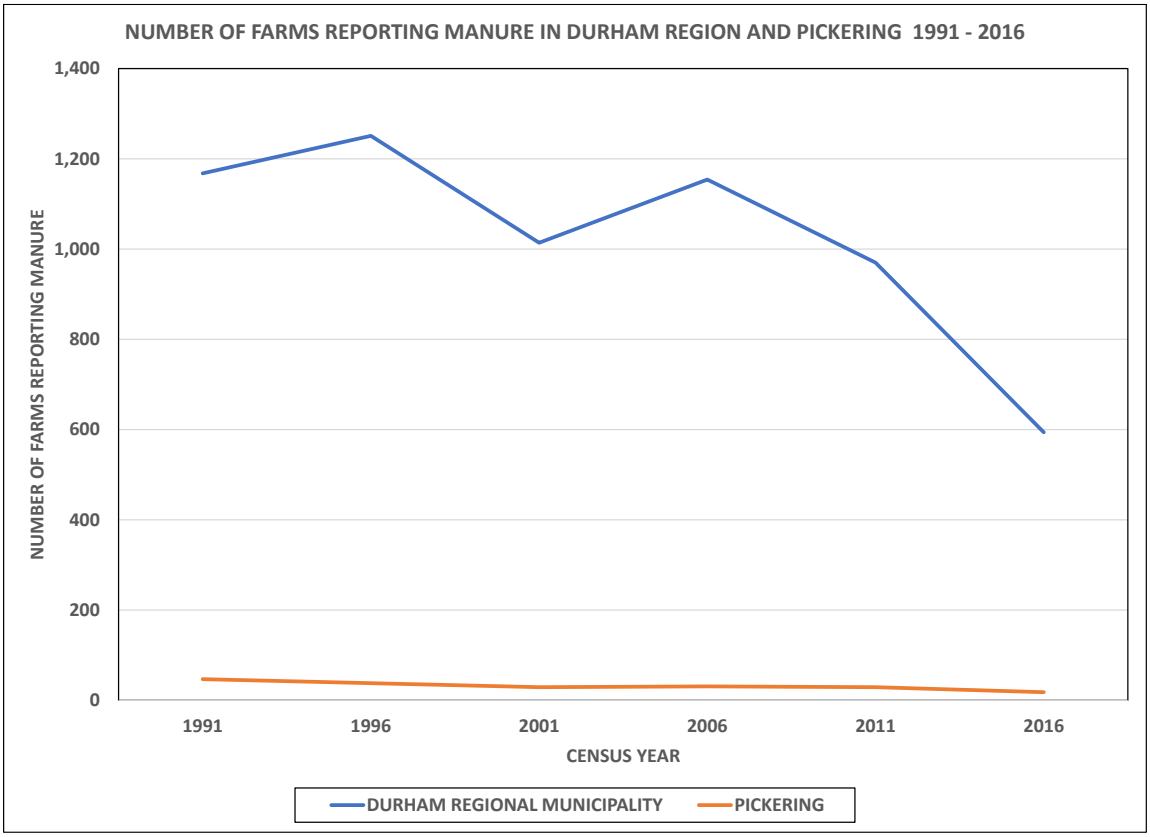


FIGURE 7

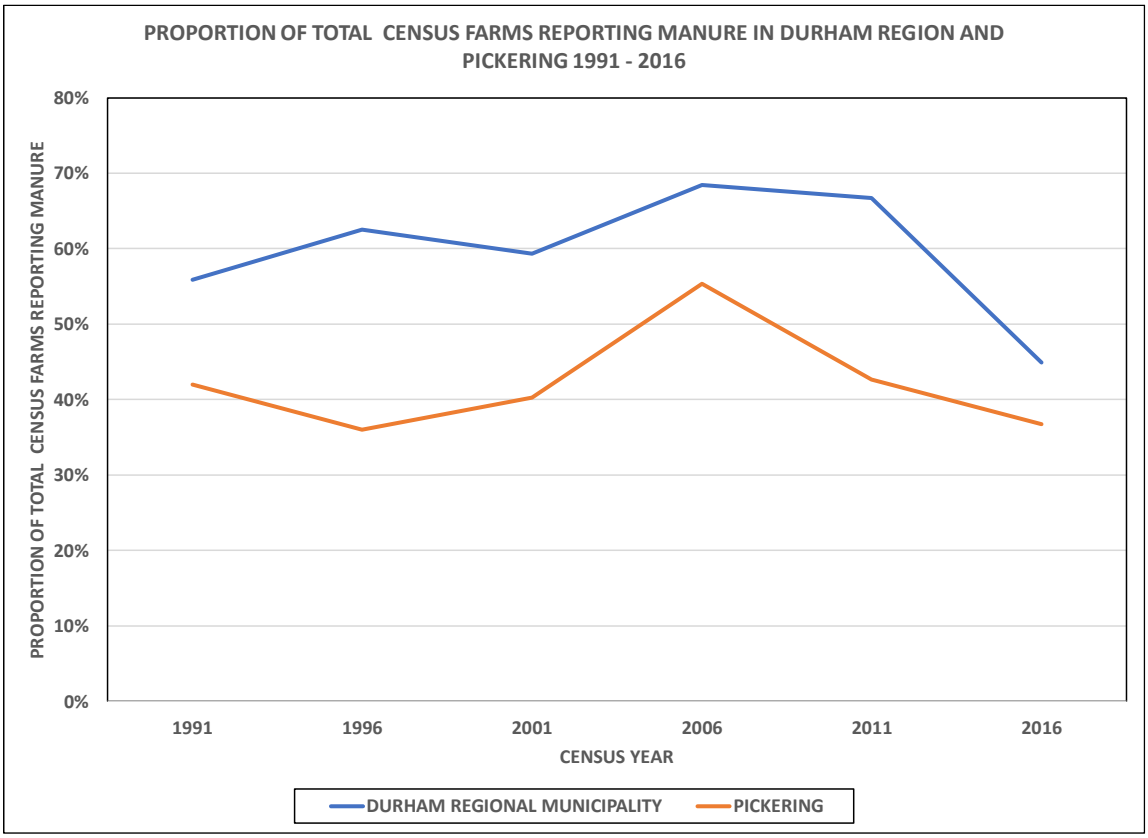


FIGURE 8

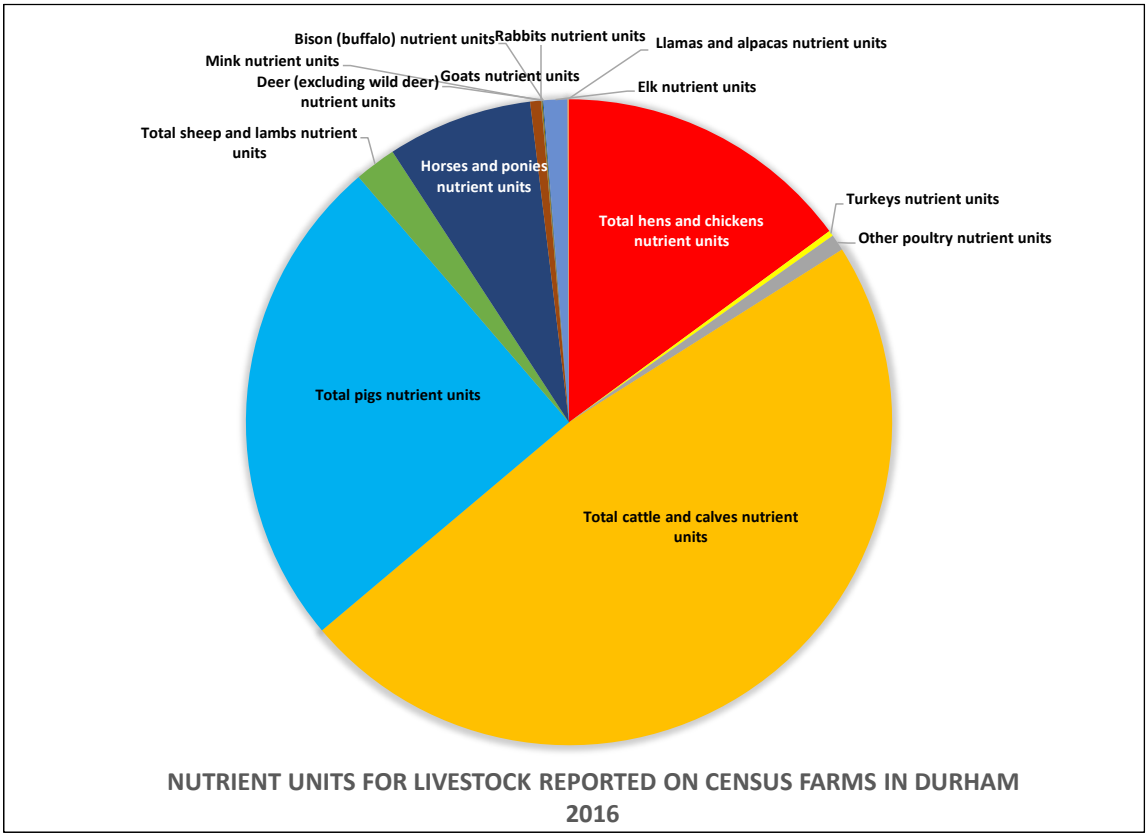
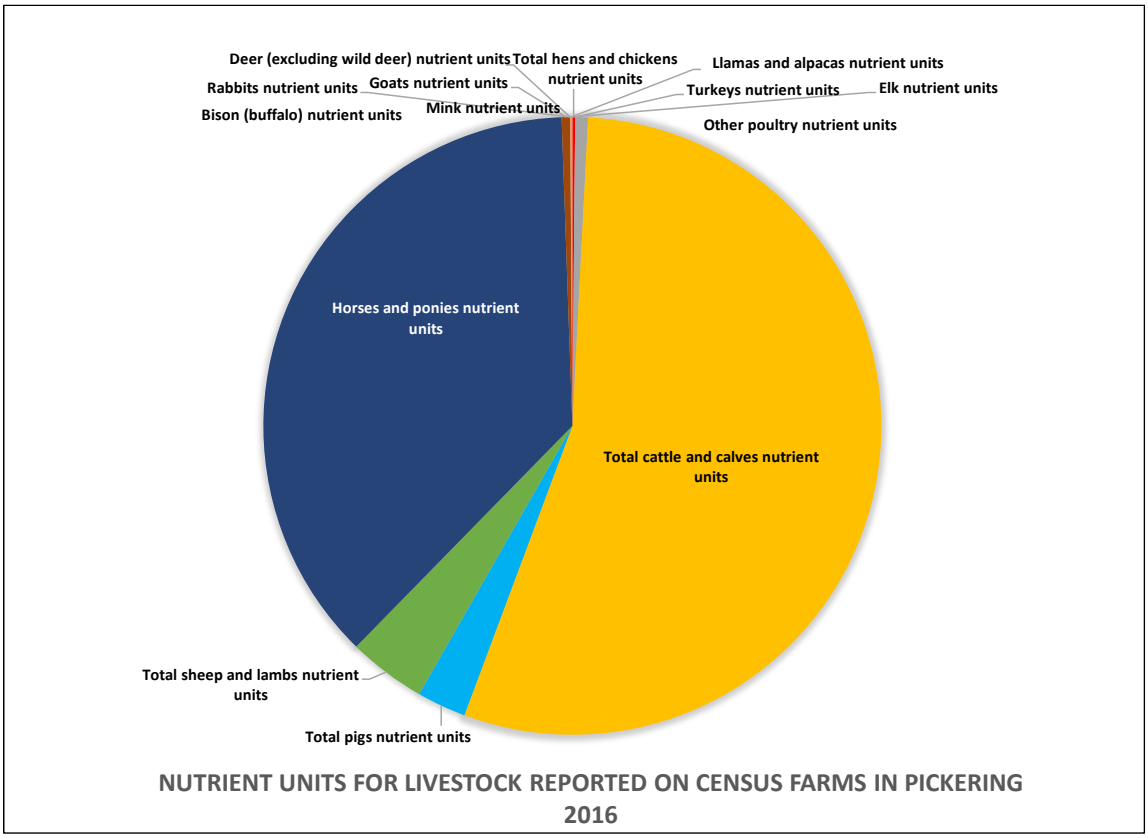
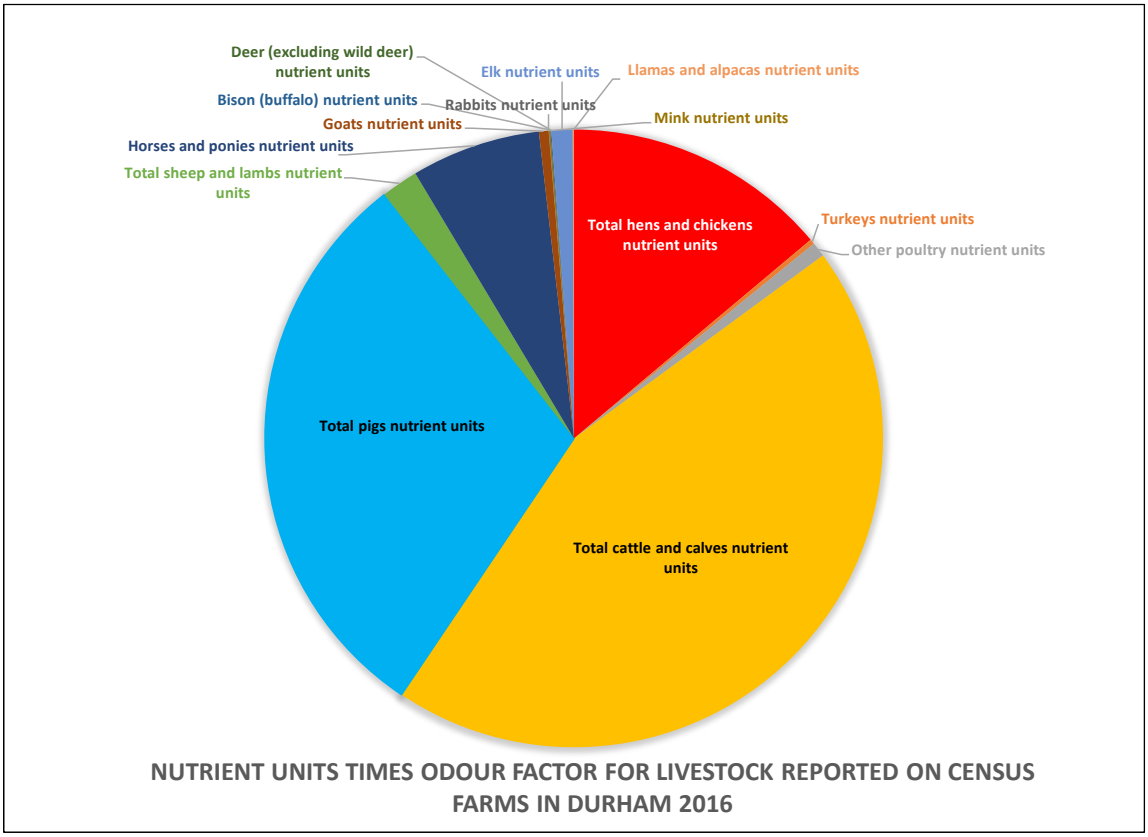


FIGURE 9



NUTRIENT UNITS FOR LIVESTOCK REPORTED ON CENSUS FARMS IN PICKERING 2016

FIGURE 10



NUTRIENT UNITS TIMES ODOUR FACTOR FOR LIVESTOCK REPORTED ON CENSUS FARMS IN DURHAM 2016

FIGURE 11

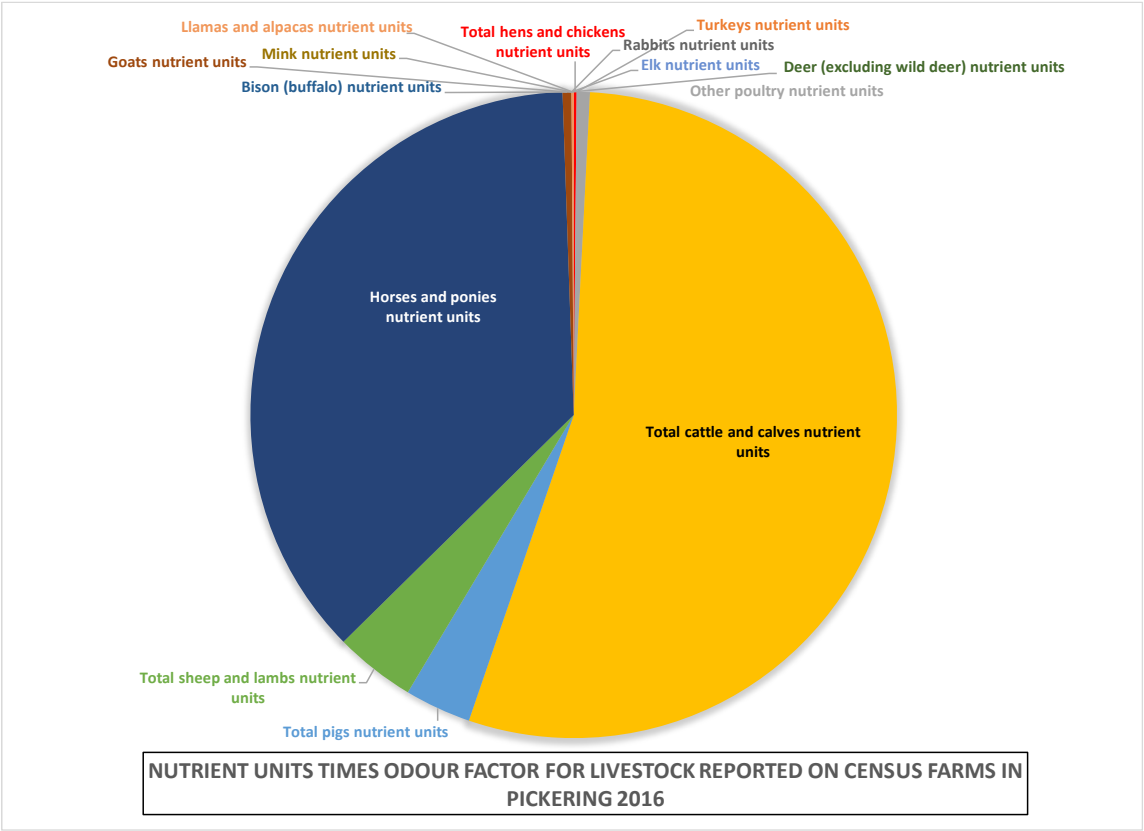


FIGURE 12

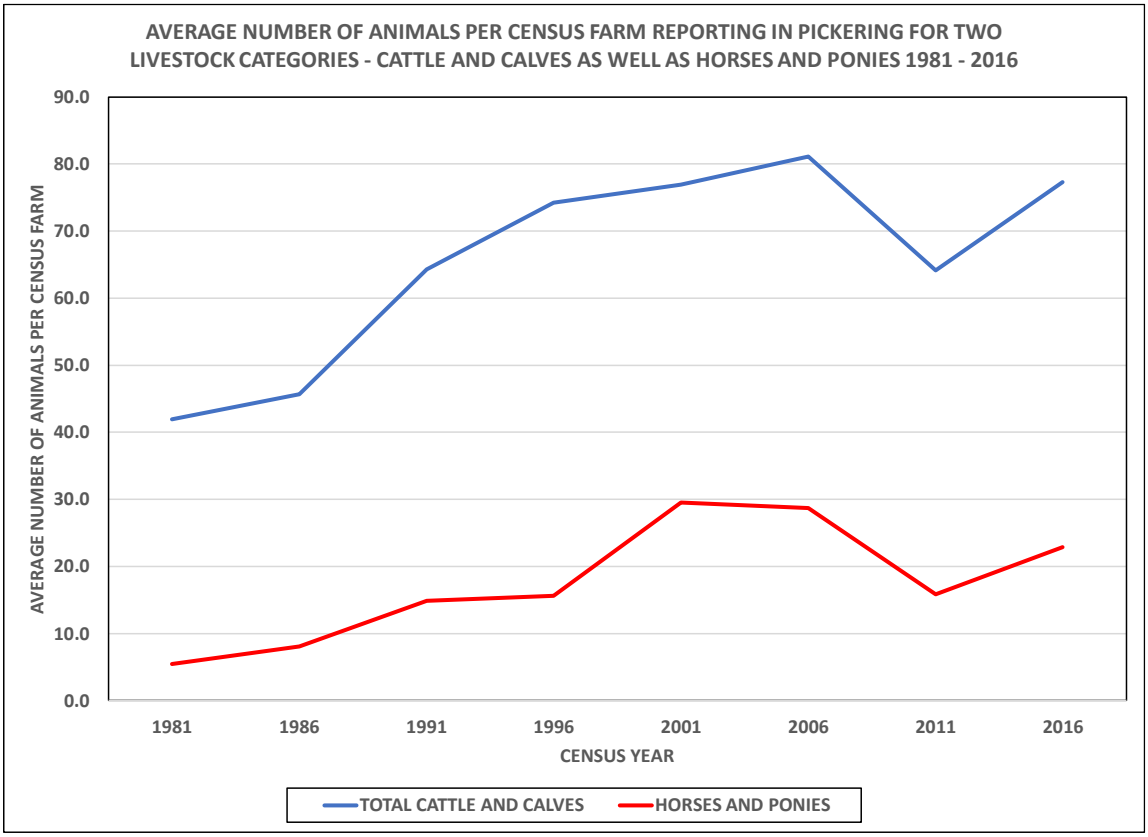
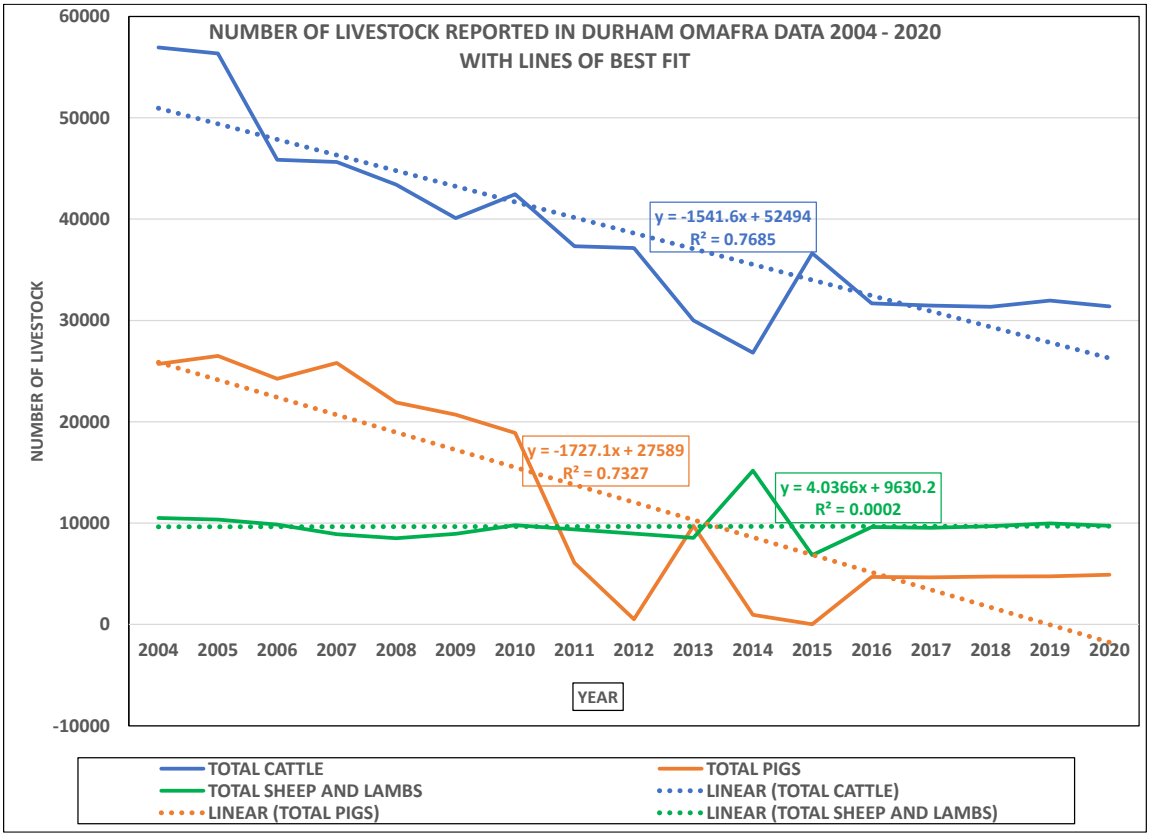


FIGURE 13



3.0 CONCLUSIONS

4. As the subject site is designated for non-agricultural development based on 1990/91 municipal planning documents, MDS I does not apply.

5. Regardless, if the MDS I setback distances were to apply, there are no potential MDS conflicts associated with the proposed Claremont development and there is sufficient distance available to allow for the expansion of an existing cattle operation or for new horse operations within the MDS study area without conflict with MDS.

6. The analyses of trends in livestock production, nutrient units, and nutrient units multiplied by odour factor indicate that the probability of conflict due to manure odours is diminishing within Pickering (which is the most precise scale of information available for these statistics).

AgPlan Limited

Michael K. Hoffman
Agricultural Analyst

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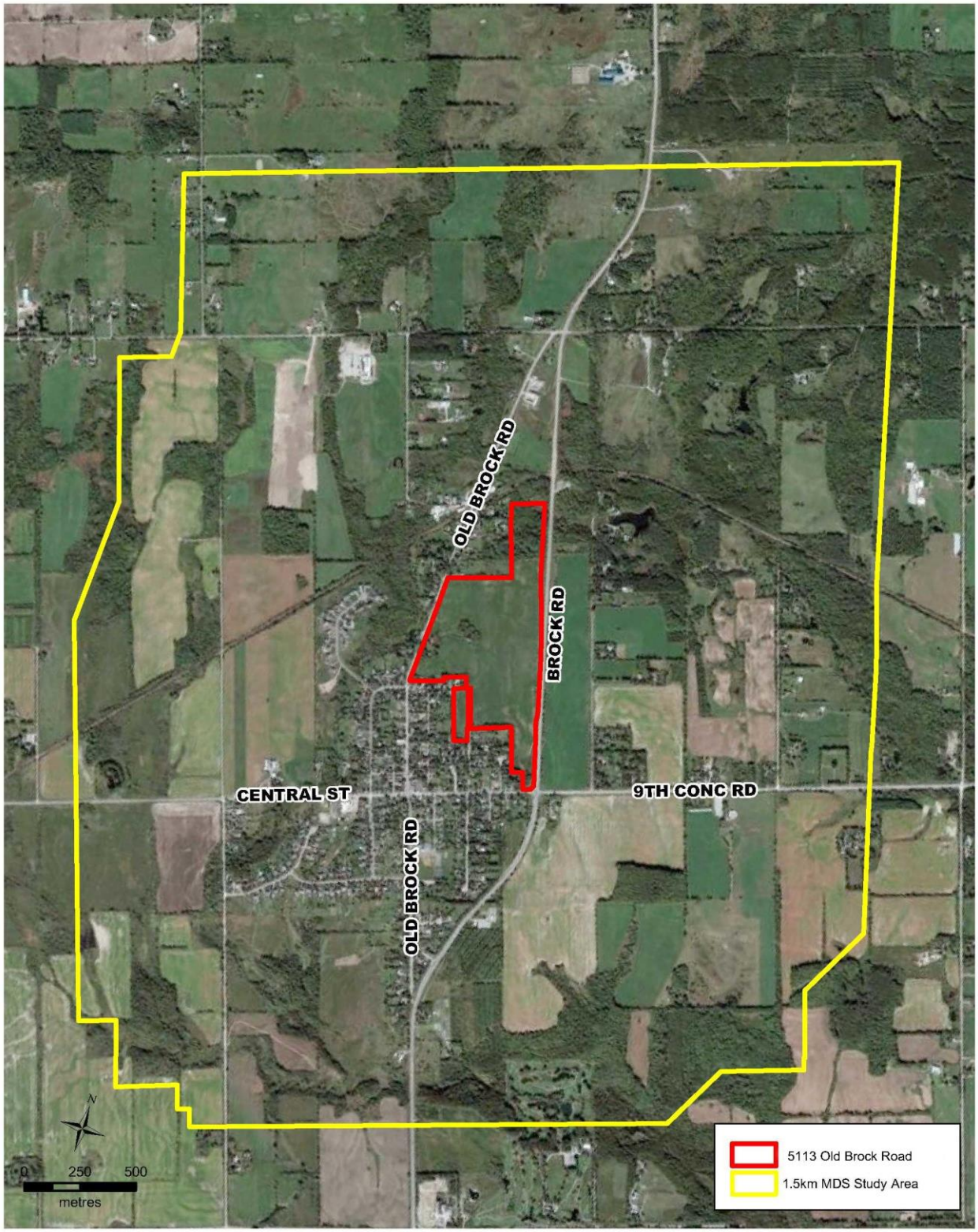
MAP 3 MDS STUDY AREA



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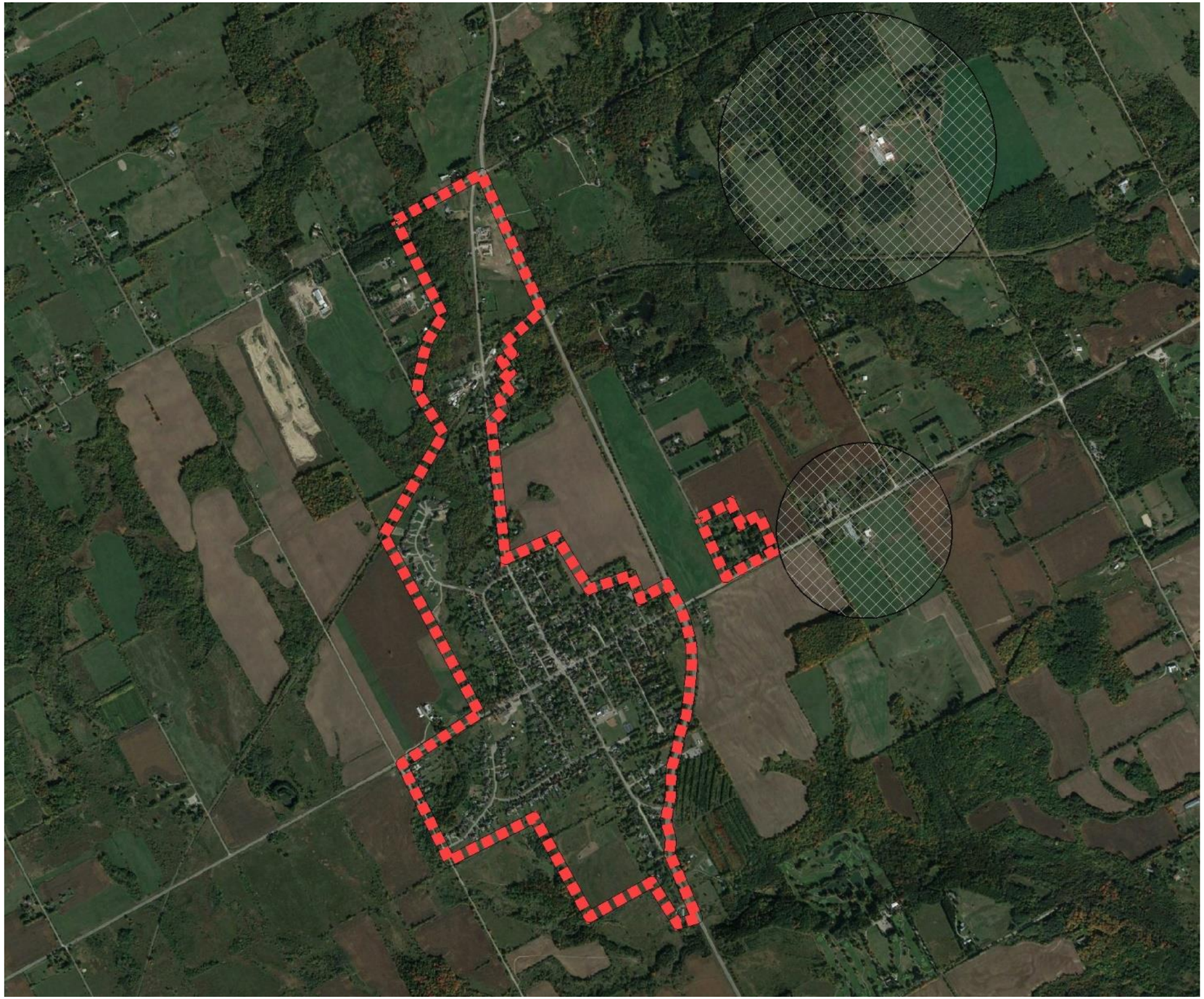
MAP 4 MDS ARCS MAP

MDS arc area

Non-agricultural use area boundary

used for Application of MDS Guideline #12



APPENDIX 1
MDS I AND MDS II CALCULATION DISCUSSION

INTRODUCTION

The following paragraphs describe a comparative analysis (a sample of 22 calculations) completed to demonstrate changes in Minimum Distance Separation (MDS) that result because of differences in:

- MDS I versus MDS II,
- manure handling system,
- kind of application which affects the use of a type “A” versus two different type “B” land-use (encroachment factors) in the MDS calculation, and,
- whether the MDS II calculation is based on a new barn as opposed to a barn expansion.

Therefore, the information presented is a small sample of the differences that can be measured based on the definitions and application of different components [manure handling system; encroachment factor (kind/type of adjacent or nearby land uses); kind, number, and character of livestock; odour potential; barn size; farm size] in MDS.

Calculations were also based on a set of questions:

1. Are MDS I and MDS II distances the same for non-farm development as for farm development, all other factors being equal?
2. Do MDS I and MDS II distances vary with number of livestock (in this instance, for example, feeder pigs, cattle with calves to weaning, broiler chickens) in the same way, all other factors being equal?
3. Do MDS II distances remain the same for new livestock facilities as opposed to expanding livestock facilities, all other factors being equal?

The MDS calculations summarized in Tables 1-1 through to 1-6 provide evidence that the answers to questions 1, 2, and 3 are all “an equivocal no”. The tables (in the header) also provide descriptions for manure management systems L1, V3, and V5. The calculations are provided in graphic form in Figures 6-1 through to 6-7 in the next section “Findings”.

METHODS

MDS was calculated using the OMAFRA software version AgriSuite 3.4.0.18. Each MDS I and MDS II calculation analysis group has been distinguished by type of livestock:

- cattle and calves to weaning,
- feeder pigs, and
- broiler chickens.

The following assumptions have been made with respect to the calculations:

1. the feeder pig livestock group has MDS calculations:
    - for type “A” land uses,
    - for an application for lot creation that results in a cluster of four, or more, non-agricultural use lots in immediate proximity to one another,
    - which apply V3 or V5 manure management.

2. the beef cows including calves to weaning livestock group has two separate MDS calculations where the first set of calculations:
    - for type "B" land uses, such as, a *new or expanding zone or designation for residential use outside of the settlement area* but not including a *new or expanding settlement area boundary* (for MDS I calculations),
    - for MDS II calculations, for type "B" land uses where lands are designated for residential uses or non-agricultural uses and are not *within a prime agricultural area or rural lands type designation*,
    - where beef cattle have access to a yard from the barn,
    - which apply L1 or V3 manure management.

3. for beef cows including calves to weaning livestock group, the second set of MDS analyses has MDS calculations:
    - for type "B" land uses, such as, adding an additional lot to an area of four or more lots for *residential use outside of the settlement area* but not including a *new or expanding settlement area boundary* (for MDS I calculations),
    - for MDS II calculations, for type "A" land uses, for new and/or expanding barns in proximity to an area of four or more lots for residential use *within a prime agricultural area or rural lands type designation,*
    - where beef cattle have access to a yard from the barn,
    - which apply L1 or V3 manure management.

4. the broiler chicken livestock group has MDS calculations:
    - for type "A" as well as type "B" land uses (where the kind of type "B" land use is a settlement area boundary expansion, which does not consider lot size), and
    - which apply L1 or V3 manure management.

5. Where *Building Base Distance* and [manure] *Storage Base Distance* are not the same, the greater distance has been used.

6. Where lot size was required for the MDS calculation, 39 ha was used.

7. MDS II calculations were also based on:
    - a new barn where no other barns currently exist on the lot, and
    - an increase in livestock number from a base number of existing livestock, such that a building addition or new barn is required, and, where no building permits for barns had been issued within the past three years (where the base number for broiler chickens was 10,000). The analyses for cattle and calves as well as feeder pigs did not use a constant base number, and instead, used a base/existing livestock number that is equal to the level of livestock number expansion. In other

words, for example, when an analysis was done for 200 feeder pigs, the existing number of feeder pigs was 100 and the number to be added was 100.

8. The number of livestock chosen for the analyses is for purposes of illustration and is not intended to have any relationship to probable herd/flock size extant or to likely size of livestock operation expansion.

The Figures (graphs) provided within this Appendix, are presented as scatter plots and/or bar graphs and include a "line of best fit". The line of best fit shown on the graphs is the one that has the highest R^2 value. If the line of best fit perfectly matched the plotted MDS values, the R^2 value would equal 1.0. The line of best fit uses an existing calculation which is part of Microsoft Excel 365 software.

FINDINGS

Graphs in this Appendix reflect the calculation results summarized in the Tables as follows:

- Figure 1-1 Table 1-1,
- Figure 1-2 Table 1-2,
- Figure 1-3 Table 1-3,
- Figure 1-4 Table 1-4,
- Figure 1-5 Table 1-5,
- Figure 1-6 Table 1-6,
- Figure 17 Table 1-6.

The following observations and conclusions are based on these Figures and Tables:

1. MDS I values are not always the highest when compared to MDS II calculations (all other factors being equal). However, MDS I values tend to be higher than MDS II values when there are lower numbers of livestock and, as livestock numbers increase, MDS II values become higher than MDS I values (reverse their relative position on the graph). Why this difference is present could not be resolved by a review of the MDS document (2017).

2. Most of the MDS I and MDS II analyses tend to increase directly with livestock number following a curve based on a power regression. However, the MDS I formula has a line of best fit following a logarithmic regression. This difference is visible in Figures 1-1, 1-3, and 1-4, where distances become constant, and the curve flattens and then subsequently increases. Why this difference is present could not be resolved by a review of the MDS document (2017).

3. As livestock numbers increase, both MDS I and MDS II calculations show a greater amount of separation difference when livestock numbers are lower, and this difference tends to decrease as livestock numbers increase (as expected with a power regression).

4. As stated in the *MDS Document* (2017), MDS I setback distance for type “A” land uses are half of those for type “B” land uses all other factors being the same. This is explained in a document by the relative density difference in human populations for type “A” versus type “B” land uses (lower versus higher densities, respectively). Why the doubling of difference is present could not be resolved by a review of the MDS document (2017).

5. MDS setbacks, or alternatively, number of livestock allowed by the MDS calculation, are greater for new barns than setbacks required for livestock facility expansions. Why this difference is present could not be resolved by a review of the MDS document (2017).

6. A type “A” land use for an existing non-agricultural use may appropriately be used when calculating MDS II for a new barn or for a barn expansion given the definitions within the MDS Document (2017). However, the same use, which triggered the requirement for MDS II setback related to new barn or barn expansion, will require a type “B” land use, if that non-agricultural use is proposed to add one more lot and is not in a prime agricultural or rural lands designation.

7. In the context of any given new barn application, the applicants could build a specific size barn and meet MDS I or II requirements as required by the wording of the MDS Document (2017). The farm applicants could subsequently (after 3 years) significantly increase the size of the barn and the number of livestock in production while still meeting MDS II requirements. MDS II distances would become less than those required for the initial smaller barn building permit.

TABLE 1-1
MDS (2017) IN METRES BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF CATTLE + CALVES

Number of Cow/calf in yard/barn	MDS I Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage	MDS I Distance (m) V3. Solid, outside, no cover >= to 30% DM	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage, Herd Expansion	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM, Herd expansion
25	298	280	279	235		
50	407	392	333	290	267	223
75	466	452	370	328		
100	512	500	394	353	314	270
125	552	541	422	381		
150	587	576	446	407	354	312
175	587	576	468	429		
200	587	576	488	450	386	345
225	587	576	507	469		
250	587	576	524	486	413	373
275	587	576	540	503		
300	587	576	555	518	437	397
400	587	576	609	573		
500	608	598	654	620	513	475
600	646	637	694	660		
700	681	673	730	697	571	534
800	712	705	762	730		
900	741	734	792	761	619	583
1000	768	762	820	790		
1500	881	878	937	910	730	698

TABLE 1-2
MDS (2017) IN METRES BASED ON ONE MANURE HANDLING SYSTEM (V3) RELATIVE TO DIFFERENT NUMBERS OF CATTLE + CALVES

Number of Cow/calf in yard/barn	MDS I Distance (m) V3. Solid, outside, no cover >= to 30% DM	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM, Herd expansion
100	500	353	270
200	576	450	345
300	576	518	397
400	576	573	439
500	598	620	475
600	637	660	506
700	673	697	534
800	705	730	560
900	734	761	583
1000	762	790	605

TABLE 1-3
MDS (2017) IN METRES BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF CATTLE + CALVES (LAND USE "A" & "B")

Number of Cow/calf in yard/barn	MDS I Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage (2)	MDS I Distance (m) V3. Solid, outside, no cover >= to 30% DM (2)	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage (2)	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM (2)	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage, Herd Expansion (2)	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM, Herd expansion (2)
25	298	280	139	117		
50	407	392	167	145	134	111
75	466	452	185	164		
100	512	500	197	176	157	135
125	552	541	211	191		
150	587	576	223	203	177	156
175	587	576	234	215		
200	587	576	244	225	193	172
225	587	576	253	234		
250	587	576	262	243	207	186
275	587	576	270	251		
300	587	576	278	259	219	199
400	587	576	304	287		
500	608	598	327	310	256	237
600	646	637	347	330		
700	681	673	365	349	285	267
800	712	705	381	365		
900	741	734	396	381	309	292
1000	768	762	410	395		
1500	881	878	469	455	365	349

TABLE 1-4
MDS (2017) IN METRES BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF FEEDER PIGS

Number of feeder pigs	MDS I Distance (m) V5. Partial slats, liquid, inside, underneath slatted floor	MDS I Distance (m) V1. Solid, inside, bedded pack	MDS II Distance (m) V5. Partial slats, liquid, inside, underneath slatted floor	MDS II Distance (m) V1. Solid, inside, bedded pack	MDS II Distance (m) V5. Partial slats, liquid, inside, underneath slatted floor, Herd Expansion	MDS II Distance (m) V1. Solid, inside, bedded pack, Herd expansion
25	317	277	164	144		
50	416	364	181	158	138	121
100	499	436	215	188	165	144
200	699	611	258	226	198	173
300	805	705	300	263		
400	891	779	322	282	247	216
500	963	843	341	298		
600	1026	898	362	317	278	243
700	1083	948	382	334		
800	1129	988	400	350	307	269
900	1129	988	417	365		
1000	1129	988	433	379	332	290
1500	1129	988	499	437		
2000	1129	988	552	483	423	370
3000	1227	1074	636	556	487	426
5000	1468	1284	761	665	583	510

TABLE 1-5
MDS (2017) IN METRES BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF BROILER CHICKENS

Number of Chicken Broilers	MDS I Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage	MDS I Distance (m) V3. Solid, outside, no cover >= to 30% DM	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage, Flock Expansion	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM, Flock Expansion
300	208	187	239	194		
5000	449	435	490	451		
10000	566	554	610	575	479	440
15000	648	639	696	662		
20000	714	707	764	732	597	561
25000	770	764	822	792		
30000	819	815	873	844	772	740
35000	863	860	919	891		
40000	895	892	951	924	863	834
45000	918	916	975	949		
50000	941	940	1000	974	930	902
55000	965	964	1024	999		
60000	988	988	1048	1023	999	973
65000	1011	1011	1072	1048		
70000	1035	1035	1096	1073	1071	1047

TABLE 1-6
MDS II (2017) IN METRES BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO NUMBER OF BROILER CHICKENS (TYPE A LAND USE)

Number of Chicken Broilers	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage. Type A Land Use	MDS II Distance (m) L1. Solid, outside, no cover, 18-30 percent DM, with uncovered liquid runoff storage. Type A Land Use, Flock Expansion	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM. Type A Land use	MDS II Distance (m) V3. Solid, outside, no cover >= to 30% DM. Type A Land use, Flock Expansion
5000	245		225	
10000	305	240	287	220
20000	382	299	366	281
30000	437	386	422	370
40000	476	431	462	417
50000	500	465	487	451
60000	524	499	512	487
70000	548	535	537	523

FIGURE 1-1


MDS (2017) IN METRES (INCLUDING LINES OF BEST FIT) BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF CATTLE + CALVES
MDS IN METRES
NUMBER OF CATTLE + CALVES
0
100
200
300
400
500
600
700
800
900
1000
0
200
400
600
800
1000
1200
1400
1600
y = 140.51x^0.2419
R² = 0.9687
y = 57.083x^0.341
R² = 0.9987
y = 79.377x^0.3009
R² = 0.9973
y = 76.609x^0.3362
R² = 0.9984
y = 100.04x^0.3023
R² = 0.9965
y = 127.91x^0.2546
R² = 0.969
MDS I DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE
MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE, HERD EXPANSION
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, HERD EXPANSION
POWER (MDS I DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE)
POWER (MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM)
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM)
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE, HERD EXPANSION)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, HERD EXPANSION)

FIGURE 1-2

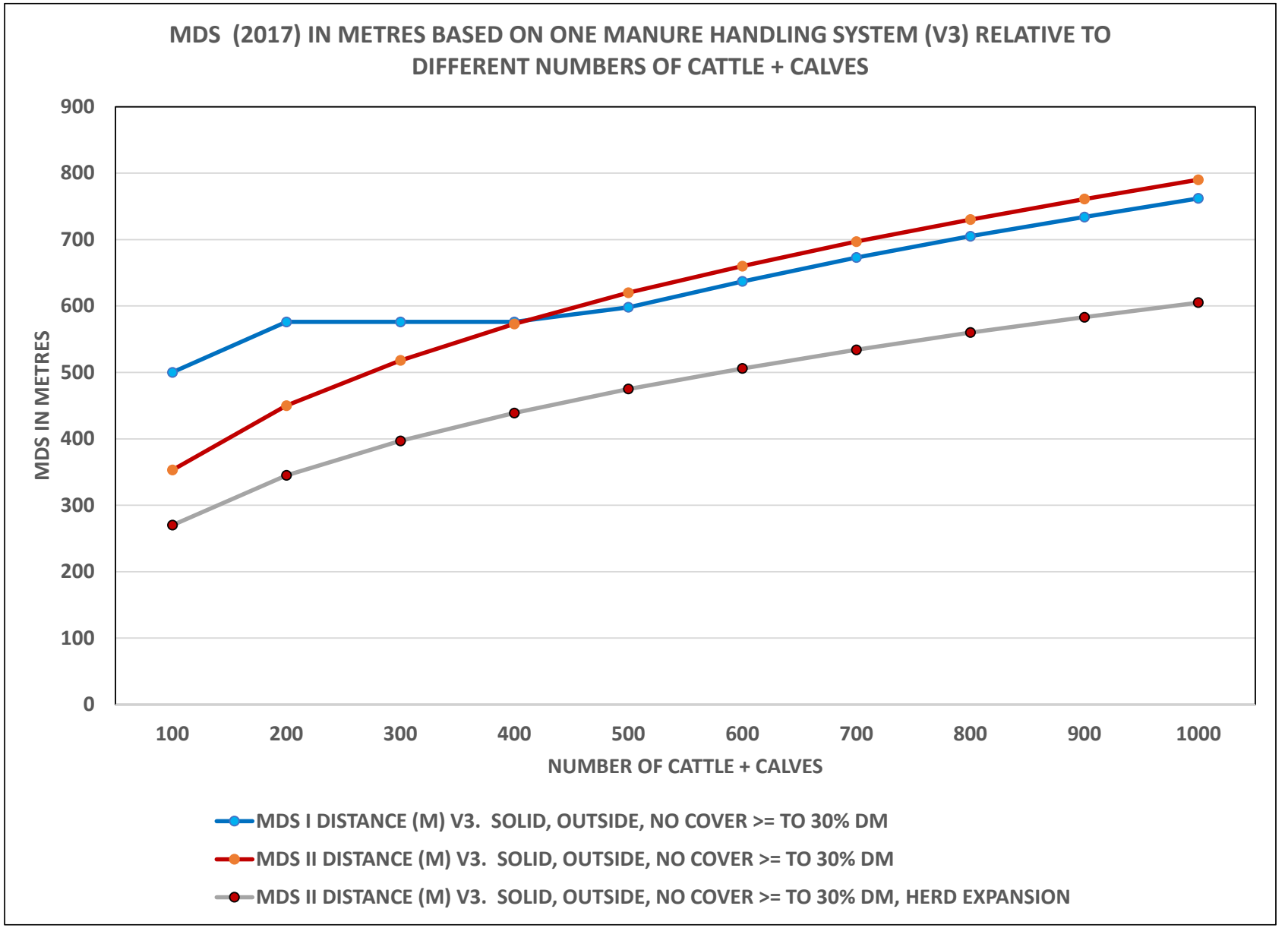

MDS (2017) IN METRES BASED ON ONE MANURE HANDLING SYSTEM (V3) RELATIVE TO DIFFERENT NUMBERS OF CATTLE + CALVES
MDS IN METRES
0
100
200
300
400
500
600
700
800
900
NUMBER OF CATTLE + CALVES
100
200
300
400
500
600
700
800
900
1000
MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, HERD EXPANSION

FIGURE 1-3


MDS (2017) IN METRES (INCLUDING LINES OF BEST FIT) BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF CATTLE + CALVES (LAND USE "A" & "B")
MDS IN METRES
NUMBER OF CATTLE + CALVES
0
100
200
300
400
500
600
700
800
900
1000
0
200
400
600
800
1000
1200
1400
1600
1800
y = 113.33ln(x) - 33.289
R² = 0.9127
y = 116.23ln(x) - 59.84
R² = 0.9126
y = 49.952x^0.3025
R² = 0.9966
y = 38.147x^0.3369
R² = 0.9985
y = 39.962x^0.2998
R² = 0.9971
y = 28.348x^0.342
R² = 0.9989
MDS I DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE (2)
MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM (2)
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE (2)
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM (2)
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE, HERD EXPANSION (2)
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, HERD EXPANSION (2)
LOG. (MDS I DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE (2))
LOG. (MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM (2))
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE (2))
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM (2))
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE, HERD EXPANSION (2))
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, HERD EXPANSION (2))

FIGURE 1-4


MDS (2017) IN METRES (INCLUDING LINES OF BEST FIT) BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO DIFFERENT NUMBERS OF FEEDER PIGS
MDS IN METRES
1600
1400
1200
1000
800
600
400
200
0
0
1000
2000
3000
4000
5000
6000
NUMBER OF FEEDER PIGS
y = 216.49ln(x) - 409.38
R² = 0.9612
y = 189.52ln(x) - 358.77
R² = 0.9611
y = 56.069x^0.2974
R² = 0.9885
y = 49.163x^0.2971
R² = 0.9883
y = 38.202x^0.3155
R² = 0.996
y = 33.417x^0.3154
R² = 0.9959
MDS I DISTANCE (M) V5. PARTIAL SLATS, LIQUID, INSIDE, UNDERNEATH SLATTED FLOOR
MDS I DISTANCE (M) V1. SOLID, INSIDE, BEDDED PACK
MDS II DISTANCE (M) V5. PARTIAL SLATS, LIQUID, INSIDE, UNDERNEATH SLATTED FLOOR
MDS II DISTANCE (M) V1. SOLID, INSIDE, BEDDED PACK
MDS II DISTANCE (M) V5. PARTIAL SLATS, LIQUID, INSIDE, UNDERNEATH SLATTED FLOOR, HERD EXPANSION
MDS II DISTANCE (M) V1. SOLID, INSIDE, BEDDED PACK, HERD EXPANSION
LOG. (MDS I DISTANCE (M) V5. PARTIAL SLATS, LIQUID, INSIDE, UNDERNEATH SLATTED FLOOR)
LOG. (MDS I DISTANCE (M) V1. SOLID, INSIDE, BEDDED PACK)
POWER (MDS II DISTANCE (M) V5. PARTIAL SLATS, LIQUID, INSIDE, UNDERNEATH SLATTED FLOOR)
POWER (MDS II DISTANCE (M) V1. SOLID, INSIDE, BEDDED PACK)
POWER (MDS II DISTANCE (M) V5. PARTIAL SLATS, LIQUID, INSIDE, UNDERNEATH SLATTED FLOOR, HERD EXPANSION)
POWER (MDS II DISTANCE (M) V1. SOLID, INSIDE, BEDDED PACK, HERD EXPANSION)

FIGURE 1-5

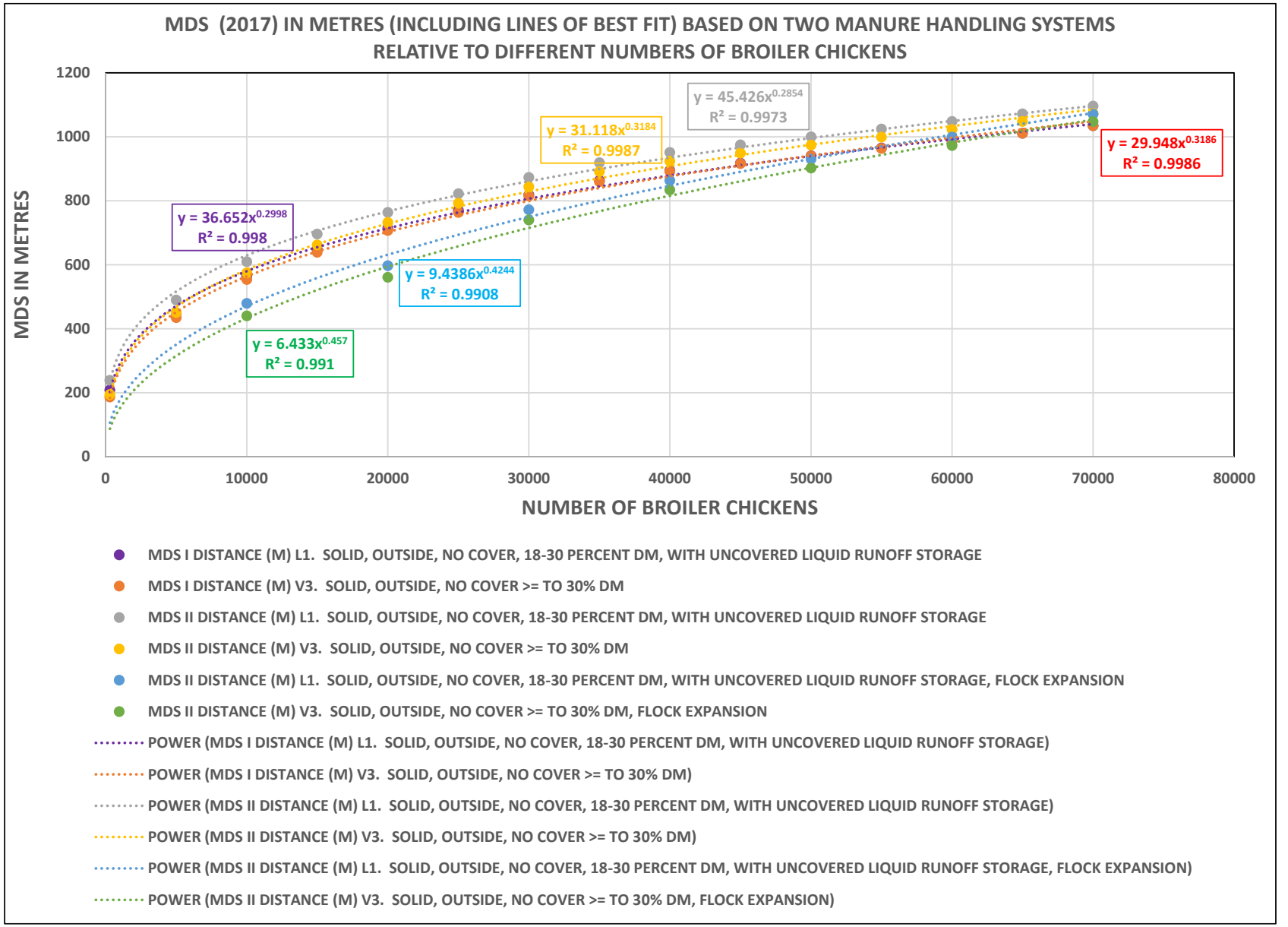

MDS (2017) IN METRES (INCLUDING LINES OF BEST FIT) BASED ON TWO MANURE HANDLING SYSTEMS
RELATIVE TO DIFFERENT NUMBERS OF BROILER CHICKENS
MDS IN METRES
NUMBER OF BROILER CHICKENS
0
200
400
600
800
1000
1200
0
10000
20000
30000
40000
50000
60000
70000
80000
y = 36.652x^0.2998
R² = 0.998
y = 6.433x^0.457
R² = 0.991
y = 9.4386x^0.4244
R² = 0.9908
y = 31.118x^0.3184
R² = 0.9987
y = 45.426x^0.2854
R² = 0.9973
y = 29.948x^0.3186
R² = 0.9986
MDS I DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE
MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE, FLOCK EXPANSION
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, FLOCK EXPANSION
POWER (MDS I DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE)
POWER (MDS I DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM)
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM)
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE, FLOCK EXPANSION)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM, FLOCK EXPANSION)

FIGURE 1-6

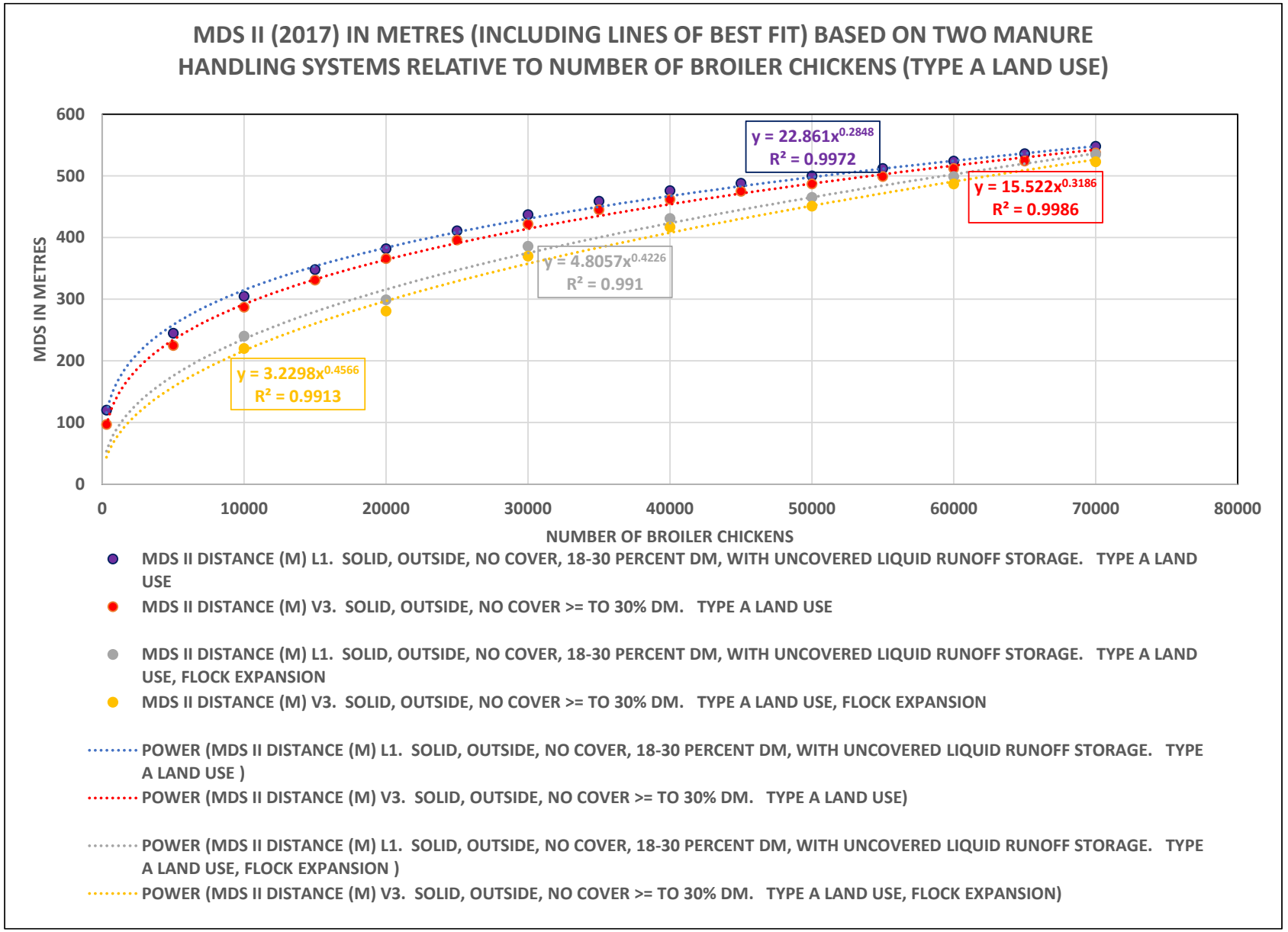
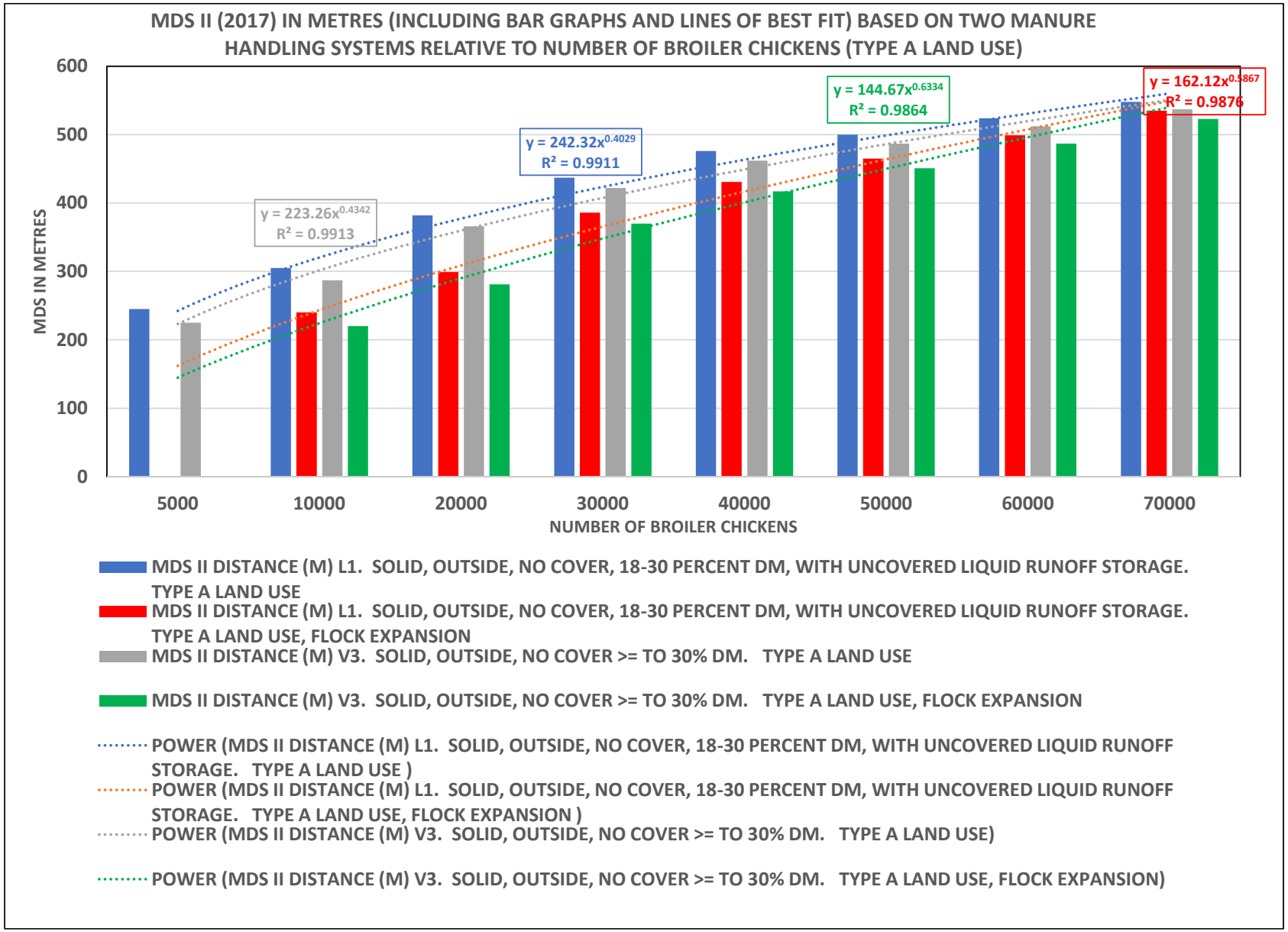

MDS II (2017) IN METRES (INCLUDING LINES OF BEST FIT) BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO NUMBER OF BROILER CHICKENS (TYPE A LAND USE)
MDS IN METRES
600
500
400
300
200
100
0
0
10000
20000
30000
40000
50000
60000
70000
80000
NUMBER OF BROILER CHICKENS
y = 22.861x^0.2848
R² = 0.9972
y = 15.522x^0.3186
R² = 0.9986
y = 4.8057x^0.4226
R² = 0.991
y = 3.2298x^0.4566
R² = 0.9913
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE, FLOCK EXPANSION
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE, FLOCK EXPANSION
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE)
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE, FLOCK EXPANSION)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE, FLOCK EXPANSION)

FIGURE 1-7


MDS II (2017) IN METRES (INCLUDING BAR GRAPHS AND LINES OF BEST FIT) BASED ON TWO MANURE HANDLING SYSTEMS RELATIVE TO NUMBER OF BROILER CHICKENS (TYPE A LAND USE)
MDS IN METRES
600
500
400
300
200
100
0
y = 223.26x^0.4342
R² = 0.9913
y = 242.32x^0.4029
R² = 0.9911
y = 144.67x^0.6334
R² = 0.9864
y = 162.12x^0.5867
R² = 0.9876
5000
10000
20000
30000
40000
50000
60000
70000
NUMBER OF BROILER CHICKENS
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE
MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE, FLOCK EXPANSION
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE
MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE, FLOCK EXPANSION
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE)
POWER (MDS II DISTANCE (M) L1. SOLID, OUTSIDE, NO COVER, 18-30 PERCENT DM, WITH UNCOVERED LIQUID RUNOFF STORAGE. TYPE A LAND USE, FLOCK EXPANSION)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE)
POWER (MDS II DISTANCE (M) V3. SOLID, OUTSIDE, NO COVER >= TO 30% DM. TYPE A LAND USE, FLOCK EXPANSION)