Kildare County Council
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Kerdiffstown Landfill Remediation Project

Kildare County Council

Environmental Impact Assessment Report (EIAR) Volume 4 of 4: Appendices (Part 4)

32EW5604 DOC 0056 | Final

August 2017



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Kerdiffstown Landfill Remediation Project

Kildare County Council

Groundwater DQRA Technical Note

Rev 2

10 March 2017

Document history and status

Revision	Date	Description	By	Review	Approved
1	15/02/2017	First issue for client comment	Ryan Turner	Vanina Saint Martin	Rhianna Rose
2	10/03/2017	Second issue for client information	Ryan Turner	Mark Burston, Vanina Saint Martin	Rhianna Rose

Distribution of copies

Revision	Issue approved	Date issued	Issued to	Comments
2	09/03/2017	10/03/2017	Kevin Motherway	For information

Kerdiffstown Landfill Remediation Project

Project No:	32EW5604
Document Title:	Groundwater DQRA Technical Note
Revision:	V2
Date:	10 March 2017
Client Name:	Kildare County Council
Project Manager:	Rhianna Rose
Author:	Ryan Turner
File Name:	\\Iedub1-fil001\ji\Sustainable Solutions\Kerdiffstown Landfill\4 - Documents\4.1 - Issued Documents\32EW5604 J Hydrogeological Task\2017_03_10 Kerdiffstown DQRA 2017.docx

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1. Introduction

1.1 Introduction and Objectives

This technical note provides details of groundwater detailed quantitative risk assessments (DQRAs) undertaken to assess the potential impacts to groundwater and associated surface water receptors from the Kerdiffstown landfill site in its current condition and following the proposed remediation works. The assessment has been undertaken for each of the five identified zones at the site which contain waste material.

The principal objective of the DQRAs is to quantify the effects of the proposed remediation of the Kerdiffstown landfill site on the water receptors, including assessing the likely effects of capping the site, one benefit of which is to reduce rainwater recharge into the wastes.

1.2 Background

Kerdiffstown landfill is a former sand and gravel quarry which has been progressively backfilled with wastes by a variety of operators from the 1950s onwards. Details of these earlier wastes are not known. However, the site was then operated as a licenced waste facility between 1995 and 2010 and was effectively abandoned in mid-2010 in an unsecured condition.

Since completion of the environmental liabilities assessment in 2010, Jacobs has been working with the EPA and KCC and was appointed as Framework Contractor in February 2013. Over the years groundwater monitoring boreholes have been installed within and outside the site to determine the extent of any groundwater contamination associated with the landfilled waste. Jacobs has completed groundwater and surface water monitoring on a monthly basis with the most recent report being produced following the six-monthly monitoring in December 2016 (Reference 1).

Reference 1 describes the site setting and defines the current groundwater quality data and assesses trends in groundwater quality. The reference also contains a plan showing monitoring borehole locations. The reference also includes details of the groundwater level monitoring and the local groundwater regime. Groundwater quality and level data are not provided in this technical note and if required Reference 1 should be read to gain an understanding of groundwater quality and groundwater levels at the site.

The most recent site investigation was undertaken in the autumn of 2016. Factual data from this investigation are provided in Reference 2 and relevant data from the investigation are considered in the geology and hydrogeology chapter of the Environmental Impact Assessment Report (EAIR, Reference 3).

The Kerdiffstown Landfill site has been split into several zones, each zone having characteristic properties in terms of historical waste disposal and site features. Descriptions and conceptualisation of each zone are provided in the Preliminary CSM Technical Note (Jacobs, Reference 4). For each zone, conceptual Site Models (CSMs) have been defined based on zone specific waste type, geology and hydrogeology.

The receptors have been identified as the groundwater within the sand and gravels or overburden deposits, the limestone aquifer (thought to be restricted to the upper 5m to 10m of weathered bedrock known as the transition zone where fractures are present) and the Morell River which is in hydraulic connection with the groundwater in the overburden.

1.3 Justification for Modelling Approach and Software

The modelling approach adopted for this assessment has used two probabilistic analytical software packages, LandSim and RAM3. An outline of these modelling packages is provided in the following sections, but for more detail Reference 5 and Reference 6 should be read.

Previous modelling of Zone 1 (Reference 7) utilised the LandSim software package which is modelling software developed by England's Environment Agency to assess the impacts from typical landfill sites. However, for the purpose of this assessment, the RAM3 modelling package has been used to model Zone 1 as it offers more

flexibility in terms of the contaminant sources, pathways and receptors to simulate the pathway from the saturated waste as well as that from recharge passing though the waste and unsaturated zone into the overburden groundwater.

The RAM3 software package has also been used for modelling impacts from Zones 2A, 2B and 4 as these have characteristics similar to Zone 1 with the presence of waste beneath the water table (except for Zone 2A) and having no engineered liner at the base of the waste.

For Zone 3, the lined landfill cell has a basal liner and, following remediation, would be completed with an engineered cap. Wastes in this zone are also above the water table and as such Zone 3 is better suited to be modelled using the LandSim program.

1.3.1 Monte Carlo Probabilistic Risk Assessment

The Monte Carlo approach to probabilistic risk assessment scientifically addresses the case where a parameter may have a range of values. In this approach, parameters which have a range of values are considered in turn. Instead of assigning a single value to each parameter, a combination of data and expert judgement are used to define the distribution of possible values that the parameter might take. This allows for the possibility that a given parameter might, at this site, have a particularly low or high value, but would also incorporate the knowledge of how likely these extreme values are. Once all the parameters with a range of values have been associated with a probability distribution in this way, the model is evaluated many times. In each simulation, values are chosen for each parameter with a range of values by sampling a random value from its probability distribution. The distribution of results from the model represents our understanding of the uncertain consequences of our range of values used for the input parameters.

This approach applies to both LandSim and RAM3.

1.3.2 RAM Methodology

RAM is an Excel spreadsheet based modelling package published by ESI Limited that provides an assessment of risk using the source-pathway-receptor methodology. In this approach, contaminant migration pathways are identified from the conceptual model. The corresponding risk of groundwater contamination is evaluated by considering the three components in sequence, with the contaminant release from the source providing the input flux to the pathway and the contaminant flux from the pathway providing the contaminant load to the receptor.

The source of the contaminants is modelled based on leachate from the contaminated material. The pathway is modelled as an advection-dispersion-retardation-decay transport model, solved using a Laplace transform solution method. The receptor can be an aquifer, abstraction borehole or a river, with for example, dilution in a river being considered. The analysis along each pathway takes account of the geometry of the pathway, but is essentially one-dimensional, with a simple description of the physical parameters affecting the contaminant migration along the pathway.

The sources, pathways and receptors determined in the CSM are entered into RAM as a graphical representation as shown in Figure 1 for Zone 1.

The spreadsheet model represents the key properties of the migration pathway as a one-dimensional flow geometry, and through the Monte Carlo method, it is able to quantify the outcome where a range of values might apply for any given parameter. Results from the RAM models have been reported at the 50%ile and 95%ile level.

1.3.3 RAM3 Model Calibration and Validation

The RAM3 models for each zone have been calibrated using groundwater quality data collected in ground investigations and monitoring works. A key consideration in the calibration of the models is the range of source concentrations which are input to each model. Source concentrations used for each zone have been determined from consideration of the leachate quality obtained from Zone 3 between 2010 and 2016, the results

of leaching tests on soil samples collected in the 2016 ground investigation and from the concentrations of the determinands measured in groundwater adjacent to each zone.

For each model, the calibration has considered the concentrations in groundwater in the overburden deposits at a point 10m from the edge of the zone and in the groundwater adjacent to the surface water receptor (Morell River). Predicted concentrations in the river, following dilution, are provided in the surface water chapter of the EIA.

Each zone has been modelled for substances that have been identified as being elevated in groundwater and leachate at the site which have a range of physiochemical properties. This includes organic and inorganic substances as shown in Table 1.1.

Table 1.1 – Substances Considered in the Assessment

Substance	Mobility	Degradation Rate	Rationale for including in the assessment
Inorganic substances			
Chloride	Highly mobile with no retardation.	Substance does not degrade	Chloride is a key contaminant of landfill leachate and is identified as being elevated in groundwater at the Kerdiffstown site.
Ammoniacal nitrogen	Moderate mobility with low retardation	In the model it is assumed that there is no degradation, although under ideal circumstances ammoniacal nitrogen can degrade to nitrate	Ammoniacal nitrogen is a key contaminant of landfill leachate and is identified as being elevated in groundwater at the Kerdiffstown site.
Nickel	Low mobility with high retardation	Substance does not degrade	Nickel is identified as being elevated in the leachate collected in Zone 3, although relatively low concentrations are identified in groundwater (for example up to 0.079mg/l .in borehole EMW03 at the edge of Zone 1) Leaching test data for samples from Zone 1 also showed relatively low concentrations of nickel ranging from <0.002mg/l to 0.075mg/l.
Zinc	Low mobility with high retardation	Substance does not degrade	Zinc is identified as being elevated in the leachate collected in Zone 3, although relatively low concentrations are identified in groundwater (although up to 0.3mg/l in EMW13 at the edge of Zone 1) Leaching test data for samples from Zone 1 showed moderate concentrations of zinc ranging from 0.0052mg/l to 0.157mg/l.
Organic substance*			
Benzene	Compared to other organic substances, benzene has a relatively high mobility	Moderate degradation rate, with a half-life in the order of a few years	Benzene has a relatively low guideline value and has been detected periodically in the leachate from Zone 3, although generally it is not detected in groundwater.

Substance	Mobility	Degradation Rate	Rationale for including in the assessment
Mecoprop	Compared to other organic substance, mecoprop has a relatively high mobility	High degradation rate, with a half-life in the order of 10s to 100s of days.	Mecoprop has been detected in groundwater at concentrations above the interim guideline value IGV* (IGV).
Phenol	Compared to other organic substance, phenol has a relatively high mobility	High to moderate degradation rate, with a half-life in the order of year.	Phenol has been detected in groundwater at concentrations above the IGV.

* For organic substances, the mobility is related to the organic content of the soils as well as the organic partition coefficient

** IGVs are provided in Reference 8

1.3.4 LandSim Methodology

LandSim allows the computer simulation of leakage from a typical landfill site to be modelled on the basis of key site-specific parameters and the landfill's setting. This includes design of the landfill cap and liner system and the control of leachate levels within the waste.

Few of the input parameters (such as rainfall infiltration, leachate concentrations) are known exactly and therefore a probabilistic model is considered to be the best approach for assessing groundwater impacts. That is because each parameter can be described by a range of possible/probable values incorporating the available information and selecting values for each simulation within this range. During each simulation the parameters are assigned a value from within the defined ranges. After say 1000 iterations, a range of possible predicted leakage or outcome values are obtained and it becomes possible to quantify the likelihood of a certain outcome.

LandSim uses statistical distributions or probability density functions (PDFs) to characterise many of the input parameters. Each time a calculation is carried out, one value from the defined input distributions is chosen by the computer code and, for example, a concentration at the receptor is calculated. Each result is stored such that after repeating the same calculation many times, an output distribution for the concentration at the receptor is obtained. The distribution output is given in terms of percentiles (%iles). These %iles specify the probability with which a certain value (e.g., leakage rate) will not be exceeded. For instance, if the 95%ile of a leakage rate distribution is given as 0.1m^3/day, there is a 95% chance that the actual leakage rate will be below or equal to 0.1 m^3/day. It follows that there is also a 5% chance that the actual leakage rate will be above this. The 50%ile output is viewed as the most likely result from the model. Jacobs considers that the 95%ile output is sufficient to represent a worst case output for the Kerdiffstown site.

1.4 Structure of this Technical Note

This technical note is divided into the models for each zone with source input data shown in a corresponding appendix for each zone. The results output from each model is also presented in the appendices with a summary of the results.

The technical note also provides an assessment of the results and considers the site as a whole, the key issues identified from the models and how this fits in with the remediation of the site.

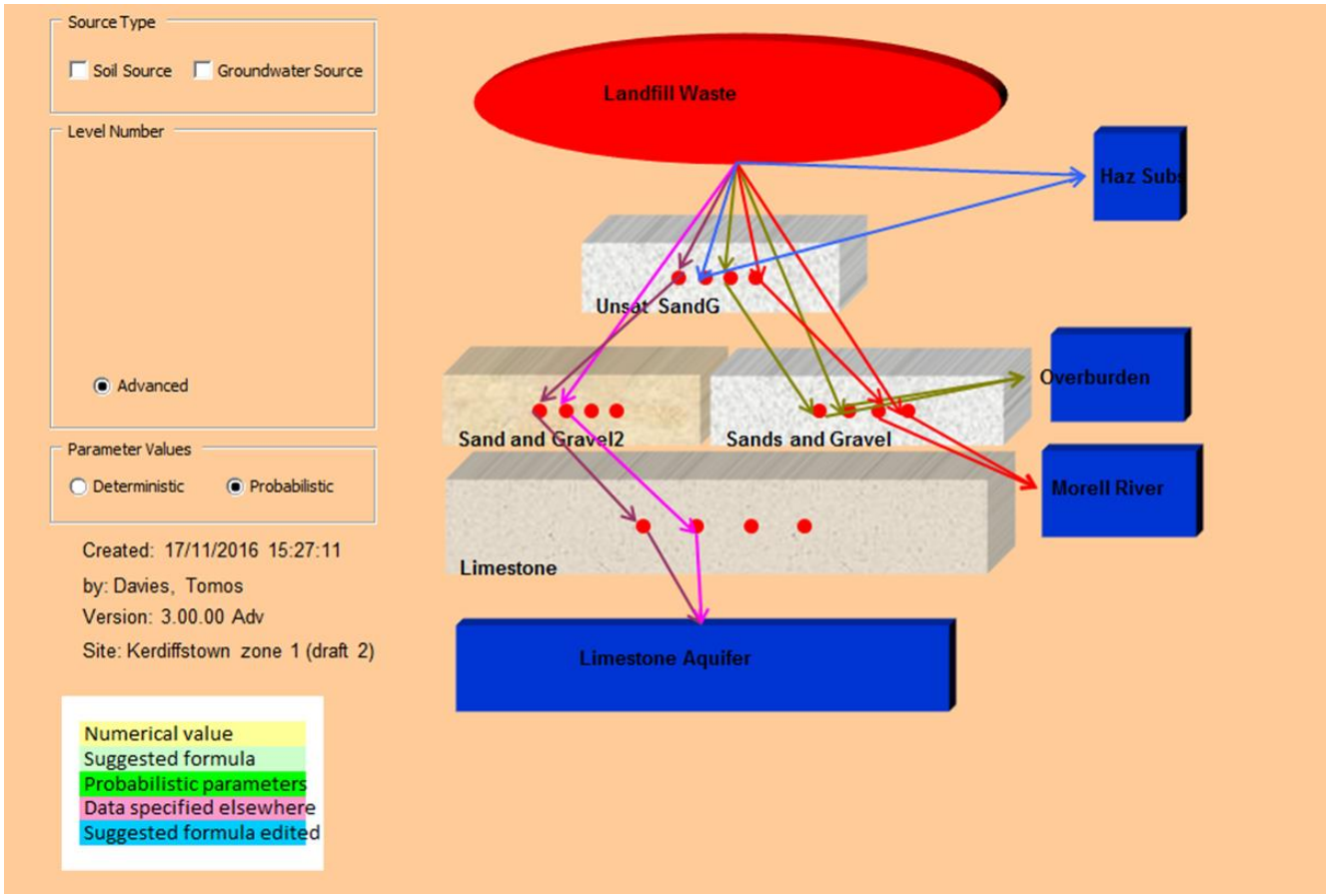
2. Zone 1

2.1 Zone 1 model construction

The CSM for Zone 1 (and other zones) is provided in the Preliminary CSM Technical Note (Reference 4).

RAM has the ability to represent waste sources below and above the groundwater table. This is simulated via the user input of different pathways and a water balance using the modelling software in Advanced Mode. The conceptual breakdown of the CSM for the RAM model is shown on Figure 1.

Figure 1 : Conceptual breakdown of the CSM of Zone 1 for the RAM model



The “Zone 1 Uncapped” model was calibrated using groundwater quality concentrations recorded immediately downgradient of Zone 1, as well as in vicinity of the Morell River. Key parameters used during the calibration process were the source term concentrations and the hydraulic conductivity of the overburden deposits.

Source term concentrations used as model inputs for ammoniacal nitrogen, chloride and metals were derived from available ground investigation data (Zone 1 leachability tests from 2016 and Zone 3 leachate quality data obtained between 2010 and 2016). Source inputs for formaldehyde, mecoprop and phenol were based upon a range of literature values as set out in the Groundwater DQRA Report (Reference 7).

Hydraulic conductivity estimates were obtained from site specific permeability estimates for the overburden deposits and the limestone bedrock.

In addition, partition coefficient (Kd) value estimates were derived from the LandSim manual, with organic partition coefficient (Koc) values for [1]mecoprop, [2]phenol and [3]formaldehyde being derived from literature values. Groundwater head, hydraulic gradient and fraction of organic carbon (foc) values were obtained from local ground investigations and porosity estimates were derived from the LandSim help files. Dry bulk density estimates were obtained from ConSim help files and half-life estimates were derived from various literature sources (from the Environment Agency, US EPA and the LandSim and ConSim help files).

Model inputs are provided in Appendix A.

Following the initial model which represents Zone 1 in its current uncapped state, a further model ("Zone 1 Capped") was created to simulate a cap being placed above the waste. For the capped scenario infiltration rates have been calculated using the RAM software based on the permeability of the cap and assuming that drains are installed around the entire edge of the zone.

It should be noted that a key limitation with RAM is the ability to run the capping scenarios applying an initial phase of open waste infiltration followed by a capped period. The period during which the waste cannot be properly simulated as open waste generates a higher source concentration and a slower decrease in the source term. This generates a level of conservatism which only applies to the capped scenario. This limitation needs to be taken into account when looking at the results obtained and comparing uncapped and capped scenarios.

2.2 Model output and Sensitivity Assessment

Tables 2.1 and 2.2 summarise the predicted peak concentrations at 50%ile and 95%ile for ammoniacal nitrogen in both the uncapped and capped scenarios. Results for the other substances are provided in Appendix A and Figures 2.1 to 2.8 show ammoniacal nitrogen concentrations for the 95%ile results.

Results are reported in Tables 2.1 and 2.2 for:

- Saturated waste : this is the source term concentration within the saturated portion of the waste;
- Overburden 10m from the zone : groundwater concentration within the overburden deposits 10m away from the zone boundary;
- Overburden at the Morell River: groundwater concentration within the overburden deposits adjacent to the Morell River (note this is not the concentration in the river itself, rather the groundwater adjacent to the river. Dilution of the contaminants would subsequently occur within the river); and
- Limestone: groundwater concentration within the limestone aquifer 50m away from the zone boundary.

Table 2.1 : Uncapped Model Results for Ammoniacal Nitrogen in Zone 1

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated waste	401	1	671	1
Overburden 10m from the zone	37	100	98	50
Overburden at the Morell River	27	150	83	80

[1] Environment Agency, 2002. The Effects of Contaminant Concentration on the Potential for Natural Attenuation R&D
[2] Environment Agency, 2008. Compilation of data for priority organic pollutants for derivation of Soil Guideline Values
[3] US EPA RBCA dataset

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Limestone	19	150	67	80

Table 2.2 : Capped Model Results for Ammoniacal Nitrogen in Zone 1

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated waste	387	1	687	1
Overburden 10m from the zone	55	250	124	250
Overburden at the Morell River	50	250	114	250
Limestone 50m from the zone	29	250	73	250

Figure 2.1 : Zone 1 Uncapped Saturated Waste (95%ile)

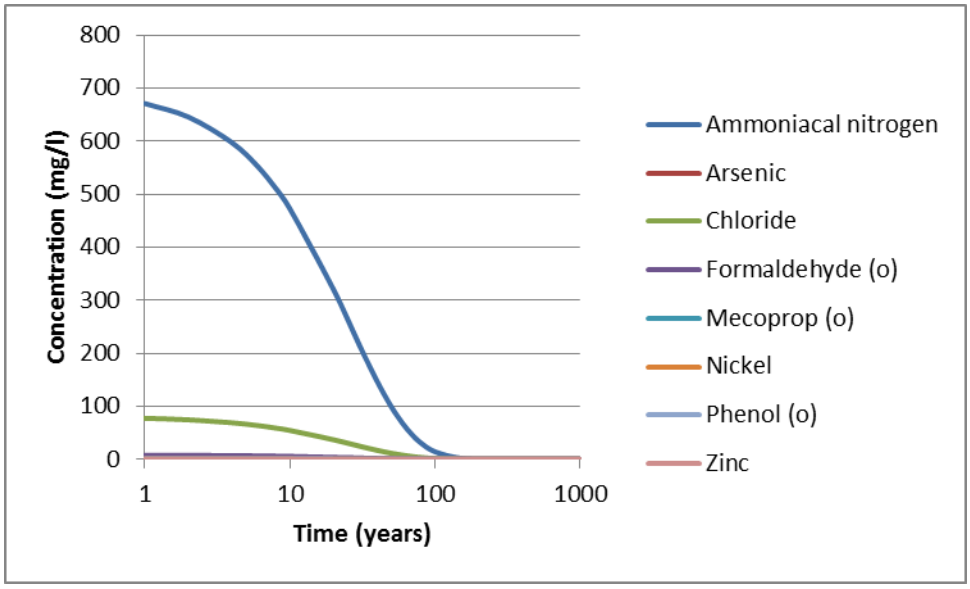
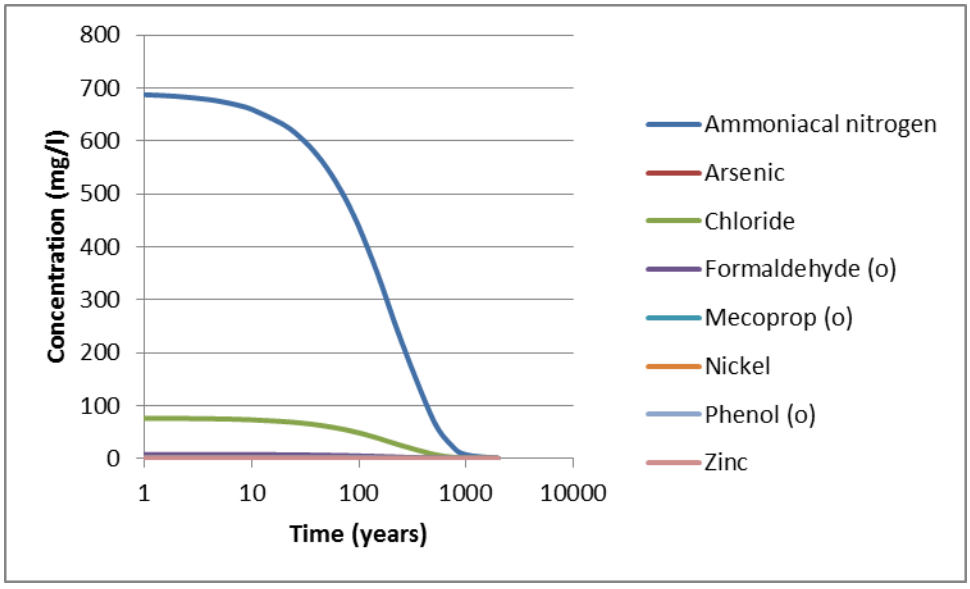


Figure 2.2 : Zone 1 Capped Saturated Waste (95%ile)



It would be expected that the saturated waste concentrations are the same in both capped and uncapped scenarios in the first 20 years (or until such time the wastes are capped), at which point the capping is placed and the concentration decline shapes would diverge. However a review of Figures 2.1 and 2.2 shows that there is a saturated waste source concentration of 200mg/l higher in the capped scenario compared to the uncapped scenario for ammoniacal nitrogen at the 95%ile at the 20 year time point. This is due to the limitation of RAM to simulate a period of open waste followed by a capped waste.

To attempt reducing the significance of this limitation, a sensitivity analysis on ammoniacal nitrogen was undertaken, with a reduced likely source concentration by 100mg/l and a reduced maximum source concentration by 200mg/l in the capped scenario. This resulted in concentrations of ammoniacal nitrogen

reasonably matching after 20 years the concentrations at 95%ile for saturated waste in the uncapped scenario. The results of this sensitivity analysis are provided in Table 2.3.

Table 2.3 : Results of sensitivity analysis (Capped Model)

Receptor	Sensitivity Analysis Capped Scenario (50%ile)		Sensitivity Analysis Capped Scenario (95%ile)	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated waste	305	1	511	1
Overburden 10m from the zone	48	250	92	150
Overburden at the Morell River	43	250	85	250
Limestone 50m from the zone	26	250	59	250

A further sensitivity analysis was undertaken to explore the effect of increasing the source terms for chloride and zinc based upon recent ground investigation data which were not available during the initial modelling. The data indicated a potentially higher source concentration within Zone 1 wastes based on the leaching test results from samples collected from Zone 1. The chloride source distribution was therefore increased to range from 0.5mg/l to 500mg/l and the zinc source term was amended to range from 0.013mg/l to 3.7mg/l. The results of this secondary sensitivity analysis is summarised in Table 2.4.

Table 2.4 : Results of sensitivity analysis to assess higher source concentrations (Uncapped Model)

Receptor	Uncapped Scenario (95%ile)		Sensitivity Analysis Uncapped Scenario (95%ile)	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Chloride				
Saturated waste	77	1	376	1
Overburden 10m from the zone	28	20	141	20
Overburden at the Morell River	27	30	137	30
Limestone 50m from the zone	40	10	197	10
Zinc				
Saturated waste	0.06	1	2.8	1
Overburden 10m from the zone	1.91×10^{-4}	2000	0.006	2000
Overburden at the Morell River	1.17×10^{-4}	2000	0.003	2000
Limestone 50m from the zone	3.51×10^{-5}	2000	0.001	2000

Figure 2.3 : Zone 1 Uncapped Overburden Receptor 10m from Zone (95%ile)

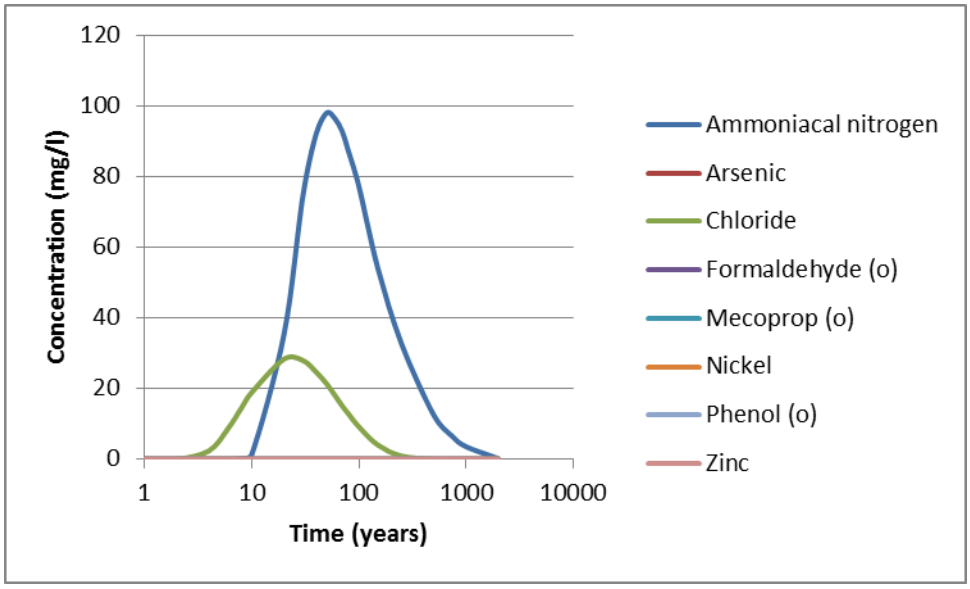


Figure 2.4 : Zone 1 Capped Overburden Receptor 10m from Zone (95%ile)

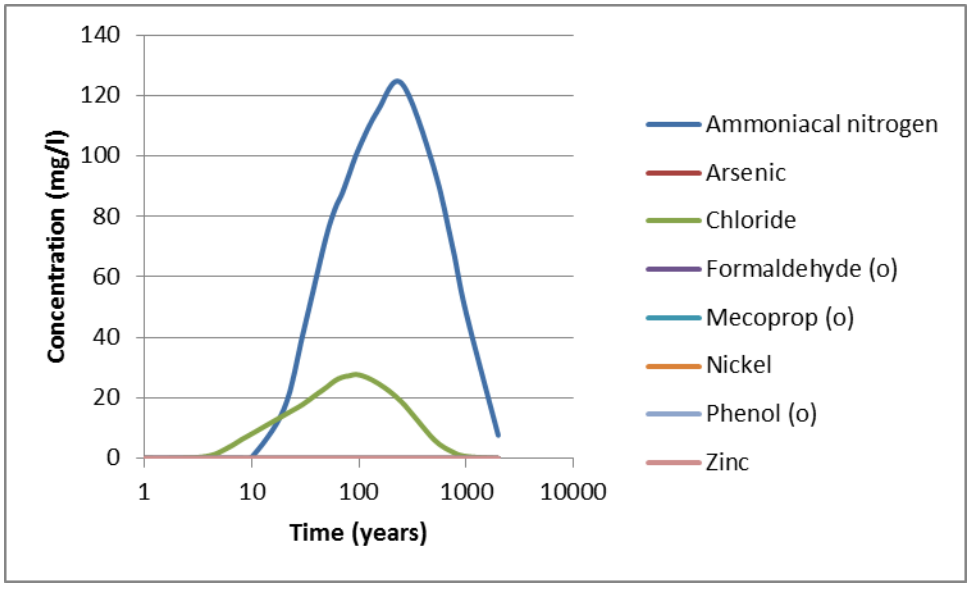


Figure 2.5 : Zone 1 Uncapped Overburden at the River Morell Receptor (95%ile)

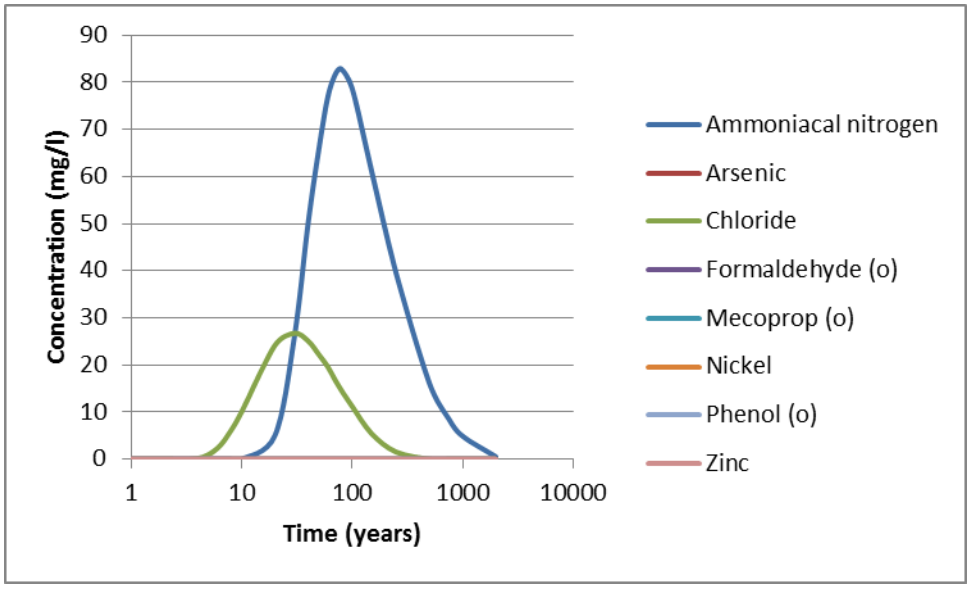


Figure 2.6 : Zone 1 Capped Overburden at the River Morell Receptor (95%ile)

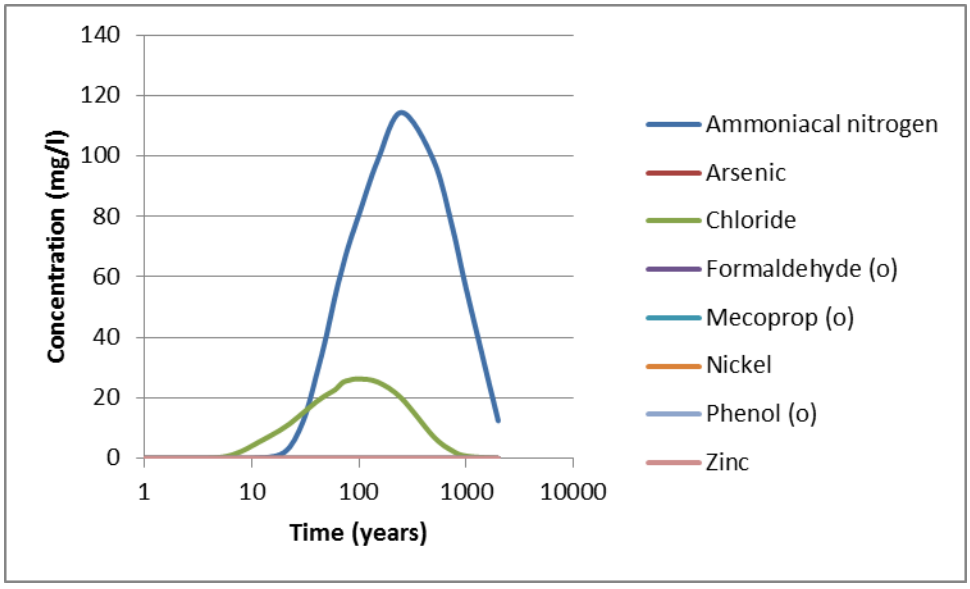


Figure 2.7 : Zone 1 Uncapped Limestone Receptor (95%ile)

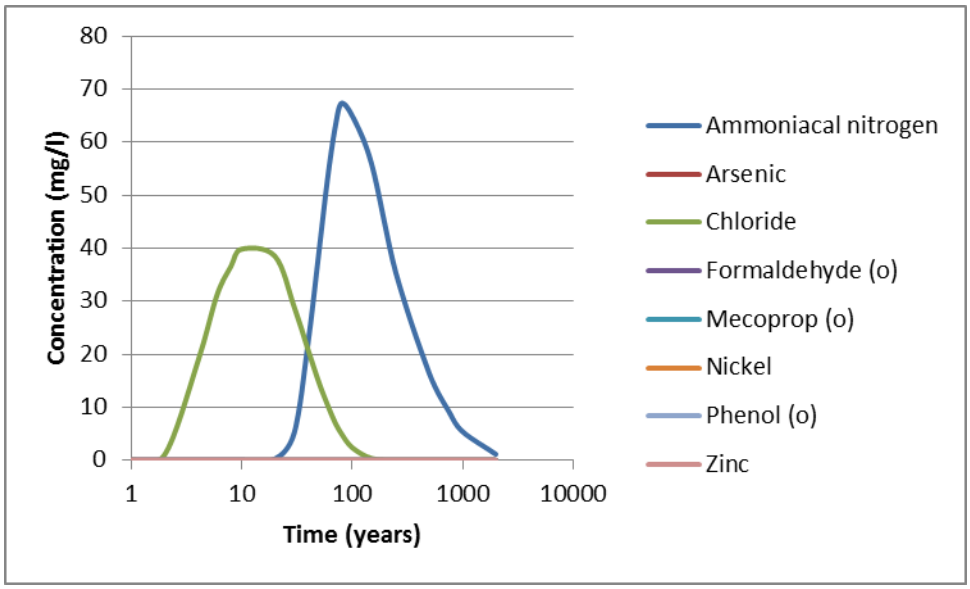
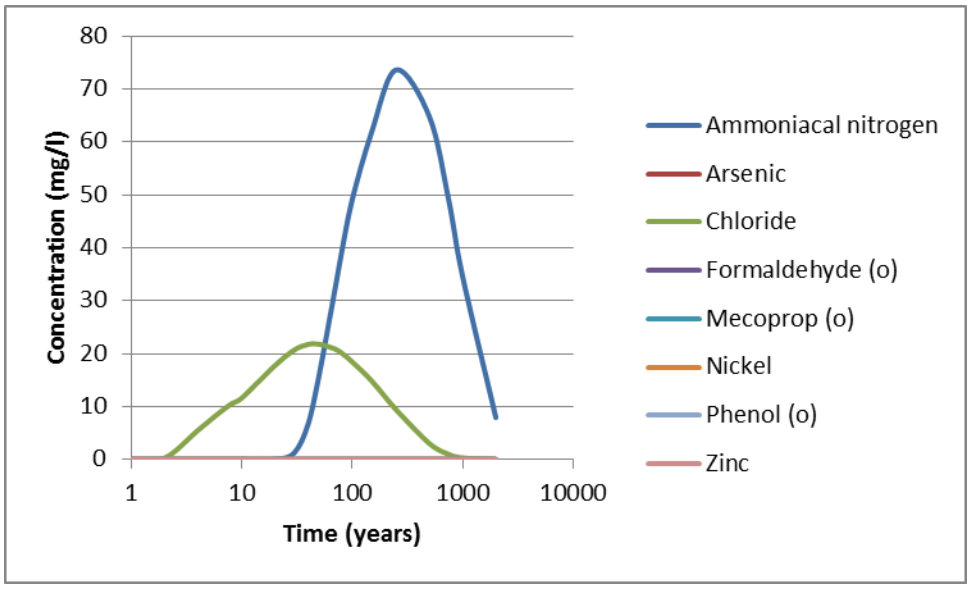


Figure 2.8 : Zone 1 Capped Limestone Receptor (95%ile)



2.3 Interpretation

2.3.1 Assessment of Predicted Concentrations in the Uncapped Model

The uncapped scenario modelling results show the following:

- For ammoniacal nitrogen the peak concentration would occur at around 50 to 100 years at the 10m overburden compliance point. For the point in the aquifer at the Morell River, the peak ammoniacal nitrogen concentration occurs at 80 to 150 years. The model results do largely agree with the

concentrations seen for ammoniacal nitrogen in the groundwater beneath and to the east of Zone 1 with concentrations in EMW03 on the zone's eastern boundary being in the order of 10s of mg/l, and up to 93mg/l.

- For chloride, as this substance is not retarded, the peak concentrations are shown to occur slightly earlier at around 20 to 30 years for the 10m point in the overburden deposits and 30 to 40 years at the Morell River. To get concentrations in the model to be the same order of magnitude as measured close to the Morell River, a relatively low source term is required. The sensitivity analysis undertaken with an increased chloride source term produces concentrations in the overburden, 10m beyond the site boundary, of 141mg/l after 20 years, which fits in with the range of concentrations of chloride recorded in groundwater at the site boundary. Concentrations of chloride in groundwater at the site boundary are variable by location, and the value of 28mg/l in the original model agreed well with the majority of recorded chloride groundwater concentrations to the east of the site boundary. This points to the likely variability of the waste in this area in terms of chloride leachability.

- For the metals (arsenic, nickel and zinc), in the 2000 years simulated, the concentrations remain below the IGVs at all off-site receptors, although with concentrations increasing as time progresses. The long times to observe peak impacts for the metals relate to the retardation coefficients with the metals being less mobile than chloride and ammoniacal nitrogen. The concentrations actually measured in the boreholes on the east of the landfill do tend to be higher than the model predicts, even though the modelled source term for nickel and arsenic are relatively elevated based on the abstracted leachate results from Zone 3 and the sensitivity analysis for zinc shows that with a high source term the concentrations still do not exceed the observed concentrations.

- For mecoprop the model shows there would be no impact above the IGV 0f 0.01mg/l on the off-site receptors due to the retardation and degradation of this compound. Low concentrations of mecoprop are recorded in the groundwater to the east of Zone 1 in certain boreholes, with the maximum concentration typically being measured in EMW03 (for example 0.013mg/l in December 2016) with lower concentrations in boreholes closer to the river (for example in EMW05 where mecoprop was not detected in December 2016).

- For formaldehyde, there is no IGV for comparison but the model results do show concentrations remain at a value significantly below the laboratory limit of detection. The groundwater monitoring for formaldehyde does show this compound to generally be absent in boreholes to the east of Zone 1.

- For phenol both the concentrations for capped and uncapped scenarios would be marginally above the IGV 0f 0.0005mg/l at the overburden receptor point 10m from the edge of the landfill for a short period with the peak concentration occurring at around 20 years. Groundwater monitoring does show phenol to be measured in boreholes immediately on the site boundary, but is generally not recorded in boreholes closer to the river.

Overall, this model is believed to be a reasonable representation of the current site conditions for Zone 1, albeit that the metal concentrations recorded in the groundwater are higher than the model predicts.

2.3.2 Comparison of Capped and Uncapped Models

For ammoniacal nitrogen, the capped model predicts greater peak concentrations than the uncapped model at each receptor for the 95%ile (although at the 50%ile the models do predict a lower concentration in the limestone aquifer). As previously discussed, the higher concentrations in the capped model is thought to be due largely to the limitations of the model to simulate the sequence of open waste followed by capping and resulting in source concentrations remaining higher in the first 20 years in the capped model. The sensitivity analysis, with a reduced source term to simulate source concentrations after 20 years matching the uncapped scenario records ammoniacal nitrogen concentrations 15 to 25% lower in overburden and 10 to 20% lower in bedrock than in the original capped model. Overall, there is no clear difference in ammoniacal nitrogen concentrations between the capped and uncapped models. That is believed to be caused that the saturated waste dominating the inflow into the groundwater system.

For chloride, the models show that at the overburden receptors 10m from the landfill and at the Morell River the peak concentrations are broadly similar, although as with ammoniacal nitrogen for the capped model the peak chloride concentration does occur at a later time. For the limestone aquifer, the models do show that the peak chloride concentration for the capped model is around 50% of the predicted concentration in the uncapped model.

For the metals and organic substances, the model results show little difference between the peak concentrations for capped and uncapped models with all peak concentrations at all compliance points in the overburden and limestone being less than 0.004mg/l (4μg/l). The greatest difference is for formaldehyde in the limestone aquifer with the capped model showing a lower concentration than the uncapped model.

2.4 Summary of Zone 1 Model

For Zone 1, the model suggests that the source term is dominated by the saturated waste component, and this is likely to remain the case for this zone such that even after capping, the saturated wastes would continue to have the major input of contaminants to groundwater. The cap will cause the rainfall infiltration which is migrating through the waste to reduce leachate generation and lead to a reduction in the build-up of leachate within the cell and potentially reduce the water levels beneath the landfill (any potential reduction in groundwater level is not included in the RAM model). A reduction in groundwater level beneath the waste, even if this reduction is small, would have benefits to the groundwater environment by:

- Reducing the amount of waste that is saturated and hence reducing the source term;

- Reducing the hydraulic gradient between the site and the Morell River such that the migration of contaminants would be slowed (allowing more time for degradation of organic compounds) and the volume of groundwater discharging to the river would be reduced; and

- Reducing the difference in groundwater levels between the overburden and bedrock water bodies and therefore reducing the flow of groundwater from the overburden deposits to the bedrock transition zone.

In addition, an engineered cap on Zone 1 has the benefit of providing better control for landfill gas and preventing the fugitive emissions of landfill gas and odour and allows surface water runoff to be controlled. It also prevents human contact with the waste materials present within the zone.

3. Zone 2A

3.1 Zone 2A Model Construction

A similar conceptualisation was developed for Zone 2A compared to Zone 1. Waste geometry and travel distances to receptors have been adjusted although for Zone 2A it is assumed that there is no significant waste present below the groundwater table. Chemical characteristics (i.e source terms and Kd values) and overburden hydraulic conductivity estimates have been amended in line with zone specific ground investigation data. The other parameters are the same as those used in the Zone 1 model. As with Zone 1, a capped ("Zone 2A Capped") and uncapped ("Zone 2A Uncapped") model was produced. For the capped scenario infiltration rates have been calculated using the RAM software based on the permeability of the cap and assuming that drains are installed around the entire edge of the zone.

Specific model inputs are provided in Appendix B.

As for Zone 1, it should be noted that a key limitation with RAM is the ability to run the capping scenarios applying an initial phase of open waste infiltration followed by a capped period. The period during which the waste cannot be properly simulated as open waste generates higher source concentrations and a slower decrease in source term in the capped model, which generates a level of conservatism in the capped scenarios that does not apply to the uncapped scenarios. This limitation needs to be taken into account when looking at the factual results obtained with the capped scenarios.

3.2 Model Output

Tables 3.1 and 3.2 summarise the peak values at 50%ile and 95%ile for ammoniacal nitrogen in both the uncapped and capped scenarios with output graphs in Figures 3.1 to 3.6. Results for the other substances are provided in Appendix B.

Results are reported in Tables 3.1 and 3.2 for:

- Overburden 10m from the zone : groundwater concentration within the overburden deposits 10m away from the zone boundary;
- Overburden at the Morell River : groundwater concentration within the overburden deposits adjacent to the Morell River; and
- Limestone: groundwater concentration within the limestone aquifer 50m away from the zone boundary.

Table 3.1 : Uncapped Model Results for Ammoniacal Nitrogen in Zone 2A

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Overburden 10m from the zone	4	40	9	30
Overburden at the Morell River	2	70	5	50
Limestone	0.3	150	2	100

Table 3.2 : Capped Model Results for Ammoniacal Nitrogen in Zone 2A

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Overburden 10m from the zone	1	150	4	100
Overburden at the Morell River	1	150	3	150
Limestone 50m from the zone	0.5	250	2	250

Figure 3.1 : Zone 2A Uncapped Overburden Receptor 10m from Zone (95%ile)

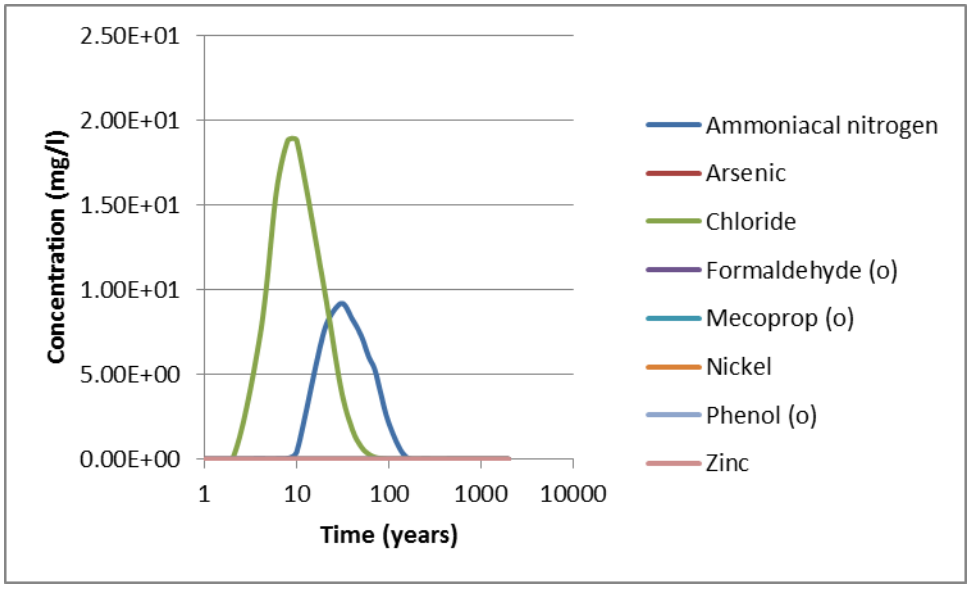


Figure 3.2 : Zone 2A Capped Overburden Receptor 10m from Zone (95%ile)

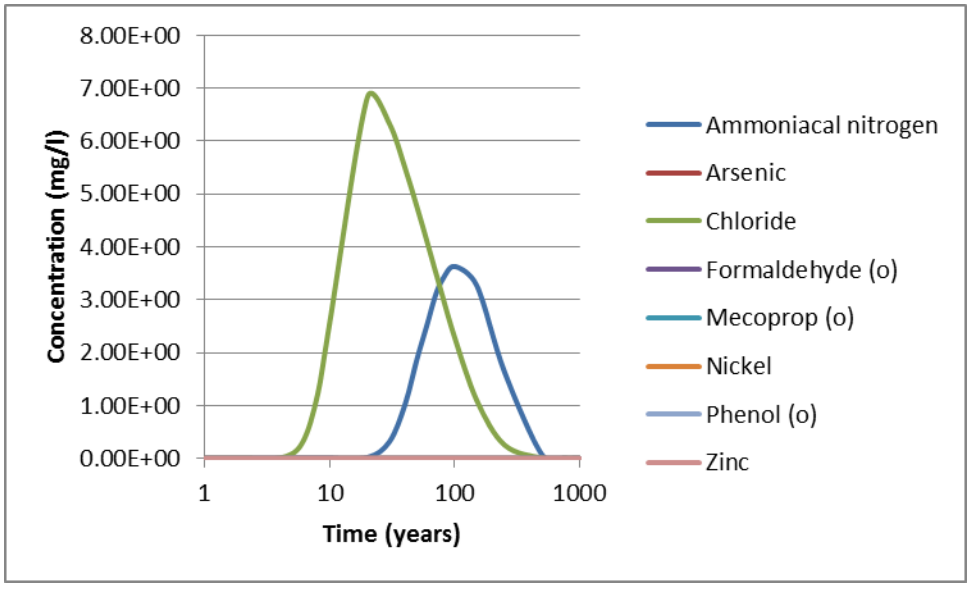


Figure 3.3 : Zone 2A Uncapped Overburden at the River Morell Receptor (95%ile)

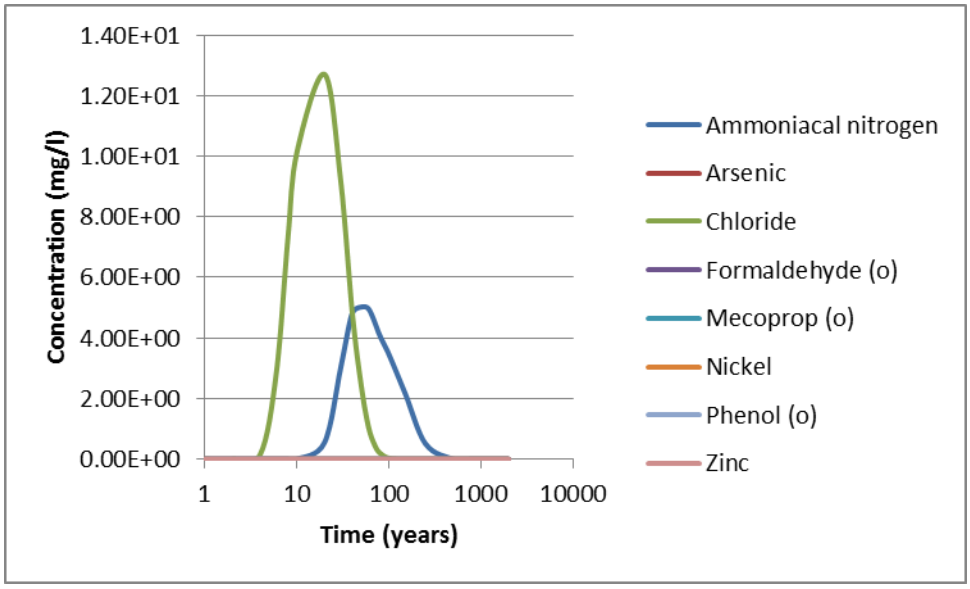


Figure 3.4 : Zone 2A Capped Overburden at the River Morell Receptor (95%ile)

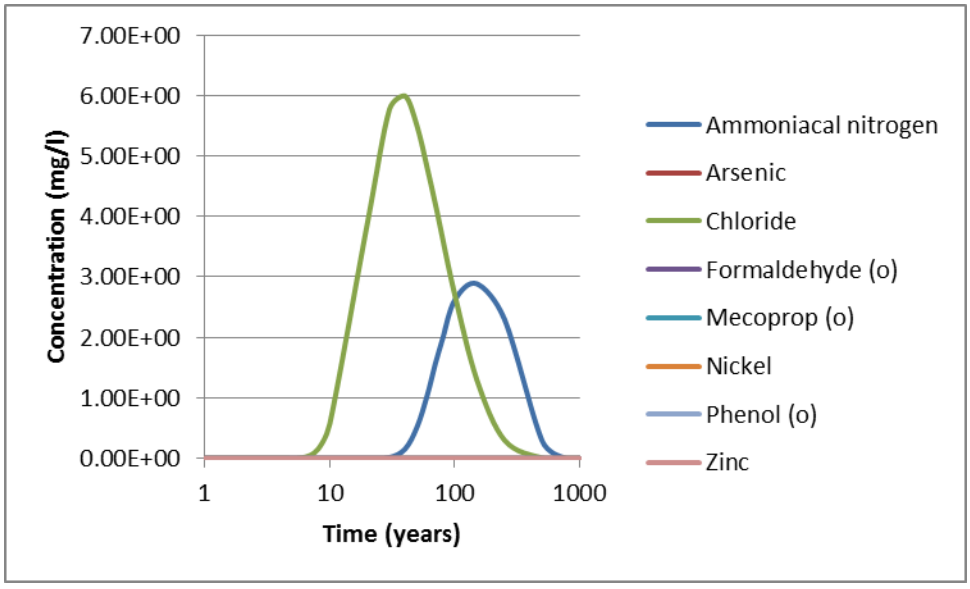


Figure 3.5 : Zone 2A Uncapped Limestone Receptor (95%ile)

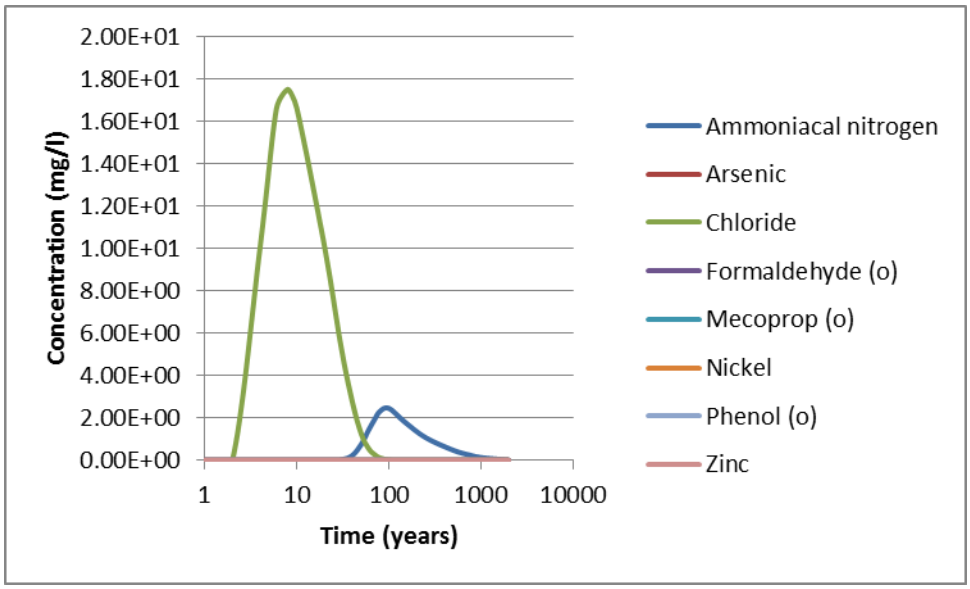
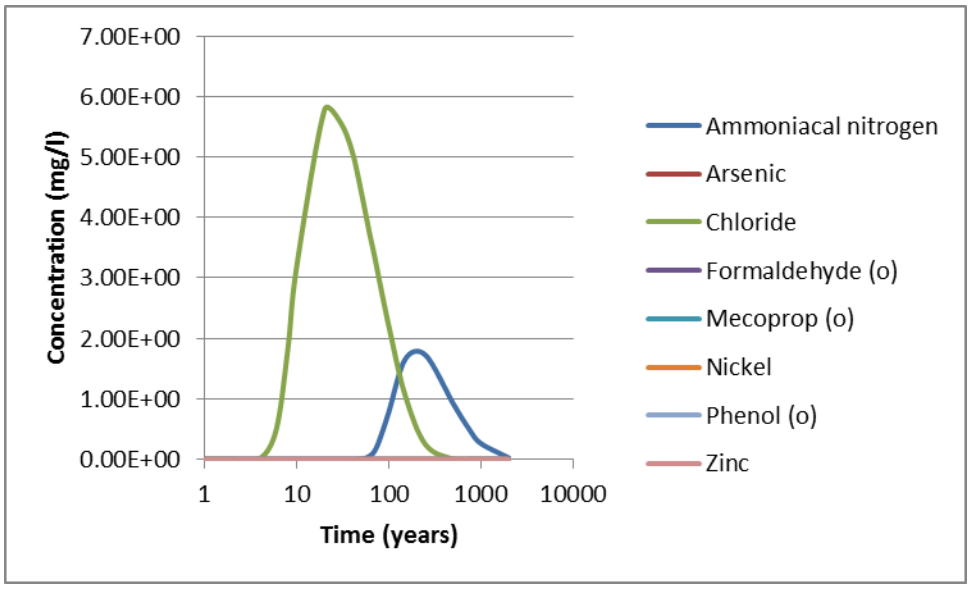


Figure 3.6 : Zone 2A Capped Limestone Receptor (95%ile)



3.3 Interpretation

3.3.1 Assessment of Uncapped Scenario Predicted Concentrations

For Zone 2A there are currently limited monitoring data available for the zone. Borehole EMW11 is situated to the north-west of the zone and this borehole shows relatively low chloride concentrations and ammoniacal nitrogen is recorded as being below the limit of detection. The data do not appear to be representative of wastes identified in Zone 2A as shown on the borehole logs. To the east of the zone (in the direction of the Morell

River) Zone 1 and Zone 2B is present and as such it is not possible to determine the concentrations of substances due solely to Zone 1A.

The uncapped scenario modelling results show the following:

- For ammoniacal nitrogen the peak concentration for the uncapped zone would occur at around 30 to 40 years at the 10m compliance point. For the point in the aquifer at the Morell River, the peak ammoniacal nitrogen concentration occurs at 50 to 70 years.

- For chloride, as this substance is not retarded, the peak concentrations are shown to occur slightly earlier than ammoniacal nitrogen at around 20 years for the 10m point in the overburden aquifer and 40 years at the Morell River.

- For the metals (arsenic, nickel and zinc), the model shows that as with Zone 1, in the 2000 years that are simulated, the concentrations remain below the IGVs at all receptors, although with concentrations increasing as time progresses.

- For mecoprop there would be no impact above the IGV on the receptors due to the retardation and degradation of this compound.

- For formaldehyde there is no IGV for comparison but the model results do show concentrations do remain at a value significantly below the laboratory limit of detection.

- The models do show that for the uncapped scenario the phenol concentration would be above the IGV at the overburden receptor point 10m from the edge of the landfill for a short period with the peak concentration occurring at around 10 years. The concentration of phenol in the capped model does not exceed the IGV at this point or other points in the overburden or limestone aquifers.

3.3.2 Comparison of Capped and Uncapped Models

For all determinands, the capped model predicts lower concentrations at all receptors than the uncapped model with the exception of the 50%ile value in the limestone aquifer which shows a slight increase in the capped model.

The reduction in groundwater concentrations occurs due to the lower recharge through the waste and more dilution in the groundwater flowing beneath the site for the capped model (for this zone it is assumed that input from waste beneath the water table is negligible). In the case of ammoniacal nitrogen and chloride, the predicted peak concentration for the capped scenario for ammoniacal nitrogen and chloride is around 40% of the uncapped concentration. For ammoniacal nitrogen the model predicts that the IGV concentration of 0.15mg/l would be exceeded at all compliance points. As with Zone 1, the peak concentration for the capped model occurs at a later time than the uncapped model.

For the metals and organic substances, the model results show the peak concentrations for the capped scenario to be lower than the uncapped scenario, although in absolute terms the difference is not that great. However, as noted above for phenol the peak concentration for the capped model does not exceed the IGV whereas it does for the uncapped model.

Because of the RAM limitation described earlier, the concentrations generated in the capped model are expected to be higher than the reality and the capped model has conservatism not present in the uncapped model. However, the original source term in Zone 2A is less significant than for Zone 1 and therefore the conservatism introduced for the capped Zone 2A is expected to be more minor than for Zone 1. Overall, this suggests that the capping would provide an overall betterment for Zone 2A.

3.4 Summary of Zone 2A Model

For Zone 2A, the uncapped and capped models do show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. As this zone is modelled as having negligible saturated waste, there is no input of leachate from this source as dominates the other zones.

In addition to the predicted improvements to groundwater quality, the emplacement of low permeability materials in Zone 2B has the benefit of providing better control for landfill gas and preventing the fugitive emissions of landfill gas and odour and allows surface water runoff to be controlled. It also prevents human contact with the waste materials present within the zone.

4. Zone 2B

4.1 Zone 2B model construction

A similar conceptualisation was developed for Zone 2B compared to Zone 1. Waste geometry and travel distances to receptors have been adjusted and in the case of Zone 2B it is assumed that for this zone that waste is present beneath the groundwater table throughout the zone. Chemical characteristics (eg source terms and Kd values) and overburden hydraulic conductivity estimates have been amended in line with zone specific ground investigation and monitoring data. The model was calibrated using groundwater quality concentrations recorded immediately downgradient of Zone 2B as well as in vicinity of the Morell River. As with the other zones, a capped ("Zone 2B Capped") and uncapped ("Zone 2B Uncapped") model was produced. For the capped scenario infiltration rates have been calculated using the RAM software based on the permeability of the cap and assuming that drains are installed around the entire edge of the zone.

Specific model inputs are provided in Appendix C.

As for Zone 1, it should be noted that a key limitation with RAM is the ability to run the capping scenarios applying an initial phase of open waste infiltration followed by a capped period. The period during which the waste cannot be properly simulated as open waste generates higher source concentrations and a slower decrease in source term, which generates a level of conservatism in the capped scenarios that does not apply to the uncapped scenarios. This limitation needs to be taken into account when looking at the factual results obtained with the capped scenarios.

4.2 Model output

Table 4.1 and Table 4.2 summarise the peak values at 50%ile and 95%ile for ammoniacal nitrogen in both the uncapped and capped scenarios with output graphs in Figures 4.1 to 4.8. Results for the other substances are provided in Appendix C.

Table 4.1 : Uncapped Model Results for Ammoniacal Nitrogen in Zone 2B

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated Waste	45	1	76	1
Overburden 10m from the zone	4	40	9	30
Overburden at the Morell River	3	50	7	30
Limestone	0.6	150	3	60

Table 4.2 : Capped Model Results for Ammoniacal Nitrogen in Zone 2B

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated Waste	46	1	76	1
Overburden 10m from the zone	3	60	7	70
Overburden at the	3	80	6	70

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Morell River				
Limestone 50m from the zone	0.8	150	3	100

Figure 4.1 : Zone 2B Uncapped Saturated Waste (95%ile)

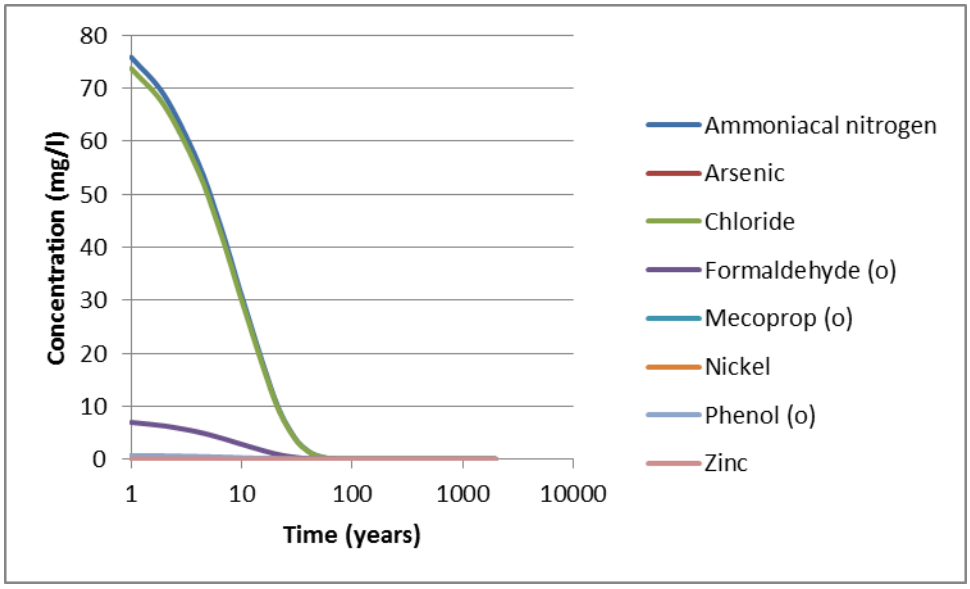


Figure 4.2 : Zone 2B Capped Saturated Waste (95%ile)

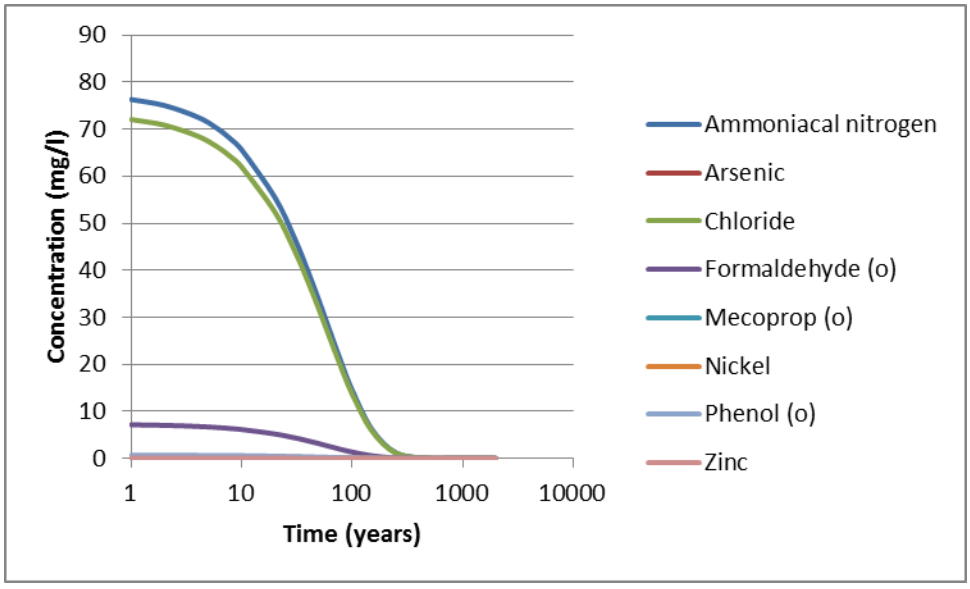


Figure 4.3 : Zone 2B Uncapped Overburden Receptor 10m from Zone (95%ile)

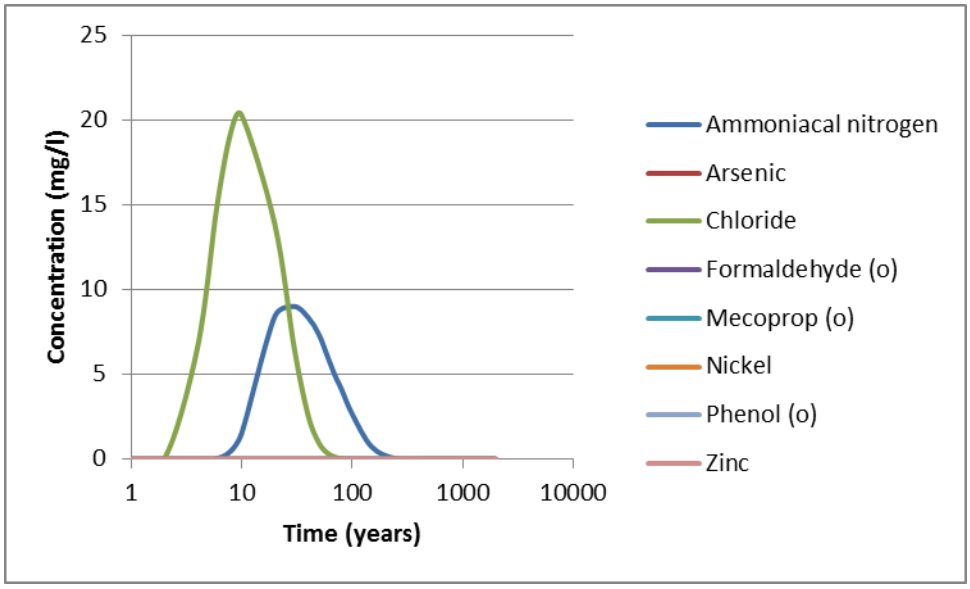


Figure 4.4 : Zone 2B Capped Overburden Receptor 10m from Zone (95%ile)

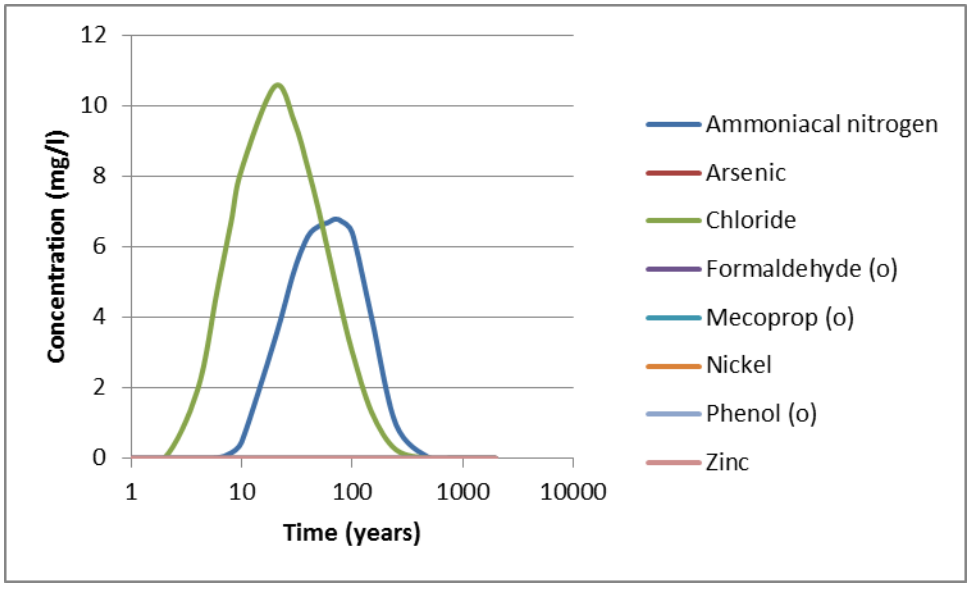


Figure 4.5 : Zone 2B Uncapped Overburden at the River Morell Receptor (95%ile)

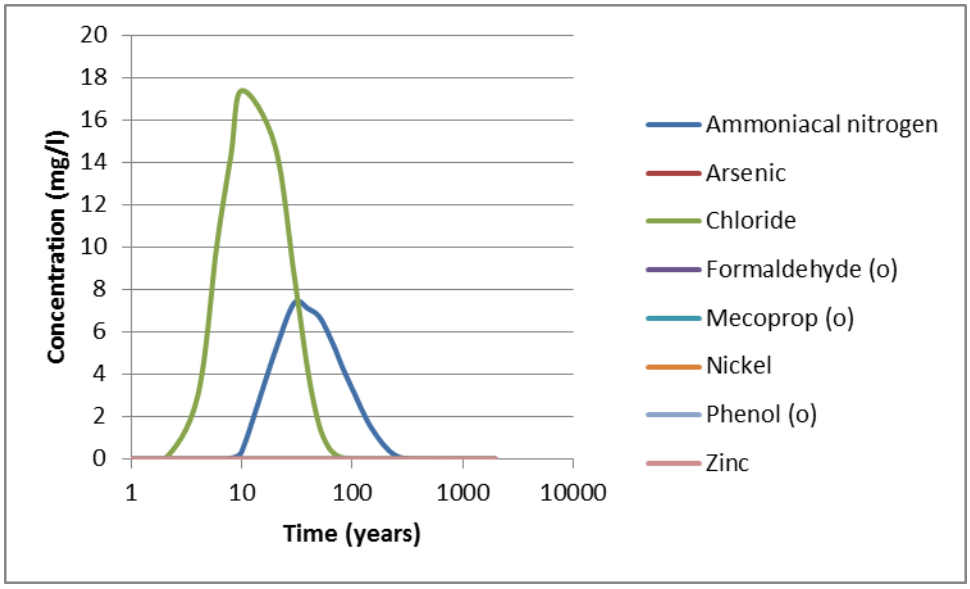


Figure 4.6 : Zone 2B Capped Overburden at the River Morell Receptor (95%ile)

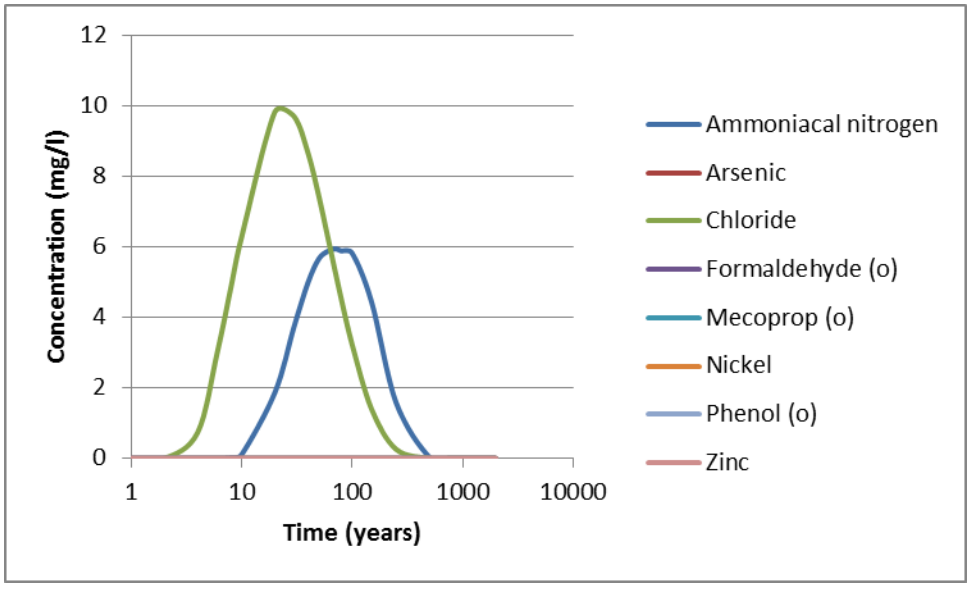


Figure 4.7 : Zone 2B Uncapped Limestone Receptor (95%ile)

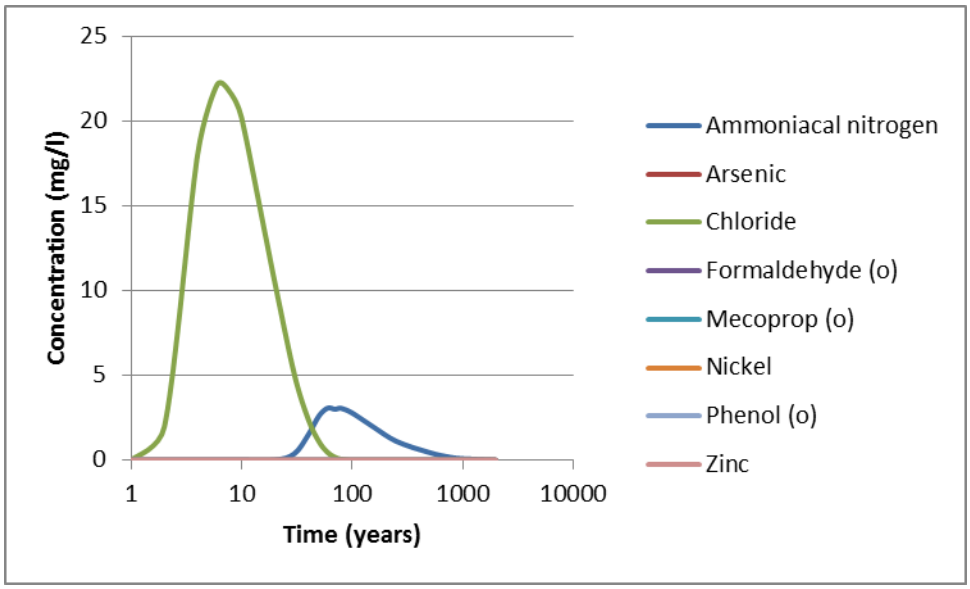
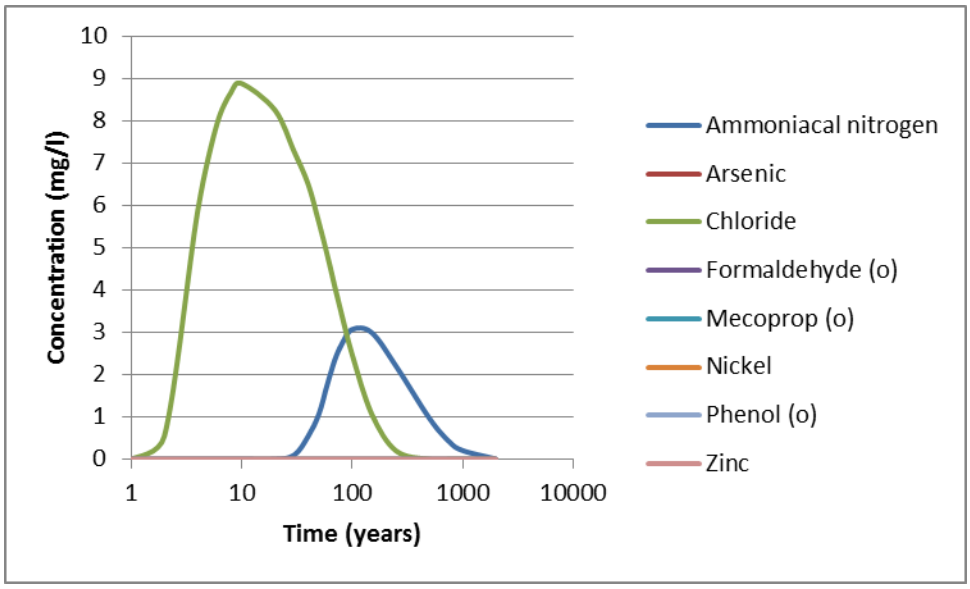


Figure 4.8 : Zone 2B Capped Limestone Receptor (95%ile)



4.3 Interpretation

4.3.1 Assessment of Uncapped Scenario Predicted Concentrations

The uncapped scenario modelling results show the following:

- for ammoniacal nitrogen the peak concentration for the uncapped zone would occur at around 30 to 40 years at the 10m compliance point. For the point in the aquifer at the Morell River, the peak ammoniacal nitrogen concentration occurs at 30 to 50 years. With respect to the observed concentrations in the groundwater, the model results do largely agree with the concentrations seen for ammoniacal nitrogen in the groundwater beneath and to the east of Zone 2B with concentrations in EMW07 and EMW19 on

the zone's eastern boundary being in the order of 5 mg/l. In both the model case and the actual monitoring results, ammoniacal nitrogen concentrations do exceed the IGV of 0.15mg/l.

- For chloride, as this substance is not retarded, the peak concentrations are shown to occur slightly earlier at around 20 years for the 10m point in the overburden aquifer and at the Morell River. For chloride, to get concentrations in the model to be the same order of magnitude as measured in groundwater between the zone and the Morell River in EMW08 a relatively low source concentration is required such that the chloride model results at the overburden 10m assessment point (20mg/l at the 95%ile) are lower than measured in borehole EMW07 and EMW19 (these being 31mg/l and 27mg/l respectively in December 2016).

- For the metals (arsenic, nickel and zinc), as with other zones the model shows that in the 2000 years that are simulated, the concentrations remain below the IGVs at all off-site receptors, although with concentrations increasing as time progresses.

- For mecoprop there would be no impact above the IGV on the receptors due to the retardation and degradation of this compound.

- For formaldehyde there is no IGV for comparison but the model results do show concentrations do remain at a value significantly below the laboratory limit of detection.

- The uncapped model shows that for phenol the concentration would be above the IGV at the overburden receptor point 10m from the edge of the landfill for a short period with the peak concentration occurring at around 10 years. This is also the case for the capped scenario.

4.3.2 Comparison of capped and uncapped models

For the majority of determinands and assessment points, the capped model predicts lower concentrations than the uncapped model (the 50%ile for impact on limestone does show the capped scenario to have slightly greater impact). In the case of ammoniacal nitrogen the predicted peak concentration for the capped scenario is around 75% of the uncapped concentration and for chloride the value is around 50%. For ammoniacal nitrogen the model predicts that the IGV concentration of 0.15mg/l would be exceeded at all compliance points. As with the other zones, the peak concentration for the capped model occurs at a later time than the uncapped.

For the metals and organic substances, the model results show that for the majority of the substances the peak concentrations for the capped scenario to be lower than the uncapped scenario, although in absolute terms the difference is not significant. However, as noted above for phenol the peak concentration for both the capped and uncapped model does exceed the IGV although the peak concentration for the capped model is around 30% lower than for the uncapped model.

Because of the RAM limitation described earlier, the concentrations generated in the capped model are expected to be higher than the reality and the capped model has conservatism not present in the uncapped model. However, the original source term in Zone 2B is less significant than for Zone 1 and therefore the conservatism introduced for the capped Zone 2B is expected to be more minor than for Zone 1. Overall, this suggests that the capping would provide an overall betterment for Zone 2B.

4.4 Summary of Zone 2B Model

For Zone 2B, the uncapped and capped models do show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. However, as the saturated waste provides the input component for this zone and the wastes are likely to remain saturated after the zone is capped, the predicted improvement in groundwater quality is not that great.

In addition to the predicted improvements to groundwater quality, the emplacement of low permeability materials in Zone 2B has the benefit of providing better control for landfill gas and preventing the fugitive emissions of landfill gas and odour and allows surface water runoff to be controlled. It also prevents human contact with the waste materials present within the zone.

5. Zone 3

5.1 Zone 3 model construction

Four LandSim models have been produced; two to represent the current site conditions and two to represent the site conditions following the filling of the lined cell and installation of an engineered cap. For each capped and uncapped scenario, two models were produced as follows:

- One model called “overburden pathway” to determine risks to the overburden groundwater quality, in particular in vicinity of the Morell River; and
- A second model called “bedrock pathway” to determine risks to the bedrock aquifer.

Model inputs are provided in Appendix D. It should be noted that the capped model represents an enlarged waste area (as wastes are removed from other zones and placed into Zone 3).

For the current site condition models, the source concentrations are based on recorded leachate concentrations from Zone 3, leachability tests and literature values. For the capped and fully landfilled scenario, the source concentrations were altered to reflect the source characteristics of waste moved from other zones at the site, using the predicted source outputs from the Zone 1 RAM model after 10 years.

5.2 Model output

Table 5.1 summarises the peak values at 50%ile and 95%ile for the contaminants of concern modelled in Zone 3 up to 1000 years and compares them against the IGV criteria. Any contaminant concentration beyond 1000 years is considered of low significance from the point of view site management and legacy. It should be noted that the concentrations for hazardous substances are taken prior to entry into the groundwater body considered as receptor, and non-hazardous substances are taken within the receptor groundwater body at its point of compliance. These point of compliance for non-hazardous substances are considered to be the overburden groundwater adjacent to the River Morell and the bedrock groundwater immediately downgradient of Zone 3. It should be noted that for Zone 3, all other determinands included in the LandSim model (arsenic, benzene, cadmium, formaldehyde, mecoprop, mercury, nickel, phenol and zinc) did not show any breakthrough at the compliance points in the 1000 years that was simulated.

Table 5.1 : Predicted Concentrations at Relevant Compliance Points

LandSim Model	Time to peak impact (years^)		Peak Concentration (mg/l)		Criteria Comparison	
	50%ile	95%ile	50%ile	95%ile	IGV (mg/l)	Exceedance Y/N?
Ammoniacal Nitrogen						
Current Model (Bedrock Pathway)	N/A	1000	ND	2.6x10-8	0.15	No
Current Model (Overburden Pathway)	1000	1000	9x10-5	0.022	0.15	No
Capped Model (Bedrock Pathway)	N/A	1000	ND	1.5x10-7	0.15	No
Capped Model (Overburden Pathway)	1000	1000	7.4x10-5	0.034	0.15	No

LandSim Model	Time to peak impact (years^)		Peak Concentration (mg/l)		Criteria Comparison	
	50%ile	95%ile	50%ile	95%ile	IGV (mg/l)	Exceedance Y/N?
Chloride						
Current Model (Bedrock Pathway)	1000	1000	0.0007	0.013	30	No
Current Model (Overburden Pathway)	370	530	0.24	0.4	30	No
Capped Model (Bedrock Pathway)	1000	1000	0.0013	0.042	30	No
Capped Model (Overburden Pathway)	1000	740	0.75	1.0	30	No

Note: arsenic, benzene, cadmium, formaldehyde, mecoprop, mercury, nickel, phenol and zinc were also modelled but showed no breakthrough and are therefore not included in the table

5.3 Interpretation

Table 5.1 shows that the scenarios simulated result in concentrations below IGVs. As a consequence, the restoration of Zone 3, with the addition of waste redistributed from other site zones is not expected to generate any additional contamination to the bedrock aquifer nor groundwater in the overburden deposits in close proximity to the Morell River.

Whilst the capped model does show slightly greater concentrations than the uncapped model for ammoniacal nitrogen and chloride, this occurs principally due to the larger area of waste being present in the capped scenario due to the importation of materials from other zones on the site and the concentrations remain below IGV. This is therefore expected to have no impact on water receptors.

A drainage failure scenario was simulated with an increased leachate head of 1m, and exceedances were only recorded for ammoniacal nitrogen after 800 years. The drainage failure scenario was simulated to reflect on temporary failures of the drainage system, and this sensitivity analysis shows that only a continuous and long term drainage failure would be a cause for concern for the site.

5.4 Summary of Zone 3 Model

Due to the capped model having a larger area than the uncapped model, the capped scenario is shown to generate slightly higher concentrations of ammoniacal nitrogen and chloride in the groundwater than the uncapped scenario. However, in both cases the predicted impacts result in concentrations below the IGVs and have therefore no impact on the water receptors.

It should also be considered that by transferring waste materials from other parts of the site to Zone 3, the risks in those other areas is reduced and placing the materials in a fully engineered landfill cell would provide overall betterment for the site.

6. Zone 4

6.1 Zone 4 model construction

A similar conceptualisation was developed for Zone 4 compared to Zone 1. However, waste geometry and travel distances to receptors have been adjusted. For Zone 4 it is assumed that there is both saturated and unsaturated waste and that the saturated waste is an area to the north of the zone. Chemical characteristics (eg source terms and Kd values) and overburden hydraulic conductivity estimates have been amended in line with zone specific ground investigation and monitoring data. The model was calibrated using groundwater quality concentrations recorded immediately downgradient of Zone 4. As with the other zones, a capped ("Zone 4 Capped") and uncapped ("Zone 4 Uncapped") model was produced. For the capped scenario infiltration rates have been calculated using the RAM software based on the permeability of the cap and assuming that drains are installed around the entire edge of the zone.

Specific model inputs are provided in Appendix E.

As for Zone 1, it should be noted that a key limitation with RAM is the ability to run the capping scenarios applying an initial phase of open waste infiltration followed by a capped period. The period during which the waste cannot be properly simulated as open waste generates higher source concentrations and a slower decrease in source term, which generates a level of conservatism in the capped scenarios that does not apply to the uncapped scenarios. This limitation needs to be taken into account when looking at the factual results obtained with the capped scenarios.

6.2 Model output

Table 6.1 and Table 6.2 summarise the peak values at 50%ile and 95%ile for ammoniacal nitrogen in both the uncapped and capped scenarios. Results for the other substances are provided in Appendix E.

Table 6.1 : Uncapped Model Results for Ammoniacal Nitrogen in Zone 4

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated Waste	5	1	8	1
Overburden 10m from the zone	0.6	20	1.1	20
Overburden at the Morell River	0.6	20	1.1	20
Limestone	0.07	150	0.3	80

Table 6.2 : Capped Model Results for Ammoniacal Nitrogen in Zone 4

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Saturated Waste	5	1	8	1
Overburden 10m from the zone	0.2	20	0.6	30
Overburden at the Morell River	0.2	30	0.6	40

Receptor	50%ile		95%ile	
	Peak Concentration (mg/l)	Time to Peak (years)	Peak Concentration (mg/l)	Time to Peak (years)
Limestone 50m from the zone	0.08	250	0.2	150

Figure 6.1 : Zone 4 Uncapped Saturated Waste (95%ile)

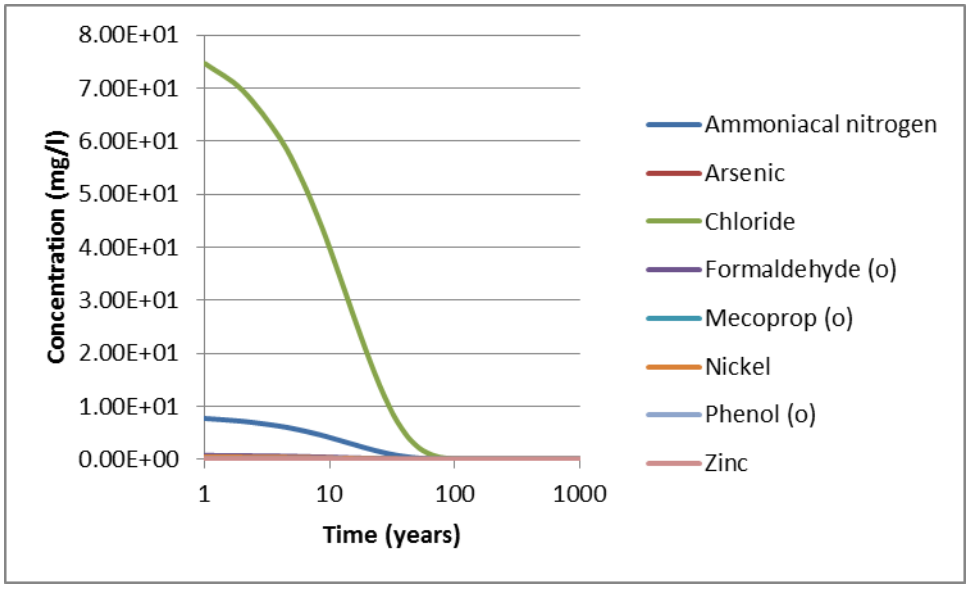


Figure 6.2 : Zone 4 Capped Saturated Waste (95%ile)

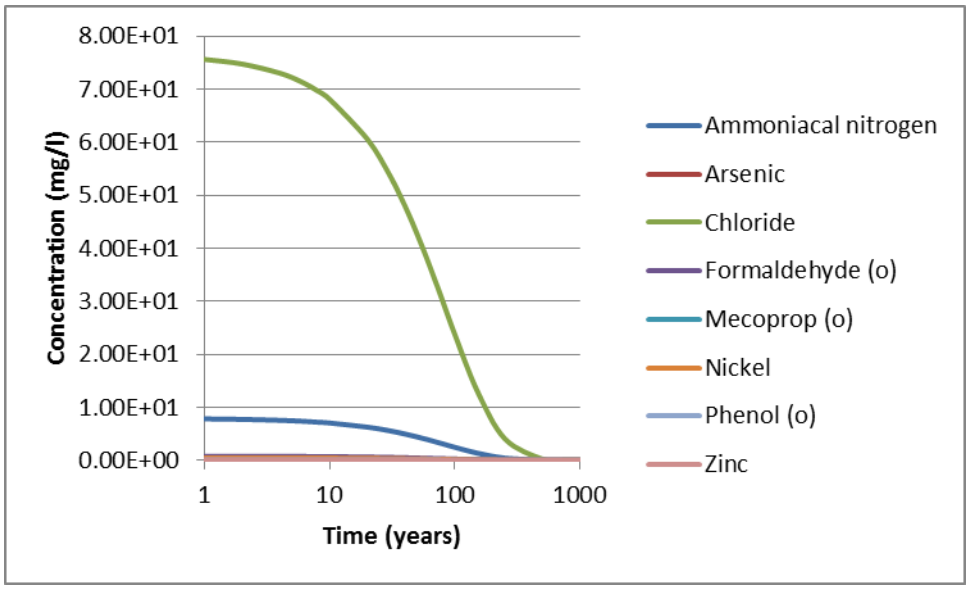


Figure 6.3 : Zone 4 Uncapped Overburden Receptor 10m from Zone (95%ile)

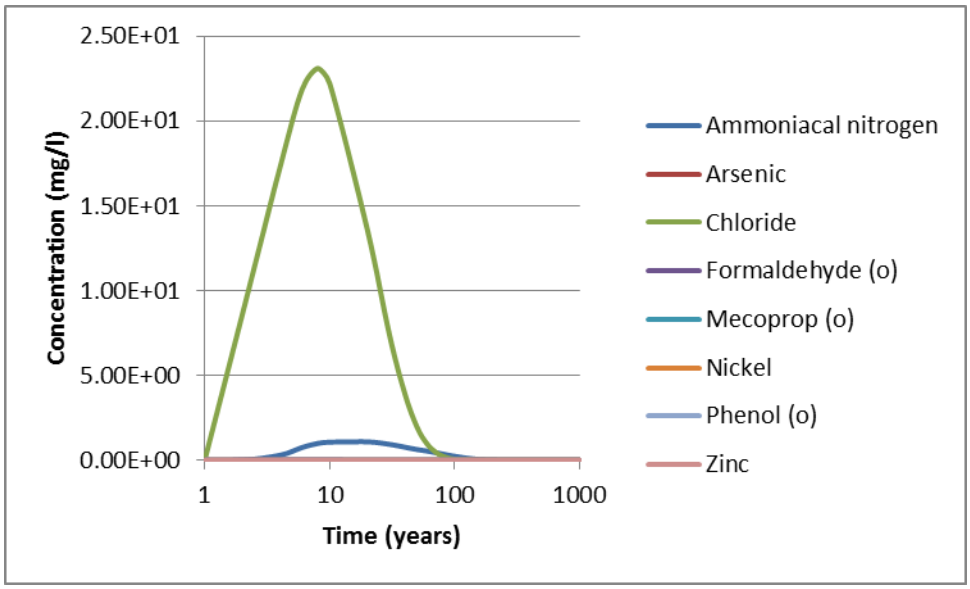


Figure 6.4 : Zone 4 Capped Overburden Receptor 10m from Zone (95%ile)

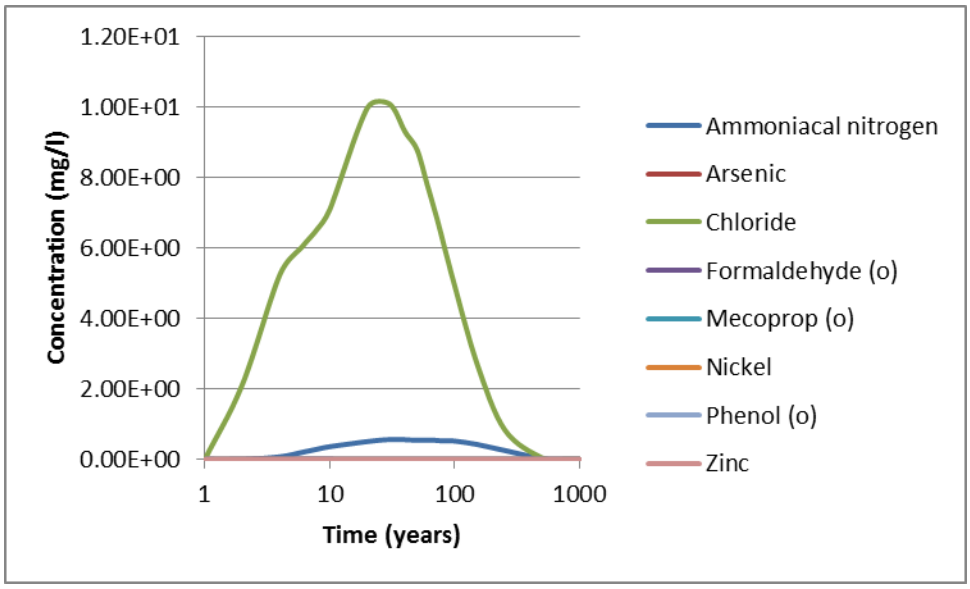


Figure 6.5 : Zone 4 Uncapped Overburden at the River Morell Receptor (95%ile)

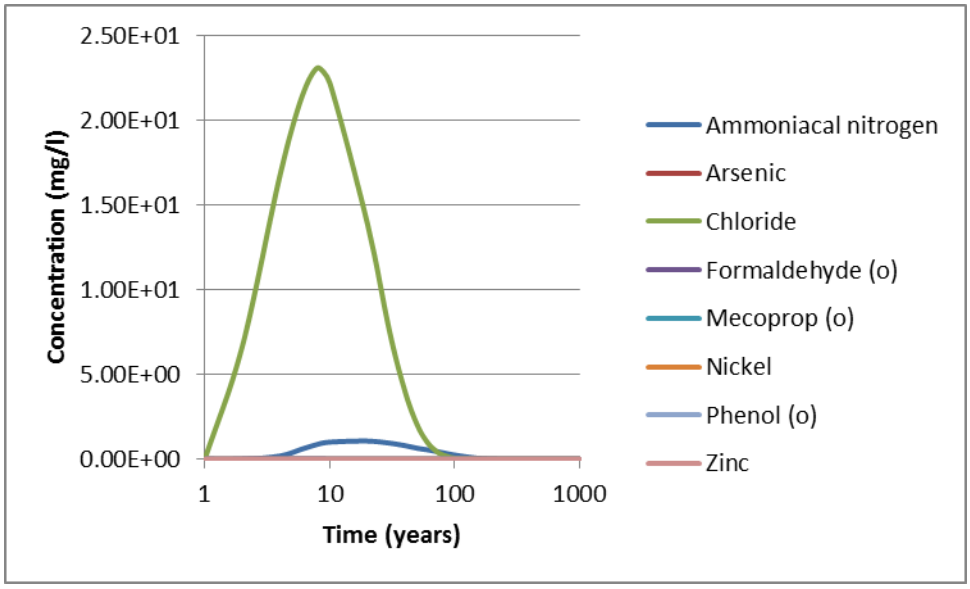


Figure 6.6 : Zone 4 Capped Overburden at the River Morell Receptor (95%ile)

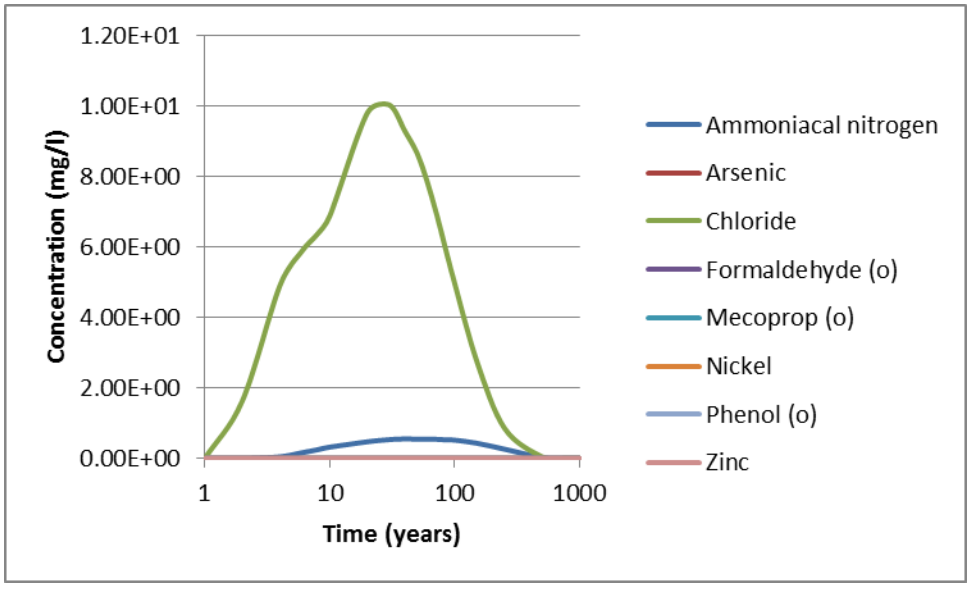


Figure 6.7 : Zone 4 Uncapped Limestone Receptor (95%ile)

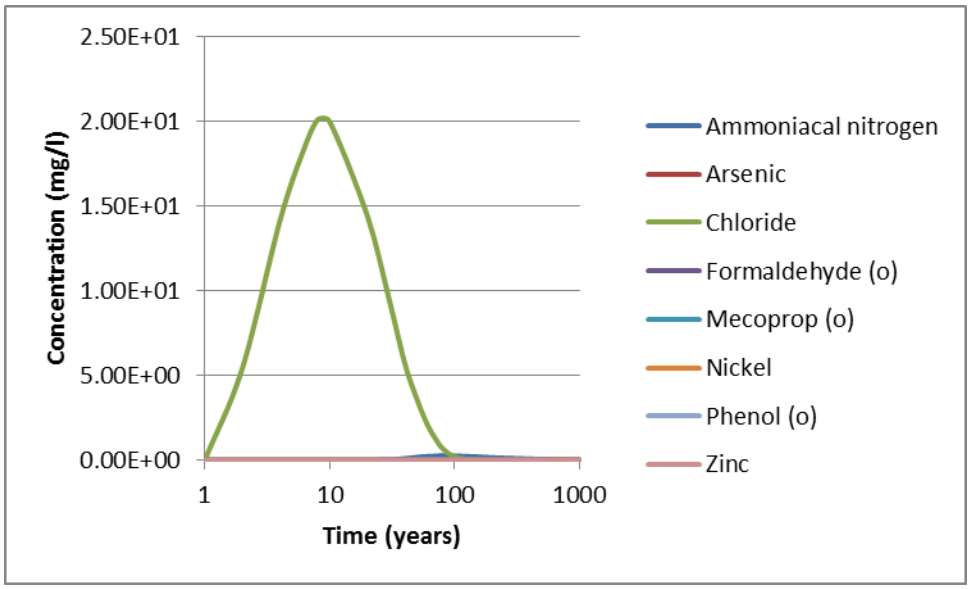
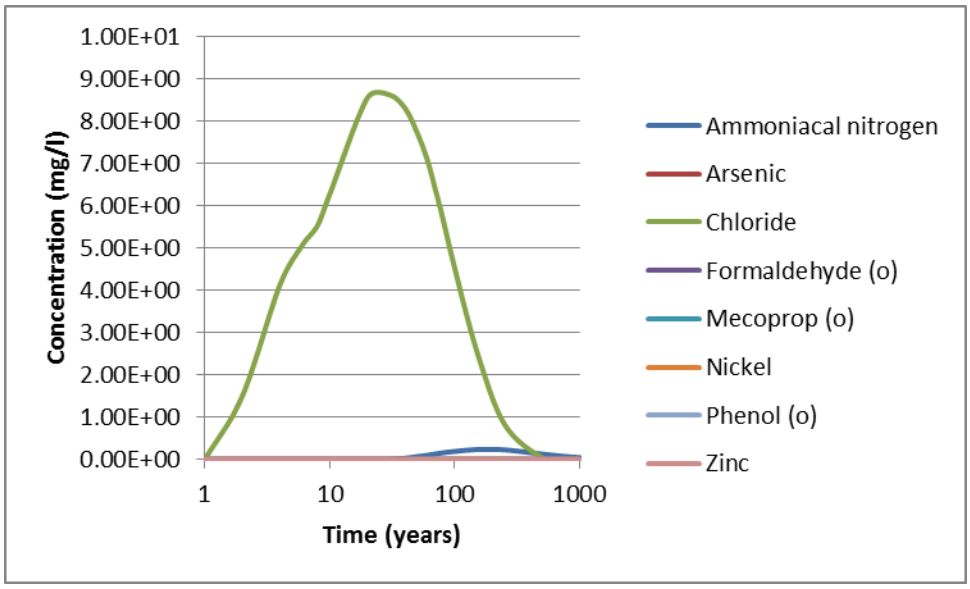


Figure 6.8 : Zone 4 Capped Limestone Receptor (95%ile)



6.3 Interpretation

6.3.1 Assessment of Predicted Concentrations

The uncapped scenario modelling results show the following:

- For ammoniacal nitrogen, the peak concentration for the uncapped zone would occur at around 20 years at the 10m compliance point. For the point in the aquifer at the Morell River, the peak ammoniacal nitrogen concentration would also occur at around 20 years due to the relatively short distance from the zone's eastern boundary to the Morell River. The model results do largely agree with the concentrations seen for ammoniacal nitrogen in the groundwater beneath and to the east of Zone 4 with concentrations

in EMW18 on the zone's eastern boundary generally being below 1 mg/l and concentrations in EMW17 typically being between 1mg/l and 2mg/l. Both actual and model results exceed the IGV for ammoniacal nitrogen of 0.15mg/l.

- For chloride, as this substance is not retarded, the peak concentrations are shown to occur slightly earlier at around 8 years for the 10m point in the overburden aquifer and at the Morell River. For chloride, the uncapped model largely agrees with the concentration in EMW18 (model results of 23mg/l at the 95%ile compared to monitoring results in the order of 20mg/l) but there are no boreholes further from the site towards the Morell River to allow further assessment.

- For the metals (arsenic, nickel and zinc), as with other zones the model shows that in the 2000 years that are simulated, the concentrations remain below the IGVs at all off-site receptors, although with concentrations increasing as time progresses.

- For mecoprop and phenol there would be no impact above the IGV on the receptors due to the retardation and degradation of these compounds. In the December 2016 monitoring round the concentrations of mecoprop and phenol were below the limit of detection.

- For formaldehyde there is no IGV for comparison but the model results do show concentrations do remain at a value significantly below the laboratory limit of detection.

6.3.2 Comparison of capped and uncapped models

For the majority of determinands and assessment points, the capped model predicts lower concentrations than the uncapped model. In the case of ammoniacal nitrogen the predicted peak concentration for the capped scenario is around 35% of the uncapped concentration and for chloride the value is around 35%. As with the other zones, the peak concentration for the capped model occurs at a later time than the uncapped.

For the organic substances, the model results show that the peak concentrations for the capped scenario to be lower than the uncapped scenario, although in absolute terms the difference is limited. For the metals, the capped model does show the peak concentrations to be marginally higher than for the uncapped model, although in all cases the difference in peak concentration is less than 0.001 mg/l (1 μg/l).

Because of the RAM limitation described earlier, the concentrations generated in the capped model are expected to be higher than the reality and the capped model has conservatism not present in the uncapped model. However, the original source term in Zone 4 is less significant than for Zone 1 and therefore the conservatism introduced for the capped Zone 4 is expected to be more minor than for Zone 1. Overall, this suggests that the capping would provide an overall betterment for Zone 4.

6.4 Summary of Zone 4 Model

For Zone 4, the uncapped and capped models do show that there would be an improvement in groundwater quality following installation of the low permeability materials in this zone. This occurs due to lower infiltration into the wastes and subsequent higher dilution of leachate in the groundwater for the capped scenario. However, as the saturated waste provides the major input component for this zone, and the wastes are likely to remain saturated after the zone is capped, the predicted improvement in groundwater quality is limited.

In addition to the predicted improvements to groundwater quality, the emplacement of low permeability materials in Zone 4 has the benefit of preventing human contact with the waste materials present within the zone.

7. Summary

The DQRA undertaken for the five zones has shown that the proposed remediation works would improve groundwater quality in the majority of the zones although for Zone 1 and Zone 3 the model do not predict an improvement on groundwater quality for the capped scenarios.

For Zone 1, the higher concentrations in the capped model is thought to be due to the limitations of the model to simulate the sequence of open waste followed by capping and resulting in source concentrations remaining higher in the first 20 years in the capped model combined with a high concentration source term and a significant proportion of saturated waste. In Zone 3, it is proposed that the capped landfill would take waste materials from other zones, resulting in a larger area containing waste compared to the current uncapped scenario. However, it should be borne in mind that by taking wastes from other zones which are currently not contained in a fully engineered landfill would reduce the risks in these other zones for the betterment of the site as a whole.

The modelling does show that where wastes are present beneath the groundwater table it is this saturated waste that provides the dominant source of contaminants to the groundwater system. Capping of the site is unlikely to reduce groundwater levels to the extent that wastes are no longer saturated and these wastes would provide an on-going contaminant source. These saturated wastes are likely to provide a source of contamination over a shorter time period than the unsaturated wastes as groundwater flowing through the saturated wastes is likely to deplete the source quicker than the infiltration through the unsaturated waste. Whilst the contaminant mass in the unsaturated zone would eventually leach/seep downwards and act as a constantly replenishing source, with the cap the rate of this movement to the groundwater is reduced.

It should be noted that the cap may lead to a reduction in groundwater levels, particularly beneath Zone 1, and this could have benefit by:

- Marginally reducing the amount of waste that is saturated and hence reducing this aspect of the source term;

- Reducing the hydraulic gradient between the site and the Morell River such that the migration of contaminants would be slowed (allowing more time for degradation of organic compounds) and the volume of groundwater discharging to the river would be reduced; and

- Reducing the difference in groundwater levels between the overburden and bedrock water bodies and therefore reducing the flow of groundwater from the overburden deposits to the bedrock transition zone.

Whilst the modelling of capping of the site to reduce infiltration does not predict a vast improvement in groundwater quality, the proposed remediation works have benefits outside of the groundwater improvements including.

- Providing better control for landfill gas and preventing the fugitive emissions of landfill gas and odour.

- Allowing surface water runoff to be collected and controlled.

- Preventing human contact with the waste materials present within the site.

These overall improvements allow for the site to be redeveloped for a beneficial community use.

8. References

1. Jacobs, 2017. Kerdiffstown Landfill Remediation Project. Groundwater and Surface Water Monitoring Report - December 2016.

2. IGSL, 2017. Factual Report of 2016 Ground Investigation (in preparation).

3. Jacobs, 2017. Kerdiffstown Landfill Remediation Project. Environmental Impact Assessment Report (EIAR) - Chapter 13 Soils, Geology, Hydrogeology and Contaminated Land (in preparation).

4. Jacobs, 2016. Kerdiffstown Landfill. Preliminary CSMs Technical Note.

5. Environment Agency, 2003. The Development of LandSim 2.5.

6. ESI Limited, 2008. Guide to Using RAM3 Risk Assessment Model.

7. Jacobs, 2014. Kerdiffstown Landfill Remediation Project. Groundwater DQRA Report.

8. Environmental Protection Agency (undated). Towards Setting Guideline Values for the Protection of Groundwater in Ireland. Interim Report.

Appendix A. Zone 1 input parameters and results

MODEL INPUTS

LANDFILL WASTE:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Distribution		triangular	triangular	triangular	triangular	triangular	triangular	triangular	triangular
Landfill waste leaching test concentration Minimum	mg/L	88	0.0025	0.47	0.0001	0.001	0.003	0.001	0.0025
Landfill waste leaching test concentration Likely	mg/L	350	0.044	27	0.1	0.011	0.127	0.03	0.039
Landfill waste leaching test concentration Maximum	mg/L	833	0.224	99	10	0.14	0.605	1	0.078

DIMENSIONS OF ZONE:

Parameter	Units	Saturated Waste	Unsaturated Waste	Total for Zone
Width (perpendicular to groundwater flow)	m	450	450	450
Length (in direction of groundwater flow)	m	100	100	200
Area	m^2	45,000	45,000	90,000
Waste thickness	m	6	18	-

CONTAMINANTS:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Contaminants Organic Carbon Water Partition Coefficient, Koc	L/kg	-	-	-	3.60E+00	1.29E+01	-	8.32E+01	-
Attenuation partition coefficient Kd Distribution		uniform	uniform	constant	-	-	uniform	-	uniform

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Attenuation partition coefficient Kd Minimum	L/kg	0.5	25	0	-	-	20	-	1
Attenuation partition coefficient Kd Maximum	L/kg	2	250	-	-	-	800	-	600
Attenuation half-life distribution		constant	constant	constant	constant	uniform	constant	uniform	constant
Attenuation half-life Minimum	days	No Decay	No Decay	No Decay	139.8	50.01	No Decay	7.3	No Decay
Attenuation half-life Maximum	days	-	-	-	-	365	-	912.5	-
Contaminants free water diffusion coefficient	m^2/s	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09

HYDROGEOLOGY:

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology unit thickness distribution		uniform	constant	uniform
Hydrogeology unit thickness Minimum	m	5	20	0.5
Hydrogeology unit thickness Maximum	m	10		5
Hydrogeology hydraulic conductivity distribution		triangular	triangular	triangular
Hydrogeology hydraulic conductivity Minimum	m/s	1.05E-08	3.25E-08	1.05E-08
Hydrogeology hydraulic conductivity Likely	m/s	1.34E-06	0.0000128	1.34E-06
Hydrogeology hydraulic conductivity Maximum	m/s	6.60E-06	0.0000625	6.60E-06

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology head	m	81	78	-
Hydrogeology hydraulic gradient distribution	[-]	uniform	uniform	constant
Hydrogeology hydraulic gradient Minimum		0.015	0.002	1
Hydrogeology hydraulic gradient Maximum		0.033	0.003	
Hydrogeology porosity distribution	[-]	uniform	uniform	constant
Hydrogeology porosity Minimum		0.31	0.01	0.2
Hydrogeology porosity Maximum		0.46	0.1	
Hydrogeology tortuosity	[-]	5	5	5
Distribution		constant	constant	constant

ATTENUATION

Parameter	Units	Sand and Gravel	Limestone	Unsat SandG
Attenuation dry bulk density	kg/m3	1590	2265	1590
Attenuation fraction organic carbon distribution		triangular	uniform	triangular
Attenuation fraction organic carbon Minimum	[-]	0.001	0.001	0.001
Attenuation fraction organic carbon Likely	[-]	0.002		0.002
Attenuation fraction organic carbon Maximum	[-]	0.024	0.016	0.024

MODEL RESULTS

Saturated Waste

Uncapped 50 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	4.01E+02	8.30E-02	3.94E+01	2.90E+00	4.48E-02	2.15E-01	2.86E-01	3.76E-02
2	3.86E+02	7.98E-02	3.79E+01	2.79E+00	4.31E-02	2.07E-01	2.75E-01	3.62E-02
4	3.57E+02	7.38E-02	3.51E+01	2.58E+00	3.98E-02	1.92E-01	2.54E-01	3.34E-02
6	3.30E+02	6.83E-02	3.24E+01	2.39E+00	3.69E-02	1.77E-01	2.35E-01	3.09E-02
8	3.05E+02	6.32E-02	3.00E+01	2.21E+00	3.41E-02	1.64E-01	2.18E-01	2.86E-02
10	2.82E+02	5.85E-02	2.78E+01	2.05E+00	3.15E-02	1.52E-01	2.01E-01	2.65E-02
20	1.91E+02	3.96E-02	1.88E+01	1.39E+00	2.14E-02	1.03E-01	1.36E-01	1.80E-02
30	1.30E+02	2.69E-02	1.28E+01	9.40E-01	1.45E-02	6.97E-02	9.25E-02	1.22E-02
40	8.80E+01	1.82E-02	8.65E+00	6.37E-01	9.82E-03	4.73E-02	6.27E-02	8.25E-03
50	5.96E+01	1.23E-02	5.86E+00	4.32E-01	6.66E-03	3.20E-02	4.25E-02	5.59E-03
60	4.04E+01	8.36E-03	3.97E+00	2.93E-01	4.51E-03	2.17E-02	2.88E-02	3.79E-03
70	2.74E+01	5.67E-03	2.69E+00	1.98E-01	3.06E-03	1.47E-02	1.95E-02	2.57E-03
80	1.86E+01	3.84E-03	1.83E+00	1.35E-01	2.07E-03	9.98E-03	1.32E-02	1.74E-03
100	8.53E+00	1.77E-03	8.39E-01	6.18E-02	9.53E-04	4.58E-03	6.08E-03	8.00E-04
150	1.22E+00	2.53E-04	1.20E-01	8.84E-03	1.36E-04	6.56E-04	8.70E-04	1.14E-04
250	2.50E-02	5.17E-06	2.46E-03	1.81E-04	2.79E-06	1.34E-05	1.78E-05	2.34E-06
500	4.51E-07	9.33E-11	4.43E-08	3.26E-09	5.03E-11	2.42E-10	3.21E-10	4.23E-11
750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Capped 50 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	3.87E+02	7.87E-02	3.69E+01	2.97E+00	4.48E-02	2.29E-01	2.97E-01	3.77E-02
2	3.85E+02	7.84E-02	3.67E+01	2.95E+00	4.46E-02	2.28E-01	2.96E-01	3.75E-02
4	3.82E+02	7.77E-02	3.64E+01	2.92E+00	4.42E-02	2.26E-01	2.93E-01	3.72E-02
6	3.78E+02	7.70E-02	3.60E+01	2.90E+00	4.38E-02	2.24E-01	2.90E-01	3.68E-02
8	3.75E+02	7.63E-02	3.57E+01	2.87E+00	4.34E-02	2.22E-01	2.88E-01	3.65E-02
10	3.72E+02	7.56E-02	3.54E+01	2.85E+00	4.30E-02	2.20E-01	2.85E-01	3.62E-02
20	3.55E+02	7.22E-02	3.38E+01	2.72E+00	4.11E-02	2.10E-01	2.72E-01	3.46E-02
30	3.39E+02	6.90E-02	3.23E+01	2.60E+00	3.93E-02	2.01E-01	2.60E-01	3.30E-02
40	3.24E+02	6.59E-02	3.09E+01	2.48E+00	3.75E-02	1.92E-01	2.49E-01	3.16E-02
50	3.10E+02	6.30E-02	2.95E+01	2.37E+00	3.59E-02	1.83E-01	2.38E-01	3.01E-02
60	2.96E+02	6.02E-02	2.82E+01	2.27E+00	3.43E-02	1.75E-01	2.27E-01	2.88E-02
70	2.83E+02	5.75E-02	2.69E+01	2.16E+00	3.27E-02	1.67E-01	2.17E-01	2.75E-02
80	2.70E+02	5.49E-02	2.57E+01	2.07E+00	3.13E-02	1.60E-01	2.07E-01	2.63E-02
100	2.47E+02	5.01E-02	2.35E+01	1.89E+00	2.86E-02	1.46E-01	1.89E-01	2.40E-02
150	1.96E+02	3.99E-02	1.87E+01	1.50E+00	2.27E-02	1.16E-01	1.51E-01	1.91E-02
250	1.24E+02	2.53E-02	1.18E+01	9.53E-01	1.44E-02	7.36E-02	9.54E-02	1.21E-02
500	3.98E+01	8.10E-03	3.79E+00	3.05E-01	4.61E-03	2.35E-02	3.05E-02	3.88E-03
750	1.27E+01	2.59E-03	1.21E+00	9.76E-02	1.48E-03	7.53E-03	9.77E-03	1.24E-03
1000	4.08E+00	8.29E-04	3.88E-01	3.12E-02	4.72E-04	2.41E-03	3.13E-03	3.97E-04
2000	4.27E-02	8.69E-06	4.07E-03	3.27E-04	4.95E-06	2.53E-05	3.28E-05	4.16E-06

Uncapped 95 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	6.71E+02	1.72E-01	7.73E+01	7.60E+00	1.08E-01	4.75E-01	7.42E-01	6.20E-02
2	6.46E+02	1.65E-01	7.43E+01	7.31E+00	1.04E-01	4.57E-01	7.13E-01	5.97E-02
4	5.97E+02	1.53E-01	6.88E+01	6.76E+00	9.64E-02	4.22E-01	6.60E-01	5.52E-02
6	5.53E+02	1.42E-01	6.36E+01	6.26E+00	8.92E-02	3.91E-01	6.11E-01	5.11E-02
8	5.11E+02	1.31E-01	5.89E+01	5.79E+00	8.25E-02	3.62E-01	5.65E-01	4.73E-02
10	4.73E+02	1.21E-01	5.44E+01	5.35E+00	7.64E-02	3.34E-01	5.23E-01	4.37E-02
20	3.21E+02	8.21E-02	3.69E+01	3.63E+00	5.18E-02	2.27E-01	3.54E-01	2.96E-02
30	2.17E+02	5.57E-02	2.50E+01	2.46E+00	3.51E-02	1.54E-01	2.40E-01	2.01E-02
40	1.47E+02	3.77E-02	1.70E+01	1.67E+00	2.38E-02	1.04E-01	1.63E-01	1.36E-02
50	9.98E+01	2.56E-02	1.15E+01	1.13E+00	1.61E-02	7.06E-02	1.10E-01	9.23E-03
60	6.77E+01	1.73E-02	7.79E+00	7.66E-01	1.09E-02	4.79E-02	7.48E-02	6.25E-03
70	4.59E+01	1.17E-02	5.28E+00	5.19E-01	7.41E-03	3.24E-02	5.07E-02	4.24E-03
80	3.11E+01	7.96E-03	3.58E+00	3.52E-01	5.02E-03	2.20E-02	3.44E-02	2.87E-03
100	1.43E+01	3.66E-03	1.64E+00	1.62E-01	2.31E-03	1.01E-02	1.58E-02	1.32E-03
150	2.04E+00	5.23E-04	2.35E-01	2.31E-02	3.30E-04	1.45E-03	2.26E-03	1.89E-04
250	4.18E-02	1.07E-05	4.81E-03	4.73E-04	6.75E-06	2.96E-05	4.62E-05	3.87E-06
500	7.55E-07	1.93E-10	8.69E-08	8.54E-09	1.22E-10	5.34E-10	8.34E-10	6.98E-11
750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Capped 95 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	6.87E+02	1.69E-01	7.60E+01	7.51E+00	1.06E-01	4.61E-01	7.52E-01	6.50E-02
2	6.84E+02	1.68E-01	7.57E+01	7.48E+00	1.06E-01	4.59E-01	7.49E-01	6.47E-02
4	6.78E+02	1.66E-01	7.50E+01	7.41E+00	1.05E-01	4.54E-01	7.42E-01	6.42E-02
6	6.72E+02	1.65E-01	7.43E+01	7.34E+00	1.04E-01	4.50E-01	7.35E-01	6.36E-02
8	6.66E+02	1.63E-01	7.36E+01	7.27E+00	1.03E-01	4.46E-01	7.29E-01	6.30E-02
10	6.60E+02	1.62E-01	7.30E+01	7.21E+00	1.02E-01	4.42E-01	7.22E-01	6.24E-02
20	6.30E+02	1.55E-01	6.97E+01	6.89E+00	9.72E-02	4.23E-01	6.90E-01	5.96E-02
30	6.02E+02	1.48E-01	6.66E+01	6.58E+00	9.29E-02	4.04E-01	6.59E-01	5.70E-02
40	5.75E+02	1.41E-01	6.36E+01	6.29E+00	8.87E-02	3.86E-01	6.30E-01	5.44E-02
50	5.50E+02	1.35E-01	6.08E+01	6.01E+00	8.48E-02	3.69E-01	6.02E-01	5.20E-02
60	5.25E+02	1.29E-01	5.81E+01	5.74E+00	8.10E-02	3.52E-01	5.75E-01	4.97E-02
70	5.02E+02	1.23E-01	5.55E+01	5.48E+00	7.74E-02	3.36E-01	5.49E-01	4.75E-02
80	4.79E+02	1.18E-01	5.30E+01	5.24E+00	7.39E-02	3.21E-01	5.25E-01	4.54E-02
100	4.38E+02	1.07E-01	4.84E+01	4.78E+00	6.75E-02	2.93E-01	4.79E-01	4.14E-02
150	3.49E+02	8.56E-02	3.85E+01	3.81E+00	5.37E-02	2.34E-01	3.82E-01	3.30E-02
250	2.21E+02	5.42E-02	2.44E+01	2.41E+00	3.41E-02	1.48E-01	2.42E-01	2.09E-02
500	7.07E+01	1.74E-02	7.82E+00	7.72E-01	1.09E-02	4.74E-02	7.74E-02	6.69E-03
750	2.26E+01	5.55E-03	2.50E+00	2.47E-01	3.49E-03	1.52E-02	2.48E-02	2.14E-03
1000	7.24E+00	1.78E-03	8.00E-01	7.91E-02	1.12E-03	4.85E-03	7.92E-03	6.85E-04
2000	7.58E-02	1.86E-05	8.39E-03	8.29E-04	1.17E-05	5.08E-05	8.30E-05	7.18E-06

Overburden

Uncapped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	4.32E-11	4.67E-15	4.03E-21	0.00E+00	4.00E-40	0.00E+00
4	4.95E-21	0.00E+00	6.70E-03	5.33E-07	3.32E-10	0.00E+00	2.45E-20	0.00E+00
6	2.75E-14	0.00E+00	3.51E-01	3.98E-06	1.91E-08	0.00E+00	4.52E-14	0.00E+00
8	1.75E-09	0.00E+00	1.72E+00	4.48E-06	5.38E-08	0.00E+00	1.97E-11	0.00E+00
10	7.21E-07	0.00E+00	3.70E+00	4.19E-06	7.41E-08	0.00E+00	4.19E-10	0.00E+00
20	6.58E-02	0.00E+00	1.05E+01	2.84E-06	6.09E-08	0.00E+00	1.63E-08	0.00E+00
30	2.12E+00	0.00E+00	1.18E+01	1.93E-06	4.14E-08	0.00E+00	2.43E-08	0.00E+00
40	1.02E+01	0.00E+00	1.14E+01	1.31E-06	2.80E-08	0.00E+00	1.75E-08	0.00E+00
50	2.10E+01	0.00E+00	9.86E+00	8.85E-07	1.90E-08	0.00E+00	1.19E-08	0.00E+00
60	3.01E+01	0.00E+00	7.74E+00	6.00E-07	1.29E-08	0.00E+00	8.05E-09	0.00E+00
70	3.54E+01	0.00E+00	5.87E+00	4.07E-07	8.73E-09	0.00E+00	5.46E-09	0.00E+00
80	3.67E+01	0.00E+00	4.36E+00	2.76E-07	5.92E-09	0.00E+00	3.70E-09	0.00E+00
100	3.69E+01	0.00E+00	2.26E+00	1.27E-07	2.72E-09	0.00E+00	1.70E-09	0.00E+00
150	2.85E+01	2.50E-38	3.66E-01	1.81E-08	3.89E-10	0.00E+00	2.43E-10	0.00E+00
250	1.42E+01	2.26E-28	7.69E-03	3.71E-10	7.96E-12	0.00E+00	4.98E-12	0.00E+00
500	1.21E+00	2.16E-16	4.07E-07	6.93E-15	1.85E-16	1.73E-34	2.06E-16	3.65E-28
750	4.89E-02	1.75E-11	0.00E+00	0.00E+00	0.00E+00	1.35E-27	0.00E+00	1.07E-21
1000	1.93E-03	3.91E-09	0.00E+00	0.00E+00	0.00E+00	4.37E-22	0.00E+00	6.59E-17
2000	3.95E-08	7.35E-06	0.00E+00	0.00E+00	0.00E+00	2.52E-12	0.00E+00	1.23E-09

Capped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	2.87E-11	6.49E-15	1.21E-20	0.00E+00	0.00E+00	0.00E+00
4	1.30E-20	0.00E+00	4.52E-03	3.74E-07	3.79E-10	0.00E+00	4.52E-19	0.00E+00
6	2.08E-14	0.00E+00	2.08E-01	2.67E-06	1.47E-08	0.00E+00	4.63E-13	0.00E+00
8	1.17E-09	0.00E+00	9.66E-01	3.29E-06	4.16E-08	0.00E+00	1.08E-10	0.00E+00
10	5.37E-07	0.00E+00	1.98E+00	3.29E-06	6.17E-08	0.00E+00	1.51E-09	0.00E+00
20	4.65E-02	0.00E+00	5.45E+00	3.15E-06	6.85E-08	0.00E+00	6.58E-08	0.00E+00
30	1.54E+00	0.00E+00	7.88E+00	3.01E-06	6.55E-08	0.00E+00	1.11E-07	0.00E+00
40	7.09E+00	0.00E+00	9.53E+00	2.87E-06	6.26E-08	0.00E+00	1.14E-07	0.00E+00
50	1.57E+01	0.00E+00	1.06E+01	2.75E-06	5.98E-08	0.00E+00	1.11E-07	0.00E+00
60	2.43E+01	0.00E+00	1.16E+01	2.62E-06	5.71E-08	0.00E+00	1.06E-07	0.00E+00
70	3.10E+01	0.00E+00	1.20E+01	2.51E-06	5.46E-08	0.00E+00	1.02E-07	0.00E+00
80	3.63E+01	0.00E+00	1.21E+01	2.39E-06	5.21E-08	0.00E+00	9.71E-08	0.00E+00
100	4.47E+01	0.00E+00	1.19E+01	2.19E-06	4.76E-08	0.00E+00	8.86E-08	0.00E+00
150	5.31E+01	6.51E-39	1.03E+01	1.74E-06	3.79E-08	0.00E+00	7.06E-08	0.00E+00
250	5.57E+01	5.83E-27	6.76E+00	1.10E-06	2.40E-08	0.00E+00	4.47E-08	0.00E+00
500	4.24E+01	4.13E-17	2.17E+00	3.53E-07	7.69E-09	3.96E-34	1.43E-08	1.92E-27
750	2.06E+01	8.19E-12	6.97E-01	1.13E-07	2.46E-09	1.90E-26	4.58E-09	6.40E-22
1000	7.50E+00	3.26E-09	2.23E-01	3.61E-08	7.87E-10	5.31E-21	1.47E-09	5.99E-18
2000	8.29E-02	1.52E-05	2.34E-03	3.79E-10	8.25E-12	2.32E-11	1.54E-11	6.97E-10

Uncapped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.27E-28	2.85E-31	2.00E-37	0.00E+00	0.00E+00	0.00E+00
2	1.25E-19	0.00E+00	1.18E-03	3.12E-06	2.35E-09	0.00E+00	2.63E-16	0.00E+00
4	1.15E-06	0.00E+00	2.40E+00	1.29E-03	1.62E-05	0.00E+00	4.71E-07	0.00E+00
6	5.00E-03	0.00E+00	8.65E+00	1.53E-03	4.57E-05	0.00E+00	3.22E-05	0.00E+00
8	1.91E-01	0.00E+00	1.45E+01	1.42E-03	5.73E-05	0.00E+00	1.89E-04	0.00E+00
10	1.33E+00	0.00E+00	1.89E+01	1.32E-03	5.99E-05	0.00E+00	4.29E-04	0.00E+00
20	3.53E+01	7.59E-41	2.83E+01	8.93E-04	4.21E-05	0.00E+00	7.08E-04	0.00E+00
30	7.44E+01	9.10E-34	2.79E+01	6.06E-04	2.86E-05	0.00E+00	5.05E-04	2.96E-37
40	9.21E+01	4.99E-31	2.46E+01	4.10E-04	1.94E-05	6.83E-40	3.43E-04	2.00E-31
50	9.80E+01	1.30E-26	2.13E+01	2.78E-04	1.31E-05	1.02E-34	2.32E-04	5.84E-31
60	9.63E+01	1.94E-23	1.80E+01	1.89E-04	8.89E-06	1.70E-31	1.57E-04	9.46E-27
70	9.27E+01	2.95E-22	1.51E+01	1.28E-04	6.03E-06	3.96E-27	1.07E-04	7.91E-24
80	8.71E+01	3.24E-20	1.28E+01	8.66E-05	4.08E-06	2.88E-30	7.23E-05	1.21E-21
100	7.72E+01	6.45E-18	9.18E+00	3.98E-05	1.88E-06	5.51E-22	3.32E-05	5.72E-20
150	5.42E+01	3.41E-12	4.04E+00	5.69E-06	2.68E-07	1.39E-17	4.75E-06	1.92E-13
250	3.27E+01	8.84E-08	9.11E-01	1.17E-07	5.50E-09	7.43E-11	9.73E-08	1.22E-08
500	1.25E+01	7.21E-05	7.13E-03	1.95E-12	1.14E-13	5.34E-06	3.23E-12	1.99E-05
750	6.41E+00	3.55E-04	6.17E-05	0.00E+00	0.00E+00	1.03E-04	3.67E-21	1.04E-04
1000	3.57E+00	5.14E-04	4.21E-07	0.00E+00	0.00E+00	4.29E-04	3.25E-27	1.56E-04
2000	1.99E-01	5.03E-04	0.00E+00	0.00E+00	0.00E+00	8.61E-04	0.00E+00	1.91E-04

Capped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	3.25E-29	1.44E-31	5.46E-38	0.00E+00	0.00E+00	0.00E+00
2	5.47E-20	0.00E+00	3.91E-04	8.10E-07	1.04E-09	0.00E+00	3.37E-17	0.00E+00
4	2.08E-07	0.00E+00	8.52E-01	4.77E-04	1.05E-05	0.00E+00	3.38E-07	0.00E+00
6	1.19E-03	0.00E+00	3.54E+00	6.48E-04	3.42E-05	0.00E+00	2.81E-05	0.00E+00
8	4.99E-02	0.00E+00	6.20E+00	6.45E-04	4.08E-05	0.00E+00	1.51E-04	0.00E+00
10	4.14E-01	0.00E+00	8.15E+00	6.40E-04	4.17E-05	0.00E+00	3.16E-04	0.00E+00
20	1.63E+01	0.00E+00	1.43E+01	6.11E-04	3.98E-05	0.00E+00	6.35E-04	0.00E+00
30	4.11E+01	9.68E-34	1.79E+01	5.84E-04	3.81E-05	0.00E+00	6.08E-04	2.16E-35
40	5.98E+01	3.26E-31	2.11E+01	5.58E-04	3.64E-05	0.00E+00	5.81E-04	5.91E-32
50	7.38E+01	1.93E-26	2.35E+01	5.33E-04	3.47E-05	2.07E-38	5.55E-04	3.30E-28
60	8.26E+01	2.53E-24	2.57E+01	5.09E-04	3.32E-05	1.92E-32	5.30E-04	3.76E-24
70	8.77E+01	2.94E-23	2.69E+01	4.87E-04	3.17E-05	1.07E-31	5.07E-04	1.01E-22
80	9.34E+01	1.07E-21	2.73E+01	4.65E-04	3.03E-05	6.54E-31	4.84E-04	1.82E-20
100	1.03E+02	8.44E-20	2.77E+01	4.24E-04	2.77E-05	8.58E-26	4.42E-04	9.35E-18
150	1.15E+02	2.15E-13	2.49E+01	3.38E-04	2.20E-05	6.64E-21	3.52E-04	2.96E-12
250	1.24E+02	1.35E-08	1.87E+01	2.14E-04	1.40E-05	1.46E-13	2.23E-04	5.20E-08
500	9.63E+01	4.33E-05	6.34E+00	6.85E-05	4.47E-06	2.82E-07	7.14E-05	6.02E-05
750	6.98E+01	5.02E-04	2.14E+00	2.19E-05	1.43E-06	3.85E-05	2.28E-05	4.43E-04
1000	4.84E+01	1.24E-03	6.95E-01	7.02E-06	4.57E-07	2.65E-04	7.31E-06	5.29E-04
2000	7.64E+00	1.93E-03	7.28E-03	7.35E-08	4.79E-09	2.46E-03	7.66E-08	6.00E-04

Overburden at the River Morell

Uncapped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	8.53E-18	3.37E-24	3.11E-32	0.00E+00	0.00E+00	0.00E+00
4	2.19E-32	0.00E+00	6.39E-06	1.43E-10	8.28E-15	0.00E+00	3.11E-30	0.00E+00
6	2.62E-22	0.00E+00	5.80E-03	1.83E-08	1.46E-11	0.00E+00	2.34E-21	0.00E+00
8	3.19E-16	0.00E+00	1.06E-01	4.39E-08	1.73E-10	0.00E+00	4.56E-17	0.00E+00
10	4.12E-13	0.00E+00	5.02E-01	4.69E-08	5.29E-10	0.00E+00	1.24E-14	0.00E+00
20	6.32E-05	0.00E+00	5.97E+00	3.22E-08	6.51E-10	0.00E+00	2.22E-11	0.00E+00
30	2.38E-02	0.00E+00	9.87E+00	2.19E-08	4.56E-10	0.00E+00	1.05E-10	0.00E+00
40	4.31E-01	0.00E+00	1.04E+01	1.48E-08	3.09E-10	0.00E+00	9.53E-11	0.00E+00
50	2.13E+00	0.00E+00	9.70E+00	1.00E-08	2.09E-10	0.00E+00	7.21E-11	0.00E+00
60	5.59E+00	0.00E+00	8.43E+00	6.80E-09	1.42E-10	0.00E+00	4.89E-11	0.00E+00
70	1.11E+01	0.00E+00	6.77E+00	4.61E-09	9.62E-11	0.00E+00	3.31E-11	0.00E+00
80	1.62E+01	0.00E+00	5.28E+00	3.13E-09	6.52E-11	0.00E+00	2.24E-11	0.00E+00
100	2.46E+01	0.00E+00	2.91E+00	1.44E-09	3.00E-11	0.00E+00	1.03E-11	0.00E+00
150	2.73E+01	0.00E+00	5.30E-01	2.05E-10	4.29E-12	0.00E+00	1.48E-12	0.00E+00
250	1.57E+01	2.75E-36	1.19E-02	4.21E-12	8.77E-14	0.00E+00	3.02E-14	0.00E+00
500	2.70E+00	1.87E-24	7.15E-07	8.63E-17	2.51E-18	0.00E+00	1.37E-18	6.36E-36
750	2.25E-01	4.37E-18	0.00E+00	0.00E+00	0.00E+00	8.99E-36	0.00E+00	1.12E-31
1000	1.77E-02	5.00E-14	0.00E+00	0.00E+00	0.00E+00	1.01E-31	0.00E+00	2.16E-25
2000	6.83E-07	3.61E-08	0.00E+00	0.00E+00	0.00E+00	4.12E-20	0.00E+00	1.40E-14

Capped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	8.42E-18	8.43E-23	1.13E-30	0.00E+00	0.00E+00	0.00E+00
4	6.03E-32	0.00E+00	4.79E-06	1.42E-10	1.63E-14	0.00E+00	4.80E-29	0.00E+00
6	1.71E-22	0.00E+00	3.96E-03	1.32E-08	1.42E-11	0.00E+00	4.83E-20	0.00E+00
8	1.95E-16	0.00E+00	6.28E-02	3.19E-08	1.92E-10	0.00E+00	6.84E-16	0.00E+00
10	2.94E-13	0.00E+00	3.04E-01	3.69E-08	4.00E-10	0.00E+00	1.24E-13	0.00E+00
20	4.86E-05	0.00E+00	3.14E+00	3.57E-08	8.13E-10	0.00E+00	2.04E-10	0.00E+00
30	1.78E-02	0.00E+00	5.52E+00	3.41E-08	8.07E-10	0.00E+00	6.78E-10	0.00E+00
40	3.15E-01	0.00E+00	7.33E+00	3.26E-08	7.71E-10	0.00E+00	7.37E-10	0.00E+00
50	1.65E+00	0.00E+00	9.13E+00	3.12E-08	7.37E-10	0.00E+00	7.33E-10	0.00E+00
60	4.64E+00	0.00E+00	1.01E+01	2.98E-08	7.04E-10	0.00E+00	7.18E-10	0.00E+00
70	8.67E+00	0.00E+00	1.08E+01	2.85E-08	6.73E-10	0.00E+00	6.87E-10	0.00E+00
80	1.38E+01	0.00E+00	1.12E+01	2.72E-08	6.43E-10	0.00E+00	6.57E-10	0.00E+00
100	2.38E+01	0.00E+00	1.15E+01	2.48E-08	5.87E-10	0.00E+00	6.00E-10	0.00E+00
150	3.80E+01	0.00E+00	1.04E+01	1.98E-08	4.67E-10	0.00E+00	4.77E-10	0.00E+00
250	5.05E+01	1.87E-38	6.99E+00	1.25E-08	2.96E-10	0.00E+00	3.03E-10	0.00E+00
500	4.40E+01	1.09E-23	2.27E+00	4.01E-09	9.47E-11	0.00E+00	9.68E-11	3.94E-39
750	2.44E+01	3.64E-19	7.27E-01	1.28E-09	3.03E-11	3.81E-36	3.10E-11	3.01E-31
1000	9.54E+00	1.79E-14	2.33E-01	4.10E-10	9.70E-12	3.55E-32	9.91E-12	1.83E-24
2000	1.11E-01	5.19E-08	2.44E-03	4.30E-12	1.02E-13	2.73E-18	1.04E-13	2.80E-15

Uncapped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.83E-38	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	9.66E-27	0.00E+00	4.04E-07	3.62E-10	3.34E-14	0.00E+00	3.93E-23	0.00E+00
4	6.01E-13	0.00E+00	1.66E-01	3.67E-05	2.04E-07	0.00E+00	8.17E-11	0.00E+00
6	8.71E-07	0.00E+00	2.26E+00	8.89E-05	2.32E-06	0.00E+00	1.00E-07	0.00E+00
8	3.78E-04	0.00E+00	6.08E+00	9.14E-05	3.98E-06	0.00E+00	2.86E-06	0.00E+00
10	1.17E-02	0.00E+00	1.00E+01	8.48E-05	5.37E-06	0.00E+00	1.42E-05	0.00E+00
20	4.98E+00	0.00E+00	2.41E+01	5.75E-05	3.95E-06	0.00E+00	7.74E-05	0.00E+00
30	2.58E+01	0.00E+00	2.67E+01	3.89E-05	2.68E-06	0.00E+00	6.29E-05	0.00E+00
40	5.01E+01	5.88E-37	2.51E+01	2.64E-05	1.82E-06	0.00E+00	4.39E-05	8.65E-41
50	6.58E+01	3.03E-33	2.22E+01	1.79E-05	1.23E-06	0.00E+00	2.98E-05	2.26E-35
60	7.66E+01	5.04E-31	1.97E+01	1.21E-05	8.34E-07	2.29E-38	2.02E-05	3.63E-34
70	8.15E+01	2.22E-30	1.69E+01	8.22E-06	5.66E-07	3.06E-35	1.37E-05	6.40E-31
80	8.28E+01	1.29E-26	1.46E+01	5.57E-06	3.83E-07	4.63E-35	9.28E-06	4.38E-31
100	7.87E+01	1.12E-23	1.12E+01	2.56E-06	1.76E-07	7.96E-32	4.26E-06	3.68E-27
150	6.12E+01	9.48E-20	5.44E+00	3.66E-07	2.52E-08	1.13E-23	6.10E-07	1.81E-20
250	3.96E+01	3.24E-12	1.54E+00	7.50E-09	5.16E-10	1.46E-17	1.25E-08	1.85E-13
500	1.62E+01	7.97E-07	3.35E-02	1.32E-13	1.24E-14	2.81E-09	6.17E-13	1.26E-07
750	8.58E+00	2.49E-05	7.37E-04	0.00E+00	0.00E+00	1.20E-06	4.08E-21	6.56E-06
1000	4.91E+00	1.11E-04	1.51E-05	0.00E+00	0.00E+00	1.79E-05	4.28E-25	3.61E-05
2000	5.30E-01	3.93E-04	1.49E-09	0.00E+00	0.00E+00	3.85E-04	0.00E+00	1.17E-04

Capped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	7.77E-39	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	5.43E-24	0.00E+00	1.27E-07	6.70E-11	8.97E-15	0.00E+00	3.15E-22	0.00E+00
4	6.29E-14	0.00E+00	6.20E-02	1.30E-05	1.16E-07	0.00E+00	4.02E-11	0.00E+00
6	1.56E-07	0.00E+00	8.10E-01	3.51E-05	1.78E-06	0.00E+00	1.23E-07	0.00E+00
8	8.60E-05	0.00E+00	2.35E+00	3.65E-05	3.25E-06	0.00E+00	2.37E-06	0.00E+00
10	2.85E-03	0.00E+00	4.11E+00	3.63E-05	3.57E-06	0.00E+00	1.10E-05	0.00E+00
20	1.96E+00	0.00E+00	1.02E+01	3.46E-05	3.71E-06	0.00E+00	6.92E-05	0.00E+00
30	1.21E+01	0.00E+00	1.50E+01	3.31E-05	3.54E-06	0.00E+00	7.26E-05	0.00E+00
40	2.73E+01	2.08E-38	1.87E+01	3.16E-05	3.39E-06	0.00E+00	7.21E-05	4.61E-40
50	4.09E+01	5.28E-34	2.11E+01	3.02E-05	3.24E-06	0.00E+00	6.89E-05	3.01E-35
60	5.36E+01	2.16E-31	2.27E+01	2.89E-05	3.09E-06	0.00E+00	6.58E-05	1.78E-34
70	6.28E+01	7.43E-31	2.50E+01	2.76E-05	2.95E-06	0.00E+00	6.29E-05	3.62E-31
80	7.02E+01	8.41E-27	2.58E+01	2.64E-05	2.82E-06	2.52E-38	6.01E-05	2.64E-31
100	8.06E+01	3.78E-24	2.63E+01	2.41E-05	2.58E-06	1.59E-33	5.48E-05	2.93E-24
150	9.86E+01	2.80E-20	2.53E+01	1.92E-05	2.05E-06	3.10E-30	4.37E-05	4.32E-20
250	1.14E+02	2.26E-13	1.99E+01	1.21E-05	1.30E-06	1.46E-20	2.77E-05	3.08E-12
500	9.85E+01	2.17E-07	7.15E+00	3.89E-06	4.16E-07	1.85E-11	8.86E-06	5.53E-07
750	7.62E+01	1.69E-05	2.49E+00	1.24E-06	1.33E-07	5.45E-08	2.83E-06	2.56E-05
1000	5.64E+01	1.31E-04	8.11E-01	3.98E-07	4.26E-08	2.71E-06	9.07E-07	1.46E-04
2000	1.24E+01	1.14E-03	8.50E-03	4.17E-09	4.46E-10	5.39E-04	9.50E-09	4.20E-04

Limestone Aquifer

Uncapped 50th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	3.44E-06	2.80E-15	1.02E-28	0.00E+00	0.00E+00	0.00E+00
4	0.00E+00	0.00E+00	1.08E+00	3.25E-06	2.02E-13	0.00E+00	7.79E-39	0.00E+00
6	1.44E-30	0.00E+00	6.72E+00	2.35E-05	2.20E-10	0.00E+00	2.02E-30	0.00E+00
8	2.51E-26	0.00E+00	1.22E+01	2.63E-05	2.50E-09	0.00E+00	5.02E-24	0.00E+00
10	5.21E-22	0.00E+00	1.55E+01	2.44E-05	6.05E-09	0.00E+00	3.76E-20	0.00E+00
20	4.06E-11	0.00E+00	1.81E+01	1.66E-05	8.14E-09	0.00E+00	8.78E-14	0.00E+00
30	5.80E-06	0.00E+00	1.34E+01	1.12E-05	5.52E-09	0.00E+00	1.10E-12	0.00E+00
40	1.66E-03	0.00E+00	9.48E+00	7.61E-06	3.74E-09	0.00E+00	2.07E-12	0.00E+00
50	4.10E-02	0.00E+00	6.55E+00	5.16E-06	2.53E-09	0.00E+00	1.66E-12	0.00E+00
60	2.89E-01	0.00E+00	4.46E+00	3.50E-06	1.72E-09	0.00E+00	1.20E-12	0.00E+00
70	1.06E+00	0.00E+00	3.04E+00	2.37E-06	1.16E-09	0.00E+00	8.25E-13	0.00E+00
80	2.67E+00	0.00E+00	2.06E+00	1.61E-06	7.89E-10	0.00E+00	5.59E-13	0.00E+00
100	8.14E+00	0.00E+00	9.47E-01	7.38E-07	3.63E-10	0.00E+00	2.57E-13	0.00E+00
150	1.96E+01	0.00E+00	1.36E-01	1.06E-07	5.19E-11	0.00E+00	3.67E-14	0.00E+00
250	1.60E+01	0.00E+00	2.77E-03	2.16E-09	1.06E-12	0.00E+00	7.52E-16	0.00E+00
500	4.59E+00	3.63E-35	7.20E-08	3.89E-14	2.90E-17	0.00E+00	4.30E-20	0.00E+00
750	6.80E-01	2.70E-30	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	8.49E-02	2.52E-25	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.64E-35
2000	1.64E-05	1.33E-14	0.00E+00	0.00E+00	0.00E+00	1.59E-30	0.00E+00	1.96E-26

Capped 50th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	4.52E-06	7.54E-15	1.03E-29	0.00E+00	0.00E+00	0.00E+00
4	0.00E+00	0.00E+00	5.74E-01	1.95E-06	2.79E-13	0.00E+00	0.00E+00	0.00E+00
6	9.58E-33	0.00E+00	2.54E+00	1.16E-05	1.99E-10	0.00E+00	5.72E-30	0.00E+00
8	5.53E-28	0.00E+00	3.71E+00	1.34E-05	1.93E-09	0.00E+00	4.05E-23	0.00E+00
10	1.93E-22	0.00E+00	4.71E+00	1.33E-05	4.84E-09	0.00E+00	1.78E-19	0.00E+00
20	2.83E-10	0.00E+00	7.12E+00	1.27E-05	7.79E-09	0.00E+00	3.73E-13	0.00E+00
30	1.40E-05	0.00E+00	8.80E+00	1.21E-05	7.45E-09	0.00E+00	3.88E-12	0.00E+00
40	2.10E-03	0.00E+00	9.22E+00	1.16E-05	7.11E-09	0.00E+00	6.63E-12	0.00E+00
50	3.85E-02	0.00E+00	9.02E+00	1.11E-05	6.80E-09	0.00E+00	7.76E-12	0.00E+00
60	2.37E-01	0.00E+00	8.76E+00	1.06E-05	6.49E-09	0.00E+00	7.52E-12	0.00E+00
70	8.68E-01	0.00E+00	8.51E+00	1.01E-05	6.20E-09	0.00E+00	7.19E-12	0.00E+00
80	1.98E+00	0.00E+00	8.18E+00	9.66E-06	5.93E-09	0.00E+00	6.87E-12	0.00E+00
100	6.17E+00	0.00E+00	7.51E+00	8.82E-06	5.41E-09	0.00E+00	6.27E-12	0.00E+00
150	1.90E+01	0.00E+00	5.98E+00	7.02E-06	4.31E-09	0.00E+00	4.99E-12	0.00E+00
250	2.99E+01	0.00E+00	3.79E+00	4.45E-06	2.73E-09	0.00E+00	3.16E-12	0.00E+00
500	2.76E+01	4.60E-38	1.21E+00	1.42E-06	8.74E-10	0.00E+00	1.01E-12	0.00E+00
750	1.63E+01	7.14E-31	3.88E-01	4.56E-07	2.80E-10	0.00E+00	3.24E-13	0.00E+00
1000	7.46E+00	2.19E-25	1.24E-01	1.46E-07	8.95E-11	0.00E+00	1.04E-13	3.03E-37
2000	1.00E-01	1.34E-14	1.30E-03	1.53E-09	9.38E-13	2.26E-31	1.09E-15	2.26E-26

Uncapped 95th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.63E-22	4.36E-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	6.24E-35	0.00E+00	9.72E-01	1.22E-05	6.25E-13	0.00E+00	5.65E-30	0.00E+00
4	8.33E-19	0.00E+00	1.85E+01	5.06E-03	3.76E-06	0.00E+00	1.72E-16	0.00E+00
6	1.21E-14	0.00E+00	3.12E+01	5.22E-03	3.23E-05	0.00E+00	9.46E-11	0.00E+00
8	1.27E-09	0.00E+00	3.66E+01	4.86E-03	4.62E-05	0.00E+00	1.72E-08	0.00E+00
10	1.48E-06	0.00E+00	3.98E+01	4.49E-03	4.52E-05	0.00E+00	2.15E-07	0.00E+00
20	2.19E-01	0.00E+00	3.85E+01	3.05E-03	3.17E-05	0.00E+00	1.10E-05	0.00E+00
30	5.19E+00	0.00E+00	2.88E+01	2.06E-03	2.15E-05	0.00E+00	1.13E-05	0.00E+00
40	2.23E+01	0.00E+00	2.08E+01	1.40E-03	1.46E-05	0.00E+00	7.84E-06	0.00E+00
50	3.92E+01	0.00E+00	1.47E+01	9.48E-04	9.88E-06	0.00E+00	5.32E-06	0.00E+00
60	5.31E+01	0.00E+00	1.04E+01	6.43E-04	6.70E-06	0.00E+00	3.60E-06	0.00E+00
70	6.26E+01	0.00E+00	7.16E+00	4.36E-04	4.54E-06	0.00E+00	2.44E-06	0.00E+00
80	6.73E+01	9.52E-38	5.04E+00	2.95E-04	3.08E-06	0.00E+00	1.66E-06	3.37E-39
100	6.50E+01	2.05E-33	2.40E+00	1.36E-04	1.41E-06	0.00E+00	7.61E-07	8.77E-34
150	5.59E+01	3.90E-30	3.47E-01	1.94E-05	2.02E-07	2.82E-34	1.09E-07	4.92E-30
250	3.53E+01	2.24E-22	7.18E-03	3.97E-07	4.14E-09	1.45E-29	2.23E-09	1.23E-22
500	1.64E+01	1.60E-13	3.60E-07	6.66E-12	8.55E-14	1.60E-18	8.74E-14	2.33E-12
750	9.23E+00	2.95E-09	0.00E+00	0.00E+00	0.00E+00	1.27E-13	5.19E-20	1.35E-08
1000	5.40E+00	2.74E-07	0.00E+00	0.00E+00	0.00E+00	3.43E-10	1.80E-24	6.87E-07
2000	1.13E+00	7.99E-05	0.00E+00	0.00E+00	0.00E+00	8.11E-06	0.00E+00	3.51E-05

Capped 95th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	7.26E-23	4.80E-35	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	2.42E-37	0.00E+00	2.47E-01	1.70E-06	1.38E-13	0.00E+00	1.43E-30	0.00E+00
4	2.68E-21	0.00E+00	5.46E+00	1.28E-03	9.18E-07	0.00E+00	1.31E-16	0.00E+00
6	2.35E-15	0.00E+00	8.47E+00	1.51E-03	9.98E-06	0.00E+00	1.02E-10	0.00E+00
8	3.81E-11	0.00E+00	1.05E+01	1.50E-03	1.76E-05	0.00E+00	2.07E-08	0.00E+00
10	6.01E-08	0.00E+00	1.16E+01	1.49E-03	2.17E-05	0.00E+00	2.42E-07	0.00E+00
20	3.15E-02	0.00E+00	1.77E+01	1.42E-03	2.26E-05	0.00E+00	8.20E-06	0.00E+00
30	1.27E+00	0.00E+00	2.07E+01	1.36E-03	2.16E-05	0.00E+00	1.05E-05	0.00E+00
40	6.70E+00	0.00E+00	2.18E+01	1.30E-03	2.07E-05	0.00E+00	1.01E-05	0.00E+00
50	1.57E+01	0.00E+00	2.18E+01	1.24E-03	1.97E-05	0.00E+00	9.68E-06	0.00E+00
60	2.45E+01	0.00E+00	2.14E+01	1.18E-03	1.89E-05	0.00E+00	9.24E-06	0.00E+00
70	3.21E+01	0.00E+00	2.09E+01	1.13E-03	1.80E-05	0.00E+00	8.83E-06	0.00E+00
80	3.89E+01	2.63E-39	2.02E+01	1.08E-03	1.72E-05	0.00E+00	8.44E-06	1.12E-39
100	4.90E+01	8.19E-35	1.85E+01	9.85E-04	1.57E-05	0.00E+00	7.70E-06	3.19E-35
150	6.18E+01	1.28E-30	1.49E+01	7.85E-04	1.25E-05	0.00E+00	6.13E-06	7.40E-31
250	7.36E+01	7.49E-24	9.43E+00	4.97E-04	7.93E-06	1.11E-31	3.89E-06	1.36E-20
500	6.48E+01	2.06E-14	3.02E+00	1.59E-04	2.54E-06	3.46E-22	1.24E-06	3.45E-12
750	4.90E+01	9.92E-10	9.65E-01	5.09E-05	8.12E-07	2.78E-16	3.98E-07	2.18E-08
1000	3.46E+01	1.96E-07	3.09E-01	1.63E-05	2.60E-07	3.66E-12	1.27E-07	1.19E-06
2000	7.90E+00	1.38E-04	3.24E-03	1.71E-07	2.72E-09	1.68E-06	1.33E-09	1.50E-04

Appendix B. Zone 2A specific input parameters and results

MODEL INPUTS

LANDFILL WASTE:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Distribution		triangular	triangular	triangular	triangular	triangular	triangular	triangular	triangular
Landfill waste leaching test concentration Minimum	mg/L	0.05	0.0025	0.47	0.0001	0.001	0.003	0.001	0.0025
Landfill waste leaching test concentration Likely	mg/L	50	0.044	27	0.1	0.011	0.127	0.03	0.039
Landfill waste leaching test concentration Maximum	mg/L	100	0.224	99	10	0.14	0.605	1	0.078

DIMENSIONS OF ZONE:

Parameter	Units	Saturated Waste	Unsaturated Waste	Total for Zone
Width (perpendicular to groundwater flow)	m	Assumed that there is no saturated waste	180	180
Length (in direction of groundwater flow)	m		100	100
Area	m^2		18,000	18,000
Waste thickness	m		8	-

CONTAMINANTS:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Contaminants Organic Carbon Water Partition Coefficient, Koc	L/kg	-	-	-	3.60E+00	1.29E+01	-	8.32E+01	-
Attenuation partition coefficient Kd Distribution		uniform	uniform	constant	-	-	uniform	-	uniform

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Attenuation partition coefficient Kd Minimum	L/kg	0.5	25	0	-	-	20	-	1
Attenuation partition coefficient Kd Maximum	L/kg	2	125	-	-	-	400	-	300
Attenuation half-life distribution		constant	constant	constant	constant	uniform	constant	uniform	constant
Attenuation half-life Minimum	days	No Decay	No Decay	No Decay	139.8	50.01	No Decay	7.3	No Decay
Attenuation half-life Maximum	days	-	-	-	-	365	-	912.5	-
Contaminants free water diffusion coefficient	m^2/s	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09

HYDROGEOLOGY:

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology unit thickness distribution		uniform	constant	constant
Hydrogeology unit thickness Minimum	m	10	20	2
Hydrogeology unit thickness Maximum	m	12		
Hydrogeology hydraulic conductivity distribution		triangular	triangular	triangular
Hydrogeology hydraulic conductivity Minimum	m/s	2.31E-05	3.25E-08	2.31E-05
Hydrogeology hydraulic conductivity Likely	m/s	6.60E-05	0.0000128	6.60E-05
Hydrogeology hydraulic conductivity Maximum	m/s	1.56E-04	0.0000625	1.56E-04

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology head	m	80.5	78	-
Hydrogeology hydraulic gradient distribution	[-]	uniform	uniform	constant
Hydrogeology hydraulic gradient Minimum		0.004	0.002	1
Hydrogeology hydraulic gradient Maximum		0.006	0.003	
Hydrogeology porosity distribution	[-]	uniform	uniform	constant
Hydrogeology porosity Minimum		0.31	0.01	0.2
Hydrogeology porosity Maximum		0.46	0.1	
Hydrogeology tortuosity	[-]	5	5	5
Distribution		constant	constant	constant

ATTENUATION

Parameter	Units	Sand and Gravel	Limestone	Unsat SandG
Attenuation dry bulk density	kg/m3	1590	2265	1590
Attenuation fraction organic carbon distribution		triangular	uniform	triangular
Attenuation fraction organic carbon Minimum	[-]	0.001	0.001	0.001
Attenuation fraction organic carbon Likely	[-]	0.002		0.002
Attenuation fraction organic carbon Maximum	[-]	0.024	0.016	0.024

MODEL RESULTS

Overburden

Uncapped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	9.67E-21	0.00E+00	2.56E-05	5.01E-07	5.87E-10	0.00E+00	1.52E-17	0.00E+00
2	1.03E-03	0.00E+00	6.69E-03	2.41E-04	3.50E-06	0.00E+00	8.85E-06	0.00E+00
4	5.61E-03	5.52E-32	1.69E+00	6.14E-04	5.78E-06	0.00E+00	1.58E-05	0.00E+00
6	6.19E-03	1.68E-23	6.55E+00	7.74E-04	1.17E-05	6.84E-40	1.55E-05	4.87E-35
8	6.26E-03	2.38E-19	8.35E+00	6.60E-04	1.42E-05	2.27E-34	1.55E-05	4.70E-28
10	6.69E-03	4.11E-16	8.05E+00	5.54E-04	1.28E-05	2.03E-29	1.60E-05	5.55E-25
20	5.95E-01	5.39E-10	3.70E+00	2.31E-04	5.38E-06	1.64E-18	1.14E-05	2.29E-15
30	2.98E+00	3.66E-08	1.54E+00	9.63E-05	2.24E-06	1.54E-13	5.14E-06	9.19E-12
40	3.57E+00	2.30E-07	6.43E-01	4.02E-05	9.35E-07	3.43E-11	2.14E-06	4.90E-10
50	2.98E+00	6.11E-07	2.68E-01	1.67E-05	3.90E-07	9.05E-10	9.06E-07	4.47E-09
60	1.85E+00	8.92E-07	1.12E-01	6.98E-06	1.63E-07	6.87E-09	3.78E-07	1.85E-08
70	9.77E-01	1.02E-06	4.66E-02	2.91E-06	6.77E-08	3.01E-08	1.58E-07	4.79E-08
80	4.81E-01	1.03E-06	1.94E-02	1.21E-06	2.82E-08	8.48E-08	6.57E-08	7.81E-08
100	9.83E-02	9.23E-07	3.37E-03	2.11E-07	4.91E-09	2.50E-07	1.14E-08	1.46E-07
150	1.32E-03	4.49E-07	4.25E-05	2.65E-09	6.17E-11	5.73E-07	1.44E-10	2.11E-07
250	2.13E-07	9.98E-08	0.00E+00	0.00E+00	0.00E+00	7.77E-07	2.04E-19	1.66E-07
500	2.04E-09	2.23E-07	0.00E+00	0.00E+00	0.00E+00	3.74E-07	0.00E+00	4.89E-08
750	0.00E+00	1.56E-05	0.00E+00	0.00E+00	0.00E+00	1.72E-07	0.00E+00	2.51E-08
1000	0.00E+00	7.65E-05	0.00E+00	0.00E+00	0.00E+00	1.28E-07	0.00E+00	4.08E-08
2000	0.00E+00	9.36E-05	0.00E+00	0.00E+00	0.00E+00	5.37E-06	0.00E+00	5.09E-06

Capped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	2.20E-21	0.00E+00	8.63E-06	1.84E-07	2.49E-10	0.00E+00	4.82E-17	0.00E+00
2	2.42E-04	0.00E+00	1.51E-03	6.45E-05	7.93E-07	0.00E+00	2.14E-06	0.00E+00
4	1.48E-03	6.21E-31	2.64E-03	6.31E-05	8.00E-07	0.00E+00	4.24E-06	0.00E+00
6	1.74E-03	6.48E-24	8.06E-02	6.26E-05	8.11E-07	4.87E-39	4.33E-06	3.79E-36
8	1.76E-03	1.73E-19	5.10E-01	6.10E-05	8.30E-07	3.96E-35	4.30E-06	6.77E-30
10	1.72E-03	2.48E-16	1.19E+00	5.92E-05	8.33E-07	8.94E-30	4.24E-06	7.61E-26
20	1.90E-03	1.85E-10	2.60E+00	5.12E-05	7.33E-07	8.92E-20	3.86E-06	1.29E-16
30	3.14E-03	1.17E-08	2.33E+00	4.42E-05	6.33E-07	1.31E-14	3.40E-06	8.52E-13
40	2.76E-02	8.27E-08	2.02E+00	3.82E-05	5.47E-07	4.71E-12	2.98E-06	6.25E-11
50	1.38E-01	2.36E-07	1.74E+00	3.30E-05	4.73E-07	1.52E-10	2.58E-06	7.55E-10
60	3.47E-01	4.40E-07	1.50E+00	2.85E-05	4.08E-07	1.54E-09	2.23E-06	4.02E-09
70	6.24E-01	6.27E-07	1.30E+00	2.46E-05	3.53E-07	7.15E-09	1.92E-06	1.24E-08
80	9.05E-01	7.66E-07	1.12E+00	2.12E-05	3.04E-07	2.28E-08	1.66E-06	2.77E-08
100	1.31E+00	9.61E-07	8.36E-01	1.58E-05	2.27E-07	1.07E-07	1.24E-06	7.88E-08
150	1.37E+00	9.45E-07	4.02E-01	7.61E-06	1.09E-07	6.41E-07	5.95E-07	2.05E-07
250	4.55E-01	3.59E-07	9.29E-02	1.76E-06	2.52E-08	9.95E-07	1.38E-07	2.23E-07
500	1.32E-02	1.51E-08	2.38E-03	4.51E-08	6.47E-10	4.60E-07	3.53E-09	5.89E-08
750	3.46E-04	1.55E-09	6.11E-05	1.16E-09	1.66E-11	8.47E-08	9.05E-11	7.57E-09
1000	8.88E-06	3.02E-09	1.56E-06	2.95E-11	4.23E-13	1.49E-08	2.31E-12	1.91E-09
2000	0.00E+00	7.86E-06	0.00E+00	0.00E+00	0.00E+00	8.89E-10	0.00E+00	5.69E-10

Uncapped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	2.76E-11	0.00E+00	6.27E-04	2.61E-05	1.64E-07	0.00E+00	8.36E-09	0.00E+00
2	5.73E-03	1.17E-29	1.51E-02	6.29E-04	1.02E-05	7.80E-35	6.19E-05	4.66E-24
4	1.09E-02	1.20E-16	7.34E+00	5.24E-03	1.60E-04	1.62E-21	8.32E-05	2.55E-12
6	1.17E-02	6.39E-12	1.58E+01	5.28E-03	3.80E-04	1.72E-14	7.93E-04	2.68E-09
8	5.85E-02	6.97E-10	1.88E+01	4.45E-03	3.89E-04	1.48E-11	3.03E-03	5.02E-08
10	4.35E-01	9.66E-09	1.88E+01	3.74E-03	3.27E-04	6.25E-10	3.94E-03	2.35E-07
20	7.64E+00	9.13E-07	9.95E+00	1.56E-03	1.36E-04	5.48E-07	2.63E-03	1.57E-06
30	9.19E+00	2.66E-06	4.22E+00	6.49E-04	5.68E-05	3.21E-06	1.10E-03	1.77E-06
40	8.27E+00	3.72E-06	1.76E+00	2.71E-04	2.37E-05	5.27E-06	4.57E-04	1.60E-06
50	7.28E+00	4.07E-06	7.35E-01	1.13E-04	9.86E-06	5.92E-06	1.90E-04	1.49E-06
60	6.07E+00	3.87E-06	3.07E-01	4.70E-05	4.11E-06	5.96E-06	7.94E-05	1.32E-06
70	5.31E+00	3.60E-06	1.28E-01	1.96E-05	1.71E-06	5.83E-06	3.31E-05	1.30E-06
80	4.08E+00	3.32E-06	5.33E-02	8.17E-06	7.15E-07	5.42E-06	1.38E-05	1.26E-06
100	2.11E+00	2.81E-06	9.26E-03	1.42E-06	1.24E-07	4.96E-06	2.40E-06	1.14E-06
150	1.86E-01	1.91E-06	1.17E-04	1.79E-08	1.56E-09	3.97E-06	3.02E-08	9.15E-06
250	5.97E-04	6.22E-06	0.00E+00	0.00E+00	0.00E+00	3.32E-06	7.77E-13	1.66E-04
500	9.12E-09	4.40E-04	0.00E+00	0.00E+00	0.00E+00	3.03E-04	0.00E+00	1.95E-04
750	5.41E-09	6.33E-04	0.00E+00	0.00E+00	0.00E+00	7.63E-04	0.00E+00	1.70E-04
1000	0.00E+00	5.77E-04	0.00E+00	0.00E+00	0.00E+00	7.89E-04	0.00E+00	1.65E-04
2000	0.00E+00	3.28E-04	0.00E+00	0.00E+00	0.00E+00	5.63E-04	0.00E+00	9.42E-05

Capped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	1.18E-11	0.00E+00	1.60E-04	6.40E-06	3.85E-08	0.00E+00	2.33E-09	0.00E+00
2	1.35E-03	1.97E-30	3.96E-03	1.66E-04	2.54E-06	2.93E-35	1.44E-05	3.59E-24
4	3.10E-03	1.85E-17	7.80E-03	1.63E-04	2.64E-06	3.28E-23	1.87E-05	1.60E-12
6	3.68E-03	1.04E-12	2.86E-01	1.60E-04	2.77E-06	2.34E-16	1.84E-05	1.11E-09
8	3.90E-03	1.14E-10	1.21E+00	1.56E-04	3.39E-06	5.30E-13	1.84E-05	1.46E-08
10	3.90E-03	1.67E-09	2.57E+00	1.52E-04	4.19E-06	3.99E-11	2.00E-05	5.06E-08
20	1.78E-02	2.25E-07	6.83E+00	1.31E-04	3.83E-06	9.66E-08	3.63E-05	5.15E-07
30	3.16E-01	8.89E-07	6.33E+00	1.13E-04	3.31E-06	7.69E-07	3.61E-05	8.88E-07
40	1.02E+00	1.59E-06	5.49E+00	9.79E-05	2.85E-06	2.15E-06	3.12E-05	9.85E-07
50	1.89E+00	2.08E-06	4.74E+00	8.46E-05	2.47E-06	3.26E-06	2.70E-05	1.04E-06
60	2.53E+00	2.50E-06	4.10E+00	7.30E-05	2.13E-06	3.94E-06	2.33E-05	1.09E-06
70	3.08E+00	2.76E-06	3.54E+00	6.31E-05	1.84E-06	4.84E-06	2.01E-05	1.09E-06
80	3.39E+00	2.90E-06	3.06E+00	5.45E-05	1.59E-06	4.87E-06	1.74E-05	1.05E-06
100	3.63E+00	3.00E-06	2.28E+00	4.07E-05	1.19E-06	5.33E-06	1.30E-05	9.87E-07
150	3.27E+00	2.70E-06	1.10E+00	1.95E-05	5.70E-07	5.11E-06	6.23E-06	9.47E-07
250	1.63E+00	1.89E-06	2.53E-01	4.51E-06	1.32E-07	4.11E-06	1.44E-06	8.48E-07
500	6.38E-02	4.00E-07	6.49E-03	1.16E-07	3.38E-09	2.63E-06	3.69E-08	2.21E-05
750	1.68E-03	6.52E-06	1.67E-04	2.97E-09	8.66E-11	2.60E-06	9.47E-10	5.55E-05
1000	4.34E-05	4.85E-05	4.25E-06	7.57E-11	2.21E-12	1.44E-05	2.42E-11	8.69E-05
2000	2.25E-09	2.93E-04	0.00E+00	0.00E+00	0.00E+00	3.54E-04	0.00E+00	8.92E-05

Overburden at the River Morell

Uncapped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	6.14E-41	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	6.12E-33	0.00E+00	9.87E-09	9.38E-12	9.29E-16	0.00E+00	1.62E-27	0.00E+00
4	2.55E-16	0.00E+00	2.40E-03	1.47E-07	3.64E-10	0.00E+00	5.68E-15	0.00E+00
6	1.47E-10	0.00E+00	2.67E-01	1.78E-06	6.83E-09	0.00E+00	1.09E-11	0.00E+00
8	4.47E-08	0.00E+00	1.57E+00	2.36E-06	3.55E-08	0.00E+00	2.07E-10	0.00E+00
10	1.11E-06	0.00E+00	3.40E+00	2.06E-06	5.49E-08	0.00E+00	9.32E-10	0.00E+00
20	7.85E-04	0.00E+00	5.30E+00	8.58E-07	3.71E-08	0.00E+00	1.08E-08	0.00E+00
30	6.73E-02	0.00E+00	2.83E+00	3.58E-07	1.55E-08	0.00E+00	1.18E-08	0.00E+00
40	5.32E-01	1.53E-38	1.25E+00	1.49E-07	6.46E-09	0.00E+00	5.64E-09	0.00E+00
50	1.26E+00	2.35E-36	5.29E-01	6.22E-08	2.69E-09	0.00E+00	2.41E-09	0.00E+00
60	1.74E+00	3.99E-34	2.21E-01	2.59E-08	1.12E-09	0.00E+00	1.02E-09	0.00E+00
70	1.84E+00	1.78E-30	9.23E-02	1.08E-08	4.68E-10	0.00E+00	4.25E-10	0.00E+00
80	1.68E+00	1.33E-29	3.85E-02	4.50E-09	1.95E-10	0.00E+00	1.77E-10	5.23E-39
100	1.26E+00	2.56E-25	6.69E-03	7.83E-10	3.39E-11	7.58E-41	3.08E-11	2.25E-35
150	2.49E-01	4.12E-20	8.42E-05	9.85E-12	4.27E-13	9.28E-35	3.87E-13	1.90E-30
250	2.82E-03	5.01E-14	6.09E-09	0.00E+00	0.00E+00	7.80E-27	2.56E-17	4.59E-23
500	4.02E-08	9.52E-10	0.00E+00	0.00E+00	0.00E+00	1.66E-16	0.00E+00	3.82E-14
750	2.91E-09	1.64E-08	0.00E+00	0.00E+00	0.00E+00	9.65E-13	0.00E+00	1.94E-11
1000	8.73E-10	1.74E-07	0.00E+00	0.00E+00	0.00E+00	6.08E-11	0.00E+00	2.82E-10
2000	0.00E+00	3.71E-05	0.00E+00	0.00E+00	0.00E+00	1.69E-08	0.00E+00	2.43E-08

Capped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	2.05E-33	0.00E+00	4.08E-09	5.40E-12	7.00E-16	0.00E+00	1.14E-28	0.00E+00
4	5.40E-17	0.00E+00	7.07E-05	2.41E-08	7.95E-11	0.00E+00	5.18E-15	0.00E+00
6	2.98E-11	0.00E+00	8.42E-04	3.93E-08	4.13E-10	0.00E+00	6.35E-12	0.00E+00
8	9.49E-09	0.00E+00	1.67E-02	4.11E-08	5.86E-10	0.00E+00	1.06E-10	0.00E+00
10	2.44E-07	0.00E+00	1.20E-01	4.06E-08	6.59E-10	0.00E+00	3.79E-10	0.00E+00
20	8.23E-05	0.00E+00	1.78E+00	3.51E-08	6.52E-10	0.00E+00	1.56E-09	0.00E+00
30	4.08E-04	0.00E+00	2.37E+00	3.03E-08	5.69E-10	0.00E+00	1.46E-09	0.00E+00
40	9.98E-04	0.00E+00	2.18E+00	2.62E-08	4.91E-10	0.00E+00	1.32E-09	0.00E+00
50	3.59E-03	9.63E-39	1.91E+00	2.26E-08	4.24E-10	0.00E+00	1.14E-09	0.00E+00
60	1.97E-02	2.27E-35	1.66E+00	1.95E-08	3.67E-10	0.00E+00	9.85E-10	0.00E+00
70	6.92E-02	8.20E-31	1.43E+00	1.69E-08	3.17E-10	0.00E+00	8.51E-10	0.00E+00
80	1.70E-01	2.13E-28	1.24E+00	1.46E-08	2.74E-10	0.00E+00	7.35E-10	1.39E-40
100	5.04E-01	1.61E-25	9.23E-01	1.09E-08	2.04E-10	0.00E+00	5.48E-10	8.43E-37
150	1.11E+00	4.07E-20	4.44E-01	5.23E-09	9.81E-11	1.17E-35	2.64E-10	1.46E-30
250	7.25E-01	4.23E-14	1.03E-01	1.21E-09	2.27E-11	3.50E-26	6.09E-11	4.58E-24
500	2.60E-02	8.48E-10	2.63E-03	3.10E-11	5.81E-13	1.85E-17	1.56E-12	6.53E-15
750	6.80E-04	1.62E-08	6.75E-05	7.95E-13	1.49E-14	2.68E-13	4.01E-14	6.40E-12
1000	1.75E-05	5.00E-08	1.72E-06	2.03E-14	3.80E-16	2.81E-11	1.02E-15	1.68E-10
2000	8.12E-10	2.03E-07	0.00E+00	0.00E+00	0.00E+00	1.49E-08	0.00E+00	9.19E-09

Uncapped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	2.16E-27	2.74E-30	3.04E-35	0.00E+00	0.00E+00	0.00E+00
2	2.62E-20	0.00E+00	7.98E-06	3.15E-08	1.02E-10	0.00E+00	1.03E-13	0.00E+00
4	1.75E-08	0.00E+00	1.56E-01	2.88E-05	3.20E-07	0.00E+00	3.48E-08	0.00E+00
6	7.43E-06	0.00E+00	2.86E+00	8.47E-05	6.61E-06	0.00E+00	1.07E-06	0.00E+00
8	9.56E-05	0.00E+00	7.30E+00	8.04E-05	1.41E-05	0.00E+00	1.79E-05	0.00E+00
10	5.55E-04	0.00E+00	1.01E+01	6.76E-05	1.64E-05	0.00E+00	8.64E-05	1.42E-36
20	5.53E-01	7.10E-32	1.27E+01	2.82E-05	7.47E-06	4.46E-39	2.54E-04	9.12E-26
30	3.03E+00	6.18E-27	9.17E+00	1.18E-05	3.12E-06	8.92E-34	1.16E-04	1.01E-22
40	4.83E+00	9.27E-24	4.85E+00	4.90E-06	1.30E-06	3.90E-29	5.15E-05	7.55E-18
50	5.02E+00	2.84E-21	2.43E+00	2.04E-06	5.41E-07	2.04E-26	2.15E-05	3.13E-15
60	4.97E+00	1.74E-18	1.06E+00	8.51E-07	2.26E-07	2.41E-23	8.98E-06	1.63E-13
70	4.53E+00	1.63E-16	4.69E-01	3.55E-07	9.41E-08	3.32E-21	3.74E-06	2.63E-12
80	4.07E+00	4.95E-15	2.02E-01	1.48E-07	3.92E-08	5.86E-19	1.56E-06	2.04E-11
100	3.46E+00	5.46E-13	3.70E-02	2.57E-08	6.81E-09	5.96E-16	2.71E-07	4.12E-10
150	2.17E+00	2.20E-10	4.66E-04	3.23E-10	8.58E-11	4.34E-12	3.41E-09	1.61E-08
250	5.06E-01	1.84E-08	8.31E-08	0.00E+00	9.37E-18	3.33E-09	3.57E-13	1.13E-06
500	3.87E-03	5.39E-06	0.00E+00	0.00E+00	0.00E+00	5.01E-07	2.04E-18	8.75E-05
750	3.20E-05	8.28E-05	0.00E+00	0.00E+00	0.00E+00	2.54E-05	0.00E+00	1.10E-04
1000	2.57E-07	2.05E-04	0.00E+00	0.00E+00	0.00E+00	1.66E-04	0.00E+00	9.73E-05
2000	2.87E-10	2.53E-04	0.00E+00	0.00E+00	0.00E+00	3.57E-04	0.00E+00	7.44E-05

Capped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	5.07E-28	6.57E-31	7.45E-36	0.00E+00	0.00E+00	0.00E+00
2	7.48E-21	0.00E+00	2.42E-06	8.53E-09	2.97E-11	0.00E+00	2.87E-14	0.00E+00
4	5.44E-09	0.00E+00	4.94E-04	4.78E-07	1.33E-08	0.00E+00	8.92E-09	0.00E+00
6	1.95E-06	0.00E+00	1.06E-02	5.65E-07	3.41E-08	0.00E+00	1.19E-07	0.00E+00
8	2.40E-05	0.00E+00	1.46E-01	6.13E-07	5.60E-08	0.00E+00	2.69E-07	0.00E+00
10	8.92E-05	0.00E+00	5.68E-01	6.05E-07	1.02E-07	0.00E+00	3.79E-07	2.89E-38
20	9.68E-04	2.68E-34	3.89E+00	5.23E-07	1.54E-07	3.22E-38	1.80E-06	6.40E-28
30	1.71E-02	9.74E-28	5.77E+00	4.52E-07	1.33E-07	1.04E-31	2.52E-06	3.80E-22
40	1.56E-01	1.96E-24	5.99E+00	3.90E-07	1.15E-07	6.63E-28	2.32E-06	6.82E-18
50	5.23E-01	3.72E-22	5.49E+00	3.37E-07	9.95E-08	1.34E-25	2.02E-06	2.53E-15
60	1.03E+00	2.92E-19	4.81E+00	2.91E-07	8.59E-08	1.09E-24	1.74E-06	1.27E-13
70	1.57E+00	2.92E-17	4.20E+00	2.52E-07	7.42E-08	3.95E-23	1.50E-06	2.04E-12
80	1.98E+00	9.98E-16	3.63E+00	2.17E-07	6.41E-08	2.64E-21	1.30E-06	1.61E-11
100	2.62E+00	1.16E-13	2.71E+00	1.62E-07	4.78E-08	6.22E-18	9.69E-07	2.78E-10
150	2.89E+00	6.03E-11	1.30E+00	7.79E-08	2.30E-08	2.09E-13	4.66E-07	8.95E-09
250	2.30E+00	8.27E-09	3.01E-01	1.80E-08	5.31E-09	6.76E-10	1.08E-07	8.39E-08
500	2.89E-01	1.70E-07	7.72E-03	4.62E-10	1.36E-10	1.20E-07	2.76E-09	7.60E-07
750	9.99E-03	3.25E-07	1.98E-04	1.19E-11	3.49E-12	4.39E-07	7.09E-11	1.10E-05
1000	2.83E-04	1.92E-06	5.06E-06	3.02E-13	8.91E-14	7.24E-07	1.81E-12	2.21E-05
2000	2.73E-09	1.22E-04	0.00E+00	0.00E+00	0.00E+00	7.07E-05	0.00E+00	7.18E-05

Limestone Aquifer

Uncapped 50th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	2.65E-31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	5.36E-04	2.01E-08	2.14E-16	0.00E+00	0.00E+00	0.00E+00
4	2.43E-31	0.00E+00	3.75E-01	2.13E-06	3.90E-10	0.00E+00	1.93E-24	0.00E+00
6	1.49E-21	0.00E+00	3.74E+00	3.87E-06	2.03E-09	0.00E+00	1.32E-17	0.00E+00
8	7.67E-17	0.00E+00	5.73E+00	4.19E-06	2.74E-09	0.00E+00	9.91E-15	0.00E+00
10	3.18E-13	0.00E+00	6.22E+00	3.59E-06	2.55E-09	0.00E+00	3.30E-13	0.00E+00
20	8.74E-07	0.00E+00	3.75E+00	1.50E-06	1.30E-09	0.00E+00	1.69E-11	0.00E+00
30	4.44E-05	0.00E+00	1.74E+00	6.24E-07	5.42E-10	0.00E+00	1.59E-11	0.00E+00
40	2.35E-04	0.00E+00	7.45E-01	2.60E-07	2.26E-10	0.00E+00	7.97E-12	0.00E+00
50	5.87E-04	0.00E+00	3.13E-01	1.09E-07	9.42E-11	0.00E+00	3.49E-12	0.00E+00
60	1.36E-03	0.00E+00	1.31E-01	4.52E-08	3.93E-11	0.00E+00	1.51E-12	0.00E+00
70	4.37E-03	0.00E+00	5.46E-02	1.89E-08	1.64E-11	0.00E+00	6.28E-13	0.00E+00
80	1.47E-02	0.00E+00	2.28E-02	7.86E-09	6.83E-12	0.00E+00	2.62E-13	0.00E+00
100	7.90E-02	0.00E+00	3.96E-03	1.37E-09	1.19E-12	0.00E+00	4.55E-14	0.00E+00
150	3.42E-01	1.09E-37	4.98E-05	1.72E-11	1.49E-14	0.00E+00	5.73E-16	0.00E+00
250	2.73E-01	2.61E-27	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.05E-20	2.14E-38
500	4.67E-02	5.56E-17	0.00E+00	0.00E+00	0.00E+00	1.78E-33	1.55E-39	1.82E-26
750	3.45E-03	7.34E-13	0.00E+00	0.00E+00	0.00E+00	1.49E-24	0.00E+00	5.21E-21
1000	2.27E-04	5.04E-11	0.00E+00	0.00E+00	0.00E+00	1.28E-21	0.00E+00	5.57E-17
2000	4.22E-09	1.07E-08	0.00E+00	0.00E+00	0.00E+00	5.66E-13	0.00E+00	2.11E-11

Capped 50th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.47E-31	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	1.22E-04	4.15E-09	1.89E-17	0.00E+00	0.00E+00	0.00E+00
4	3.84E-34	0.00E+00	1.30E-03	5.01E-07	6.31E-11	0.00E+00	2.67E-25	0.00E+00
6	3.07E-22	0.00E+00	1.84E-02	5.40E-07	4.46E-10	0.00E+00	4.17E-19	0.00E+00
8	2.18E-17	0.00E+00	2.09E-01	5.26E-07	6.42E-10	0.00E+00	5.95E-16	0.00E+00
10	7.09E-14	0.00E+00	6.39E-01	5.12E-07	7.03E-10	0.00E+00	2.44E-14	0.00E+00
20	1.88E-07	0.00E+00	2.11E+00	4.43E-07	6.31E-10	0.00E+00	3.41E-12	0.00E+00
30	1.39E-05	0.00E+00	2.13E+00	3.82E-07	5.45E-10	0.00E+00	6.47E-12	0.00E+00
40	8.98E-05	0.00E+00	1.91E+00	3.30E-07	4.70E-10	0.00E+00	6.23E-12	0.00E+00
50	2.28E-04	0.00E+00	1.67E+00	2.85E-07	4.06E-10	0.00E+00	6.01E-12	0.00E+00
60	3.82E-04	0.00E+00	1.44E+00	2.46E-07	3.51E-10	0.00E+00	5.19E-12	0.00E+00
70	5.77E-04	0.00E+00	1.25E+00	2.13E-07	3.03E-10	0.00E+00	4.48E-12	0.00E+00
80	7.51E-04	0.00E+00	1.08E+00	1.84E-07	2.62E-10	0.00E+00	3.87E-12	0.00E+00
100	1.61E-03	0.00E+00	8.06E-01	1.37E-07	1.95E-10	0.00E+00	2.89E-12	0.00E+00
150	4.48E-02	0.00E+00	3.89E-01	6.59E-08	9.39E-11	0.00E+00	1.39E-12	0.00E+00
250	4.72E-01	2.29E-29	9.02E-02	1.52E-08	2.17E-11	0.00E+00	3.21E-13	0.00E+00
500	2.25E-01	2.62E-17	2.32E-03	3.90E-10	5.56E-13	2.68E-35	8.23E-15	1.66E-27
750	3.47E-02	4.63E-13	5.94E-05	1.00E-11	1.43E-14	1.39E-25	2.11E-16	4.46E-22
1000	2.79E-03	4.24E-11	1.52E-06	2.55E-13	3.64E-16	1.00E-21	5.38E-18	1.60E-17
2000	3.82E-08	1.38E-08	0.00E+00	0.00E+00	0.00E+00	5.49E-13	0.00E+00	1.40E-11

Uncapped 95th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.87E-14	2.89E-24	7.57E-34	0.00E+00	0.00E+00	0.00E+00
2	8.17E-26	0.00E+00	2.40E-02	2.23E-05	7.51E-09	0.00E+00	2.10E-20	0.00E+00
4	4.61E-14	0.00E+00	1.01E+01	5.08E-04	5.95E-07	0.00E+00	5.20E-10	0.00E+00
6	9.07E-09	0.00E+00	1.66E+01	8.03E-04	3.57E-06	0.00E+00	3.79E-08	0.00E+00
8	1.21E-06	0.00E+00	1.75E+01	6.93E-04	8.45E-06	0.00E+00	1.95E-07	0.00E+00
10	1.81E-05	0.00E+00	1.66E+01	5.82E-04	1.06E-05	0.00E+00	3.95E-07	0.00E+00
20	1.36E-03	0.00E+00	1.01E+01	2.43E-04	4.67E-06	0.00E+00	7.80E-07	0.00E+00
30	1.87E-02	2.31E-36	5.43E+00	1.01E-04	1.95E-06	0.00E+00	9.09E-07	5.13E-34
40	2.24E-01	1.47E-33	2.77E+00	4.22E-05	8.12E-07	1.95E-39	4.43E-07	8.97E-30
50	7.45E-01	2.90E-29	1.25E+00	1.76E-05	3.38E-07	2.89E-37	1.86E-07	1.51E-26
60	1.41E+00	1.35E-28	5.61E-01	7.33E-06	1.41E-07	6.48E-37	7.75E-08	3.76E-24
70	1.93E+00	1.64E-26	2.64E-01	3.06E-06	5.88E-08	7.62E-33	3.23E-08	9.48E-23
80	2.31E+00	2.51E-24	1.12E-01	1.27E-06	2.45E-08	9.21E-33	1.35E-08	4.11E-21
100	2.45E+00	2.79E-23	2.10E-02	2.21E-07	4.26E-09	6.69E-29	2.34E-09	1.55E-17
150	1.79E+00	1.04E-16	2.64E-04	2.78E-09	5.36E-11	2.12E-23	2.95E-11	5.04E-13
250	1.07E+00	9.79E-12	4.56E-08	0.00E+00	2.43E-17	1.73E-16	5.02E-15	1.24E-09
500	4.70E-01	1.56E-08	0.00E+00	0.00E+00	0.00E+00	2.89E-10	2.52E-18	4.77E-08
750	2.49E-01	8.49E-08	0.00E+00	0.00E+00	0.00E+00	1.67E-08	1.15E-22	3.40E-07
1000	1.29E-01	2.17E-07	0.00E+00	0.00E+00	0.00E+00	6.73E-08	0.00E+00	4.55E-06
2000	1.11E-02	2.75E-05	0.00E+00	0.00E+00	0.00E+00	1.61E-06	0.00E+00	2.67E-05

Capped 95th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	5.05E-15	1.01E-24	6.33E-34	0.00E+00	0.00E+00	0.00E+00
2	1.05E-26	0.00E+00	1.72E-03	5.17E-06	2.36E-09	0.00E+00	4.74E-20	0.00E+00
4	8.45E-15	0.00E+00	1.68E-02	1.25E-05	1.30E-07	0.00E+00	3.78E-10	0.00E+00
6	1.61E-09	0.00E+00	4.99E-01	1.24E-05	1.62E-07	0.00E+00	1.80E-08	0.00E+00
8	2.81E-07	0.00E+00	1.83E+00	1.23E-05	1.69E-07	0.00E+00	7.48E-08	0.00E+00
10	3.87E-06	0.00E+00	3.21E+00	1.20E-05	1.69E-07	0.00E+00	1.17E-07	0.00E+00
20	3.89E-04	0.00E+00	5.78E+00	1.03E-05	1.61E-07	0.00E+00	2.07E-07	0.00E+00
30	1.02E-03	3.63E-40	5.56E+00	8.92E-06	1.39E-07	0.00E+00	1.93E-07	7.69E-35
40	2.11E-03	1.05E-35	5.09E+00	7.70E-06	1.20E-07	0.00E+00	1.67E-07	5.54E-30
50	7.85E-03	2.74E-33	4.43E+00	6.65E-06	1.04E-07	9.61E-40	1.44E-07	1.32E-26
60	4.25E-02	1.70E-29	3.82E+00	5.74E-06	8.97E-08	4.42E-36	1.25E-07	1.48E-25
70	1.40E-01	4.64E-29	3.35E+00	4.96E-06	7.74E-08	1.91E-35	1.08E-07	6.61E-23
80	3.45E-01	2.57E-26	2.91E+00	4.29E-06	6.69E-08	1.77E-32	9.29E-08	1.11E-20
100	7.89E-01	3.90E-24	2.20E+00	3.20E-06	4.99E-08	5.82E-29	6.93E-08	2.35E-17
150	1.66E+00	5.85E-19	1.06E+00	1.54E-06	2.40E-08	1.84E-24	3.33E-08	5.20E-13
250	1.72E+00	3.57E-13	2.45E-01	3.55E-07	5.54E-09	1.08E-16	7.70E-09	8.79E-10
500	9.22E-01	4.59E-09	6.35E-03	9.11E-09	1.42E-10	2.41E-10	1.98E-10	6.63E-08
750	4.92E-01	5.29E-08	1.63E-04	2.34E-10	3.65E-12	1.58E-08	5.07E-12	1.06E-07
1000	2.63E-01	1.10E-07	4.16E-06	5.96E-12	9.30E-14	8.95E-08	1.29E-13	1.36E-07
2000	2.77E-02	2.92E-07	0.00E+00	0.00E+00	0.00E+00	3.35E-07	0.00E+00	4.68E-06

Appendix C. Zone 2B specific input parameters and results

LANDFILL WASTE:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Distribution		triangular	triangular	triangular	triangular	triangular	triangular	triangular	triangular
Landfill waste leaching test concentration Minimum	mg/L	0.05	0.0025	0.47	0.0001	0.001	0.003	0.001	0.0025
Landfill waste leaching test concentration Likely	mg/L	50	0.044	27	0.1	0.011	0.127	0.03	0.039
Landfill waste leaching test concentration Maximum	mg/L	100	0.224	99	10	0.14	0.605	1	0.078

DIMENSIONS OF ZONE:

Parameter	Units	Saturated Waste	Unsaturated Waste	Total for Zone
Width (perpendicular to groundwater flow)	m	200	Assumed there is no unsaturated waste	200
Length (in direction of groundwater flow)	m	150		150
Area	m^2	30,000		30,000
Waste thickness	m	1.5		-

CONTAMINANTS:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Contaminants Organic Carbon Water Partition Coefficient, Koc	L/kg	-	-	-	3.60E+00	1.29E+01	-	8.32E+01	-
Attenuation partition coefficient Kd Distribution		uniform	uniform	constant	-	-	uniform	-	uniform

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Attenuation partition coefficient Kd Minimum	L/kg	0.5	25	0	-	-	20	-	1
Attenuation partition coefficient Kd Maximum	L/kg	2	125	-	-	-	400	-	300
Attenuation half-life distribution		constant	constant	constant	constant	uniform	constant	uniform	constant
Attenuation half-life Minimum	days	No Decay	No Decay	No Decay	139.8	50.01	No Decay	7.3	No Decay
Attenuation half-life Maximum	days	-	-	-	-	365	-	912.5	-
Contaminants free water diffusion coefficient	m^2/s	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09

HYDROGEOLOGY:

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology unit thickness distribution		uniform	constant	constant
Hydrogeology unit thickness Minimum	m	10	20	0.1
Hydrogeology unit thickness Maximum	m	13		
Hydrogeology hydraulic conductivity distribution		triangular	triangular	triangular
Hydrogeology hydraulic conductivity Minimum	m/s	2.31E-06	3.25E-08	2.31E-06
Hydrogeology hydraulic conductivity Likely	m/s	6.60E-06	0.0000128	6.60E-06
Hydrogeology hydraulic conductivity Maximum	m/s	1.56E-05	0.0000625	1.56E-05

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology head	m	81	78	-
Hydrogeology hydraulic gradient distribution	[-]	uniform	uniform	constant
Hydrogeology hydraulic gradient Minimum		0.018	0.002	1
Hydrogeology hydraulic gradient Maximum		0.022	0.003	
Hydrogeology porosity distribution	[-]	uniform	uniform	constant
Hydrogeology porosity Minimum		0.31	0.01	0.2
Hydrogeology porosity Maximum		0.46	0.1	
Hydrogeology tortuosity	[-]	5	5	5
Distribution		constant	constant	constant

ATTENUATION

Parameter	Units	Sand and Gravel	Limestone	Unsat SandG
Attenuation dry bulk density	kg/m3	1590	2265	1590
Attenuation fraction organic carbon distribution		triangular	uniform	triangular
Attenuation fraction organic carbon Minimum	[-]	0.001	0.001	0.001
Attenuation fraction organic carbon Likely	[-]	0.002		0.002
Attenuation fraction organic carbon Maximum	[-]	0.024	0.016	0.024

MODEL RESULTS

Saturated Waste

Uncapped 50 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	4.49E+01	7.72E-02	3.57E+01	2.59E+00	4.16E-02	1.94E-01	2.75E-01	3.57E-02
2	4.06E+01	6.98E-02	3.23E+01	2.34E+00	3.77E-02	1.76E-01	2.49E-01	3.23E-02
4	3.32E+01	5.72E-02	2.64E+01	1.92E+00	3.08E-02	1.44E-01	2.04E-01	2.65E-02
6	2.72E+01	4.68E-02	2.17E+01	1.57E+00	2.52E-02	1.18E-01	1.67E-01	2.17E-02
8	2.23E+01	3.83E-02	1.77E+01	1.29E+00	2.07E-02	9.63E-02	1.37E-01	1.77E-02
10	1.82E+01	3.14E-02	1.45E+01	1.05E+00	1.69E-02	7.89E-02	1.12E-01	1.45E-02
20	6.71E+00	1.15E-02	5.34E+00	3.88E-01	6.23E-03	2.90E-02	4.12E-02	5.35E-03
30	2.47E+00	4.25E-03	1.96E+00	1.43E-01	2.29E-03	1.07E-02	1.51E-02	1.97E-03
40	9.08E-01	1.56E-03	7.23E-01	5.24E-02	8.42E-04	3.93E-03	5.57E-03	7.23E-04
50	3.34E-01	5.75E-04	2.66E-01	1.93E-02	3.10E-04	1.44E-03	2.05E-03	2.66E-04
60	1.23E-01	2.11E-04	9.78E-02	7.10E-03	1.14E-04	5.31E-04	7.54E-04	9.79E-05
70	4.52E-02	7.78E-05	3.60E-02	2.61E-03	4.19E-05	1.96E-04	2.77E-04	3.60E-05
80	1.66E-02	2.86E-05	1.32E-02	9.61E-04	1.54E-05	7.19E-05	1.02E-04	1.32E-05
100	2.25E-03	3.87E-06	1.79E-03	1.30E-04	2.09E-06	9.73E-06	1.38E-05	1.79E-06
150	1.50E-05	2.59E-08	1.20E-05	8.68E-07	1.40E-08	6.50E-08	9.23E-08	1.20E-08
250	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Capped 50 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	4.64E+01	7.71E-02	3.59E+01	2.63E+00	4.20E-02	2.12E-01	2.97E-01	3.61E-02
2	4.57E+01	7.58E-02	3.53E+01	2.58E+00	4.13E-02	2.08E-01	2.93E-01	3.55E-02
4	4.41E+01	7.33E-02	3.42E+01	2.50E+00	4.00E-02	2.02E-01	2.83E-01	3.44E-02
6	4.27E+01	7.09E-02	3.31E+01	2.42E+00	3.86E-02	1.95E-01	2.74E-01	3.32E-02
8	4.13E+01	6.86E-02	3.20E+01	2.34E+00	3.74E-02	1.89E-01	2.65E-01	3.21E-02
10	3.99E+01	6.63E-02	3.09E+01	2.26E+00	3.61E-02	1.82E-01	2.56E-01	3.11E-02
20	3.38E+01	5.61E-02	2.61E+01	1.91E+00	3.06E-02	1.54E-01	2.16E-01	2.63E-02
30	2.86E+01	4.74E-02	2.21E+01	1.62E+00	2.59E-02	1.30E-01	1.83E-01	2.22E-02
40	2.42E+01	4.01E-02	1.87E+01	1.37E+00	2.19E-02	1.10E-01	1.55E-01	1.88E-02
50	2.04E+01	3.39E-02	1.58E+01	1.16E+00	1.85E-02	9.33E-02	1.31E-01	1.59E-02
60	1.73E+01	2.87E-02	1.34E+01	9.78E-01	1.56E-02	7.89E-02	1.11E-01	1.35E-02
70	1.46E+01	2.43E-02	1.13E+01	8.28E-01	1.32E-02	6.68E-02	9.37E-02	1.14E-02
80	1.24E+01	2.05E-02	9.57E+00	7.00E-01	1.12E-02	5.65E-02	7.92E-02	9.63E-03
100	8.85E+00	1.47E-02	6.85E+00	5.01E-01	8.01E-03	4.04E-02	5.67E-02	6.89E-03
150	3.83E+00	6.36E-03	2.97E+00	2.17E-01	3.47E-03	1.75E-02	2.45E-02	2.98E-03
250	7.18E-01	1.19E-03	5.56E-01	4.06E-02	6.50E-04	3.28E-03	4.60E-03	5.59E-04
500	1.09E-02	1.81E-05	8.45E-03	6.18E-04	9.88E-06	4.98E-05	6.99E-05	8.50E-06
750	1.66E-04	2.75E-07	1.28E-04	9.38E-06	1.50E-07	7.57E-07	1.06E-06	1.29E-07
1000	2.39E-06	3.98E-09	1.85E-06	1.36E-07	2.17E-09	1.09E-08	1.53E-08	1.86E-09
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Uncapped 95 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	7.58E+01	1.65E-01	7.37E+01	6.95E+00	1.01E-01	4.40E-01	7.08E-01	5.90E-02
2	6.86E+01	1.49E-01	6.67E+01	6.29E+00	9.15E-02	3.98E-01	6.40E-01	5.34E-02
4	5.62E+01	1.22E-01	5.46E+01	5.15E+00	7.49E-02	3.26E-01	5.24E-01	4.37E-02
6	4.60E+01	9.99E-02	4.47E+01	4.21E+00	6.13E-02	2.67E-01	4.29E-01	3.58E-02
8	3.77E+01	8.18E-02	3.66E+01	3.45E+00	5.02E-02	2.18E-01	3.51E-01	2.93E-02
10	3.08E+01	6.70E-02	3.00E+01	2.82E+00	4.11E-02	1.79E-01	2.88E-01	2.40E-02
20	1.13E+01	2.46E-02	1.10E+01	1.04E+00	1.51E-02	6.58E-02	1.06E-01	8.82E-03
30	4.17E+00	9.07E-03	4.06E+00	3.82E-01	5.56E-03	2.42E-02	3.89E-02	3.24E-03
40	1.54E+00	3.34E-03	1.49E+00	1.41E-01	2.05E-03	8.91E-03	1.43E-02	1.19E-03
50	5.65E-01	1.23E-03	5.49E-01	5.17E-02	7.53E-04	3.28E-03	5.27E-03	4.39E-04
60	2.08E-01	4.51E-04	2.02E-01	1.90E-02	2.77E-04	1.21E-03	1.94E-03	1.62E-04
70	7.64E-02	1.66E-04	7.43E-02	7.00E-03	1.02E-04	4.43E-04	7.13E-04	5.94E-05
80	2.81E-02	6.11E-05	2.73E-02	2.58E-03	3.75E-05	1.63E-04	2.62E-04	2.19E-05
100	3.81E-03	8.27E-06	3.70E-03	3.49E-04	5.07E-06	2.21E-05	3.55E-05	2.96E-06
150	2.54E-05	5.52E-08	2.47E-05	2.33E-06	3.39E-08	1.47E-07	2.37E-07	1.98E-08
250	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Capped 95 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	7.63E+01	1.60E-01	7.21E+01	7.16E+00	1.03E-01	4.38E-01	6.87E-01	5.85E-02
2	7.50E+01	1.58E-01	7.09E+01	7.04E+00	1.01E-01	4.31E-01	6.76E-01	5.76E-02
4	7.26E+01	1.53E-01	6.85E+01	6.81E+00	9.75E-02	4.17E-01	6.54E-01	5.57E-02
6	7.02E+01	1.48E-01	6.63E+01	6.58E+00	9.43E-02	4.03E-01	6.32E-01	5.38E-02
8	6.79E+01	1.43E-01	6.41E+01	6.37E+00	9.12E-02	3.90E-01	6.11E-01	5.21E-02
10	6.56E+01	1.38E-01	6.20E+01	6.16E+00	8.82E-02	3.77E-01	5.91E-01	5.04E-02
20	5.55E+01	1.17E-01	5.24E+01	5.21E+00	7.46E-02	3.19E-01	5.00E-01	4.26E-02
30	4.70E+01	9.87E-02	4.43E+01	4.40E+00	6.31E-02	2.70E-01	4.23E-01	3.60E-02
40	3.97E+01	8.35E-02	3.75E+01	3.73E+00	5.34E-02	2.28E-01	3.58E-01	3.05E-02
50	3.36E+01	7.06E-02	3.17E+01	3.15E+00	4.51E-02	1.93E-01	3.03E-01	2.58E-02
60	2.84E+01	5.97E-02	2.68E+01	2.67E+00	3.82E-02	1.63E-01	2.56E-01	2.18E-02
70	2.40E+01	5.05E-02	2.27E+01	2.25E+00	3.23E-02	1.38E-01	2.16E-01	1.84E-02
80	2.03E+01	4.27E-02	1.92E+01	1.91E+00	2.73E-02	1.17E-01	1.83E-01	1.56E-02
100	1.45E+01	3.06E-02	1.37E+01	1.36E+00	1.95E-02	8.36E-02	1.31E-01	1.12E-02
150	6.30E+00	1.32E-02	5.94E+00	5.90E-01	8.46E-03	3.62E-02	5.67E-02	4.83E-03
250	1.18E+00	2.48E-03	1.11E+00	1.11E-01	1.59E-03	6.78E-03	1.06E-02	9.05E-04
500	1.79E-02	3.77E-05	1.69E-02	1.68E-03	2.41E-05	1.03E-04	1.62E-04	1.38E-05
750	2.72E-04	5.73E-07	2.57E-04	2.56E-05	3.66E-07	1.57E-06	2.45E-06	2.09E-07
1000	3.94E-06	8.28E-09	3.72E-06	3.69E-07	5.29E-09	2.26E-08	3.54E-08	3.02E-09
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Overburden

Uncapped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.15E-35	7.46E-40	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	9.28E-29	0.00E+00	7.13E-05	7.82E-08	1.72E-11	0.00E+00	3.42E-24	0.00E+00
4	2.87E-12	0.00E+00	9.19E-01	2.75E-04	1.79E-06	0.00E+00	7.11E-11	0.00E+00
6	9.65E-07	0.00E+00	4.89E+00	3.63E-04	7.94E-06	0.00E+00	6.55E-08	0.00E+00
8	2.30E-04	0.00E+00	7.95E+00	3.07E-04	9.11E-06	0.00E+00	7.85E-07	0.00E+00
10	4.95E-03	0.00E+00	9.27E+00	2.52E-04	8.05E-06	0.00E+00	3.05E-06	0.00E+00
20	1.01E+00	0.00E+00	5.47E+00	9.26E-05	3.06E-06	0.00E+00	7.23E-06	0.00E+00
30	3.32E+00	1.83E-40	2.09E+00	3.41E-05	1.13E-06	0.00E+00	3.70E-06	0.00E+00
40	3.87E+00	6.53E-35	7.71E-01	1.25E-05	4.15E-07	0.00E+00	1.44E-06	0.00E+00
50	3.31E+00	1.41E-32	2.84E-01	4.61E-06	1.53E-07	0.00E+00	5.31E-07	0.00E+00
60	2.41E+00	1.34E-30	1.04E-01	1.70E-06	5.61E-08	0.00E+00	1.97E-07	1.84E-40
70	1.70E+00	2.42E-27	3.84E-02	6.24E-07	2.06E-08	0.00E+00	7.27E-08	2.23E-36
80	1.09E+00	1.48E-25	1.41E-02	2.30E-07	7.60E-09	2.69E-40	2.68E-08	5.33E-35
100	3.42E-01	1.93E-21	1.91E-03	3.11E-08	1.03E-09	3.00E-35	3.62E-09	3.87E-32
150	1.32E-02	1.43E-15	1.29E-05	2.08E-10	6.89E-12	1.81E-31	2.44E-11	4.00E-27
250	2.30E-05	5.73E-10	0.00E+00	0.00E+00	0.00E+00	1.38E-22	5.09E-23	5.30E-19
500	3.73E-09	4.12E-06	0.00E+00	0.00E+00	0.00E+00	5.48E-13	0.00E+00	1.15E-10
750	2.37E-12	4.97E-05	0.00E+00	0.00E+00	0.00E+00	3.34E-09	0.00E+00	4.12E-08
1000	3.19E-14	1.08E-04	0.00E+00	0.00E+00	0.00E+00	2.09E-07	0.00E+00	7.11E-07
2000	0.00E+00	9.73E-05	0.00E+00	0.00E+00	0.00E+00	3.36E-05	0.00E+00	1.26E-05

Capped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.05E-36	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	6.42E-30	0.00E+00	1.88E-05	2.23E-08	3.67E-12	0.00E+00	3.38E-24	0.00E+00
4	3.46E-13	0.00E+00	2.84E-01	8.59E-05	3.91E-07	0.00E+00	1.71E-11	0.00E+00
6	1.70E-07	0.00E+00	1.59E+00	1.31E-04	1.90E-06	0.00E+00	2.72E-08	0.00E+00
8	4.69E-05	0.00E+00	2.81E+00	1.29E-04	2.77E-06	0.00E+00	4.42E-07	0.00E+00
10	1.11E-03	0.00E+00	3.55E+00	1.25E-04	2.88E-06	0.00E+00	1.33E-06	0.00E+00
20	3.22E-01	0.00E+00	4.31E+00	1.06E-04	2.53E-06	0.00E+00	4.60E-06	0.00E+00
30	1.45E+00	0.00E+00	3.74E+00	8.96E-05	2.14E-06	0.00E+00	4.07E-06	0.00E+00
40	2.56E+00	3.78E-36	3.17E+00	7.58E-05	1.81E-06	0.00E+00	3.44E-06	0.00E+00
50	3.15E+00	1.92E-34	2.68E+00	6.41E-05	1.53E-06	0.00E+00	2.91E-06	0.00E+00
60	3.34E+00	4.10E-31	2.26E+00	5.42E-05	1.29E-06	0.00E+00	2.46E-06	0.00E+00
70	3.25E+00	2.47E-27	1.92E+00	4.58E-05	1.09E-06	0.00E+00	2.08E-06	5.58E-38
80	3.03E+00	2.00E-24	1.62E+00	3.88E-05	9.26E-07	0.00E+00	1.76E-06	8.26E-36
100	2.43E+00	1.11E-21	1.16E+00	2.77E-05	6.62E-07	4.75E-36	1.26E-06	6.07E-33
150	1.12E+00	1.64E-16	5.02E-01	1.20E-05	2.87E-07	1.20E-31	5.45E-07	2.58E-25
250	2.14E-01	1.60E-10	9.40E-02	2.25E-06	5.37E-08	2.02E-23	1.02E-07	3.57E-19
500	3.26E-03	3.31E-06	1.43E-03	3.42E-08	8.17E-10	1.03E-13	1.55E-09	1.30E-10
750	4.96E-05	5.37E-05	2.17E-05	5.20E-10	1.24E-11	1.21E-09	2.36E-11	5.63E-08
1000	7.47E-07	1.46E-04	3.13E-07	7.49E-12	1.79E-13	1.14E-07	3.45E-13	8.07E-07
2000	0.00E+00	1.73E-04	0.00E+00	0.00E+00	0.00E+00	3.70E-05	0.00E+00	2.02E-05

Uncapped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	7.33E-24	5.85E-26	1.63E-31	0.00E+00	0.00E+00	0.00E+00
2	1.10E-15	0.00E+00	5.09E-02	1.61E-04	4.68E-07	0.00E+00	2.75E-10	0.00E+00
4	1.71E-04	0.00E+00	6.63E+00	7.30E-03	2.05E-04	0.00E+00	1.06E-04	0.00E+00
6	4.59E-02	0.00E+00	1.49E+01	6.72E-03	3.67E-04	0.00E+00	1.12E-03	0.00E+00
8	4.89E-01	0.00E+00	1.93E+01	5.52E-03	3.31E-04	0.00E+00	2.43E-03	1.27E-38
10	1.52E+00	9.91E-39	2.03E+01	4.52E-03	2.88E-04	0.00E+00	3.03E-03	5.43E-34
20	8.43E+00	1.79E-27	1.38E+01	1.66E-03	1.07E-04	1.00E-34	1.78E-03	1.34E-21
30	9.00E+00	2.30E-23	6.54E+00	6.11E-04	3.93E-05	2.74E-29	6.79E-04	9.31E-18
40	8.36E+00	5.75E-20	2.58E+00	2.25E-04	1.45E-05	9.26E-24	2.52E-04	1.36E-13
50	7.36E+00	1.20E-17	9.58E-01	8.27E-05	5.32E-06	4.93E-23	9.27E-05	3.88E-11
60	6.05E+00	8.17E-15	3.56E-01	3.04E-05	1.96E-06	3.36E-21	3.41E-05	1.58E-09
70	4.94E+00	7.59E-13	1.32E-01	1.12E-05	7.20E-07	6.20E-19	1.25E-05	2.14E-08
80	4.14E+00	2.08E-11	4.86E-02	4.12E-06	2.65E-07	2.14E-16	4.62E-06	1.45E-07
100	2.68E+00	2.46E-09	6.59E-03	5.57E-07	3.58E-08	2.61E-13	6.25E-07	1.95E-06
150	7.41E-01	8.61E-07	4.45E-05	3.73E-09	2.40E-10	2.92E-09	4.21E-09	4.58E-05
250	3.14E-02	6.33E-05	1.81E-11	0.00E+00	0.00E+00	3.16E-06	6.51E-14	1.73E-04
500	1.54E-05	5.00E-04	0.00E+00	0.00E+00	0.00E+00	3.27E-04	0.00E+00	1.93E-04
750	8.18E-08	5.50E-04	0.00E+00	0.00E+00	0.00E+00	6.33E-04	0.00E+00	1.75E-04
1000	2.39E-09	4.88E-04	0.00E+00	0.00E+00	0.00E+00	6.83E-04	0.00E+00	1.60E-04
2000	0.00E+00	3.21E-04	0.00E+00	0.00E+00	0.00E+00	5.81E-04	0.00E+00	9.31E-05

Capped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	2.32E-24	5.23E-27	1.62E-32	0.00E+00	0.00E+00	0.00E+00
2	3.87E-16	0.00E+00	9.06E-03	3.60E-05	9.92E-08	0.00E+00	2.09E-11	0.00E+00
4	6.46E-05	0.00E+00	1.95E+00	1.90E-03	5.59E-05	0.00E+00	2.53E-05	0.00E+00
6	1.51E-02	0.00E+00	4.74E+00	2.01E-03	1.11E-04	0.00E+00	3.01E-04	0.00E+00
8	1.54E-01	0.00E+00	6.67E+00	1.94E-03	1.23E-04	0.00E+00	6.66E-04	0.00E+00
10	4.65E-01	6.25E-37	8.19E+00	1.88E-03	1.23E-04	0.00E+00	1.07E-03	1.47E-35
20	3.37E+00	4.09E-27	1.05E+01	1.59E-03	1.04E-04	1.92E-35	1.29E-03	1.14E-24
30	5.33E+00	2.63E-22	9.55E+00	1.34E-03	8.80E-05	9.22E-27	1.10E-03	7.84E-19
40	6.31E+00	5.46E-20	8.21E+00	1.14E-03	7.44E-05	3.24E-22	9.33E-04	1.50E-14
50	6.58E+00	2.86E-16	7.01E+00	9.61E-04	6.30E-05	4.19E-21	7.89E-04	5.51E-12
60	6.68E+00	8.42E-14	5.93E+00	8.13E-04	5.33E-05	1.72E-19	6.67E-04	2.71E-10
70	6.78E+00	4.48E-12	5.02E+00	6.88E-04	4.50E-05	2.33E-16	5.64E-04	3.56E-09
80	6.72E+00	9.22E-11	4.24E+00	5.82E-04	3.81E-05	2.07E-14	4.77E-04	2.69E-08
100	6.41E+00	6.39E-09	3.04E+00	4.16E-04	2.73E-05	1.08E-11	3.42E-04	4.97E-07
150	4.00E+00	1.54E-06	1.31E+00	1.80E-04	1.18E-05	3.65E-08	1.48E-04	2.39E-05
250	9.63E-01	1.11E-04	2.46E-01	3.38E-05	2.21E-06	1.92E-05	2.77E-05	1.78E-04
500	1.60E-02	9.03E-04	3.75E-03	5.13E-07	3.36E-08	8.61E-04	4.21E-07	3.44E-04
750	2.43E-04	9.61E-04	5.69E-05	7.80E-09	5.11E-10	1.35E-03	6.40E-09	2.71E-04
1000	3.71E-06	8.42E-04	8.24E-07	1.12E-10	7.36E-12	1.49E-03	9.28E-11	2.38E-04
2000	1.73E-12	5.79E-04	0.00E+00	0.00E+00	0.00E+00	1.00E-03	0.00E+00	1.71E-04

Overburden at the River Morell

Uncapped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	3.12E-32	0.00E+00	3.14E-07	1.96E-10	7.25E-15	0.00E+00	3.82E-31	0.00E+00
4	7.49E-17	0.00E+00	1.67E-01	2.67E-05	1.01E-07	0.00E+00	3.44E-14	0.00E+00
6	9.11E-10	0.00E+00	2.11E+00	6.41E-05	1.17E-06	0.00E+00	6.07E-10	0.00E+00
8	1.65E-06	0.00E+00	4.99E+00	5.66E-05	1.64E-06	0.00E+00	2.32E-08	0.00E+00
10	1.04E-04	0.00E+00	7.01E+00	4.65E-05	1.57E-06	0.00E+00	1.42E-07	0.00E+00
20	1.96E-01	0.00E+00	6.43E+00	1.71E-05	6.67E-07	0.00E+00	1.04E-06	0.00E+00
30	1.41E+00	0.00E+00	2.67E+00	6.29E-06	2.45E-07	0.00E+00	6.38E-07	0.00E+00
40	2.74E+00	6.33E-39	1.01E+00	2.31E-06	9.03E-08	0.00E+00	2.54E-07	0.00E+00
50	3.02E+00	3.99E-36	3.78E-01	8.52E-07	3.32E-08	0.00E+00	9.51E-08	0.00E+00
60	2.74E+00	5.11E-34	1.39E-01	3.13E-07	1.22E-08	0.00E+00	3.50E-08	0.00E+00
70	2.19E+00	2.07E-32	5.12E-02	1.15E-07	4.49E-09	0.00E+00	1.29E-08	0.00E+00
80	1.69E+00	2.08E-29	1.88E-02	4.24E-08	1.65E-09	0.00E+00	4.73E-09	1.89E-40
100	9.18E-01	1.20E-26	2.55E-03	5.74E-09	2.24E-10	0.00E+00	6.41E-10	4.82E-37
150	8.98E-02	1.93E-20	1.72E-05	3.85E-11	1.50E-12	4.53E-35	4.32E-12	1.23E-31
250	6.14E-04	6.39E-13	8.74E-13	0.00E+00	0.00E+00	6.67E-27	3.00E-20	3.17E-23
500	1.86E-08	1.68E-07	0.00E+00	0.00E+00	0.00E+00	3.73E-17	0.00E+00	1.35E-13
750	9.19E-12	6.94E-06	0.00E+00	0.00E+00	0.00E+00	5.85E-12	0.00E+00	5.48E-10
1000	1.06E-12	3.49E-05	0.00E+00	0.00E+00	0.00E+00	2.03E-09	0.00E+00	2.66E-08
2000	0.00E+00	9.14E-05	0.00E+00	0.00E+00	0.00E+00	5.86E-06	0.00E+00	4.42E-06

Capped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	1.10E-31	0.00E+00	8.21E-08	4.66E-11	1.43E-15	0.00E+00	8.84E-30	0.00E+00
4	1.90E-17	0.00E+00	4.53E-02	8.24E-06	1.98E-08	0.00E+00	9.77E-15	0.00E+00
6	1.23E-10	0.00E+00	6.44E-01	2.26E-05	2.29E-07	0.00E+00	2.39E-10	0.00E+00
8	3.01E-07	0.00E+00	1.68E+00	2.32E-05	4.09E-07	0.00E+00	1.39E-08	0.00E+00
10	2.23E-05	0.00E+00	2.56E+00	2.25E-05	4.95E-07	0.00E+00	8.00E-08	0.00E+00
20	5.54E-02	0.00E+00	4.26E+00	1.90E-05	4.59E-07	0.00E+00	5.60E-07	0.00E+00
30	5.37E-01	0.00E+00	3.84E+00	1.61E-05	3.88E-07	0.00E+00	5.79E-07	0.00E+00
40	1.37E+00	1.72E-39	3.28E+00	1.36E-05	3.29E-07	0.00E+00	5.14E-07	0.00E+00
50	2.19E+00	5.55E-36	2.78E+00	1.15E-05	2.78E-07	0.00E+00	4.34E-07	0.00E+00
60	2.63E+00	7.52E-34	2.35E+00	9.73E-06	2.35E-07	0.00E+00	3.68E-07	0.00E+00
70	2.87E+00	4.89E-32	1.99E+00	8.23E-06	1.99E-07	0.00E+00	3.11E-07	0.00E+00
80	2.92E+00	2.49E-30	1.68E+00	6.96E-06	1.68E-07	0.00E+00	2.63E-07	1.16E-39
100	2.57E+00	1.44E-26	1.20E+00	4.98E-06	1.20E-07	0.00E+00	1.88E-07	1.70E-35
150	1.41E+00	1.55E-20	5.20E-01	2.16E-06	5.21E-08	2.83E-34	8.14E-08	2.67E-31
250	2.83E-01	1.14E-13	9.75E-02	4.04E-07	9.76E-09	3.65E-27	1.53E-08	1.02E-22
500	4.36E-03	1.01E-07	1.48E-03	6.14E-09	1.48E-10	4.88E-18	2.32E-10	1.44E-13
750	6.63E-05	7.18E-06	2.25E-05	9.33E-11	2.25E-12	1.58E-12	3.52E-12	7.46E-10
1000	1.00E-06	4.01E-05	3.28E-07	1.34E-12	3.25E-14	8.14E-10	5.10E-14	3.40E-08
2000	0.00E+00	1.57E-04	0.00E+00	0.00E+00	0.00E+00	5.31E-06	0.00E+00	6.28E-06

Uncapped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	3.57E-28	2.42E-30	1.38E-35	0.00E+00	0.00E+00	0.00E+00
2	1.19E-18	0.00E+00	2.57E-03	5.07E-06	6.91E-09	0.00E+00	1.06E-13	0.00E+00
4	1.35E-06	0.00E+00	2.96E+00	1.61E-03	3.94E-05	0.00E+00	6.07E-06	0.00E+00
6	2.08E-03	0.00E+00	1.02E+01	1.86E-03	1.19E-04	0.00E+00	1.71E-04	0.00E+00
8	5.68E-02	0.00E+00	1.43E+01	1.53E-03	1.31E-04	0.00E+00	6.49E-04	0.00E+00
10	3.45E-01	0.00E+00	1.74E+01	1.25E-03	1.10E-04	0.00E+00	9.88E-04	3.96E-38
20	5.05E+00	5.93E-32	1.48E+01	4.60E-04	4.10E-05	1.17E-40	7.73E-04	3.08E-24
30	7.37E+00	1.10E-26	8.64E+00	1.69E-04	1.51E-05	2.86E-32	3.01E-04	1.19E-21
40	7.10E+00	1.82E-23	4.08E+00	6.22E-05	5.55E-06	3.01E-30	1.11E-04	6.93E-18
50	6.75E+00	2.50E-21	1.66E+00	2.29E-05	2.04E-06	8.33E-27	4.09E-05	1.51E-14
60	6.00E+00	1.07E-19	6.39E-01	8.42E-06	7.51E-07	8.57E-25	1.51E-05	2.39E-12
70	5.23E+00	5.49E-17	2.40E-01	3.10E-06	2.76E-07	2.96E-21	5.54E-06	8.50E-11
80	4.46E+00	5.52E-15	8.91E-02	1.14E-06	1.02E-07	2.10E-21	2.04E-06	1.20E-09
100	3.34E+00	3.15E-12	1.22E-02	1.54E-07	1.38E-08	1.19E-17	2.76E-07	4.54E-08
150	1.47E+00	1.33E-08	8.36E-05	1.03E-09	9.25E-11	3.94E-12	1.86E-09	4.57E-06
250	1.64E-01	6.21E-06	6.60E-09	0.00E+00	0.00E+00	8.71E-08	5.64E-14	9.66E-05
500	4.49E-04	2.12E-04	0.00E+00	0.00E+00	0.00E+00	6.26E-05	1.88E-22	1.37E-04
750	1.59E-06	4.01E-04	0.00E+00	0.00E+00	0.00E+00	3.28E-04	0.00E+00	1.31E-04
1000	1.83E-08	4.09E-04	0.00E+00	0.00E+00	0.00E+00	4.70E-04	0.00E+00	1.32E-04
2000	5.98E-13	2.98E-04	0.00E+00	0.00E+00	0.00E+00	5.19E-04	0.00E+00	9.24E-05

Capped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.15E-28	3.80E-31	5.78E-36	0.00E+00	0.00E+00	0.00E+00
2	3.03E-19	0.00E+00	3.98E-04	9.71E-07	1.25E-09	0.00E+00	4.62E-15	0.00E+00
4	4.14E-07	0.00E+00	7.32E-01	4.29E-04	1.04E-05	0.00E+00	1.11E-06	0.00E+00
6	7.93E-04	0.00E+00	2.97E+00	5.56E-04	3.23E-05	0.00E+00	4.73E-05	0.00E+00
8	1.90E-02	0.00E+00	4.85E+00	5.39E-04	4.10E-05	0.00E+00	1.65E-04	0.00E+00
10	1.09E-01	0.00E+00	6.28E+00	5.21E-04	4.21E-05	0.00E+00	2.94E-04	0.00E+00
20	1.86E+00	1.43E-31	9.82E+00	4.41E-04	3.62E-05	4.36E-39	4.96E-04	1.68E-30
30	3.76E+00	1.69E-25	9.69E+00	3.73E-04	3.07E-05	2.07E-31	4.32E-04	2.58E-22
40	5.00E+00	2.39E-22	8.65E+00	3.16E-04	2.59E-05	6.37E-27	3.65E-04	5.82E-19
50	5.66E+00	2.25E-20	7.43E+00	2.67E-04	2.19E-05	2.79E-26	3.09E-04	1.63E-15
60	5.87E+00	4.30E-18	6.30E+00	2.26E-04	1.85E-05	2.63E-23	2.61E-04	3.04E-13
70	5.94E+00	1.03E-15	5.33E+00	1.91E-04	1.57E-05	6.56E-20	2.21E-04	1.33E-11
80	5.88E+00	6.12E-14	4.51E+00	1.61E-04	1.33E-05	1.66E-19	1.87E-04	2.21E-10
100	5.82E+00	1.59E-11	3.23E+00	1.16E-04	9.49E-06	1.71E-15	1.34E-04	8.58E-09
150	4.44E+00	3.20E-08	1.40E+00	5.00E-05	4.11E-06	1.27E-10	5.79E-05	1.55E-06
250	1.59E+00	1.11E-05	2.62E-01	9.37E-06	7.70E-07	7.55E-07	1.09E-05	5.01E-05
500	3.55E-02	4.31E-04	3.99E-03	1.43E-07	1.17E-08	2.31E-04	1.65E-07	2.45E-04
750	5.94E-04	7.11E-04	6.06E-05	2.16E-09	1.78E-10	8.61E-04	2.51E-09	2.48E-04
1000	9.18E-06	7.13E-04	8.87E-07	3.12E-11	2.56E-12	1.01E-03	3.63E-11	1.98E-04
2000	2.59E-12	5.07E-04	0.00E+00	0.00E+00	0.00E+00	8.99E-04	0.00E+00	1.56E-04

Limestone Aquifer

Uncapped 50th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	2.35E-37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	6.66E-05	9.56E-14	1.16E-26	0.00E+00	0.00E+00	0.00E+00
4	2.45E-39	0.00E+00	2.34E+00	8.27E-06	5.82E-13	0.00E+00	2.30E-35	0.00E+00
6	5.95E-30	0.00E+00	7.09E+00	3.51E-05	6.36E-10	0.00E+00	2.43E-28	0.00E+00
8	1.69E-26	0.00E+00	8.57E+00	3.35E-05	4.47E-09	0.00E+00	1.38E-24	0.00E+00
10	1.49E-22	0.00E+00	8.48E+00	2.78E-05	9.37E-09	0.00E+00	6.20E-21	0.00E+00
20	7.59E-12	0.00E+00	4.20E+00	1.02E-05	6.75E-09	0.00E+00	3.64E-14	0.00E+00
30	6.80E-07	0.00E+00	1.64E+00	3.76E-06	2.53E-09	0.00E+00	5.61E-13	0.00E+00
40	1.46E-04	0.00E+00	6.08E-01	1.38E-06	9.33E-10	0.00E+00	1.04E-12	0.00E+00
50	2.88E-03	0.00E+00	2.24E-01	5.09E-07	3.43E-10	0.00E+00	7.22E-13	0.00E+00
60	1.90E-02	0.00E+00	8.26E-02	1.87E-07	1.26E-10	0.00E+00	3.70E-13	0.00E+00
70	6.74E-02	0.00E+00	3.04E-02	6.89E-08	4.64E-11	0.00E+00	1.42E-13	0.00E+00
80	1.59E-01	0.00E+00	1.12E-02	2.53E-08	1.71E-11	0.00E+00	5.25E-14	0.00E+00
100	4.03E-01	0.00E+00	1.51E-03	3.43E-09	2.31E-12	0.00E+00	7.11E-15	0.00E+00
150	5.58E-01	0.00E+00	1.02E-05	2.30E-11	1.56E-14	0.00E+00	4.79E-17	0.00E+00
250	2.99E-01	5.82E-35	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.28E-22	0.00E+00
500	2.05E-02	1.58E-26	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.66E-35
750	6.85E-04	5.59E-21	0.00E+00	0.00E+00	0.00E+00	5.18E-34	0.00E+00	4.84E-31
1000	2.13E-05	2.28E-16	0.00E+00	0.00E+00	0.00E+00	6.48E-31	0.00E+00	1.70E-26
2000	1.28E-09	4.84E-09	0.00E+00	0.00E+00	0.00E+00	8.68E-22	0.00E+00	5.77E-16

Capped 50th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	5.61E-39	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	2.11E-05	8.49E-15	4.65E-28	0.00E+00	0.00E+00	0.00E+00
4	0.00E+00	0.00E+00	6.83E-01	1.76E-06	7.20E-14	0.00E+00	1.28E-38	0.00E+00
6	1.41E-31	0.00E+00	2.42E+00	9.75E-06	8.75E-11	0.00E+00	1.57E-31	0.00E+00
8	9.33E-30	0.00E+00	3.15E+00	1.08E-05	8.27E-10	0.00E+00	1.27E-25	0.00E+00
10	1.77E-25	0.00E+00	3.46E+00	1.05E-05	1.80E-09	0.00E+00	4.43E-22	0.00E+00
20	6.43E-13	0.00E+00	3.45E+00	8.91E-06	3.31E-09	0.00E+00	4.08E-15	0.00E+00
30	9.80E-08	0.00E+00	2.99E+00	7.54E-06	2.80E-09	0.00E+00	1.16E-13	0.00E+00
40	2.96E-05	0.00E+00	2.57E+00	6.37E-06	2.37E-09	0.00E+00	4.63E-13	0.00E+00
50	7.47E-04	0.00E+00	2.18E+00	5.39E-06	2.00E-09	0.00E+00	5.33E-13	0.00E+00
60	5.87E-03	0.00E+00	1.84E+00	4.56E-06	1.69E-09	0.00E+00	4.67E-13	0.00E+00
70	2.41E-02	0.00E+00	1.56E+00	3.86E-06	1.43E-09	0.00E+00	3.96E-13	0.00E+00
80	6.45E-02	0.00E+00	1.32E+00	3.26E-06	1.21E-09	0.00E+00	3.35E-13	0.00E+00
100	2.27E-01	0.00E+00	9.46E-01	2.33E-06	8.67E-10	0.00E+00	2.40E-13	0.00E+00
150	7.85E-01	0.00E+00	4.10E-01	1.01E-06	3.75E-10	0.00E+00	1.04E-13	0.00E+00
250	7.46E-01	1.46E-37	7.68E-02	1.89E-07	7.04E-11	0.00E+00	1.94E-14	0.00E+00
500	1.11E-01	3.72E-28	1.17E-03	2.88E-09	1.07E-12	0.00E+00	2.96E-16	1.43E-36
750	6.15E-03	3.10E-21	1.77E-05	4.37E-11	1.62E-14	9.27E-35	4.50E-18	3.26E-33
1000	2.49E-04	5.32E-17	2.56E-07	6.30E-13	2.35E-16	1.58E-32	6.78E-20	3.15E-28
2000	3.77E-09	3.64E-09	0.00E+00	0.00E+00	0.00E+00	4.00E-21	0.00E+00	8.29E-17

Uncapped 95th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.90E-21	1.27E-30	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	1.78E-36	0.00E+00	1.98E+00	2.34E-05	1.00E-11	0.00E+00	3.65E-26	0.00E+00
4	8.44E-22	0.00E+00	1.80E+01	6.14E-03	1.02E-05	0.00E+00	6.26E-15	0.00E+00
6	7.24E-16	0.00E+00	2.21E+01	5.61E-03	4.39E-05	0.00E+00	1.38E-09	0.00E+00
8	3.63E-11	0.00E+00	2.16E+01	4.59E-03	6.14E-05	0.00E+00	1.93E-07	0.00E+00
10	4.56E-08	0.00E+00	2.02E+01	3.76E-03	6.47E-05	0.00E+00	2.15E-06	0.00E+00
20	1.36E-02	0.00E+00	1.05E+01	1.38E-03	2.53E-05	0.00E+00	3.53E-05	0.00E+00
30	3.80E-01	0.00E+00	5.08E+00	5.09E-04	9.30E-06	0.00E+00	1.94E-05	0.00E+00
40	1.49E+00	0.00E+00	2.43E+00	1.87E-04	3.42E-06	0.00E+00	7.29E-06	1.06E-39
50	2.61E+00	0.00E+00	1.11E+00	6.89E-05	1.26E-06	0.00E+00	2.71E-06	4.30E-34
60	3.07E+00	2.78E-39	4.65E-01	2.53E-05	4.63E-07	0.00E+00	9.97E-07	4.82E-33
70	3.01E+00	6.27E-36	1.79E-01	9.32E-06	1.70E-07	0.00E+00	3.67E-07	1.57E-30
80	3.06E+00	1.08E-32	6.63E-02	3.43E-06	6.26E-08	0.00E+00	1.35E-07	9.92E-29
100	2.79E+00	1.01E-30	9.21E-03	4.64E-07	8.48E-09	1.20E-39	1.83E-08	1.02E-25
150	2.04E+00	2.85E-25	6.65E-05	3.10E-09	5.71E-11	4.08E-33	1.23E-10	7.88E-21
250	1.12E+00	1.69E-19	7.46E-09	0.00E+00	1.35E-21	1.12E-25	1.30E-14	1.36E-13
500	4.54E-01	4.12E-11	0.00E+00	0.00E+00	0.00E+00	8.12E-17	2.04E-18	1.50E-07
750	1.93E-01	6.42E-08	0.00E+00	0.00E+00	0.00E+00	2.24E-11	1.05E-24	6.25E-06
1000	9.58E-02	1.63E-06	0.00E+00	0.00E+00	0.00E+00	7.64E-09	2.46E-33	1.55E-05
2000	4.12E-03	7.25E-05	0.00E+00	0.00E+00	0.00E+00	1.50E-05	0.00E+00	3.57E-05

Capped 95th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	4.66E-22	9.37E-32	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	7.39E-37	0.00E+00	5.51E-01	9.09E-06	7.35E-12	0.00E+00	3.23E-27	0.00E+00
4	1.76E-22	0.00E+00	5.86E+00	2.06E-03	4.08E-06	0.00E+00	6.63E-15	0.00E+00
6	8.46E-17	0.00E+00	7.93E+00	2.31E-03	1.78E-05	0.00E+00	9.08E-10	0.00E+00
8	2.69E-12	0.00E+00	8.66E+00	2.24E-03	2.46E-05	0.00E+00	8.89E-08	0.00E+00
10	4.95E-09	0.00E+00	8.88E+00	2.16E-03	2.47E-05	0.00E+00	1.33E-06	0.00E+00
20	2.83E-03	0.00E+00	8.25E+00	1.83E-03	2.14E-05	0.00E+00	1.54E-05	0.00E+00
30	1.06E-01	0.00E+00	7.26E+00	1.55E-03	1.81E-05	0.00E+00	1.74E-05	0.00E+00
40	5.48E-01	0.00E+00	6.50E+00	1.31E-03	1.53E-05	0.00E+00	1.48E-05	0.00E+00
50	1.07E+00	0.00E+00	5.60E+00	1.11E-03	1.29E-05	0.00E+00	1.25E-05	0.00E+00
60	1.79E+00	4.65E-37	4.80E+00	9.37E-04	1.10E-05	0.00E+00	1.06E-05	1.02E-37
70	2.36E+00	3.15E-33	4.07E+00	7.92E-04	9.26E-06	0.00E+00	8.93E-06	1.47E-34
80	2.70E+00	3.94E-32	3.45E+00	6.70E-04	7.83E-06	0.00E+00	7.55E-06	4.60E-32
100	3.07E+00	5.52E-30	2.48E+00	4.79E-04	5.60E-06	2.52E-37	5.40E-06	1.04E-30
150	3.00E+00	4.91E-24	1.08E+00	2.08E-04	2.43E-06	1.55E-30	2.34E-06	1.25E-24
250	2.20E+00	2.76E-19	2.03E-01	3.89E-05	4.55E-07	3.41E-23	4.38E-07	1.54E-18
500	9.74E-01	3.38E-10	3.08E-03	5.91E-07	6.91E-09	5.98E-16	6.67E-09	1.64E-09
750	4.30E-01	3.29E-07	4.68E-05	8.98E-09	1.05E-10	8.50E-11	1.01E-10	6.71E-07
1000	2.10E-01	6.40E-06	6.77E-07	1.30E-10	1.51E-12	2.51E-08	1.47E-12	3.20E-06
2000	9.92E-03	1.34E-04	0.00E+00	0.00E+00	0.00E+00	3.44E-05	0.00E+00	3.38E-05

Appendix D. Zone 3 input parameters

Infiltration Used in LandSim Model

Parameter	Units	Distribution	Justification
Active tipping phase			
Infiltration to open waste or via temporary cover	mm/yr	Uniform (530 to 720)	70 to 95 % of average Rainfall
Post-tipping phase			
Current model Infiltration following capping of landfill	mm/yr	Uniform (250 to 450)	Jacobs' experience of evapotranspiration calculations and as used in previous assessment
Capped model Infiltration following capping of landfill	mm/yr	Uniform (25 to 50)	To reflect reduced infiltration following capping. Professional experience of similar simulations

Landfill Geometry

LandSim Model Base Area	Area (Ha)	Final Waste Thickness (m)
Current Model	1.35	Uniform (1 - 15)
Capped Model	1.875	Uniform (4 - 19)

Leachate Quality – Uncapped Scenario

Determinand	Minimum (mg/l)	Likely (mg/l)	Maximum (mg/l)	Source
Ammoniacal nitrogen	88	350	833	Zone 3 leachate quality monitoring (2010 to 2016)
Arsenic	0.0005	0.073	0.224	Zone 3 leachate quality monitoring as used in Zone 1 DQRA (Reference 7)
Benzene (o)	0.0007	0.0038	0.0059	Zone 3 leachate quality monitoring as used in Zone 1 DQRA (Reference 7)
Cadmium	0.0000006	0.00014	0.0003	Zone 3 leachate quality monitoring as used in Zone 1 DQRA (Reference 7)
Chloride	171	434	1142	Zone 3 leachate quality monitoring (2010 to 2016)
Formaldehyde (o)	0.0001	0.1	10	Text book values as used in Zone 1 DQRA (Reference 7)
Mecoprop (o)	0.001	0.011	0.14	Text book values as used in Zone 1 DQRA (Reference 7)
Mercury	0.00005	0.000092	0.0001	Zone 3 leachate quality monitoring as used in Zone 1 DQRA (Reference 7)
Nickel	0.0003	0.203	0.605	Zone 3 leachate quality monitoring as used in Zone 1 DQRA (Reference 7)
Phenol (o)	0.001	0.03	1	Text book values as used in

Determinand	Minimum (mg/l)	Likely (mg/l)	Maximum (mg/l)	Source
				Zone 1 DQRA (Reference 7)
Zinc	0.013	0.302	1.6	Zone 3 leachate quality monitoring as used in Zone 1 DQRA (Reference 7)

(o) – indicates organic compound

Leachate Quality – Capped and Fully Landfilled Scenario (based on Zone 1 RAM results)

Determinand	Minimum (mg/l)	Likely (mg/l)	Maximum (mg/l)
Ammoniacal nitrogen	88	140	500
Arsenic	0.0005	0.073	0.224
Benzene (o)	0.0007	0.0038	0.0059
Cadmium	0.0000006	0.00014	0.0003
Chloride	70	200	800
Formaldehyde (o)	0.0001	0.1	10
Mecoprop (o)	0.001	0.011	0.3
Mercury	0.00005	0.0000917	0.0001
Nickel	0.0003	0.303	0.605
Phenol (o)	0.001	0.03	1.2
Zinc	0.013	0.302	1.6

Inputs for Declining Source Term

Parameter	Units	Distribution		Justification
		M	C	
Field capacity of waste	fraction	Uniform (0.2, 0.3)		Values as used in Zone 1 DQRA (Reference 7)
Waste porosity	fraction	Uniform (0.25, 0.4)		
Waste density	Kg/l	Uniform (0.8, 1)		
Kappa values for declining source*				
Ammoniacal Nitrogen	Kg/l	0	0.59	Values as used in Zone 1 DQRA (Reference 7)
Arsenic	Kg/l	0.0415	0.0862	
Benzene (o)	Kg/l	0.298	0.2919	
Cadmium	Kg/l	0.0823	0.1589	
Chloride	Kg/l	0.0298	0.2919	
Formaldehyde (o)	Kg/l	0.0298	0.2919	
Mecoprop (o)	Kg/l	0.0298	0.2919	
Mercury	Kg/l	0.0767	0.1643	
Nickel	Kg/l	0.0987	0.1479	
Phenol (o)	Kg/l	0	0.36	
Zinc	Kg/l	0.0403	0.0561	
* m and c are the slope of the line and the x-axis intercept respectively when the experimental data are plotted with initial leachate concentration on the x axis and kappa on the y axis.				

Inputs Used for LandSim Unsaturated Zone

Model	Thickness (m)	Hydraulic Conductivity (m/s)	Moisture Content (fraction)	Density (kg/l)
Unsaturated Pathway	Single (0.3)	Uniform (1.16 x 10-6, 1.16 x 10-7)	Uniform (0.34, 0.6)	Uniform (1, 2.4)
Vertical Pathway	Uniform (4, 7)	Uniform (1.16 x 10-6, 1.16 x 10-7)	Uniform (0.34, 0.6)	Uniform (1, 2.4)

Aquifer Properties

Model	Parameter	Distribution	Justification
Aquifer Pathway (Bedrock)	Regional gradient (-)	Uniform (0.002, 0.003)	As measured on site
	Mixing zone thickness (m)	Uniform (2.5, 5)	Transition zone in the bedrock
	Pathway porosity (fraction)	Uniform (0.01, 0.1)	Assumes fracture flow
	Hydraulic conductivity (m/s)	0.0000625	As measured in site permeability test in EMW12D and assuming transition zone has relatively high permeability
Aquifer Pathway (Overburden)	Regional gradient (-)	Single (0.04)	As measured on site
	Mixing zone thickness (m)	Uniform (2.5, 5)	Assumes mixing is relatively narrow due to layering in overburden deposits
	Pathway Porosity (fraction)	Uniform (0.34, 0.6)	Sand and gravel aquifer from ConSim help file
	Hydraulic Conductivity (m/s)	Uniform (1.16 x 10-7, 1.16 x 10-6)	Typical value for silty sand and gravel, within the middle of the range of on-site measurements

Retardation and Decay Parameters

Determinand	Assumed Background Concentration (mg/l)	Unsaturated Zone / Vertical / Aquifer Pathway half-life (years)	Source	Kd / KoC (l/kg)	Source	Fraction of Organic Carbon (foc) (fraction) - Bedrock Pathway	Fraction of Organic Carbon (foc) (fraction) - Unsaturated / Vertical Pathway	Source
Ammoniacal nitrogen	0	single (1x10+9)	As used for Zone 1 DQRA (Reference 7)	uniform (0.5, 2)	As used for Zone 1 DQRA (Reference 7)	Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	Results from 2016 ground investigation
Arsenic	0	single (1x10+9)		uniform (25, 250)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Benzene (o)	0	uniform (0.003, 1)		single (67.6)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Cadmium	0	single (1x10+9)		uniform (1.6, 1500)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Chloride	0	single (1x10+9)		single (0)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Formaldehyde (o)	0	single (0.383)		single (3.6)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Mecoprop (o)	0	uniform (0.137, 1)		single (12.9)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Mercury	0	single (1x10+9)		uniform (450, 3835)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Nickel	0	single (1x10+9)		uniform (20, 800)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Phenol (o)	0	uniform (0.02, 2.5)		single (83.2)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	
Zinc	0	single (1x10+9)		uniform (1, 600)		Uniform (0.0002,0.0159)	Uniform (0.001,0.0039)	

Appendix E. Zone 4 specific input parameters and results

LANDFILL WASTE:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Distribution		triangular	triangular	triangular	triangular	triangular	triangular	triangular	triangular
Landfill waste leaching test concentration Minimum	mg/L	0.05	0.0025	0.47	0.0001	0.001	0.003	0.001	0.0025
Landfill waste leaching test concentration Likely	mg/L	5	0.044	27	0.1	0.011	0.127	0.03	0.039
Landfill waste leaching test concentration Maximum	mg/L	10	0.224	99	1	0.14	0.605	0.1	0.078

DIMENSIONS OF ZONE:

Parameter	Units	Saturated Waste	Unsaturated Waste	Total for Zone
Width (perpendicular to groundwater flow)	m	200	200	200
Length (in direction of groundwater flow)	m	130	170	300
Area	m^2	26,000	34,000	60,000
Waste thickness	m	2.5	10	-

CONTAMINANTS:

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Contaminants Organic Carbon Water Partition Coefficient, Koc	L/kg	-	-	-	3.60E+00	1.29E+01	-	8.32E+01	-
Attenuation partition coefficient Kd Distribution		uniform	uniform	constant	-	-	uniform	-	uniform

Parameter	Units	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
Attenuation partition coefficient Kd Minimum	L/kg	0.5	25	0	-	-	20	-	1
Attenuation partition coefficient Kd Maximum	L/kg	2	125	-	-	-	400	-	300
Attenuation half-life distribution		constant	constant	constant	constant	uniform	constant	uniform	constant
Attenuation half-life Minimum	days	No Decay	No Decay	No Decay	139.8	50.01	No Decay	7.3	No Decay
Attenuation half-life Maximum	days	-	-	-	-	365	-	912.5	-
Contaminants free water diffusion coefficient	m^2/s	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09	2.00E-09

HYDROGEOLOGY:

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology unit thickness distribution		uniform	constant	constant
Hydrogeology unit thickness Minimum	m	5	20	2.5
Hydrogeology unit thickness Maximum	m	10		
Hydrogeology hydraulic conductivity distribution		triangular	triangular	triangular
Hydrogeology hydraulic conductivity Minimum	m/s	1.16E-06	3.25E-08	1.16E-06
Hydrogeology hydraulic conductivity Likely	m/s	2.84E-04	0.0000128	2.84E-04
Hydrogeology hydraulic conductivity Maximum	m/s	3.76E-04	0.0000625	3.76E-04

Parameter	Units	Sand and Gravel	Limestone	Unsaturated sand and gravel
Hydrogeology head	m	80.5	78	-
Hydrogeology hydraulic gradient distribution		uniform	uniform	constant
Hydrogeology hydraulic gradient Minimum	[-]	0.003	0.002	1
Hydrogeology hydraulic gradient Maximum	[-]	0.004	0.003	
Hydrogeology porosity distribution		uniform	uniform	constant
Hydrogeology porosity Minimum	[-]	0.31	0.01	0.2
Hydrogeology porosity Maximum	[-]	0.46	0.1	
Hydrogeology tortuosity	[-]	5	5	5
Distribution		constant	constant	constant

ATTENUATION

Parameter	Units	Sand and Gravel	Limestone	Unsat SandG
Attenuation dry bulk density	kg/m3	1590	2265	1590
Attenuation fraction organic carbon distribution		triangular	uniform	triangular
Attenuation fraction organic carbon Minimum	[-]	0.001	0.001	0.001
Attenuation fraction organic carbon Likely	[-]	0.002		0.002
Attenuation fraction organic carbon Maximum	[-]	0.024	0.016	0.024

MODEL RESULTS

JACOBS

Saturated Waste

Uncapped 50 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	4.75E+00	7.86E-02	3.81E+01	3.02E-01	4.30E-02	2.07E-01	3.65E-02	3.73E-02
2	4.43E+00	7.33E-02	3.55E+01	2.82E-01	4.01E-02	1.93E-01	3.40E-02	3.48E-02
4	3.85E+00	6.37E-02	3.09E+01	2.45E-01	3.48E-02	1.67E-01	2.96E-02	3.02E-02
6	3.35E+00	5.54E-02	2.68E+01	2.13E-01	3.03E-02	1.46E-01	2.57E-02	2.63E-02
8	2.91E+00	4.81E-02	2.33E+01	1.85E-01	2.63E-02	1.27E-01	2.24E-02	2.28E-02
10	2.53E+00	4.19E-02	2.03E+01	1.61E-01	2.29E-02	1.10E-01	1.95E-02	1.99E-02
20	1.26E+00	2.08E-02	1.01E+01	7.99E-02	1.14E-02	5.46E-02	9.66E-03	9.86E-03
30	6.24E-01	1.03E-02	5.00E+00	3.97E-02	5.65E-03	2.71E-02	4.80E-03	4.90E-03
40	3.10E-01	5.13E-03	2.48E+00	1.97E-02	2.80E-03	1.35E-02	2.38E-03	2.43E-03
50	1.54E-01	2.55E-03	1.23E+00	9.78E-03	1.39E-03	6.69E-03	1.18E-03	1.21E-03
60	7.64E-02	1.26E-03	6.12E-01	4.86E-03	6.91E-04	3.32E-03	5.87E-04	6.00E-04
70	3.79E-02	6.28E-04	3.04E-01	2.41E-03	3.43E-04	1.65E-03	2.92E-04	2.98E-04
80	1.88E-02	3.12E-04	1.51E-01	1.20E-03	1.71E-04	8.19E-04	1.45E-04	1.48E-04
100	4.64E-03	7.69E-05	3.72E-02	2.95E-04	4.20E-05	2.02E-04	3.57E-05	3.65E-05
150	1.40E-04	2.32E-06	1.12E-03	8.92E-06	1.27E-06	6.10E-06	1.08E-06	1.10E-06
250	1.15E-07	1.90E-09	9.21E-07	7.31E-09	1.04E-09	5.00E-09	8.83E-10	9.02E-10
500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Capped 50 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	4.52E+00	8.05E-02	3.62E+01	3.15E-01	4.09E-02	2.14E-01	3.81E-02	3.49E-02
2	4.47E+00	7.96E-02	3.57E+01	3.12E-01	4.05E-02	2.12E-01	3.76E-02	3.45E-02
4	4.36E+00	7.77E-02	3.49E+01	3.05E-01	3.95E-02	2.07E-01	3.67E-02	3.37E-02
6	4.26E+00	7.59E-02	3.41E+01	2.97E-01	3.86E-02	2.02E-01	3.59E-02	3.29E-02
8	4.16E+00	7.42E-02	3.33E+01	2.91E-01	3.77E-02	1.97E-01	3.51E-02	3.22E-02
10	4.07E+00	7.25E-02	3.25E+01	2.84E-01	3.69E-02	1.93E-01	3.42E-02	3.14E-02
20	3.62E+00	6.44E-02	2.89E+01	2.52E-01	3.28E-02	1.71E-01	3.05E-02	2.80E-02
30	3.22E+00	5.73E-02	2.57E+01	2.25E-01	2.92E-02	1.52E-01	2.71E-02	2.49E-02
40	2.86E+00	5.10E-02	2.29E+01	2.00E-01	2.59E-02	1.36E-01	2.41E-02	2.21E-02
50	2.55E+00	4.53E-02	2.04E+01	1.78E-01	2.31E-02	1.21E-01	2.14E-02	1.97E-02
60	2.26E+00	4.03E-02	1.81E+01	1.58E-01	2.05E-02	1.07E-01	1.91E-02	1.75E-02
70	2.01E+00	3.59E-02	1.61E+01	1.41E-01	1.82E-02	9.54E-02	1.70E-02	1.56E-02
80	1.79E+00	3.19E-02	1.43E+01	1.25E-01	1.62E-02	8.48E-02	1.51E-02	1.38E-02
100	1.42E+00	2.52E-02	1.13E+01	9.88E-02	1.28E-02	6.71E-02	1.19E-02	1.09E-02
150	7.88E-01	1.40E-02	6.30E+00	5.50E-02	7.14E-03	3.73E-02	6.64E-03	6.09E-03
250	2.44E-01	4.35E-03	1.95E+00	1.70E-02	2.21E-03	1.16E-02	2.06E-03	1.89E-03
500	1.30E-02	2.32E-04	1.04E-01	9.09E-04	1.18E-04	6.17E-04	1.10E-04	1.01E-04
750	6.96E-04	1.24E-05	5.56E-03	4.85E-05	6.30E-06	3.30E-05	5.86E-06	5.37E-06
1000	3.71E-05	6.61E-07	2.97E-04	2.59E-06	3.36E-07	1.76E-06	3.12E-07	2.87E-07
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Uncapped 95 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	7.69E+00	1.67E-01	7.47E+01	7.14E-01	1.03E-01	4.37E-01	7.60E-02	6.26E-02
2	7.17E+00	1.56E-01	6.96E+01	6.66E-01	9.61E-02	4.08E-01	7.09E-02	5.84E-02
4	6.23E+00	1.35E-01	6.05E+01	5.79E-01	8.35E-02	3.54E-01	6.16E-02	5.07E-02
6	5.42E+00	1.18E-01	5.26E+01	5.04E-01	7.26E-02	3.08E-01	5.36E-02	4.41E-02
8	4.71E+00	1.02E-01	4.57E+01	4.38E-01	6.31E-02	2.68E-01	4.66E-02	3.83E-02
10	4.09E+00	8.89E-02	3.98E+01	3.81E-01	5.49E-02	2.33E-01	4.05E-02	3.33E-02
20	2.03E+00	4.41E-02	1.97E+01	1.89E-01	2.72E-02	1.16E-01	2.01E-02	1.66E-02
30	1.01E+00	2.19E-02	9.81E+00	9.38E-02	1.35E-02	5.74E-02	9.99E-03	8.22E-03
40	5.01E-01	1.09E-02	4.87E+00	4.66E-02	6.72E-03	2.85E-02	4.96E-03	4.08E-03
50	2.49E-01	5.41E-03	2.42E+00	2.31E-02	3.34E-03	1.42E-02	2.46E-03	2.03E-03
60	1.24E-01	2.68E-03	1.20E+00	1.15E-02	1.66E-03	7.03E-03	1.22E-03	1.01E-03
70	6.14E-02	1.33E-03	5.96E-01	5.71E-03	8.23E-04	3.49E-03	6.07E-04	5.00E-04
80	3.05E-02	6.62E-04	2.96E-01	2.83E-03	4.09E-04	1.73E-03	3.02E-04	2.48E-04
100	7.52E-03	1.63E-04	7.30E-02	6.99E-04	1.01E-04	4.27E-04	7.44E-05	6.12E-05
150	2.27E-04	4.93E-06	2.20E-03	2.11E-05	3.04E-06	1.29E-05	2.25E-06	1.85E-06
250	1.86E-07	4.04E-09	1.81E-06	1.73E-08	2.49E-09	1.06E-08	1.84E-09	1.51E-09
500	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
750	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Capped 95 th Percentile Concentrations in mg/L in Haz Subs

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	7.80E+00	1.73E-01	7.56E+01	7.49E-01	1.03E-01	4.49E-01	7.65E-02	6.13E-02
2	7.71E+00	1.71E-01	7.47E+01	7.40E-01	1.02E-01	4.43E-01	7.56E-02	6.06E-02
4	7.53E+00	1.67E-01	7.30E+01	7.23E-01	9.94E-02	4.33E-01	7.38E-02	5.92E-02
6	7.36E+00	1.63E-01	7.13E+01	7.06E-01	9.71E-02	4.23E-01	7.21E-02	5.78E-02
8	7.19E+00	1.59E-01	6.97E+01	6.90E-01	9.48E-02	4.13E-01	7.04E-02	5.65E-02
10	7.02E+00	1.56E-01	6.80E+01	6.74E-01	9.26E-02	4.04E-01	6.88E-02	5.52E-02
20	6.24E+00	1.38E-01	6.05E+01	5.99E-01	8.24E-02	3.59E-01	6.12E-02	4.91E-02
30	5.55E+00	1.23E-01	5.38E+01	5.33E-01	7.33E-02	3.19E-01	5.44E-02	4.36E-02
40	4.94E+00	1.10E-01	4.79E+01	4.74E-01	6.52E-02	2.84E-01	4.84E-02	3.88E-02
50	4.39E+00	9.74E-02	4.26E+01	4.22E-01	5.80E-02	2.53E-01	4.31E-02	3.45E-02
60	3.91E+00	8.66E-02	3.79E+01	3.75E-01	5.16E-02	2.25E-01	3.83E-02	3.07E-02
70	3.48E+00	7.71E-02	3.37E+01	3.34E-01	4.59E-02	2.00E-01	3.41E-02	2.73E-02
80	3.09E+00	6.85E-02	3.00E+01	2.97E-01	4.08E-02	1.78E-01	3.03E-02	2.43E-02
100	2.45E+00	5.42E-02	2.37E+01	2.35E-01	3.23E-02	1.41E-01	2.40E-02	1.92E-02
150	1.36E+00	3.02E-02	1.32E+01	1.31E-01	1.80E-02	7.82E-02	1.33E-02	1.07E-02
250	4.21E-01	9.34E-03	4.08E+00	4.04E-02	5.56E-03	2.42E-02	4.13E-03	3.31E-03
500	2.25E-02	4.99E-04	2.18E-01	2.16E-03	2.97E-04	1.29E-03	2.20E-04	1.77E-04
750	1.20E-03	2.66E-05	1.16E-02	1.15E-04	1.58E-05	6.90E-05	1.18E-05	9.43E-06
1000	6.41E-05	1.42E-06	6.21E-04	6.15E-06	8.45E-07	3.68E-06	6.28E-07	5.03E-07
2000	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Overburden

Uncapped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	3.01E-14	3.83E-19	1.47E-22	0.00E+00	0.00E+00	0.00E+00
2	2.52E-08	0.00E+00	2.75E+00	3.01E-03	1.69E-04	0.00E+00	4.07E-08	0.00E+00
4	1.09E-02	0.00E+00	8.29E+00	5.07E-03	6.76E-04	0.00E+00	9.90E-05	0.00E+00
6	1.31E-01	0.00E+00	1.08E+01	4.44E-03	6.14E-04	0.00E+00	2.82E-04	0.00E+00
8	3.35E-01	0.00E+00	1.13E+01	3.86E-03	5.37E-04	0.00E+00	3.40E-04	0.00E+00
10	4.76E-01	1.27E-38	1.06E+01	3.36E-03	4.67E-04	0.00E+00	3.37E-04	0.00E+00
20	5.90E-01	1.08E-23	5.80E+00	1.67E-03	2.32E-04	0.00E+00	1.82E-04	1.15E-34
30	4.98E-01	1.64E-18	2.93E+00	8.28E-04	1.15E-04	1.62E-34	9.02E-05	4.62E-27
40	4.04E-01	5.42E-14	1.46E+00	4.11E-04	5.71E-05	7.42E-31	4.48E-05	2.05E-22
50	3.18E-01	2.12E-11	7.26E-01	2.04E-04	2.84E-05	1.16E-24	2.22E-05	2.12E-20
60	2.24E-01	1.01E-09	3.61E-01	1.01E-04	1.41E-05	1.51E-21	1.10E-05	8.90E-18
70	1.37E-01	1.60E-08	1.79E-01	5.03E-05	7.00E-06	8.91E-20	5.48E-06	1.85E-15
80	7.90E-02	1.20E-07	8.90E-02	2.50E-05	3.47E-06	2.18E-18	2.72E-06	9.83E-14
100	2.33E-02	1.69E-06	2.19E-02	6.16E-06	8.57E-07	1.03E-14	6.72E-07	2.56E-11
150	8.00E-04	5.36E-05	6.62E-04	1.86E-07	2.59E-08	3.60E-10	2.03E-08	3.35E-08
250	7.41E-07	3.38E-04	5.55E-07	1.52E-10	2.12E-11	1.20E-06	1.71E-11	6.10E-06
500	2.01E-10	2.89E-04	0.00E+00	0.00E+00	0.00E+00	1.77E-04	0.00E+00	6.84E-05
750	0.00E+00	1.81E-04	0.00E+00	0.00E+00	0.00E+00	3.02E-04	0.00E+00	7.64E-05
1000	0.00E+00	1.30E-04	0.00E+00	0.00E+00	0.00E+00	3.25E-04	0.00E+00	6.45E-05
2000	0.00E+00	7.77E-05	0.00E+00	0.00E+00	0.00E+00	1.78E-04	0.00E+00	2.54E-05

Capped 50 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	5.51E-15	1.05E-19	9.24E-24	0.00E+00	0.00E+00	0.00E+00
2	2.26E-09	0.00E+00	6.80E-01	7.79E-04	4.38E-05	0.00E+00	1.68E-08	0.00E+00
4	1.89E-03	0.00E+00	2.19E+00	1.51E-03	2.00E-04	0.00E+00	3.17E-05	0.00E+00
6	3.04E-02	0.00E+00	2.49E+00	1.48E-03	2.01E-04	0.00E+00	9.42E-05	0.00E+00
8	8.64E-02	0.00E+00	2.69E+00	1.44E-03	1.97E-04	0.00E+00	1.23E-04	0.00E+00
10	1.39E-01	0.00E+00	2.99E+00	1.41E-03	1.92E-04	0.00E+00	1.32E-04	0.00E+00
20	2.45E-01	2.39E-24	3.94E+00	1.25E-03	1.71E-04	0.00E+00	1.23E-04	1.43E-35
30	2.42E-01	2.16E-19	3.66E+00	1.11E-03	1.52E-04	3.03E-34	1.09E-04	4.22E-28
40	2.26E-01	8.05E-15	3.27E+00	9.91E-04	1.35E-04	6.46E-31	9.72E-05	2.58E-24
50	2.12E-01	3.77E-12	2.91E+00	8.81E-04	1.20E-04	2.14E-26	8.64E-05	5.66E-21
60	2.07E-01	2.06E-10	2.59E+00	7.84E-04	1.07E-04	2.72E-22	7.69E-05	1.01E-18
70	2.03E-01	3.54E-09	2.30E+00	6.97E-04	9.52E-05	1.05E-20	6.84E-05	2.30E-16
80	1.98E-01	2.95E-08	2.05E+00	6.20E-04	8.47E-05	7.01E-20	6.08E-05	1.34E-14
100	1.92E-01	5.64E-07	1.62E+00	4.91E-04	6.70E-05	3.51E-16	4.81E-05	3.98E-12
150	1.60E-01	2.33E-05	9.02E-01	2.73E-04	3.73E-05	2.83E-11	2.68E-05	7.59E-09
250	7.34E-02	3.10E-04	2.79E-01	8.45E-05	1.15E-05	2.33E-07	8.29E-06	2.94E-06
500	4.65E-03	5.37E-04	1.49E-02	4.51E-06	6.16E-07	1.14E-04	4.43E-07	7.64E-05
750	2.54E-04	2.67E-04	7.96E-04	2.41E-07	3.29E-08	3.36E-04	2.36E-08	1.06E-04
1000	1.36E-05	9.02E-05	4.25E-05	1.29E-08	1.76E-09	3.86E-04	1.26E-09	9.25E-05
2000	1.04E-10	1.40E-05	0.00E+00	0.00E+00	0.00E+00	2.15E-04	0.00E+00	2.33E-05

Uncapped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	5.30E-29	0.00E+00	7.53E-09	2.17E-12	2.41E-15	0.00E+00	3.09E-22	0.00E+00
2	8.98E-04	0.00E+00	8.59E+00	1.54E-02	2.41E-03	0.00E+00	3.67E-04	0.00E+00
4	2.96E-01	1.33E-32	1.73E+01	1.78E-02	4.86E-03	1.03E-40	3.38E-03	2.87E-27
6	7.49E-01	2.18E-26	2.19E+01	1.55E-02	4.42E-03	6.98E-34	3.86E-03	1.66E-20
8	9.92E-01	3.16E-23	2.31E+01	1.35E-02	3.89E-03	4.78E-27	3.78E-03	2.16E-16
10	1.06E+00	3.02E-20	2.22E+01	1.18E-02	3.39E-03	8.81E-25	3.29E-03	4.18E-13
20	1.08E+00	4.48E-11	1.36E+01	5.83E-03	1.68E-03	3.33E-14	1.72E-03	5.08E-07
30	9.38E-01	1.12E-07	7.40E+00	2.90E-03	8.35E-04	1.46E-09	8.55E-04	3.52E-05
40	7.68E-01	3.80E-06	3.88E+00	1.44E-03	4.15E-04	2.27E-07	4.25E-04	1.75E-04
50	6.33E-01	3.03E-05	1.94E+00	7.14E-04	2.06E-04	4.83E-06	2.11E-04	3.98E-04
60	5.40E-01	1.15E-04	9.63E-01	3.55E-04	1.02E-04	3.06E-05	1.05E-04	5.54E-04
70	4.54E-01	2.57E-04	4.86E-01	1.76E-04	5.08E-05	1.17E-04	5.20E-05	7.57E-04
80	3.67E-01	4.61E-04	2.41E-01	8.75E-05	2.52E-05	2.80E-04	2.58E-05	7.64E-04
100	2.36E-01	1.09E-03	5.95E-02	2.16E-05	6.22E-06	9.11E-04	6.37E-06	8.83E-04
150	5.89E-02	1.91E-03	1.80E-03	6.51E-07	1.88E-07	2.35E-03	1.92E-07	7.15E-04
250	1.76E-03	1.50E-03	1.59E-06	5.32E-10	1.54E-10	2.39E-03	1.58E-10	5.37E-04
500	1.36E-07	9.91E-04	0.00E+00	0.00E+00	0.00E+00	1.76E-03	0.00E+00	3.23E-04
750	4.62E-10	6.69E-04	0.00E+00	0.00E+00	0.00E+00	1.43E-03	0.00E+00	2.35E-04
1000	2.52E-10	5.01E-04	0.00E+00	0.00E+00	0.00E+00	1.19E-03	0.00E+00	1.85E-04
2000	0.00E+00	2.59E-04	0.00E+00	0.00E+00	0.00E+00	6.55E-04	0.00E+00	9.57E-05

Capped 95 th Percentile Concentrations in mg/L in Overburden

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	1.59E-29	0.00E+00	3.74E-09	1.51E-12	1.03E-15	0.00E+00	2.32E-23	0.00E+00
2	2.27E-04	0.00E+00	2.12E+00	4.05E-03	5.18E-04	0.00E+00	8.01E-05	0.00E+00
4	7.70E-02	4.27E-32	5.25E+00	5.10E-03	1.21E-03	0.00E+00	7.75E-04	9.70E-28
6	2.02E-01	4.82E-27	6.03E+00	4.98E-03	1.19E-03	3.02E-33	9.86E-04	3.56E-22
8	2.95E-01	1.40E-22	6.54E+00	4.87E-03	1.16E-03	6.79E-31	9.96E-04	6.28E-18
10	3.62E-01	1.59E-20	7.08E+00	4.75E-03	1.14E-03	1.77E-25	9.78E-04	2.11E-14
20	5.07E-01	2.70E-11	9.97E+00	4.23E-03	1.01E-03	1.29E-15	8.73E-04	3.74E-08
30	5.64E-01	5.00E-08	1.01E+01	3.76E-03	8.99E-04	8.49E-11	7.77E-04	3.53E-06
40	5.60E-01	1.98E-06	9.29E+00	3.34E-03	8.00E-04	1.90E-08	6.91E-04	3.43E-05
50	5.44E-01	1.56E-05	8.77E+00	2.97E-03	7.11E-04	4.59E-07	6.14E-04	1.38E-04
60	5.46E-01	6.06E-05	7.80E+00	2.65E-03	6.33E-04	3.75E-06	5.46E-04	3.11E-04
70	5.41E-01	1.45E-04	6.98E+00	2.35E-03	5.63E-04	1.98E-05	4.86E-04	4.65E-04
80	5.27E-01	2.74E-04	6.21E+00	2.09E-03	5.01E-04	6.08E-05	4.32E-04	6.25E-04
100	5.22E-01	6.81E-04	4.91E+00	1.66E-03	3.96E-04	2.47E-04	3.42E-04	7.55E-04
150	4.27E-01	1.74E-03	2.73E+00	9.21E-04	2.20E-04	1.29E-03	1.90E-04	9.54E-04
250	2.55E-01	2.24E-03	8.47E-01	2.85E-04	6.82E-05	3.05E-03	5.89E-05	7.57E-04
500	2.48E-02	1.70E-03	4.52E-02	1.52E-05	3.64E-06	3.14E-03	3.15E-06	5.24E-04
750	1.45E-03	1.32E-03	2.41E-03	8.13E-07	1.94E-07	2.31E-03	1.68E-07	4.19E-04
1000	7.74E-05	1.03E-03	1.29E-04	4.34E-08	1.04E-08	2.08E-03	8.96E-09	3.28E-04
2000	8.06E-10	3.54E-04	0.00E+00	0.00E+00	0.00E+00	1.25E-03	0.00E+00	1.87E-04

Overburden at the River Morell

Uncapped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	6.36E-17	3.84E-20	6.57E-26	0.00E+00	0.00E+00	0.00E+00
2	1.11E-09	0.00E+00	1.86E+00	1.77E-03	8.18E-05	0.00E+00	4.09E-09	0.00E+00
4	3.53E-03	0.00E+00	7.90E+00	3.76E-03	4.75E-04	0.00E+00	4.30E-05	0.00E+00
6	7.54E-02	0.00E+00	1.05E+01	3.28E-03	4.51E-04	0.00E+00	1.66E-04	0.00E+00
8	2.35E-01	0.00E+00	1.11E+01	2.86E-03	3.95E-04	0.00E+00	2.37E-04	0.00E+00
10	3.89E-01	8.45E-41	1.07E+01	2.48E-03	3.45E-04	0.00E+00	2.28E-04	0.00E+00
20	5.84E-01	1.47E-26	5.89E+00	1.23E-03	1.72E-04	0.00E+00	1.28E-04	2.12E-36
30	5.03E-01	3.52E-20	2.99E+00	6.12E-04	8.52E-05	7.73E-36	6.40E-05	3.33E-31
40	4.15E-01	4.83E-16	1.49E+00	3.04E-04	4.23E-05	2.23E-31	3.19E-05	1.61E-24
50	3.30E-01	5.49E-13	7.39E-01	1.51E-04	2.10E-05	3.33E-27	1.58E-05	4.90E-22
60	2.35E-01	4.88E-11	3.67E-01	7.50E-05	1.04E-05	4.11E-24	7.86E-06	2.81E-20
70	1.48E-01	1.19E-09	1.82E-01	3.72E-05	5.18E-06	1.16E-21	3.90E-06	1.26E-17
80	8.62E-02	1.30E-08	9.04E-02	1.85E-05	2.57E-06	6.42E-20	1.94E-06	1.26E-15
100	2.61E-02	3.12E-07	2.23E-02	4.56E-06	6.34E-07	6.84E-17	4.78E-07	7.80E-13
150	9.22E-04	1.79E-05	6.73E-04	1.38E-07	1.92E-08	1.30E-11	1.44E-08	3.45E-09
250	8.61E-07	2.26E-04	5.69E-07	1.12E-10	1.57E-11	1.69E-07	1.23E-11	1.75E-06
500	2.02E-10	2.94E-04	0.00E+00	0.00E+00	0.00E+00	8.63E-05	0.00E+00	5.18E-05
750	0.00E+00	2.10E-04	0.00E+00	0.00E+00	0.00E+00	2.49E-04	0.00E+00	6.71E-05
1000	0.00E+00	1.47E-04	0.00E+00	0.00E+00	0.00E+00	2.92E-04	0.00E+00	6.71E-05
2000	0.00E+00	8.25E-05	0.00E+00	0.00E+00	0.00E+00	1.94E-04	0.00E+00	2.90E-05

Capped 50 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	1.27E-17	8.32E-21	3.78E-26	0.00E+00	0.00E+00	0.00E+00
2	7.61E-11	0.00E+00	4.46E-01	4.60E-04	2.15E-05	0.00E+00	2.11E-09	0.00E+00
4	6.19E-04	0.00E+00	2.10E+00	1.08E-03	1.41E-04	0.00E+00	1.46E-05	0.00E+00
6	1.57E-02	0.00E+00	2.39E+00	1.06E-03	1.50E-04	0.00E+00	5.78E-05	0.00E+00
8	5.75E-02	0.00E+00	2.63E+00	1.04E-03	1.46E-04	0.00E+00	8.62E-05	0.00E+00
10	1.08E-01	6.80E-40	2.92E+00	1.01E-03	1.43E-04	0.00E+00	9.19E-05	0.00E+00
20	2.31E-01	1.89E-27	3.93E+00	9.02E-04	1.27E-04	0.00E+00	8.75E-05	5.75E-39
30	2.40E-01	9.83E-21	3.67E+00	8.02E-04	1.13E-04	2.01E-36	7.92E-05	3.89E-32
40	2.27E-01	6.79E-17	3.28E+00	7.13E-04	1.00E-04	2.88E-32	7.04E-05	3.26E-26
50	2.14E-01	8.33E-14	2.92E+00	6.34E-04	8.93E-05	5.93E-27	6.26E-05	1.46E-22
60	2.08E-01	9.30E-12	2.60E+00	5.64E-04	7.94E-05	2.81E-24	5.57E-05	8.57E-21
70	2.03E-01	2.47E-10	2.31E+00	5.02E-04	7.06E-05	2.67E-22	4.95E-05	1.45E-18
80	1.99E-01	2.93E-09	2.05E+00	4.46E-04	6.28E-05	6.56E-21	4.41E-05	1.57E-16
100	1.93E-01	8.87E-08	1.63E+00	3.53E-04	4.97E-05	1.34E-18	3.49E-05	1.12E-13
150	1.61E-01	7.46E-06	9.04E-01	1.96E-04	2.77E-05	8.04E-13	1.94E-05	7.13E-10
250	7.45E-02	1.79E-04	2.80E-01	6.08E-05	8.56E-06	2.78E-08	6.01E-06	7.44E-07
500	4.73E-03	4.96E-04	1.50E-02	3.25E-06	4.57E-07	4.43E-05	3.21E-07	5.09E-05
750	2.59E-04	3.14E-04	7.98E-04	1.73E-07	2.44E-08	2.20E-04	1.71E-08	8.12E-05
1000	1.39E-05	1.30E-04	4.26E-05	9.25E-09	1.30E-09	3.18E-04	9.13E-10	8.59E-05
2000	1.11E-10	2.00E-05	0.00E+00	0.00E+00	0.00E+00	2.41E-04	0.00E+00	3.06E-05

Uncapped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	3.02E-29	0.00E+00	2.02E-10	3.07E-14	1.42E-17	0.00E+00	4.84E-24	0.00E+00
2	1.83E-04	0.00E+00	6.66E+00	1.04E-02	1.50E-03	0.00E+00	1.76E-04	0.00E+00
4	1.91E-01	3.28E-34	1.68E+01	1.39E-02	4.06E-03	0.00E+00	2.60E-03	2.78E-31
6	6.01E-01	1.08E-28	2.14E+01	1.21E-02	3.72E-03	8.41E-35	3.36E-03	2.77E-22
8	8.81E-01	1.80E-24	2.31E+01	1.05E-02	3.30E-03	1.70E-30	3.20E-03	7.10E-19
10	1.01E+00	6.42E-22	2.22E+01	9.14E-03	2.89E-03	4.54E-26	2.89E-03	5.97E-15
20	1.07E+00	1.20E-12	1.39E+01	4.54E-03	1.43E-03	2.38E-16	1.50E-03	6.84E-08
30	9.51E-01	1.06E-08	7.56E+00	2.25E-03	7.11E-04	5.99E-11	7.44E-04	9.83E-06
40	8.00E-01	7.47E-07	3.99E+00	1.12E-03	3.53E-04	2.21E-08	3.69E-04	8.51E-05
50	6.49E-01	8.01E-06	2.03E+00	5.56E-04	1.75E-04	7.23E-07	1.83E-04	2.26E-04
60	5.61E-01	3.89E-05	1.02E+00	2.76E-04	8.71E-05	7.01E-06	9.11E-05	4.29E-04
70	4.71E-01	1.15E-04	5.14E-01	1.37E-04	4.33E-05	3.20E-05	4.52E-05	4.94E-04
80	3.85E-01	2.28E-04	2.55E-01	6.81E-05	2.15E-05	1.01E-04	2.25E-05	6.73E-04
100	2.48E-01	5.93E-04	6.30E-02	1.68E-05	5.30E-06	4.28E-04	5.54E-06	7.99E-04
150	6.96E-02	1.57E-03	1.90E-03	5.07E-07	1.60E-07	1.81E-03	1.67E-07	6.86E-04
250	2.64E-03	1.42E-03	1.66E-06	4.14E-10	1.31E-10	1.99E-03	1.41E-10	5.20E-04
500	3.40E-07	9.49E-04	0.00E+00	0.00E+00	0.00E+00	1.75E-03	0.00E+00	3.13E-04
750	4.85E-10	6.78E-04	0.00E+00	0.00E+00	0.00E+00	1.41E-03	0.00E+00	2.19E-04
1000	2.67E-10	5.15E-04	0.00E+00	0.00E+00	0.00E+00	1.12E-03	0.00E+00	1.81E-04
2000	0.00E+00	2.69E-04	0.00E+00	0.00E+00	0.00E+00	6.51E-04	0.00E+00	9.71E-05

Capped 95 th Percentile Concentrations in mg/L in River Morell

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	6.76E-30	0.00E+00	1.01E-10	2.58E-14	8.69E-18	0.00E+00	1.25E-24	0.00E+00
2	4.77E-05	0.00E+00	1.63E+00	2.88E-03	3.36E-04	0.00E+00	3.63E-05	0.00E+00
4	4.89E-02	6.14E-35	4.91E+00	3.95E-03	9.65E-04	0.00E+00	5.84E-04	1.74E-32
6	1.63E-01	1.10E-27	5.88E+00	3.86E-03	9.72E-04	1.16E-36	8.51E-04	1.59E-24
8	2.49E-01	7.15E-25	6.37E+00	3.77E-03	9.50E-04	1.29E-31	8.65E-04	1.15E-20
10	3.21E-01	4.74E-22	6.87E+00	3.69E-03	9.28E-04	1.22E-30	8.52E-04	2.22E-16
20	4.73E-01	8.45E-13	9.80E+00	3.28E-03	8.25E-04	7.86E-18	7.60E-04	4.68E-09
30	5.35E-01	5.19E-09	1.00E+01	2.92E-03	7.34E-04	2.99E-12	6.76E-04	8.89E-07
40	5.52E-01	3.58E-07	9.27E+00	2.59E-03	6.53E-04	1.58E-09	6.01E-04	1.13E-05
50	5.45E-01	4.29E-06	8.65E+00	2.31E-03	5.81E-04	6.40E-08	5.35E-04	6.18E-05
60	5.42E-01	2.09E-05	7.86E+00	2.05E-03	5.16E-04	7.30E-07	4.76E-04	1.65E-04
70	5.43E-01	6.46E-05	7.04E+00	1.82E-03	4.59E-04	4.14E-06	4.23E-04	3.19E-04
80	5.33E-01	1.35E-04	6.26E+00	1.62E-03	4.09E-04	1.74E-05	3.76E-04	4.40E-04
100	5.20E-01	3.80E-04	4.95E+00	1.28E-03	3.23E-04	1.10E-04	2.98E-04	6.25E-04
150	4.33E-01	1.27E-03	2.76E+00	7.14E-04	1.80E-04	7.57E-04	1.66E-04	8.54E-04
250	2.62E-01	1.96E-03	8.54E-01	2.21E-04	5.57E-05	2.50E-03	5.13E-05	7.02E-04
500	2.67E-02	1.62E-03	4.56E-02	1.18E-05	2.97E-06	2.94E-03	2.74E-06	5.22E-04
750	1.54E-03	1.26E-03	2.43E-03	6.30E-07	1.59E-07	2.31E-03	1.46E-07	3.79E-04
1000	8.21E-05	9.63E-04	1.30E-04	3.36E-08	8.47E-09	1.89E-03	7.80E-09	3.17E-04
2000	8.30E-10	3.80E-04	0.00E+00	0.00E+00	0.00E+00	1.18E-03	0.00E+00	1.94E-04

Limestone Aquifer

Uncapped 50 th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	2.36E-36	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	6.32E-03	1.65E-11	4.00E-25	0.00E+00	0.00E+00	0.00E+00
4	0.00E+00	0.00E+00	2.72E+00	3.58E-06	9.14E-12	0.00E+00	2.05E-38	0.00E+00
6	5.49E-32	0.00E+00	5.70E+00	7.94E-06	1.60E-09	0.00E+00	4.44E-31	0.00E+00
8	3.50E-29	0.00E+00	7.24E+00	7.20E-06	5.82E-09	0.00E+00	7.46E-24	0.00E+00
10	5.27E-25	0.00E+00	8.06E+00	6.27E-06	9.98E-09	0.00E+00	2.84E-20	0.00E+00
20	1.02E-11	0.00E+00	6.32E+00	3.11E-06	6.37E-09	0.00E+00	1.29E-14	0.00E+00
30	1.81E-07	0.00E+00	3.53E+00	1.55E-06	3.17E-09	0.00E+00	1.23E-13	0.00E+00
40	1.92E-05	0.00E+00	1.87E+00	7.68E-07	1.57E-09	0.00E+00	2.03E-13	0.00E+00
50	2.90E-04	0.00E+00	9.56E-01	3.81E-07	7.81E-10	0.00E+00	1.62E-13	0.00E+00
60	1.65E-03	0.00E+00	4.79E-01	1.89E-07	3.88E-10	0.00E+00	8.86E-14	0.00E+00
70	5.51E-03	0.00E+00	2.39E-01	9.40E-08	1.93E-10	0.00E+00	4.56E-14	0.00E+00
80	1.22E-02	0.00E+00	1.19E-01	4.67E-08	9.56E-11	0.00E+00	2.32E-14	0.00E+00
100	3.11E-02	0.00E+00	2.93E-02	1.15E-08	2.36E-11	0.00E+00	5.73E-15	0.00E+00
150	6.60E-02	0.00E+00	8.85E-04	3.48E-10	7.12E-13	0.00E+00	1.73E-16	0.00E+00
250	5.41E-02	1.53E-38	7.69E-07	2.88E-13	6.37E-16	0.00E+00	1.59E-19	0.00E+00
500	1.86E-02	7.60E-28	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.29E-29	2.99E-36
750	5.08E-03	2.50E-20	0.00E+00	0.00E+00	0.00E+00	1.54E-37	0.00E+00	8.20E-31
1000	1.19E-03	1.05E-15	0.00E+00	0.00E+00	0.00E+00	8.11E-33	0.00E+00	7.02E-25
2000	2.39E-06	4.40E-09	0.00E+00	0.00E+00	0.00E+00	1.78E-20	0.00E+00	1.28E-14

Capped 50 th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2	0.00E+00	0.00E+00	1.74E-03	3.66E-12	1.67E-25	0.00E+00	0.00E+00	0.00E+00
4	0.00E+00	0.00E+00	7.22E-01	8.62E-07	2.09E-12	0.00E+00	0.00E+00	0.00E+00
6	3.20E-38	0.00E+00	1.45E+00	2.13E-06	3.66E-10	0.00E+00	5.69E-30	0.00E+00
8	3.04E-31	0.00E+00	1.80E+00	2.22E-06	1.86E-09	0.00E+00	2.83E-24	0.00E+00
10	4.35E-25	0.00E+00	2.09E+00	2.17E-06	2.96E-09	0.00E+00	8.81E-21	0.00E+00
20	7.08E-13	0.00E+00	3.09E+00	1.93E-06	4.28E-09	0.00E+00	7.75E-15	0.00E+00
30	2.36E-08	0.00E+00	3.20E+00	1.72E-06	3.81E-09	0.00E+00	7.33E-14	0.00E+00
40	3.35E-06	0.00E+00	3.04E+00	1.53E-06	3.38E-09	0.00E+00	1.39E-13	0.00E+00
50	6.04E-05	0.00E+00	2.78E+00	1.36E-06	3.01E-09	0.00E+00	1.45E-13	0.00E+00
60	3.92E-04	0.00E+00	2.50E+00	1.21E-06	2.68E-09	0.00E+00	1.59E-13	0.00E+00
70	1.39E-03	0.00E+00	2.25E+00	1.08E-06	2.38E-09	0.00E+00	1.44E-13	0.00E+00
80	3.53E-03	0.00E+00	2.01E+00	9.57E-07	2.12E-09	0.00E+00	1.28E-13	0.00E+00
100	1.18E-02	0.00E+00	1.60E+00	7.57E-07	1.68E-09	0.00E+00	1.02E-13	0.00E+00
150	4.51E-02	0.00E+00	8.97E-01	4.21E-07	9.32E-10	0.00E+00	5.65E-14	0.00E+00
250	7.71E-02	0.00E+00	2.78E-01	1.31E-07	2.89E-10	0.00E+00	1.75E-14	0.00E+00
500	4.47E-02	4.57E-27	1.48E-02	6.97E-09	1.54E-11	0.00E+00	9.35E-16	1.20E-37
750	1.89E-02	2.39E-20	7.92E-04	3.72E-10	8.23E-13	1.11E-38	4.99E-17	1.10E-32
1000	6.41E-03	1.24E-15	4.23E-05	1.98E-11	4.39E-14	2.16E-33	2.66E-18	9.04E-27
2000	2.01E-05	6.50E-09	0.00E+00	0.00E+00	0.00E+00	1.29E-20	0.00E+00	1.14E-15

Uncapped 95 th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	2.18E-15	3.10E-27	3.25E-38	0.00E+00	0.00E+00	0.00E+00
2	1.24E-32	0.00E+00	5.42E+00	8.86E-05	7.88E-09	0.00E+00	1.65E-24	0.00E+00
4	6.03E-21	0.00E+00	1.41E+01	1.25E-03	3.83E-05	0.00E+00	5.94E-12	0.00E+00
6	2.19E-15	0.00E+00	1.81E+01	1.15E-03	8.64E-05	0.00E+00	1.58E-08	0.00E+00
8	1.22E-10	0.00E+00	2.01E+01	1.00E-03	8.70E-05	0.00E+00	4.41E-07	0.00E+00
10	4.06E-08	0.00E+00	2.00E+01	8.73E-04	7.95E-05	0.00E+00	1.49E-06	0.00E+00
20	1.58E-03	0.00E+00	1.44E+01	4.33E-04	3.98E-05	0.00E+00	3.85E-06	0.00E+00
30	2.99E-02	0.00E+00	9.40E+00	2.15E-04	1.98E-05	0.00E+00	2.74E-06	0.00E+00
40	1.03E-01	0.00E+00	5.66E+00	1.07E-04	9.82E-06	0.00E+00	1.42E-06	0.00E+00
50	1.78E-01	2.39E-40	3.57E+00	5.31E-05	4.88E-06	0.00E+00	7.18E-07	1.34E-37
60	2.27E-01	1.04E-37	2.14E+00	2.64E-05	2.42E-06	0.00E+00	3.57E-07	6.57E-33
70	2.50E-01	6.50E-33	1.28E+00	1.31E-05	1.20E-06	0.00E+00	1.77E-07	5.83E-31
80	2.71E-01	1.22E-32	6.88E-01	6.50E-06	5.97E-07	0.00E+00	8.79E-08	4.95E-30
100	2.53E-01	2.45E-30	2.08E-01	1.60E-06	1.47E-07	1.93E-37	2.17E-08	3.25E-26
150	2.00E-01	5.90E-24	7.04E-03	4.84E-08	4.45E-09	3.02E-31	6.55E-10	1.15E-20
250	1.25E-01	6.51E-19	7.23E-06	3.97E-11	3.78E-12	1.04E-23	6.00E-13	2.39E-14
500	5.55E-02	3.65E-10	5.67E-10	0.00E+00	0.00E+00	4.40E-15	1.33E-18	2.43E-08
750	3.22E-02	1.92E-07	0.00E+00	0.00E+00	0.00E+00	1.67E-10	1.70E-22	1.53E-06
1000	2.21E-02	2.98E-06	0.00E+00	0.00E+00	0.00E+00	2.72E-08	1.31E-27	9.23E-06
2000	5.69E-03	6.10E-05	0.00E+00	0.00E+00	0.00E+00	2.28E-05	0.00E+00	3.35E-05

Capped 95 th Percentile Concentrations in mg/L in Limestone Aquifer

Time(years)	Ammoniacal nitrogen	Arsenic	Chloride	Formaldehyde (o)	Mecoprop (o)	Nickel	Phenol (o)	Zinc
1	0.00E+00	0.00E+00	6.26E-16	6.62E-27	5.28E-38	0.00E+00	0.00E+00	0.00E+00
2	3.79E-36	0.00E+00	1.50E+00	3.98E-05	2.47E-09	0.00E+00	6.03E-25	0.00E+00
4	2.68E-22	0.00E+00	4.13E+00	4.37E-04	7.66E-06	0.00E+00	8.81E-13	0.00E+00
6	1.32E-16	0.00E+00	5.05E+00	4.37E-04	2.15E-05	0.00E+00	3.75E-09	0.00E+00
8	9.26E-12	0.00E+00	5.53E+00	4.27E-04	2.64E-05	0.00E+00	8.37E-08	0.00E+00
10	4.32E-09	0.00E+00	6.27E+00	4.17E-04	2.70E-05	0.00E+00	4.03E-07	0.00E+00
20	2.68E-04	0.00E+00	8.54E+00	3.71E-04	2.41E-05	0.00E+00	1.53E-06	0.00E+00
30	6.48E-03	0.00E+00	8.61E+00	3.30E-04	2.14E-05	0.00E+00	1.51E-06	0.00E+00
40	2.98E-02	0.00E+00	8.30E+00	2.93E-04	1.91E-05	0.00E+00	1.39E-06	0.00E+00
50	6.73E-02	0.00E+00	7.72E+00	2.61E-04	1.70E-05	0.00E+00	1.24E-06	2.69E-37
60	9.85E-02	3.91E-35	7.10E+00	2.32E-04	1.51E-05	0.00E+00	1.10E-06	1.27E-31
70	1.30E-01	1.34E-33	6.37E+00	2.06E-04	1.34E-05	0.00E+00	9.77E-07	3.02E-33
80	1.57E-01	2.57E-32	5.71E+00	1.84E-04	1.19E-05	0.00E+00	8.69E-07	1.45E-27
100	1.90E-01	3.97E-31	4.52E+00	1.45E-04	9.44E-06	6.37E-38	6.87E-07	2.26E-24
150	2.36E-01	1.76E-23	2.56E+00	8.08E-05	5.25E-06	4.37E-32	3.83E-07	4.81E-20
250	2.27E-01	7.14E-19	8.28E-01	2.50E-05	1.63E-06	1.34E-23	1.19E-07	7.92E-13
500	1.27E-01	2.73E-10	4.42E-02	1.34E-06	8.68E-08	1.09E-15	6.32E-09	1.75E-07
750	7.25E-02	1.53E-07	2.36E-03	7.13E-08	4.64E-09	8.66E-11	3.38E-10	5.62E-06
1000	4.64E-02	2.69E-06	1.26E-04	3.81E-09	2.47E-10	1.84E-08	1.80E-11	2.77E-05
2000	1.10E-02	9.16E-05	0.00E+00	0.00E+00	0.00E+00	1.81E-05	0.00E+00	4.52E-05

Appendix A13.1 Flood Risk Assessment

Kerdiffstown Landfill Remediation Project

Kildare County Council

Flood Risk Assessment

June 2017

Kerdiffstown Landfill Remediation Project

Project no:	32EW5604
Document title:	Flood Risk Assessment
Document No.:	
Revision:	1
Date:	June 2017
Client name:	Kildare County Council
Client No.:	
Project manager:	Rihanna Rose
Author:	Jennifer Johnston
File Name:	G:\JI\Sustainable Solutions\Kerdiffstown Landfill\4 - Documents\4.3 - Draft Documents\32EW5604 E EIA IED Planning\EIA\Specialists EIS\Hydrology\FRA

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Document history and status

Revision	Date	Description	By	Review	Approved
Original	March 2017	Issue for Planning	Jennifer Johnston	Mairéad Conlon	Peter Smyth
Rev 1	June 2017	Final EIAR Issue		Sharon Sugrue	Rhianna Rose

Glossary

Annual Exceedance Probability **Or AEP**	The probability of a flood event of a given magnitude being equalled or exceeded in any given year. For example: • a 0.1% AEP flood event has a 0.1%, or 1 in a 1000, chance of occurring or being exceeded in any given year. • a 1% AEP flood event has a 1%, or 1 in a 100, chance of occurring or being exceeded in any given year. • a 10% AEP flood event has a 10%, or 1 in a 10, chance of occurring or being exceeded in any given year.
Q_{BAR}	Mean Annual Flood

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Appendix A. Information Sources Checklist
Appendix B. OPW Summary Local Area Report
Appendix C. Eastern CFRAM Study – Flood Risk Review Maps
Appendix D. OPW Eastern CFRAMS Fluvial Flood Map

1. Introduction

Jacobs Engineering was commissioned by Kildare County Council to provide consultancy services in respect of the proposed remediation of the former Kerdiffstown Landfill site in Co. Kildare (hereafter 'the proposed Project'). The proposed Project includes the remediation and development of an amenity site on the former Kerdiffstown Landfill site.

The planned works within the site boundary include works to re-profile the site including excavation of waste and other materials for deposition on site to achieve the proposed final landform. The works will also include the installation of landfill infrastructure such as capping, landfill gas, leachate and surface water management.

The capping material used will increase the rate of pluvial runoff from the site therefore the purpose of the surface water management system is to maintain runoff from the site to greenfield runoff rates with attenuation ponds for storage. The proposed Project is shown on Figure 4.20.

A second stage of remediation will comprise the works required to restore the site to the proposed park end use, including planting and landscaping, installation of sports pitches, changing rooms, car parks and associated services. The proposed Project is shown on Figure 4.20.

In accordance with Section 28 of the Planning and Development Act 2000, Kildare County Council is required to have regard to the Guidelines on the Planning System and Flood Risk Management, 2009. These guidelines outline the requirement for a flood risk assessment to be carried out to assess the flood risk to the proposed Project, the impact that the proposed works will have on flooding in the surrounding areas and to present mitigation measures, if any, that may be required as a result.

2. Flood Risk Assessment Methodology

The FRM guidelines outline the key principles that should be used to assess flood risk to proposed development sites. It is recommended that a staged approach to flood risk assessment should be used:

- **Stage 1: Flood risk identification** – to identify whether there may be any flooding or surface water management issues relating to the proposed development site that may warrant further investigations.
- **Stage 2: Initial flood risk assessment** – to confirm sources of flooding that may affect the proposed development site, to appraise the adequacy of existing information and to determine what surveys and modelling approach is appropriate to match the spatial resolution required and complexity of the flood risk issues. This stage involves the review of existing studies, to assess flood risk and to assist with the development of FRM measures.
- **Stage 3: Detailed flood risk assessment** – to assess flood risk issues in sufficient detail and to provide a quantitative appraisal of potential flood risk to a proposed or existing development, of its potential impacts on flood risk elsewhere and of the effectiveness of any proposed mitigation measures. This will typically involve use of an existing or construction of a hydraulic model across a wide enough area to appreciate the catchment wide impacts and hydrological process involved.

This report represents a **Flood Risk Identification (Stage 1 Assessment)** and **Initial Flood Risk Assessment (Stage 2 Assessment)** and provides an overview of the potential flood risks to the proposed site and assesses the potential impact of the proposed Project. In addition it proposes mitigation principles that should be pursued as the design is progressed. A Stage 3 Assessment is not proposed as the results from the Stage 1 and 2 Assessments, as outlined in this report, indicate a Stage 3 Assessment is not required.

3. Flood Risk Identification (Stage 1)

3.1 Flood History of the Site

As part of the Stage 1 Assessment (Flood Risk Identification), all readily available data was reviewed (as per the list referenced in Table 4 – Appendix A) to identify whether there may be any flooding or surface water management issues relating to the site that may warrant further investigations.

The aim of this section is to outline the flood history of this site. The main historical flood events in the area were identified, assessed and are described below.

3.1.1 Local Watercourses

Prior to describing historical flood risk below this section describes the watercourses adjacent to the site, illustrated in Diagram 1.1. The closest surface water body to the site is the Morell River (WBR005) which lies to the east of the proposed Project. The Morell River flows generally northwards within 50m of the site boundary before flowing into the River Liffey. The River Liffey itself lies approximately 3km north-west of the site at its closest point, also flowing generally northwards, before following a more eastward flow direction some 5 to 6km north of the landfill site.

The Rathmore Stream (WBR006) lies to the south east of the proposed Project and joins the Morell River upstream east of the proposed Project.

The Canal Feeder Stream (WBR004) is an engineered feature that collects surface water run-off from lands generally to the south and south-west of the site. The Canal Feeder Stream flows generally westward to the Grand Canal, which is located approximately 2km west of the site.

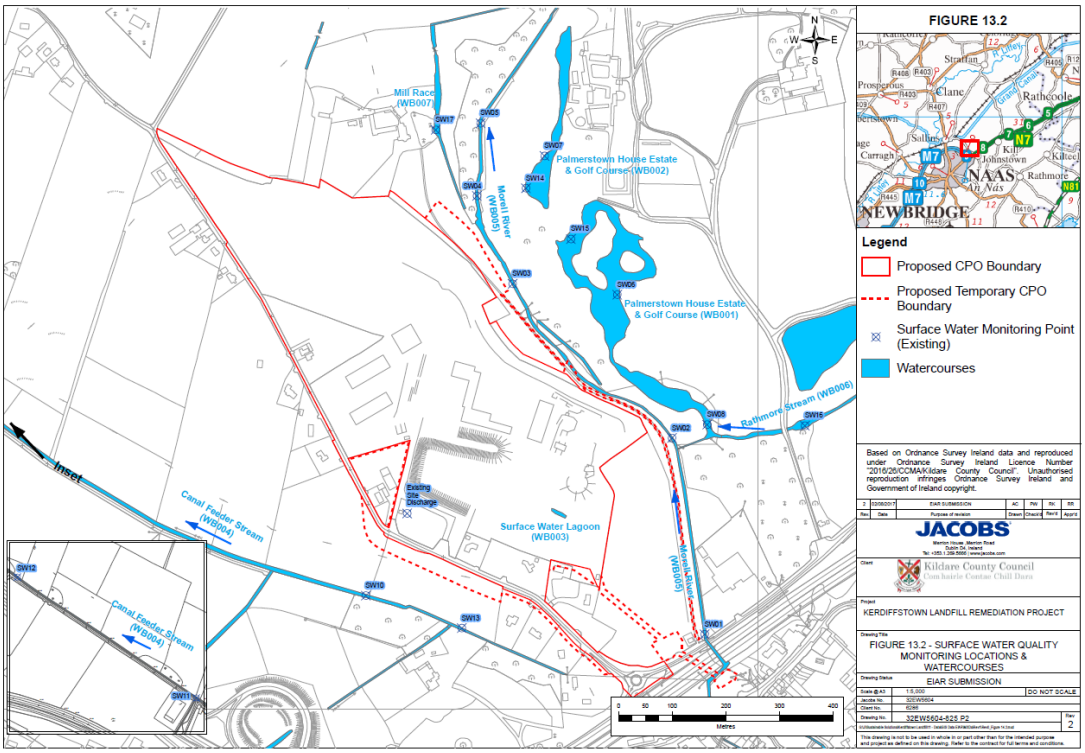


Diagram 1.1:Local Watercourses and Site locations

3.1.2 OPW National Flood Hazard Mapping

With reference to the OPW Flood Hazard Mapping website (www.floodmaps.ie) which is the national portal for retaining flood information, a number of historical flood events were identified within the areas around the proposed Project, namely the Kill, Johnstown and Sallins areas. A Summary Local Area Report detailing this information was downloaded and is included in Appendix B. The key flood event information from this report is outlined in Table 1.

Ref. No.	Date of Flood Event	Address	Description of Event / Comments	Approximate Distance from Project Site
1	30 November 2009	Monread, Sallins, Co. Kildare	Flooding of the Sallins area, particularly the Waterways Estate in Sallins, Co. Kildare	
2	05 November 2000	River Morell, Johnstown, Co.Kildare	Flooding in Johnstown area of Co Kildare due to constrictions caused by under-capacity structures as well as some under-capacity channels.	
3	05 November 2000	Kill River, N7 Road, Co.Kildare	Flooding in Kill area of Co Kildare due to constrictions caused by under-capacity structures.	
4	10 June 1993	Kill River, N7 Road, Co.Kildare	Flooding in Kill area of Co Kildare due to constrictions caused by under-capacity structures.	
5	10 June 1993	River Morell, Johnstown, Co.Kildare	Flooding in Johnstown area of Co Kildare due to constrictions caused by under-capacity structures as well as some under-capacity channels.	
6	26 November 2012	Killeenmore, Co. Kildare	This flooding event occurred close to the location where the Dublin/Cork railway line crosses the Morrell River. The Morrell River broke its banks upstream of the railway line in this location (just downstream of the Canal). The river then flowed across the land and made its way across/through the railway line by flowing through the river culvert and two other local culverts. The water, which flowed through the local culverts, caused the flooding. Flooding frequently occurs in this area.	
7	Recurring	River Morell, Johnstown, Co.Kildare	Flooding in Johnstown area of Co Kildare due to constrictions caused by under-capacity structures as well as some under-capacity channels.	

Table 1: Flood events recorded within the area from the OPW Flood Hazard Mapping Report

A number of reports are also available on the OPW Flood Hazard Mapping website. A selection of these reports are listed below:

- Kildare County Council, National Roads Design Office, N7 Naas Road Widening & Interchanges Scheme, Kill & Johnstown Flood Alleviation Measures Report, June 2002.
- Kildare County Council, National Roads Design Office, N7 Naas Road Widening Interchange Scheme, Hydraulic Model & Flood Alleviation Measures Report, January 2002.
- Kildare County Council Memo, Report Re: Flooding In County Kildare, 5 – 7 November 2000
- OPW Flood Event Report, Flooding at Killeenmore, Co. Kildare, 26th November 2012.

Although these reports identify and describe flood events in the areas surrounding the site, flooding within the site boundary is not mentioned.

3.1.3 Eastern CFRAM Study – Flood Risk Review Report

The Eastern River Basin District Flood Risk Review was carried out as part of the Catchment Based Flood Risk Assessment and Management Study (CFRAMS) process to help validate the findings of the OPW draft Preliminary Flood Risk Assessment (PFRA). These Flood Risk Reviews informed which sites were to be taken forward for a more detailed assessment within the CFRAMS Programme.

The Eastern CFRAM Study Flood Risk Review Report indicates that there is evidence of fluvial flooding from the Morell River in the areas around the proposed Project site. As stated in the Flood Risk Review Report;

'Both Kildare County Council and OPW regional engineering staff have identified the full Morell catchment, as an area of significant flood risk. There is a known recurring flood risk from the Morell River and associated tributaries that has flooded properties in the past.'

The Report indicates that there is a history of flooding of the Johnstown area, approximately 0.6km to the south of the proposed Project site, from the Morell River.

The report also indicates that the Sallins area (approximately 3km from the Project site) is also at risk of flooding from the canal feeder stream which is located to the left of the proposed Project site.

The Johnstown, Naas and Sallins Flood Risk Review Maps (Appendix C) indicate that the land directly adjacent to the proposed Project site is at risk of fluvial flooding in the 0.1%, 1% and 10% Annual Exceedance Probability (AEP) flood events, however it does not show the proposed Project site at risk of flooding.

Although this reports identifies and describes flooding in the areas surrounding the site, flooding within the site boundary is not mentioned.

3.1.4 Flood Risk Maps

The Eastern CFRAM Study Flood Extent and Depth Maps are available online (http://maps.opw.ie/fhrm_pdf_final//east/uom09/naas/01_ex/fluvial/e09naa_exfcd_f0_20.pdf) and the relevant map tile is included in Appendix D. The CFRAM maps are the most up to date flood maps indicating the fluvial & coastal flood risk to an area. Due to the location of the proposed Project site, coastal flooding is not a risk in this area. The CFRAM fluvial extent map of the area indicates that the some of the land directly outside the site perimeter is at risk of fluvial flooding in the 0.1%, 1% and 10% fluvial AEP flood events.

Although this map identifies fluvial flooding in the area surrounding the site, flooding within the site boundary is not shown.

3.1.5 Local Libraries and Newspaper Reports

There are a number of newspaper articles which detail flooding in areas around the study area such as the Sallins and the Johnstown areas. However there are no newspaper articles which detail flooding of the proposed Project site.

3.2 Summary

While it has been concluded that no flooding has occurred within the site boundary, flooding has previously occurred in the vicinity of the site. Proposed works to the site including re-profiling of the site and provision of a capping layer which will increase the rate of runoff from the site. On this basis, a Stage II Flood Risk Assessment has been carried out to develop an understanding of the impacts these proposed works may have to the flood risk on the site and the surrounding areas.

4. Initial Flood Risk Assessment (Stage 2)

This section assesses the risk of flooding to the site once the works are complete from a range of different sources, which is then used to develop a broad understanding of the risk characteristics to the proposed Project and if any mitigation measures are required.

4.1 Potential Sources of Flooding

There is a potential risk from several sources of flooding, as listed below:

- **Coastal** - flooding from the sea;
- **Fluvial** - flooding from rivers and watercourses;
- **Estuarine** - flooding from a combination of fluvial and coastal;
- **Pluvial** – flooding that is caused by runoff during high rainfall events;
- **Artificial Drainage Systems** – flooding that occurs as a result of surcharging or blocking of drainage networks;
- **Groundwater** – flooding when water normally stored below the ground rises above surface level or into below ground spaces (such as basements).

The following sections assess the potential risk from each of these separate sources of flooding.

4.2 Coastal Flood Risk

Coastal flooding is caused by higher sea levels than normal, resulting in the sea overflowing onto the land. Coastal flooding is influenced by three main factors, which often work in combination. These are:

- **High tide levels** – caused by normal, and predictable, astronomical factors.
- **Storm surges** – where sea levels are artificially raised by areas of low barometric pressure such as depression weather systems.
- **Wave action** – this is dependent on wind speed and direction, as well as local topography and exposure.

Due to the sites proximity and elevation from the sea (ground level is above 80mOD), it is reasonable to conclude that there is no flood risk to the proposed Project or site from coastal sources.

4.3 Fluvial Flood Risk

Existing Situation

As stated in Section 3.2, the Eastern CFRAM flood risk maps indicate that there is no fluvial flood risk to the existing site, however areas directly outside the perimeter of the site are currently at risk of fluvial flooding, from the Morell River, in the 0.1%, 1% and 10% fluvial AEP flood events.

Risk Following Proposed Works

As the proposed works to the site include re-profiling of the existing ground contours, this could potentially change the fluvial flood risk extents. The predicted flood level for the Morell River for the 0.1% AEP event, upstream of the site is 83.02mOD. The final landscaped contours of the proposed Project, as shown in Figure 4.20, indicate that the minimum level along the site boundary adjacent to the Morell River is 84mOD.

It is therefore reasonable to conclude that the proposed ground levels at the boundary of the site, adjacent to the Morell River, will be higher than the predicted 0.1% AEP Water Level shown on the CFRAMS mapping; therefore there will be no fluvial flood risk to the site once the proposed works are complete.

4.4 Estuarine Flood Risk

Estuarine flooding occurs due to a combination of tidal and fluvial flows, rivers and the sea. A combination of a high flow and a high tide will force water back upstream, increasing water levels and leading to a river bursting its banks.

For the reasons outlined in Section 4.2 regarding Coastal Flood Risk, it is reasonable to conclude that there is no estuarine flood risk to the proposed Project or site.

4.5 Pluvial Flood Risk

Pluvial flooding occurs during periods of heavy rainfall, when the rainfall rate is greater than the infiltration capacity. It is usually associated with high intensity rainfall events (typically > 30mm/h) resulting in overland flow and ponding in depressions in the topography.

Existing Situation

No evidence of pluvial flood risk on the site was identified in Section 3.

Risk Following Proposed Works

The proposed capping material will increase the runoff rate from the site and limit the infiltration capacity of the site. A Surface Water Management Plan has been developed for the proposed Project. This plan describes a proposed drainage system for the site which limits outflow from the site to $Q_{BAR,}$ which has been calculated as 56.58l/s, in order to ensure that the surface water run-off from the site does not have a detrimental impact on the downstream river network and increase the risk of flooding. The drainage system also comprises a series of ponds which provide attenuation for additional flows during a 1% AEP event, with a 10% climate change factor applied. Further details are included in the Surface Water Management Plan (Document number 32EW5604/DOC/0042 | 0) but given that a design is proposed that will limit the discharge to 56.58l/s, which is equivalent to the greenfield run off rate of Q_{BAR}, it is reasonable to conclude that there will be no pluvial flood risk to the Project or site once the works are complete.

4.6 Artificial Drainage Systems

Existing Situation

Section 1.1.1 of the Environmental Impact Statement (EIS) Volume 2 of 4: Main Report outlines the Current Site Conditions and Drainage System on site. There are no known flooding issues in the existing Artificial Drainage System.

Risk Following Proposed Works

As detailed in Section 4.5, there will be an appropriately designed drainage network to address pluvial runoff on the site. It can therefore be concluded that there will be no flood risk to the Project or site from Artificial Drainage Systems once the works are complete.

4.7 Groundwater Flood Risk

Existing Situation

Groundwater flooding during times when the catchment is saturated and the ground water levels are elevated above the level of the site is unlikely as the site is elevated relative to the surrounding topography. Further to this groundwater monitoring boreholes were in place from 2010-2016 as outlined in Chapter 13 of the EIS Volume 2 of 4: Main Report. During this time, groundwater levels only marginally increased above 83mOD. The ground levels on the site are currently higher than the monitored groundwater levels, therefore the risk of flooding from groundwater is considered low.

Risk Following Proposed Works

The proposed Project involves reprofiling of the site. The lowest levels on the site will be located at the bottom of the attenuation ponds. The ponds are designed to be above groundwater levels. As there are no proposed works below existing groundwater level, it is reasonable to conclude that the risk of flooding from groundwater sources to the Project or site is not increased.

4.8 Flood Risk due to Climate Change

In the future, it is predicted that climate change will increase sea levels, storm events magnitude and frequency, and rainfall depths, intensities and patterns. It is therefore necessary to consider the impact this might have on the flood risk to the proposed Project.

For fluvial flow the standard allowance for climate change for the 1% AEP event is a 20% increase in flow.

The final landscaped contours along the boundary of the proposed Project site will be higher than the predicted water level for the 0.1% AEP fluvial event (which is higher than the 1% AEP plus Climate Change event). Therefore the risk of fluvial flooding to the site as a result of climate change once the proposed works are complete is considered low.

For pluvial flooding, as detailed in Section 4.5, the proposed drainage network design has included a 10% climate change factor. Therefore the risk of pluvial flooding to the site as a result of climate change once the proposed works are complete is considered low.

4.9 Summary of Flood Risk

Table 2 below provides a summary of the potential impact from each of the sources of flooding considered, to the road once the works are complete.

Flood Risk	Summary of Impact	Notes
Coastal	N/A	N/A
Fluvial	Low	The final landscaped contours along the boundary of the proposed Project will be higher than the 0.1% AEP Predicted Water Level.
Estuarine	N/A	N/A
Pluvial	Low	A Surface Water Management Plan has been developed for the proposed Project which includes an adequately designed drainage network for the site.
Artificial Drainage Systems	Low	A Surface Water Management Plan has been developed for the proposed Project which includes an adequately designed drainage network for the site.
Groundwater	Low	No works are proposed below groundwater level.
Climate Change	Low	The final landscaped contours along the boundary of the proposed Project will be higher than the predicted water level of the 0.1% AEP fluvial event (which is higher than the 1% AEP plus Climate Change event).

Table 2: Summary of Flood Risk to Proposed Project

5. Potential Flood Risk Impacts to Surrounding Areas from the Proposed Project

Section 4 considered the flood risk to the Project site once the works were completed. This section, Section 5 considers the potential increased flood risk to the surrounding areas as a result of the works.

The proposed Project could result in an increase in flood risk if it:

- Reduces the conveyance of an existing watercourse and floodplain network;
- Reduces the volume of flood storage available on the watercourse floodplains; or
- Increases site runoff rates and volume.

5.1 Fluvial Flood Risk

As described in Section 4.5 the surface water design for the proposed Project will be a controlled outfall from the site with a discharge rate of 56.58l/s (Q_{BAR}). The outfall will discharge from an on-site attenuation pond to the Morell River. For flood events greater than a Q_{BAR} event the proposed drainage system will reduce the runoff from the site to the River Morell. For flood events below Q_{BAR} the outfall from the site is negligible considering the size of the site is 0.25km^2 compared to overall catchment of 45km^2.

Therefore the proposed Project has no impact on the fluvial flood risk to surrounding areas as a result of the works.

5.2 Pluvial Flood Risk

As described in Section 5.1, a Surface Water Management Plan has been developed for the proposed Project which includes an adequately designed drainage network for the site. The site is landscaped to allow all runoff from the site to flow into the attenuation ponds, therefore flood risk from pluvial sources to the surrounding area will not be increased.

5.3 Artificial Drainage Systems

As described in Section 5.1, a Surface Water Management Plan has been developed for the proposed Project which includes an adequately designed drainage network for the site, therefore flood risk from Artificial Drainage Systems on site to the surrounding area will not be increased.

5.4 Groundwater Flood Risk

The proposed Project involves re-profiling of the site but does not include significant earthworks below groundwater levels that would increase the risk of flooding to the surrounding area from groundwater sources.

5.5 Summary of Flood Risk

Table 3 below provides a summary of the potential flood risk impacts on surrounding areas as a result of the proposed Project.

Flood Risk	Summary of Impact	Notes
Coastal	N/A	
Fluvial	Negligible Impact	Any increase in Flood risk from fluvial sources to the surrounding area is considered negligible.
Estuarial	N/A	
Pluvial	No Impact	Flood risk from pluvial sources to the surrounding area will not be increased.
Artificial Drainage Systems	No Impact	Flood risk from artificial drainage systems to the surrounding area will not be increased.
Groundwater	No Impact	Flood risk from groundwater sources to the surrounding area will not be increased.
Climate Change	N/A	The impact from the proposed Project on Climate Change is considered non-applicable.

Table 3: Summary of the potential flood risk impacts on surrounding areas as a result of the proposed Project.

6. Conclusions and Recommendations

6.1 Conclusions

This report provides an assessment of the flood risk issues that could affect the proposed Project and the surrounding area. The assessment has included desktop investigations into the potential flood risks and an assessment of the potential impacts the development could have on flood risk in the surrounding areas.

In the design of the project the following mitigation measures have been applied;

- The proposed finished ground levels along the Morell River are above the predicted flood levels.
- As the proposed works reduce onsite infiltration of runoff, surface water management systems have been included as part of the design to limit runoff from the site to greenfield rates.

Further to these mitigation measures all residual flood risks and impacts have been assessed as having a 'low' categorisation as the potential increase in flow discharging from the Project is being controlled by the planned surface water management system.

As per 'The Planning System and Flood Risk Management, Guidelines for Planning Authorities' (2009), a Justification Test was not deemed necessary for the works as there is no existing flood risk to the site and the site is not located in a Flood Zone.

6.2 Recommendations

It has been concluded that flood risks and impacts associated with the proposed Project are low or negligible, therefore further detailed modelling, i.e. Stage 3 Detailed Risk Assessment is not required.

On securing lands necessary to facilitate the remediation of the site, detailed design will be undertaken for the final surface water management system. This design will reaffirm the landscaping and ensure that levels are maintained above the predicted flood risk levels and meets the requirements of the EIS and the Surface Water Management Plan. These levels will need to be subsequently verified during the construction phase of the works.

Appendix A. Information Sources Checklist

No.	Information Source	Status	Reference/Comments
1	OPW Preliminary Flood Risk Assessment indicative fluvial flood maps	√	Eastern CFRAMS Preliminary Flood Risk Assessment Maps
2	National Coastal Protection Strategy Study flood and coastal erosion risk maps.	N/A	
3	Predictive and historic flood maps, and Benefiting Lands Map	√	
4	Predictive flood maps produced under the CFRAM studies	√	
5	River Basin Management Plans and reports	√	Kildare County Development Plan 2011 – 2017, Maps
6	Indicative assessment of existing flood risk under Preliminary Flood Risk Assessment	√	Eastern CFRAMS Flood Risk Review Report and Maps – Appendix C
7	Previous Strategic Flood Risk Assessments	√	1) Strategic Flood Risk Assessment for Kildare County Development Plan 2011-2017 2) Draft Strategic Flood Risk Assessment for Kildare Draft County Development Plan 2017-2023
8	Expert advice from OPW who may be able to provide reports containing the results of detailed modelling and flood-mapping studies including critical damage areas, and information on historic flood events and local studies etc.	N/A	
9	Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques.	√	
10	Information on flood defence condition and performance	N/A	
11	Alluvial deposit maps	N/A	
12	'Liable to Flood' markings on the old 6" Inch Map	√	Historic OSI 6" Map

13	Local Libraries and newspaper reports	√	Adequate information on Flooding History was provided by OPW floodmaps.ie.
14	Interviews with local people, local history/ natural history societies etc;	X	
15	Walkover survey to asses potential sources of flooding, likely routes for flood water and the site's key features, including flood defences, and their condition	X	
16	National , regional and local spatial plans, such as the National Spatial Strategy, regional planning guidelines, development plans and local area plans provide key information on existing and potential future receptors	√	The following Plans were referred to: 1) Kildare County Development Plan 2011-2017 2) Strategic Flood Risk Assessment for Kildare County Development Plan 2011-2017 3) Kildare Draft County Development Plan 2017-2023 4) Draft Strategic Flood Risk Assessment for Kildare Draft County Development Plan 2017-2023

Table 4: Information Checklist Table

Appendix B. OPW Summary Local Area Report

OPW National Flood Hazard Mapping

Summary Local Area Report

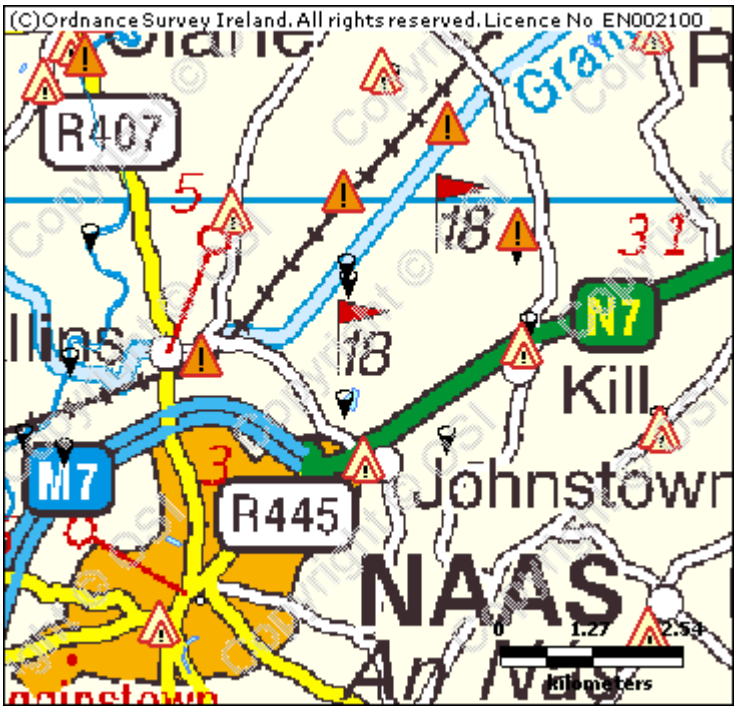
This Flood Report summarises all flood events within 2.5 kilometres of the map centre.

The map centre is in:

County: Kildare

NGR: N 919 229

This Flood Report has been downloaded from the Web site www.floodmaps.ie. The users should take account of the restrictions and limitations relating to the content and use of this Web site that are explained in the Disclaimer box when entering the site. It is a condition of use of the Web site that you accept the User Declaration and the Disclaimer.



Map Scale 1:105,097

Map Legend	
	Flood Points
	Multiple / Recurring Flood Points
	Areas Flooded
	Hydrometric Stations
	Rivers
	Lakes
	River Catchment Areas
	Land Commission *
	Drainage Districts *
	Benefiting Lands *

* Important: These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

7 Results

1. Monread Sallins Co Kildare 30th Nov 2009
Start Date: 29/Nov/2009
County: Kildare
Flood Quality Code:3
Additional Information: Reports (2) More Mapped Information

2. Morell Johnstown Nov 2000
Start Date: 05/Nov/2000
County: Kildare
Flood Quality Code:2
Additional Information: Reports (2) More Mapped Information

3. Kill River N7 road Nov 2000
Start Date: 05/Nov/2000
County: Kildare
Flood Quality Code:3
Additional Information: Reports (2) More Mapped Information

4. Kill River N7 road June 1993
Start Date: 10/Jun/1993
County: Kildare
Flood Quality Code:3
Additional Information: Reports (1) More Mapped Information

5. Morell Johnstown June 1993
Start Date: 10/Jun/1993
County: Kildare
Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

---

6. Flooding at Killeenmore, Co. Kildare 26th November 2013

Start Date: 26/Nov/2012

County: Kildare

Flood Quality Code:3

Additional Information: Reports (1) More Mapped Information

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7. Morell Johnstown Recurring

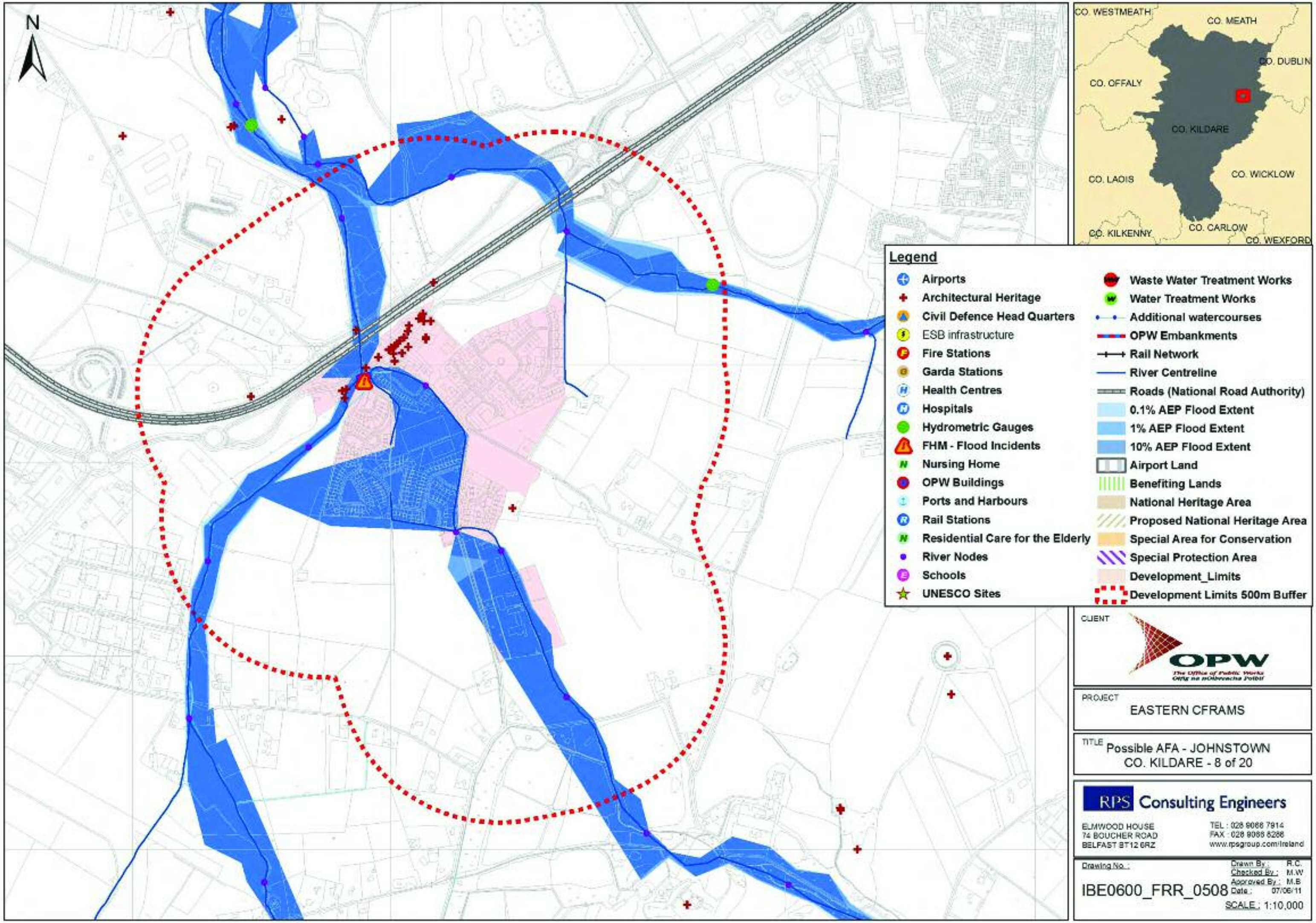
Start Date:

County: Kildare

Flood Quality Code:3

Additional Information: Reports (2) More Mapped Information

Appendix C. Eastern CFRAM Study – Flood Risk Review Maps


N
CO. WESTMEATH
CO. MEATH
CO. DUBLIN
CO. OFFALY
CO. KILDARE
CO. LAOIS
CO. WICKLOW
CO. KILKENNY
CO. CARLOW
CO. WEXFORD
Legend
Airports
Architectural Heritage
Civil Defence Head Quarters
ESB infrastructure
Fire Stations
Garda Stations
Health Centres
Hospitals
Hydrometric Gauges
FHM - Flood Incidents
Nursing Home
OPW Buildings
Ports and Harbours
Rail Stations
Residential Care for the Elderly
River Nodes
Schools
UNESCO Sites
Waste Water Treatment Works
Water Treatment Works
Additional watercourses
OPW Embankments
Rail Network
River Centreline
Roads (National Road Authority)
0.1% AEP Flood Extent
1% AEP Flood Extent
10% AEP Flood Extent
Airport Land
Benefiting Lands
National Heritage Area
Proposed National Heritage Area
Special Area for Conservation
Special Protection Area
Development_Limits
Development Limits 500m Buffer
CLIENT
OPW
The Office of Public Works
Oifig na nOibreacha Poiblí
PROJECT
EASTERN CFRAMS
TITLE
Possible AFA - JOHNSTOWN
CO. KILDARE - 8 of 20
RPS Consulting Engineers
ELMWOOD HOUSE
74 BOUCHER ROAD
BELFAST BT12 6RZ
TEL : 028 9066 7914
FAX : 028 9066 6266
www.rpsgroup.com/ireland
Drawing No. :
IBE0600_FRR_0508
Drawn By : R.C.
Checked By : M.W
Approved By : M.B
Date : 07/06/11
SCALE : 1:10,000



Legend

- Airports
- Architectural Heritage
- Civil Defence Head Quarters
- ESB infrastructure
- Fire Stations
- Garda Stations
- Health Centres
- Hospitals
- Hydrometric Gauges
- FHM - Flood Incidents
- Nursing Home
- OPW Buildings
- Ports and Harbours
- Rail Stations
- Residential Care for the Elderly
- River Nodes
- Schools
- UNESCO Sites
- Waste Water Treatment Works
- Water Treatment Works
- Additional watercourses
- OPW Embankments
- Rail Network
- River Centreline
- Roads (National Road Authority)
- 0.1% AEP Flood Extent
- 1% AEP Flood Extent
- 10% AEP Flood Extent
- Airport Land
- Benefiting Lands
- National Heritage Area
- Proposed National Heritage Area
- Special Area for Conservation
- Special Protection Area
- Development_Limits
- Development Limits 500m Buffer

CLIENT

OPW
The Office of Public Works
Oifig na nOibreacha Poiblí

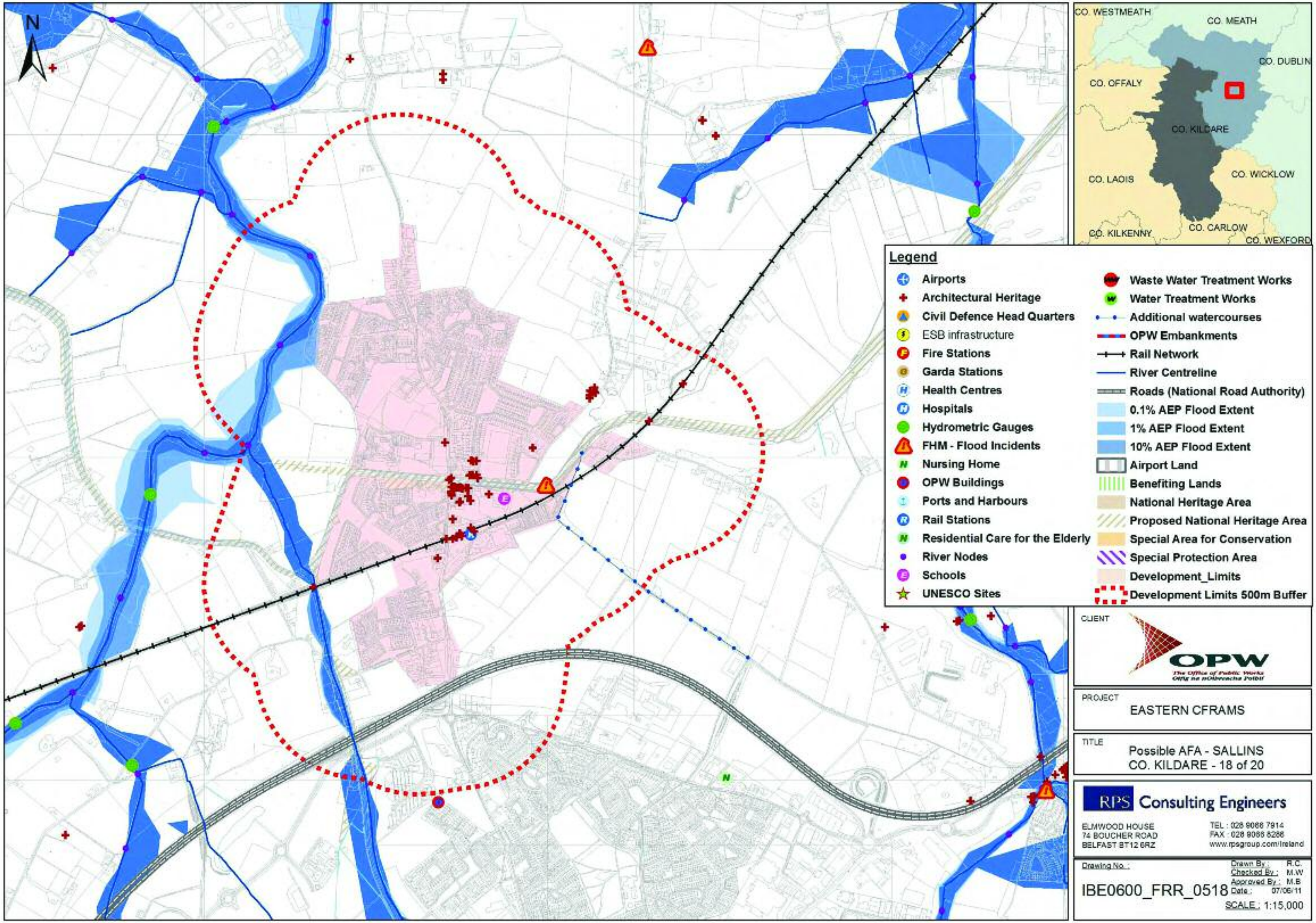
PROJECT
EASTERN CFRAMS

TITLE
Probable AFA - NAAS
CO. KILDARE - 15 of 20

RPS Consulting Engineers
ELMWOOD HOUSE
74 BOUCHER ROAD
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TEL : 028 9066 7914
FAX : 028 9066 6266
www.rpsgroup.com/ireland

Drawing No. : IBE0600_FRR_0515

Drawn By : S.N.
Checked By : M.W
Approved By : M.B
Date : 13/06/11
SCALE : 1:30,000



CLIENT

OPW
An Oifig na nOibreacha Poiblí

PROJECT

EASTERN CFRAMS

TITLE

Possible AFA - SALLINS
CO. KILDARE - 18 of 20

RPS Consulting Engineers
ELMWOOD HOUSE
74 BOUCHER ROAD
BELFAST BT12 6RZ
TEL : 028 9066 7914
FAX : 028 9066 6266
www.rpsgroup.com/ireland

Drawing No. :

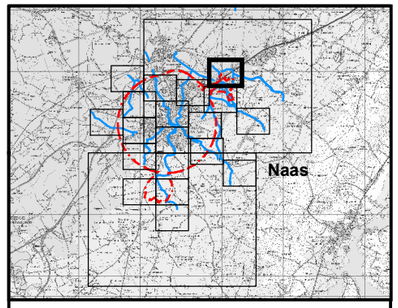
IBE0600_FRR_0518

Drawn By : R.C.
Checked By : M.W
Approved By : M.B
Date : 07/06/11

SCALE : 1:15,000

Appendix D. OPW Eastern CFRAMS Fluvial Flood Map

Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
01NAAS2400	81.27	N/A	81.45	N/A	82.23	N/A
09HART00185	87.74	6.86	88.16	11.97	88.49	18.39
09HART00177	87.27	6.97	87.64	11.90	88.11	21.39
09HART00137	84.82	N/A	85.25	N/A	85.63	N/A
09HART00096aD	82.46	7.20	82.73	11.54	82.91	20.20
09HAYN00008	83.88	1.47	84.07	2.09	84.33	3.56
09JOHN00004	83.47	0.08	84.11	0.39	84.37	0.91
09MORE00841	83.27	8.80	83.68	14.66	84.21	25.36
09MORE00834	83.14	10.33	83.53	16.82	83.84	30.47
09MORE00806	82.42	10.44	82.84	18.06	83.02	30.94
09MORE00782	82.08	N/A	82.51	N/A	82.83	N/A
09TOBE00050	89.64	0.11	89.68	0.20	89.74	0.37
09TOBE00007	87.27	0.33	87.64	0.44	88.11	2.62



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Amendments made to wire grid.	20/09/16

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

OPW Oifig na nOibreacha Poiblí The Office of Public Works
RPS

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Trim
Co Meath

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Map:	Naas Fluvial Flood Extents
Map Type:	EXTENT
Source:	FLUVIAL
Map Area:	HPW
Scenario:	CURRENT
Drawn By : C.C.	Date : 20 September 2016
Checked By : T.D.	Date : 20 September 2016
Approved By : G.G.	Date : 20 September 2016
Drawing No. :	E09NAA_EXFCD_F1_20
Map Series :	Page 20 of 21
Drawing Scale :	1:5,000 @ A3

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Appendix A13.2 Monitoring Details

1. Sampling Suites - Surface

Table 1: Comprehensive Suite (Six Monthly Sampling)

Metals and Metalloids
Aluminium
Arsenic
Boron
Barium
Beryllium
Calcium
Cadmium
Lead
Chromium
Copper
Iron
Mercury
Potassium
Magnesium
Manganese
Sodium
Antimony
Selenium
Vanadium
Zinc
Nickel
Indicator Parameters
BOD
COD
Electrical conductivity
Ammoniacal nitrogen (as N)
Total alkalinity
Total organic carbon (TOC)

Anions
Phosphates
Chloride
Nitrite
Nitrate
Sulphate
Sulphide
Free cyanide
Total cyanide
Petroleum Hydrocarbons
TPH (CWG)Polycyclic aromatic hydrocarbons
Polycyclic aromatic hydrocarbons (PAHs)
PAH (USEPA 16)
Volatile organic compounds (VOCs)
VOCs
Semi VOCs
Other Organics
Phenols (low level)
Formaldehyde
Pesticides
OCP and OPP pesticides (to include mecoprop)
Field Measurements
Dissolved oxygen
pH
Electrical Conductivity
Redox (Eh)
Temperature

Table 2: Key Parameter Suite (Monthly Sampling)

Metals and Metalloids
Potassium
Arsenic
Iron
Calcium
Manganese
Sodium
Indicator Parameters
BOD
COD
pH
TOC
Total alkalinity

Anions
Chloride
Nitrate
Sulphate
Total cyanide
Field Measurements
Dissolved oxygen
pH
Electrical Conductivity
Redox (Eh)
Temperature

In Situ sampling provided results for the following suite of parameters:

- Temperature;
- pH;
- Electrical Conductivity (EC);
- Dissolved Oxygen (DO); and
- Redox potential (Eh).

2. Surface Water Monitoring Results

Table 3: Six Monthly Surface Water Monitoring Sites

Analyte	Freq	Units	Fresh Water EQS (AA)	SW01 (Morell River upstream)						SW02					
Sampling Date				**Oct-13**	**Jul-14**	**Dec-14**	**Aug-15**	**Dec-15**	**Jun-16**	**Oct-13**	**Jul-14**	**Dec-14**	**Aug-15**	**Dec-15**	**Jun-16**
Calcium , Total as Ca	M	mg/l	-	123	96	112	100	123	98.5	94	90	107	97.7	116	98.9
Magnesium, Total as Mg	B	mg/l	-	12.3	11.7	11.2	12.6	10.6	11.8	9.2	11.3	9.4	12.2	8.5	10.8
Potassium , Total as K	M	mg/l	-	1.6	1.0	1.1	1.15	1.33	0.71	3.2	1.1	1.2	1.24	1.47	1.22
Sodium , Total as Na	M	mg/l	-	9.5	7.9	7.8	8.9	8.1	7.55	11.1	8.8	7.8	9.72	8.28	8.69
Alkalinity as CaCO3	M	mg/l	-	289	265	287	248	315	277	234	263	273	240	292	256
Sulphate as SO4	M	mg/l	-	18.9	14.7	16.4	15.2	18.4	15.7	25.6	17.0	16.0	17.1	49.3	17.6
Chloride as Cl	M	mg/l	-	18.7	17.0	16.2	19.5	17.2	19	20.4	18.5	16.2	19.4	16.2	17.7
Nitrate as NO3*	M	mg/l	-	13.4	11.8	11.0	13.8	10.5	12.5	9.8	13.1	10.2	12.7	9.9	14
Ammoniacal Nitrogen as N#	M	mg/l	-	<0.27	<0.06	<0.06	<0.06	<0.28	<0.06	<0.27	<0.06	<0.06	<0.06	<0.06	<0.06
Nitrite as NO2*	B	mg/l	-	<0.83	<0.083	<0.083	<0.083	<0.28	<0.28	<0.083	<0.083	<0.083	<0.083	<0.28	<0.28
Phosphates , Total as PO4*	B	mg/l	-	<0.120	<0.37	<0.37	<0.37	<0.120	<0.120	<0.120	<0.37	<0.37	<0.37	<0.120	<0.120
Boron, Total as B	B	mg/l	-	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23
Fluoride as F	B	mg/l	-	<0.2	<0.2	<0.2	0.1	0.1	0.1	<0.2	<0.2	<0.2	0.1	<0.1	0.1
Iron , Total as Fe	M	mg/l	-	1.1	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23
Manganese , Total as Mn	M	mg/l	-	0.22	0.03	0.03	0.008	0.04	<0.007	0.06	0.02	0.03	0.012	0.036	0.032
Arsenic, Total as As	M	µg/l	25	<1.4	<1.4	<1.0	<1	<1	<1	1.4	<1.4	<1.0	<1	<1	<1
Barium, Total as Ba	B	µg/l	-	88	69	77	73	79	68	69	68	70	72	68	65
Beryllium, Total as Be	B	µg/l	-	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
Cadmium , Total as Cd	B	µg/l	0.2	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chromium , Total as Cr	B	µg/l	5	<2.0	<2.0	<2.0	<2	<2	<2	<2.0	<2.0	<2.0	<2	<2	<2
Copper, Total as Cu	B	µg/l	5	<9.0	<9.0	<9.0	<1.9	2.2	<1.9	<9.0	<9.0	<9.0	<1.9	<1.9	<1.9
Lead , Total as Pb	B	µg/l	7.2	<6.0	<6.0	<6.0	<6	<6	<6	<6.0	<6.0	<6.0	<6	<6	<6
Nickel , Total as Ni	B	µg/l	20	3	<3.0	<3.0	<3	7	<3	3	<3.0	<3.0	<3	<3	8
Selenium, Total as Se	B	µg/l	-	<1.6	<1.6	2	<0.8	3.3	1.5	5	<1.6	2	0.8	2.7	1.1
Vanadium , Total as V	B	µg/l	-	<4.0	<4.0	<4.0	<4	<4	<4	<4.0	<4.0	<4.0	<4	<4	<4
Zinc, Total as Zn	B	µg/l	50	30	<18.0	<18.0	<18	<18	<18	<18	<18.0	<18.0	<18	<18	<18
Cyanide, Total	M	µg/l	-		14	<9.0	<9	<9	<9		<9.0	<9.0	<9	<9	<9
Conductivity- Electrical 20C	M	uS/cm							515						547
TOC (Filtered)	M	mg/l		1.5	1.7	1.3	<0.7	2.5	1.1	3.9	1.5	1.4	0.8	2.6	12.9
BOD + ATU (5 day)	M	mg/l			1	<1	<1	2	2	1.8	<1	<1	<1	1	1
COD (Total)	M	mg/l		<10	<10	<10	<10	7	<11	14	<10	<10	<10	<5	15
pH	M	pH units		8.36	8.1		8.12	8.13	8.14	7.88	8.18		8.13	8.38	8.19

Analyte	Freq	Units	Fresh Water EQS (AA)	SW03						SW05						Site Discharge					
Sampling Date				Oct-13	Jul-14	Dec-14	Aug-15	Dec-15	Jun-16	Oct-13	Jul-14	Dec-14	Aug-15	Dec-15	Jun-16	Oct-13	Jul-14	Dec-14	Aug-15	Dec-15	Jun-16
Calcium , Total as Ca	M	mg/l	-	93	89	115	98.3	116	101	101	95	111	88.1	115	99.6	29	29		20.2	25.1	17.8
Magnesium, Total as Mg	B	mg/l	-	8.8	10.9	10.0	12.3	8.5	11.1	9.4	11.5	9.6	11.2	8.4	10.8	1.4	1.8		<0.6	1.2	<0.6
Potassium , Total as K	M	mg/l	-	3.2	1.1	1.5	1.24	1.47	0.83	2.9	1.2	1.2	0.98	1.47	0.79	1.2	0.7		1.59	1.57	1.15
Sodium , Total as Na	M	mg/l	-	11.5	8.6	8.8	9.76	8.16	8.13	10.2	9.2	8.0	8.8	8.18	7.8	2.4	2.4		1.4	1.38	1.1
Alkalinity as CaCO3	M	mg/l	-	228	274	274	240	292	247	262	235	271	241	288	270	371	48		44.7	104	44.4
Sulphate as SO4	M	mg/l	-	27.0	17.4	16.1	16.7	19.5	18.7	26.4	18.2	16.1	16.4	17.1	16.8	14.1	10.1		12.6	20.1	5.3
Chloride as Cl	M	mg/l	-	20.1	18.2	15.8	20	16.2	18.5	21.0	17.9	16.8	17.7	17.8	18.8	6.3	7.0		4.23	<3.7	<3.7
Nitrate as NO3*	M	mg/l	-	9.2	11.9	10.0	12.3	9.9	10.8	9.3	11.0	13.4	12	9.8	11	<1.9	<1.9		<3.1	<3.1	<3.1
Ammoniacal Nitrogen as N#	M	mg/l	-	<0.27	<0.06	<0.06	<0.06	<0.06	<0.06	<0.27	<0.06	<0.06	<0.06	<0.06	<0.06	<0.27	<0.06		0.12	<0.06	0.15
Nitrite as NO2*	B	mg/l	-	<0..083	<0.083	<0.083	<0.083	<0.28	<0.28	<0.083	<0.083	<0.083	<0.083	<0.28	<0.28	<0.025	<0.083		<0.025	<0.28	<0.28
Phosphates , Total as PO4*	B	mg/l	-	<0.120	<0.37	<0.37	<0.37	<0.120	<0.120	<0.120	<0.37	<0.37	<0.37	<0.120	<0.120	<0.120	0.58		<0.37	<0.120	<0.120
Boron, Total as B	B	mg/l	-	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23		1.29	<0.23	<0.23
Fluoride as F	B	mg/l	-	-	<0.2	<0.2	0.1	<0.1	0.1	-	<0.2	<0.2	0.1	<0.1	0.1	<0.2	<0.2		<0.1	<0.1	<0.1
Iron , Total as Fe	M	mg/l	-	0.4	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	0.8	3.4		<0.23	<0.23	<0.23
Manganese , Total as Mn	M	mg/l	-	0.08	0.02	0.03	0.01	0.038	0.01	0.06	0.02	0.03	0.018	0.037	0.011	0.06	0.27		0.012	0.017	0.102
Arsenic, Total as As	M	µg/l	25	1.6	<1.4	<1.0	<1	<1	<1	<1.4	<1.4	<1.0	<1	<1	<1	3.5	9.4		<1	1.5	2.5
Barium, Total as Ba	B	µg/l	-	69	66	74	73	0.069	67	74	70	71	66	68	65	19	48		14	11	13
Beryllium, Total as Be	B	µg/l	-	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1		<2.1	<2.1	<2.1
Cadmium , Total as Cd	B	µg/l	0.2	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	0.6		<0.6	<0.6	<0.6
Chromium , Total as Cr	B	µg/l	5	<2.0	<2.0	<2.0	<2	<2	<2	<2.0	<2.0	<2.0	<2	<2	<2	<2.0	4.0		<2	<2	<2
Copper, Total as Cu	B	µg/l	5	<9.0	<9.0	<9.0	<1.9	<1.9	<1.9	<9.0	<9.0	<9.0	2.3	<1.9	<1.9	18	21		2.9	2.8	3.9
Lead , Total as Pb	B	µg/l	7.2	<6.0	<6.0	<6.0	<6	<6	<6	<6.0	<6.0	<6.0	<6	<6	<6	<6	25		<6	<6	<6
Nickel , Total as Ni	B	µg/l	20	4	<3.0	<3.0	<3	4	<3	5	<3.0	<3.0	4	3	<3	4	9		<3	<3	<3
Selenium, Total as Se	B	µg/l	-	4	<1.6	2	<0.8	2.7	1.5	5	<1.6	1	0.9	3	1.6	<1.6	<1.6		<0.8	<0.8	<0.8
Vanadium , Total as V	B	µg/l	-	<4.0	<4.0	<4.0	<4	<4	<4	5	<4.0	<4.0	<4	<4	<4	4	9		<4	<4	<4
Zinc, Total as Zn	B	µg/l	50	<18	<18.0	<18.0	<18	<18	<18	<18	<18.0	<18.0	<18	<18	<18	90	90		<18	70	20
Cyanide, Total	M	µg/l	-		<9.0	<9.0	<9	<9	<9		<9.0	<9.0	<9	<9	<9		<9.0		<9	<9	<9
Conductivity- Electrical 20C	M	uS/cm							515						520						100
TOC (Filtered)	M	mg/l		3.8	1.5	1.3	<0.7	2.6	1.3	3.9	1.7	1.5	<0.7	2.5	1.4	9	5.8		3.2	1	2.2
BOD + ATU (5 day)	M	mg/l			<1	<1	<1	1	1		<1	<1	<1	3	2		4	N/S	<1	<1	1
COD (Total)	M	mg/l		16	<10	<10	<10	<5	<11.0		<10	<10	<10	<5	<11.0	34	170	N/S	<10	<5	<11.0
pH	M	pH units		7.66	8.18		8.15	8.35	8.16	7.83	8.01		8.14	8.25	8.15				7.98	7.58	7.5

Analyte	Freq	Units	Fresh Water EQS (AA)	SW11						SW13					
Sampling Date				Oct-13	Jul-14	Dec-14	Aug-15	Dec-15	Jun-16	Oct-13	Jul-14	Dec-14	Aug-15	Dec-15	Jun-16
Calcium , Total as Ca	M	mg/l	-	114	117	115	99.7	113	103	150	120	150	103	80	68.2
Magnesium, Total as Mg	B	mg/l	-	7.0	8.8	9.3	8.6	8.4	6.7	8.2	6.3	8.4	5.5	4.3	3.8
Potassium , Total as K	M	mg/l	-	4.8	1.9	2.2	2.23	2.91	2.9	4.1	2.5	3.5	3.6	1.7	1.45
Sodium , Total as Na	M	mg/l	-	91.9	29.8	15.6	16.3	17.7	35.9	43.1	34.6	53.6	40.8	24.5	21.1
Alkalinity as CaCO3	M	mg/l	-	313	299	319	245	255	267	395	340	355	244	167	169
Sulphate as SO4	M	mg/l	-	32.5	22.7	17.5	16.9	20.9	25.7	31.1	27.7	45.6	33.6	37.3	22.9
Chloride as Cl	M	mg/l	-	136.0	48.9	31.0	29.5	32.1	51.6	62.0	53.1	88.3	62.1	38.8	36.7
Nitrate as NO3*	M	mg/l	-	4.7	8.9	11.9	6.9	9.6	4.8	<1.9	<1.9	2.8	<3.1	<3.1	<3.1
Ammoniacal Nitrogen as N#	M	mg/l	-	<0.27	<0.06	<0.06	0.07	<0.06	<0.06	5.0	2.9	1.3	3.3	0.7	0.62
Nitrite as NO2*	B	mg/l	-	0.11	0.18	<0.083	<0.28	<0.28	<0.28	<0.083	<0.083	<0.083	<0.025	<0.28	<0.28
Phosphates , Total as PO4*	B	mg/l	-	0.15	<0.37	<0.37	<0.37	0.16	<0.120	0.46	0.67	0.55	2.21	0.19	<0.120
Boron, Total as B	B	mg/l	-	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	<0.23	1.74	<0.23	<0.23
Fluoride as F	B	mg/l	-	0.3	<0.2	<0.2	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.5
Iron , Total as Fe	M	mg/l	-	0.4	<0.23	<0.23	<0.23	<0.23	<0.23	1.7	1.2	1.4	1.4	1.2	0.58
Manganese , Total as Mn	M	mg/l	-	0.12	0.02	0.02	0.021	0.009	0.028	0.73	0.43	0.60	0.48	0.26	0.169
Arsenic, Total as As	M	µg/l	25	<1.4	<1.4	<1.0	<1	<1	<1	5.7	6.8	3.8	4.6	5.2	4.1
Barium, Total as Ba	B	µg/l	-	73	74	66	62	59	61	119	89	106	72	53	42
Beryllium, Total as Be	B	µg/l	-	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1	<2.1
Cadmium , Total as Cd	B	µg/l	0.2	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6
Chromium , Total as Cr	B	µg/l	5	<2.0	<2.0	<2.0	<2	<2	<2	<2.0	<2.0	<2.0	<2	4.0	4
Copper, Total as Cu	B	µg/l	5	<9.0	<9.0	<9.0	2.2	2	4.4	<9.0	<9.0	<9.0	<1.9	8	3.9
Lead , Total as Pb	B	µg/l	7.2	<0.6	<6.0	<6.0	<6	<6	<6	<0.6	<6.0	<6.0	<6	<6	<6
Nickel , Total as Ni	B	µg/l	20	10	5	5	3	3	8	<3	<3.0	<3.0	<3	9	16
Selenium, Total as Se	B	µg/l	-	<1.6	4	2	<0.8	1.8	1.7	<1.6	<1.6	2	<0.8	<0.8	<0.8
Vanadium , Total as V	B	µg/l	-	<4	<4.0	7	<4	<4	<4	7	6	9	<4	<4	<4
Zinc, Total as Zn	B	µg/l	50	60	<18.0	<18.0	<18	<18	<18	<18	<18.0	<18.0	<18	50	<18
Cyanide, Total	M	µg/l	-		<9.0	<9.0	<9	<9	<9		<9.0	<9.0	<9	<9	<9
Conductivity- Electrical 20C	M	uS/cm							620						444
TOC (Filtered)	M	mg/l		3.4	3.1	2.6	2.7	4	3	7.8	9.2	6.6	5.9	4.7	3
BOD + ATU (5 day)	M	mg/l			<1	2	1	3	1		2	2	3	2	3
COD (Total)	M	mg/l		<20	<10	35	<10	13	<11.0	27	22	11	20	87	12
pH	M	pH units		8.16			7.79	8.1	7.75	7.64			7.56	7.44	7.19

Appendix A13.3 Biological Q-rating Assessment of the Morell River

WATER QUALITY ASSESSMENT OF THE MORELL AND HARTWELL RIVERS ADJACENT TO THE KERDIFFSTOWN FACILITY IN CO. KILDARE

FINAL REPORT

PREPARED BY AQUENS LTD.

DECEMBER 2012

INTRODUCTION

AQUENS Ltd. was commissioned by Environmental Protection Agency to undertake a biological assessment of the water quality of the Morell and Hartwell River, Co. Kildare to assess the potential impact the Kerdiffstown facility may be having on the aquatic habitat. In December 2012 an assessment was undertaken at six sampling localities on the Morell River and one on the Hartwell stream to assess the upstream and downstream water quality as indicated by the benthic macroinvertebrate community. As the Hartwell River joins the Morell River adjacent to the Kerdiffstown facility the water quality of the Hartwell River and its influence in the Morell River had to be included during this assessment.

MATERIALS & METHODS

The water quality assessment was undertaken using the benthic macroinvertebrates as bioindicators. These are an excellent tool for water quality assessment as they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They provide a realistic record of the prevailing water quality conditions.

On request of the client macroinvertebrate sampling took place on 11th December 2012. Seven sites were selected on the Morell and Hartwell Rivers and positioned to indicate the upstream and downstream water quality in relation to the facility (Figure 1). As the Hartwell River joins the Morell River along the length of the river that may be affected by the facility both upstream and downstream of the confluence had to be included (Plate 1M&H). One upstream site (M1) provides an indication of the water quality entering the area, and the other sites provided the progression downstream (M2 to M6) (Figure 1). One site (H1) provides the water quality status of the Harwell River (Figure 1), the location of the tributary and feeder streams of the constructed ponds on the golf course are not as indicated on the OSI maps. The characteristics of the sites are provided in Table 1 and these have been taken into account in the interpretation of the water quality. These measurements do no provide an exhaustive account of the physical conditions of the sampling sites.

Table 1: Site characteristics at each of the seven sites assessed on the Morell and Hartwell Rivers.

Sampling Site (OSI)	Width	Depth	T°C	DO	pH	Cond.	Dominant Substrates	In-stream Vegetation	Flow Conditions
Morell River									
M1 (N918 216)	3.6	0.55	5.0	10.08	7.96	781	Gravel, Sand (Fine & Course)	*Ranunculus* spp., good marginal	Deep fast flowing run
M2 (N918 219)	3.1	0.35	6.0	9.39	8.02	695	Sand (F & C) some Gravel	None	Shallow depositing
M3 (N918 220)	3	0.30	5.8	10.20	8.06	690	Gravel, Sand and some cobble	Some *Ranunculus* spp.	Fast shallow run
M4 (N915 222)	4.3	0.25	5.7	10.73	8.48	680	Cobble, Gravel & Sand	little *Fontinalis* spp.	Glide, Run & Riffle
M5 (N914 225)	4.4	0.30	5.5	11.60	8.44	688	Cobble, Gravel & Sand	little *Fontinalis* spp.	Run & Riffle some glide
M6 (N916 227)	3.2	0.45	5.8	12.18	7.97	662	Cobble, Gravel & Sand	little *Fontinalis* spp.	Glide, Run & Riffle
Hartwell River									
H1 (N919 220)	3.0	0.32	5.0	10.18	8.28	708	Compact clay, Gravel and some Cobble & Boulders	None	Fast Riffle & Run

The sampling method adopted was that applied by the EPA in the national river monitoring programme (McGarrigle *et. al*., 2002). Using an FBA (Freshwater Biological Association) pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one minute stone-washing was also undertaken. The samples were preserved in 70% IMS and processed in the laboratory. They were sorted in an illuminated tray and all the macroinvertebrates were identified to the appropriate taxonomic resolution using FBA taxonomic keys.

The macroinvertebrate data were used to derive a Q-value using the EPA methodology (McGarrigle *et al*., 2002). This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances. Two other biotic indices (BMWP and ASPT) were calculated. The BMWP score is based on the presence of pollution-tolerant to pollution-sensitive families. Each family is assigned a score. The BMWP score is the sum of these family scores. Families that are sensitive to pollution are assigned higher scores than pollution-tolerant families. A

high overall score indicates that the water quality is good. The ASPT is determined by dividing the BMWP score by the number of scoring taxa yielding a score between 1 and 10, values >6 usually indicate excellent water quality. In addition, the taxon richness and the percentage of Ephemeroptera/Plecoptera/Trichoptera (%EPT) were determined.

A range of physical (average depth and width, mesohabitat type and substrate composition) and chemical characteristics (dissolved oxygen, temperature, conductivity and pH) were determined on site using hand-held meters (Table 1).

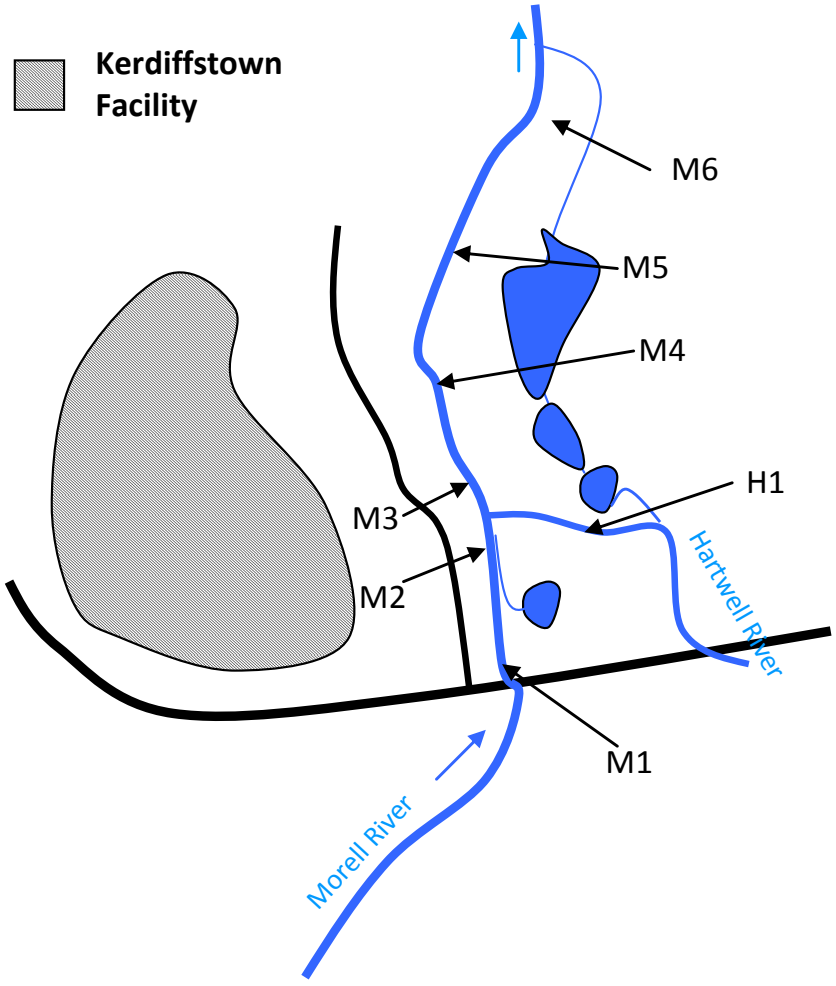


Figure 1: Schematic diagramme showing the location of sampling sites M1-6 on the Morell River and H1 on the Hartwell River in relation to the Kerdiffstown facility.



Plate 1: Sites assessed on the Morell (M) and Hartwell (H) Rivers adjacent to Kerdiffstown facility. M1 upstream, M2 upstream of two tributaries, M3 ~30m downstream of tributaries, M4, M5 & M6 further downstream, H1 50m before it joins the Morell River, M&H site where the Hartwell (left) and drainage ditch (right) joins the Morell River.

RESULTS

Site Characteristics

Sites on both rivers show that the river has been channelized in the past as the bank sides are high (1m -1.5m) throughout. The sampling sites were relatively fast flowing with little in-stream vegetation, with the exception of *Ranunculus* spp. at site M1 and M3 (Table 1). Most of the substrates were clean and sites appeared scoured. The water chemistry is indicative of the soil and geology in the area with high pH and conductivities (Table 1). Oxygen levels were within normal ranges (9.39 & 12.08 mg/l).

Benthic Invertebrates

A total of 43 taxa were recorded during the survey, with individual sites recording between 19 and 29 taxa in the single, 2-minute kick sample taken at each site (Table 2). Overall the list of species was well represented by the more sensitive groups, including Ephemeroptera, Plecoptera and Trichoptera making up almost half of the taxon richness. The cased caddis were not well represented, probably as a result of the fast flow, lack of in-stream and marginal vegetation and lack of sheltered habitats.

Water Quality

Several metrics were applied to the benthic invertebrates collected at each site. The Q-values were assigned on the basis of the sensitivity groups present in abundance, % representation and taxon richness (Table 3). It is clear that the two upstream sites (M1 & M2) have fewer Group A & B taxa present and a dominance of Group C. Although the flow was good the substrate at M2 was poor with very little suitable substrate available. With the result, few Heptigeniidae and Plecoptera were recorded. There was also no broken flow and exposed substrates at M1 presenting little habitat suitable for mayflies and stoneflies, although better substrates were present in the deeper run and glide at M1 compared to M2. The status at these two sites was assigned bearing this in mind. All the other sites had suitable habitat present and the status could be assigned with not adjustments needed to account for the lack of suitable substrates.

Table 2: Benthic invertebrate species recorded at sampling site.

Order/Group	Family	Species/genus	M1	M2	M3	M4	M5	M6	H1
Crustacea	Asellidae	*Asellus aquaticus* (L.)	94	12	9	6	4	5	7
	Gammaridae	*Gammarus duebeni* (Lilj.)	660	130	348	59	152	177	94
	Astacidae	*Austropotamobius pallipes* (L.)	1						1
Ephemeropte	Baetidae	*Baetis rhodani* (Pictet.)	213	65	396	140	568	122	360
		Alianites muticus (L.)	4		12	20	24	14	15
	Ephemerelliidae	*Seratella ignita* (Poda)	1						
	Ephemeridae	*Ephemera danica* L.			1				
	Heptageniidae	*Ecdyonurus* spp.			12		16		9
		Rhithrogena semicolorata (Curtis)	4	3	196	584	500	315	282
Plecoptera	Leuctridae	*Leuctra spp.*	2		7	9	4	7	8
	Perlodidae	*Isoperla grammatica* (Poda)	3		27	25	20	15	24
		Siphonoperla torrentium (Pictet)				2	1	1	
	Neumoridae	*Protnemura meyeri* (Pictet)		1			1		
Trichoptera	Hydropsychidae	*Hydropsyche siltalai* (Döhler)	5	4		4	8	3	3
		H. fulvipes (Curtis)	5	3	10	4	20	12	2
		Hydropsyche sp.	93	64	78	112	600	112	41
	Polcentropodida	*Plectrocnemia* spp.	2		1				
	Rhyacophilidae	*Rhyacophila dorsalis* (Curtis)	8	3	6		8	15	2
	Psychomyiidae	*Lype phaeopa* (Stephens)	16		4			9	1
		Lype reducta (Hagen)		10					1
	Limnephilidae	*Micropterna sequax* McLachlan	4						1
		Chaetopteryx villosa (Fab.)	2		3	3		3	
	Sericostomatidae	*Sericostoma personatum* (Spence in K & S)			1	1			
	Lepidostomatida	*Lepidostoma hirtum* (Fabricius)	2	2			3		
	Glossosomatidae	spp. indet.					1		
Coleoptera	Elmidae	*Elmis aenea* (Müller)	8	2	3	13	8	16	2
		Oulimnius tuberculatus (Müller)						1	
		Limnius volckmari (Panzer)	7	4	4	4	3	3	3
		Esolus parallelepipedus (Müller)	4	2	5	17	3	26	3
Mollusca	Sphaeriidae	*Sphaerium/Pisidium* spp.				2		1	
	Hyrobiidae	*Potamopyrgus antipodarum* (Gray)			1			1	
	Lymnaeidae	*Lymnaea peregra* (Müller)	5	1					
Hirudinea	Erpobdellidae	*Erpobdella octoculata* (L.)		1	1	1	1	2	4
Diptera	Chironomidae	spp. indet.	37	9	12	9	6	22	
	Simuliidae	spp. indet.	52	5	264	256	160	20	256
	Tipulidae	*Tipula* spp.	1		2	1			
	Pedicidae	*Dicranota* spp.	6	2	16	12	5	30	7
	Limonidae	*Antocha* spp.	8			1	6	67	
	Empedidae	spp. indet.	3		1		1	1	
	Muscidae	Limnophora spp.							1
	Ceratapogonidae	spp. indet.						1	
	Psychodidae	spp. indet.			1			1	1
Oligochaeta	Oligochaeta	spp. indet.	51	35	9	37	13	31	22
Arachnida	Hydracarnia	spp. indet.	1				1	6	

Table 3: The representation of each invertebrate group as separated by the Q-value system in each of the sampling sites.

Q-value Grouping	M1	M2	M3	M4	M5	M6	H1
Total Abundance							
Group A	12	4	248	631	562	345	331
Group B	10	2	11	13	8	10	9
Group C	1129	303	1152	632	1548	1649	777
Group D	150	49	19	46	18	39	33
Group E	0	1	6	2	3	4	5
Percentage							
Group A	0.9	1.1	17.3	47.7	26.3	16.9	28.8
Group B	0.8	0.6	0.8	1.0	0.4	0.5	0.8
Group C	86.8	84.6	80.6	47.8	72.5	80.7	67.6
Group D	11.5	13.7	1.3	3.5	0.8	1.9	2.9
Group E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of Taxa							
Group A	4	2	5	4	6	4	5
Group B	4	1	3	3	3	2	2
Group C	18	13	17	13	14	19	15
Group D	3	4	3	4	3	4	3
Group E	0	1	6	2	3	4	5

All the sites except the two upsteam sites M1 & M2 were assigned a Q4-5, indicating that the sites had good ecological status (Table 4). The two sites M1 & M2 were assigned a Q4 which represents good ecological status but does indicate that the water quality is poorer upstream of the point at which the Hartwell enters the Morell River. The BMWP and ASPT values seem to be broadly in line with the Q values assigned (Table 4). The ASPT indicates that the community was dominated by sensitive taxa with values ranging between 5.44 and 6.32 (Table 4). The % EPT shows that most of the taxa belonged to this group, in terms of their abundances, with the lowest recorded at M1 & M2, again in keeping with the lower Q values assigned.

Table 4: Water quality scores, metric scores and invertebrate richness and abundances for 7 sampling sites.

	M1	M2	M3	M4	M5	M6	H1
Q value	Q4	Q4	Q4-5	Q4-5	Q4-5	Q4-5	Q4-5
BMWP	149	87	123	99	120	113	89
ASPT	6.21	5.44	6.15	5.82	6.32	5.65	5.93
Scoring	24	16	20	17	19	20	15
EPT Taxa (%)	28.0	43.3	52.7	68.4	83.0	79.9	65.1
Taxon Richness	29	19	27	23	26	29	24
Total Abundance	1301	358	1430	1322	2136	2043	1150

CONCLUDING COMMENTS

It is clear that both these rivers have been modified in the past, probably in order to prevent flooding and to redirect the stream to supply the ponds in the golf course. This has provided limited suitable habitat for the deposition of materials and the formation of a healthy marginal vegetation, which would provide suitable habitat for taxa that require more sheltered habitats (such as cased Trichoptera, various Coleoptera and Hemiptera). The sampling sites were all quite scoured and the invertebrate community recorded reflects this condition. However, the water quality is still quite reasonable and there are numerous sensitive taxa present in large abundances, such as *Rhithrogena* sp. and *Isoperla grammatica*. As a result of the high EPT taxa most of the sites were assigned a Q4-5, representing good ecological status. It appears that the Hartwell River is improving the water quality of the Morell River as the sites downstream of the confluence have a better ecological quality than the two upstream sites. Therefore, a pressure further upstream is probably reducing the water quality before it flows adjacent to the Kerdiffstown facility. As the water quality remains good throughout the length of the Morell River assessed during this survey, there does not seem to be deterioration in the ecological status as a result of the Kerdiffstown facility. As the assessment was completed in December the status as indicated here should be interpreted with some care particularly if direct comparisons between this and past surveys completed by the EPA (as part of their monitoring programme) are made. However, the upstream downstream comparisons are still appropriate and the trend downstream indicates that there are

no discernible changes to the invertebrate community as a result of the facility. It may be advisable to conduct bank side assessments in the summer, when water levels may be lower and temperatures higher, to confirm the status and have comparable values to previous EPA surveys, which are usually completed during the summer months.

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WATER QUALITY ASSESSMENT OF THE MORELL AND HARTWELL RIVERS ADJACENT TO THE KERDIFFSTOWN FACILITY IN CO. KILDARE

FINAL REPORT

PREPARED BY AQUENS LTD.

OCTOBER 2015

INTRODUCTION

AQUENS Ltd. was commissioned by Environmental Protection Agency to undertake a biological assessment of the water quality of the Morell and Hartwell River, Co. Kildare to assess the potential impact the Kerdiffstown facility may be having on the Morell stream. A water quality assessment was undertaken at six sampling localities on the Morell River and one on the Hartwell stream to assess the upstream and downstream water quality as indicated by the benthic macroinvertebrate community. As the Hartwell River joins the Morell River adjacent to the Kerdiffstown facility the water quality of the Hartwell River and its influence in the Morell River had to be included to complete the water quality assessment. The same assessment was conducted in 2012 which assigned the Morell river a Q4, which indicated that there was no discernable impact arising from the facility. The national monitoring programme has shown that both these rivers have been impacted in the past with Q-values as low as Q3 recorded (www.epa.ie last accessed November 2015). The most recent water quality results (2013) indicate that the Morell river has deteriorated from 2012 with a Q3 above Kerdiffstown and improving to a Q3-4 ~1.5km below. Similarly the Hartwell had also deteriorated from 2012 and was assigned a Q3-4 in 2013.

MATERIALS & METHODS

The water quality assessment was undertaken using the benthic macroinvertebrates as bioindicators. These are an excellent tool for water quality assessment as they exhibit differential responses to physical and chemical changes in their environment. Some macroinvertebrates are sensitive to pollution while others are tolerant. They provide a realistic record of the prevailing water quality conditions.

On request of the client macroinvertebrate sampling took place on 11th October 2015. The same seven sites were sampled on the Morell and Hartwell Rivers to compare to a previous survey conducted (Baars & Kelly-Quinn, 2012). The sites were positioned to indicate the upstream and downstream water quality in relation to the facility (Figure 1). As the Hartwell River joins the Morell River along the length of the

river that may be affected by the facility both upstream and downstream of the confluence were included (Plate 1M&H). One upstream site (M1) provides an indication of the water quality entering the area, and the other sites provided the progression downstream (M2 to M6) (Figure 1). One site (H1) provides the water quality status of the Harwell River (Figure 1), the location of the tributary and feeder streams of the constructed ponds on the golf course are not as indicated on the OSI maps. The indicative site characteristics are provided in Table 1 to assist in the interpretation of the water quality. These measurements do no provide an exhaustive account of the physical conditions of the sampling sites.

Table 1: Characteristics of the sampling sites on the Morell and Hartwell Rivers.

Sampling Site (OSI)	Width	Depth	T°C	DO	pH	Cond.	Dominant Substrates	In-stream Vegetation	Flow Conditions
Morell River									
M1 (N918 216)	3.6	0.55	9.9	10.28	7.74	602	Gravel, Sand (Fine & Course)	*Ranunculus* spp., *Fontinalis*, *Apium* & good marginal	Deep fast flowing run
M2 (N918 219)	3.1	0.35	9.5	15.03	8.12	604	Sand (F & C) some Gravel	Algae & little *Fontinalis* spp.	Shallow depositing, limited riffle
M3 (N918 220)	3	0.30	9.5	12.26	8.61	590	Gravel, Sand and some cobble	*Ranunculus* spp., *Fontinalis* spp., Filamentous algae	Fast shallow run & riffle
M4 (N915 222)	4.3	0.25	9.3	12.19	8.23	610	Cobble, Gravel & Sand	little *Fontinalis* spp.	Glide, Run & Riffle
M5 (N914 225)	4.4	0.30	9.5	12.89	8.43	620	Cobble, Gravel & Sand	little *Fontinalis* spp., *Apium nodiflorum*	Run & Riffle some glide
M6 (N916 227)	3.2	0.45	9.4	13.21	8.01	618	Cobble, Gravel & Sand	little *Fontinalis* spp.	Glide, Run & Riffle
Hartwell River									
H1 (N919 220)	3.0	0.32	9.4	12.46	8.20	531	Compact clay, Gravel and some Cobble & Boulders	Filamentous algae & *Fontinalis* sp.	Fast Riffle & Run

The sampling method adopted was that applied by the EPA in the national river monitoring programme (McGarrigle *et. al*., 2002). Using an FBA (Freshwater Biological Association) pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one minute stone-washing was also undertaken. The samples were preserved in 70% IMS and processed in the laboratory. They were sorted in an illuminated tray and all the macroinvertebrates were identified to the appropriate taxonomic resolution using FBA taxonomic keys.

The macroinvertebrate data were used to derive a Q-value using the EPA methodology (McGarrigle *et al*., 2002). This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances (Appendix A). Two other biotic indices (BMWP and ASPT) were calculated (See Appendix B). The BMWP score is based on the presence of pollution-tolerant to pollution-sensitive families. Each family is assigned a score. The BMWP score is the sum of these family scores. Families that are sensitive to pollution are assigned higher scores than pollution-tolerant families. A high overall score indicates that the water quality is good. The ASPT is determined by dividing the BMWP score by the number of scoring taxa yielding a score between 1 and 10, values >6 usually indicate good water quality. In addition, the taxon richness and the percentage of Ephemeroptera/Plecoptera/Trichoptera (%EPT) were determined.

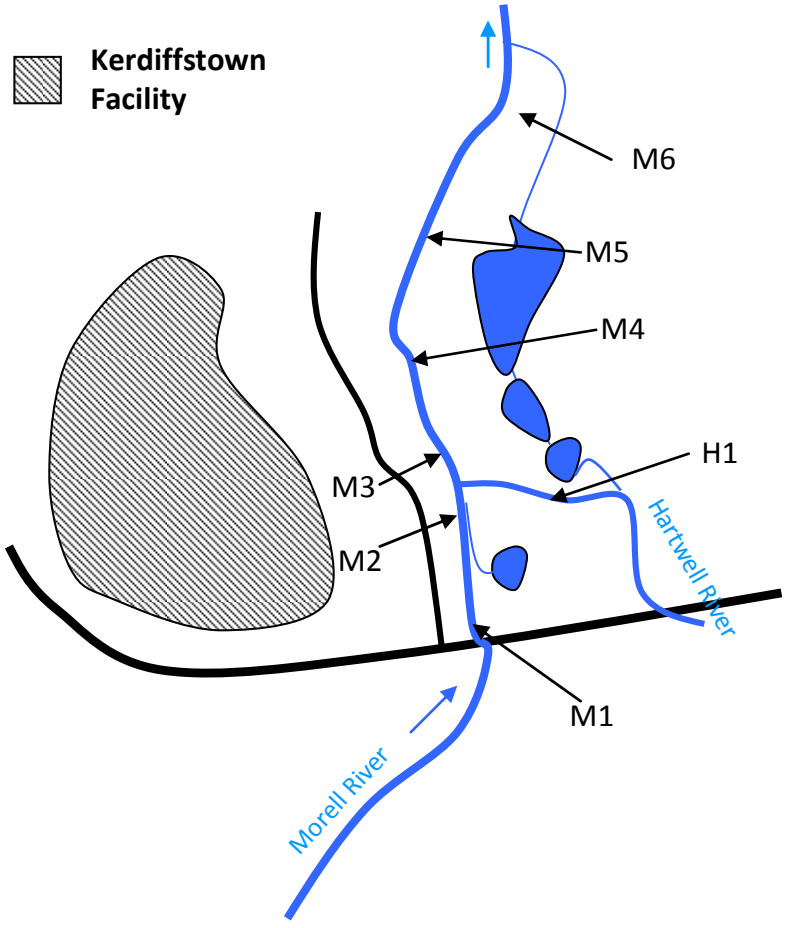


Figure 1: Schematic diagramme showing the location of sampling sites M1-6 on the Morell River and H1 on the Hartwell River in relation to the Kerdiffstown facility.



Plate 1: Sites assessed on the Morell (M) and Hartwell (H) Rivers adjacent to Kerdiffstown facility. M1 upstream, M2 upstream of two tributaries, M3 ~30m downstream of tributaries, M4, M5 & M6 further downstream, H1 50m before it joins the Morell River, M&H site where the Hartwell (left) and drainage ditch (right) joins the Morell River.

A range of physical (average depth and width, mesohabitat type and substrate composition) and chemical characteristics (dissolved oxygen, temperature, conductivity and pH) were determined on site using hand-held meters (Table 1).

RESULTS

Site Characteristics

As in the previous survey the banks of both rivers are disconnected from the adjacent habitat due to past flood relief/river redirection works. Most of the banks were at least >1m in height and steep sided. Most of the sites were relatively fast flowing with little in-stream vegetation, with the exception of *Fontinalis* sp., *Ranunculus* spp., liverworts and some filamentous algae (see Table 1). Most of the substrates were relatively clean but largely consolidated through calcification leaving little loose cobble and coarse gravel available for invertebrates. Sites did have accumulations of fine sand and sediments. Very few boulders were present and most sites appeared scoured. The water chemistry is indicative of the soil and geology in the area with high pH and conductivities (Table 1). Oxygen levels were within normal ranges (80-120%) with the exception of Site M2 & M6 (>120%).

Benthic Invertebrates

A total of 42 taxa were recorded during the survey, with individual sites recording between 19 and 30 taxa in the single, 2-minute kick sample taken at each site (Table 2). Overall the list of taxa were dominated in diversity by the less sensitive species, with only 17 taxa belonging to the Ephemeroptera, Plecoptera and Trichoptera (EPT) groups considered more pollution sensitive. In terms of abundance EPT made up the majority of the taxa at only four of the seven sites. One of the notable absences were the cased caddis (Trichoptera) as had been noted in the previous assessment (Baars and Kelly-Quinn, 2012), again probably as a result of the fast flow, embedded substrates and limited marginal vegetation (steep disconnected river banks) that usually offer sheltered microhabitats.

Water Quality

Several metrics were applied to the benthic invertebrates collected at each site. The Q-values were assigned on the basis of the sensitivity groups present in abundance, % representation and taxon richness (Table 3). It is clear that the two upstream sites (M1 & M2) have fewer Group A & B taxa present and a dominance of Group C. It is noteworthy that the substrate and habitats at both these sites were limited. Site M1 was deep largely dominated by embedded course gravel and cobble with very limited riffle habitat. Site M2 had some riffles present but largely dominated by fine sediment and where coarse substrates occurred these were largely embedded as a result of calcification. As a result of the lack of riffles and suitable substrates more time was spent sampling where suitable habitats occurred. This was taken into account when the Q-value assessment was done. At all the other sites there was enough suitable habitat/substrate to return a reliable sample.

Sites M1, M2 & M3 were assigned a Q3 and are thus moderately polluted. These three sites were dominated by Group C taxa with low abundances and diversity of Group A & B (Table 3 & Table 4). Site M3 is ~50m below the point at which the Hartwell river enters the Morell river. The site on the Hartwell was assigned a Q3-4, on the basis of the high proportion of Group C and relatively higher proportion of Group B. The Hartwell at this point is considered slightly polluted. All the sites further downstream on the Morell were assigned a Q 3-4 and are considered slightly polluted. The ASPT values are in broad alignment with the Q values (Table 4), with the exception of M4 & M5 which have a lower Q value assigned considering the ASPT values were 6.31 & 6.0 respectively. This was as a result of the low % abundance in Group B. The EPT were well represented in terms of their abundance, but were largely made up of those considered less sensitive, e.g. *Baetis rhodani* and *Hydropsyche* species.

Table 2: Benthic macroinvertebrate taxa recorded at each sampling site.

Order/Group	Family	Species/genus	M1	M2	M3	M4	M5	M6	H1
Crustacea	Asellidae	*Asellus aquaticus* (L.)	10	8	3	5	6	4	17
	Gammaridae	*Gammarus duebeni* (Lilj.)	297	47	55	31	102	62	15
	Astacidae	*Austropotamobius pallipes* (L.)				1			
Ephemeroptera	Baetidae	*Baetis rhodani* (Pictet.)	105	10	266	61	27	103	155
		Alianites muticus (L.)	3	2	5	5	3	1	1
	Ephemerelliidae	*Seratella ignita* (Poda)	2			2	2	1	
	Heptageniidae	*Ecdyonurus* spp.							2
		Rhithrogena semicolorata (Curtis)				1			3
Plecoptera	Leuctridae	*Leuctra fusca* L.			6	27	2	11	19
		Leuctra spp.					1	1	11
	Perlodidae	*Isoperla grammatica* (Poda)	3			1	1	1	1
	Neumoridae	*Protnemura meyeri* (Pictet)		1	1	1	1		
Trichoptera	Hydropsychidae	*Hydropsyche instabilis*	9	32	21	21	19	12	10
		H. fulvipes (Curtis)	9	4	9	10	6	16	10
		Hydropsyche sp.	41	26	195	285	39	204	217
	Polcentropodidae	*Plectrocnemia* spp.					1	1	1
	Psychomyiidae	*Lype phaeopa* (Stephens)		1	3	1			4
		Chaetopteryx villosa (Fab.)		1					
	Sericostomatidae	*Sericostoma personatum* (Spence)	1				3	9	
	Lepidostomatidae	*Lepidostoma hirtum* (Fabricius)		1		3	1		
	Hydroptilidae	*Hydroptilla* sp.					5		
Coleoptera	Elmidae	*Elmis aenea* (Müller)	14	12	15	52	14	147	6
		Oulimnius tuberculatus (Müller)					1		
		Limnius volckmari (Panzer)	9	4	5	19	4	17	4
		Esolus parallelepipedus (Müller)			33	55	26	45	
	Haliplidae	*Haliplus sp.*					1	2	
		Orectochilus villosus	2		1	6	5	9	3
Mollusca	Hyrobiidae	*Potamopyrgus antipodarum* (Gray)		4	4		4		1
	Lymnaeidae	*Lymnaea peregra* (Müller)		1					
Hirudinea	Erpobdellidae	*Erpobdella octoculata* (L.)							17
Diptera	Chironomidae	spp. indet.	23	7	111	2	3	13	
	Simuliidae	spp. indet.	27	3	51			6	11
	Tipulidae	*Tipula* spp.							11
	Pedicidae	*Dicranota* spp.	1	1	5	15	11	11	72
	Limonidae	*Antocha* spp.	1		5	10	8	37	2
	Empedidae	spp. indet.	6	2	4		12	2	3
	Muscidae	*Limnophora* spp.			2			2	2
	Ceratapogonidae	spp. indet.				1	1		1
	Dixidae	Dixa spp.	2	1			2		
	Psychodidae	spp. indet.				1			
Oligochaeta	Oligochaeta indet.	spp. indet.	6	13	4	31	11	9	9
		Einsella		2	2	2	2	1	
Arachnida	Hydracarnia	spp. indet.	2				2		

Table 3: The representation of each invertebrate group as separated by the Q-value system in each of the sampling sites on Morell (M1-6) and Hartwell (H1) rivers.

Q-value Grouping	M1	M2	M3	M4	M5	M6	H1
Total Abundance							
Group A	3	1	1	4	2	1	6
Group B	4	4	11	35	15	22	31
Group C	548	154	785	572	288	690	528
Group D	16	24	9	38	19	14	43
Group E	0	0	0	0	0	0	0
% Abundance							
Group A	0.5	0.5	0.1	0.6	0.6	0.1	1.0
Group B	0.7	2.2	1.4	5.4	4.6	3.0	5.1
Group C	96.0	84.2	97.4	88.1	88.9	94.9	86.8
Group D	2.8	13.1	1.1	5.9	5.9	1.9	7.1
Group E	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of Taxa							
Group A	1	1	1	4	2	1	3
Group B	2	3	2	3	6	4	3
Group C	14	13	16	15	19	17	17
Group D	2	4	3	3	3	3	3
Group E	0	0	0	0	0	0	0

Table 4: Water quality scores, metric scores and invertebrate richness and abundances for 7 sampling sites on Morell (M1-6) and Hartwell (H1) rivers.

	M1	**M2**	**M3**	**M4**	**M5**	**M6**	**H1**
Q value	Q3	Q3	Q3	Q3-4	Q3-4	Q3-4	Q3-4
BMWP	71	74	69	101	109	88	90
ASPT	5.46	4.93	4.93	6.31	6.06	5.87	5.63
Scoring	13	15	14	16	18	15	16
EPT Taxa (%)	30.3	42.6	62.8	64.4	34.3	49.5	71.4
Taxon Richness	19	21	22	25	30	25	26
Total Abundance	571	183	806	649	324	727	608

CONCLUDING COMMENTS

Both these rivers have been modified in the past (flood relief & urbanisation) and are quite disconnected from the riparian habitats and river banks. The steep banks, the lack of natural sinuosity as a result of past modification and rhithral nature of these rivers have resulted in very limited marginal habitats. The steep sides and linear nature are likely to have increased the flow which has led to the stretches under investigation being scoured with limited amounts of cobbles and boulders available for invertebrate colonisation. Both rivers are also high in calcium carbonate which has led to the substrates being embedded through calcium precipitation. It would be expected that as a result of these factors the community would be under stress and highly heterogeneous in spatial distribution. However, these two rivers can support a high density and diversity of sensitive taxa as indicated by the 2012 survey and earlier surveys conducted by the EPA (Hartwell Q4-5 in 2002/5 and Q5 in 1980, and Morell Q4 in 1982-1991 & 2005)(see Figure 2).

The results of this assessment indicate that both rivers are impacted. The Morell river is moderately polluted upstream of the Kerdiffstown facility and then improves to slightly polluted some distance after the confluence with Hartwell river. The Morell river has a larger volume and it seems that the Q3-4 water quality from the Hartwell river only improves the water quality status in the Morell river some distance downstream of the confluence. It is likely that this and possible recharge from groundwater is improving the water quality downstream. Because the river maintains a Q3-4 status while it passes the Kerdiffstown facility there is no indication that the facility is having a discernable impact on the water quality status of the Morell river.

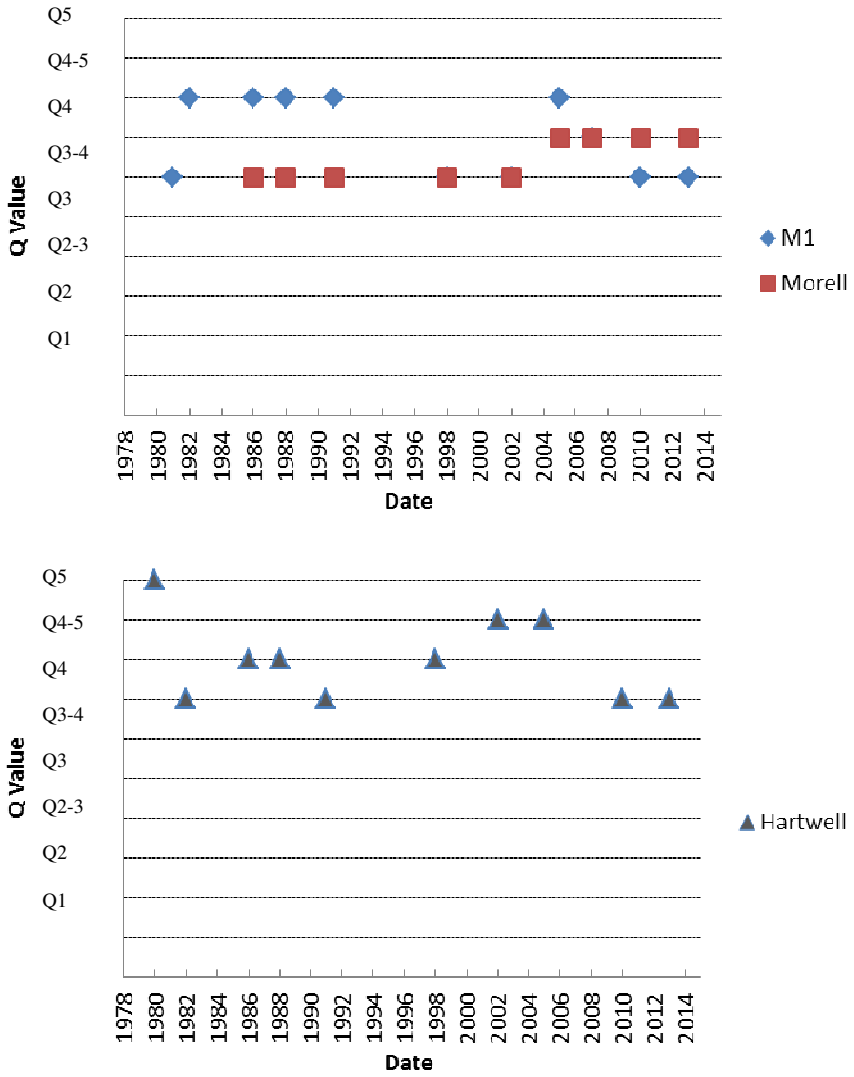


Figure 2: Historical EPA water quality data on the Morell and Hartwell rivers. Sites on Morell refer to same upstream site as one assessed in present survey and Morell refers to site 1.5km downstream of the facility. Site on Hartwell river about 500m upstream of H1 in present study.

It is concerning that in such a short period the Morell and Hartwell river have deteriorated in water quality since the 2012 survey (Baars and Kelly-Quinn, 2012). However, it seems indicative of this catchment because the water quality of both these rivers has been fluctuating over many years according to the data available from the EPA river monitoring programme. As indicated in Figure 2 the Morell has

fluctuated between Q3 and Q4 and Hartwell between Q3-4 and Q5 over last 30 years. Due to their low volume I is likely these rivers are vulnerable to low volume of inputs.

Based on the results of the survey conducted, there is no indication that the Kerdiffstown facility is causing a discernible impact on the Morell river as it passes the area. With a moderately polluted water status small changes in water quality as a result of the Kerdiffstown facility will be difficult to detect. It is advisable that the water quality assessment is done regularly and that the assessments be conducted in the summer months (towards early summer, i.e. May-June). In order to detect potential impact of the groundwater other biological indicators should be considered. These could include 1) a population density assessment of key taxa (to include sensitive and less sensitive taxa), 2) heavy metal bioaccumulation in the freshwater shrimp *Gammarus deubeni*, 3) assessment of the fish tissues for bioaccumulation of heavy metals.

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Appendix A: Macroinvertebrates grouped according to their sensitivity to organic pollution (taken from McGarrigle *et al.*, 2002).

Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except *Leuctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera danica*	Baetidae (excl. *Baetis rhodani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		***Aphelocheirus aestivalis***	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gastropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	***Margaritifera margaritifera***		*Anodonta* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminthes			All		

Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure. See overleaf for details of the Faunal Groups.						
Macroinvertebrate Faunal Groups**	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous *Baetis rhodani* often Abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few or Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few / Absent to Common	Dominant
Additional Qualifying Criteria						
Cladophora spp. Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growths	Absent to Abundant	Present/Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from < 80% to >120%	Very unstable. Potential fish-kills	Low (but > 20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
Note occurrence/abundance of groups in above table refers to some but not necessarily all of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account. * Macroinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc. ** See Further Observations overleaf.						

Appendix A cont.: Abundance categories and interpretation of macroinvertebrate survey results.

Table 3 Abundance categories and relationship to percentage frequency of occurrence (After McGarrigle *et al*., 2002).

Abundance Category	Approx. percentage frequency of occurrence
Absent	no specimens
Present	1 or 2 individuals
Scarce/few	<1% of the total fauna
Small numbers	<5%
Fair Numbers	5-10%
Common	10-20%
Numerous	25 -50%
Dominant	50 -75%
Excessive	>75%

Table 4 Interpretation of quality ratings (After McGarrigle *et al.,* 2002).

Quality ratings	Pollution status
Q5, Q4-5 and Q4	Unpolluted
Q3-4,	Slightly polluted
Q3 and Q2-3	Moderately polluted
Q2, Q1-2 and Q1	Serious pollution

APPENDIX B: BMWP (Biological Monitoring Working Party) Score (after Armitage *et al.,* 1983).

Families	Score
Siphlonuridae, Heptageniidae, Ephemerellidae, Leptophlebiidae, Potamanthidae, Ephemeridae, Taeniopterygidae, Leuctridae, Capniidae, Perlididae, Chloroplidae, Aphelocheiridae, Phyrganidae, Molannidae, Beraeidae, Odontoceridae, Leptoceridae, Goeridae, Lepidostomatidae, Brachycentridae, Sericostomatidae, Perlodidae	10
Astacidae, Lestidae, Agriidae, Gomphidae, Cordulegarsteridae, Aeshnidae, Cordulliidae, Libellulidae, Psychomyidae, Philopotamidae	8
Caenidae, Nemouridae, Rhyacophilidae, Polycentropodidae, Limnephilidae	7
Neritidae, Viviparidae, Ancylidae, Hydroptilidae, Unionidae, Corophidae, Gammaridae, Platycnemididae, Coenagriidae	6
Mesovelidae, Hydrometridae, Gerridae, Nepidae, Naurcoridae, Notonectidae, Pleidae, Corixidae, Halipildae, Hygrobiidae, Dytiscidae, Gyrinidae, Hydrophilidae Clambeidae, Helodidae, Dryopidae, Elmidae, Chrysomelidae, Curculonidae, Hydropschyidae, Tipulidae, Simuliidae, Planariidae, Dendrocoelidae	5
Baetidae, Sialidae, Piscicolidae	4
Valvatidae, Hydrobiidae, Lymnaeidae, Physidae, Planorbidae, Sphaeridae, Glossophoniidae, Hirudinidae, Eropbellidae, Asellidae	3
Chironomidae	2
Oligochaeta	1

WATER QUALITY ASSESSMENT OF THE MORELL AND HARTWELL RIVERS ADJACENT TO THE KERDIFFSTOWN FACILITY IN CO. KILDARE

FINAL REPORT

PREPARED BY AQUENS LTD.

SEPTEMBER 2016

INTRODUCTION

AQUENS Ltd. was commissioned by Kildare County Council to undertake a biological assessment of the water quality of the Morell and Hartwell Rivers, Co. Kildare to assess the potential impact the Kerdiffstown facility may be having on the Morell River. A water quality assessment was undertaken at eight sampling localities on the Morell River and two on the Hartwell stream to assess the upstream and downstream water quality as indicated by the benthic macroinvertebrate community. The Hartwell River joins the Morell River adjacent to the Kerdiffstown facility and therefore the water quality had to be assessed to determine its influence on the Morell River.

Most of the sites were previously monitored in 2012 and 2015 at which time the quality rating indicated that the Morell upstream of the facility was moderately polluted and improved to slightly polluted once the Hartwell joined the Morell River. The results showed that the facility had no discernible impact on the biological quality of the Morell River. Upstream sources of pollution meant that the Morell River was already impacted upstream of the Kerdiffstown landfill and no further impact was detected in 2015. in addition, the quality improved further downstream of the facility, probably as a result of the dilution effect of the Hartwell River on the Morell River. An additional two sites on the Morell and one on the Hartwell River were monitored in the present survey to determine the water quality further upstream and assess the extent of the impacted stretch.

The national monitoring programme conducted by the Environmental Protection Agency (EPA) has shown that both these rivers have been impacted in the past with Q-values as low as Q3 recorded (www.epa.ie last accessed November 2015). The most recent water quality results (2013) indicate that the Morell River has deteriorated from 2012 with a Q3 recorded above Kerdiffstown and improving to a Q3-4 ~1.5km below. Similarly the Hartwell River had also deteriorated from 2012 and was assigned a Q3-4 in 2013.

MATERIALS & METHODS

The water quality assessment was undertaken using the benthic macroinvertebrates as bioindicators. These are standard bioindicators of water quality as the various taxa exhibit differential responses to physical and chemical changes in their environment and the composition reflects the extent of environmental change. Some macroinvertebrates are sensitive to pollution while others are tolerant and the percentage composition of the community provides a realistic record of the prevailing water quality conditions (as an integrated signal of relatively long water quality conditions).

On request of the client macroinvertebrate sampling took place on 23rd June 2016. The same seven sites were sampled on the Morell and Hartwell Rivers to compare to previous surveys conducted in 2012 and 2015 (Baars & Kelly-Quinn, 2012; 2015). Three additional sites were added in the present survey (2016), and included two further upstream on the Morell River (M7 & M 8) 1km upstream of M1 and one on the Hartwell River (H2) above H1. The sites were chosen to represent the upstream water quality and to help interpret the proximity of the source of upstream pollution sources (Figure 1). Because the Hartwell River joins the Morell River along the length of the river that may be affected by the Kerdiffstown facility the Hartwell had to be included to determine its influence on the water quality of the Morell River. As a result three sites (M1, M7 & M8) provided an indication of the water quality entering the area immediately upstream, and the other sites provided the progression downstream (M2 to M6) (Figure 1). Two sites (H1 & H2) provided an indication of the water quality status of the Harwell River (Figure 1). The location of the tributary and feeder streams of the constructed ponds on the golf course are not as indicated on the OSI maps but no other natural or man-made surface runoff point enters the Morell River along the length assessed. The Hartwell River enters the Morell River directly below sampling site M2. The indicative site characteristics are provided in Table 1 to assist in the interpretation of the water quality. These measurements do no provide an exhaustive account of the physical conditions of the sampling sites.

Table 1: Characteristics of the sampling sites on the Morell and Hartwell Rivers.

Sampling Site (OSI)	Width	Depth	T°C	DO	pH	Cond.	Dominant Substrates	In-stream Vegetation	Flow Conditions
Morell River									
M1 (N918 216)	2.8	0.50	14.3	10.65	8.84	622	Gravel (fine & course)	*Ranunculus* spp., *Fontinalis*, *Apium* & good marginal	Deep fast flowing run
M2 (N918 219)	4.9	0.35	14.4	10.25	8.82	637	Sand (F & C) some gravel, large parts consolidated	Algae & little *Fontinalis* spp.	Shallow depositing, limited riffle
M3 (N918 220)	3.9	0.26	14.7	10.34	8.92	598	Gravel, sand and some cobble	*Ranunculus* spp., *Fontinalis* spp., Filamentous algae	Fast shallow run & riffle
M4 (N915 222)	5.4	0.26	14.6	10.31	8.93	613	Cobble, gravel & sand	little *Fontinalis* spp.	Glide, Run & Riffle
M5 (N914 225)	4.9	0.31	14.4	10.34	8.64	628	Cobble, gravel & sand	little *Fontinalis* spp., *Apium nodiflorum*	Run & Riffle some glide
M6 (N916 227)	3.4	0.43	14.3	10.43	7.48	605	Cobble, gravel & sand	little *Fontinalis* spp.	Glide, Run & Riffle
M7 (926 204) ~1km upstream of M1	1.5	0.21	14.8	10.88	8.92	667	Course gravel dominated and some cobble, mostly consolidated substrate	Some *Fontinalis*	Mostly glide/run, minimal Riffle
M8 (913 204) ~1km upstream of M1	2.8	0.24	12.6	10.01	8.55	619	Cobble course gravel dominated, some fine sediment and consolidated sections	Large *Apium* beds, some liverworts and *Fontinalis* spp.	Run/Glide and some deep riffle
Hartwell River									
H1 (N919 220)	4.1	0.25	15.9	9.95	8.95	541	Compact clay, gravel and some cobble & boulders	Filamentous algae & *Fontinalis* sp., *Glyceria* on margins	Fast Riffle & Run
H2 (N926 218)	2.4	0.13	15.9	9.82	8.93	545	Cobble, course gravel dominated with some boulders	Considerable algal growth, marginal Glyceria and *V. becabunga*	Fast riffle & Run

The sampling method adopted was that applied by the EPA in the national river monitoring programme (McGarrigle *et. al*., 2002). Using an FBA (Freshwater Biological Association) pond net (1mm mesh), a 2-minute, multi-habitat kick-sample was taken at each site. In addition, one minute stone-washing was also undertaken. The samples were preserved in 70% IMS and processed in the laboratory. They were sorted in an illuminated tray and all the macroinvertebrates were identified to the appropriate taxonomic resolution using FBA taxonomic keys.

The macroinvertebrate data were used to derive a Q-value using the EPA methodology (McGarrigle *et al*., 2002). This Q-value system is a five point scale (Q1-Q5: with intermediate scores obtainable, e.g. Q3-4) based on the proportions of five groups of macroinvertebrates, with different pollution tolerances (Appendix A). Two other biotic indices (BMWP and ASPT) were calculated (See Appendix B). The BMWP score is based on the presence of pollution-tolerant to pollution-sensitive families. Each family is assigned a score. The BMWP score is the sum of these family scores. Families that are sensitive to pollution are assigned higher scores than pollution-tolerant families. A high overall score indicates that the water quality is good. The ASPT is determined by dividing the BMWP score by the number of scoring taxa yielding a score between 1 and 10, values >6 usually indicate good water quality. In addition, taxon richness and the percentage of Ephemeroptera/Plecoptera/ Trichoptera (%EPT) were determined.

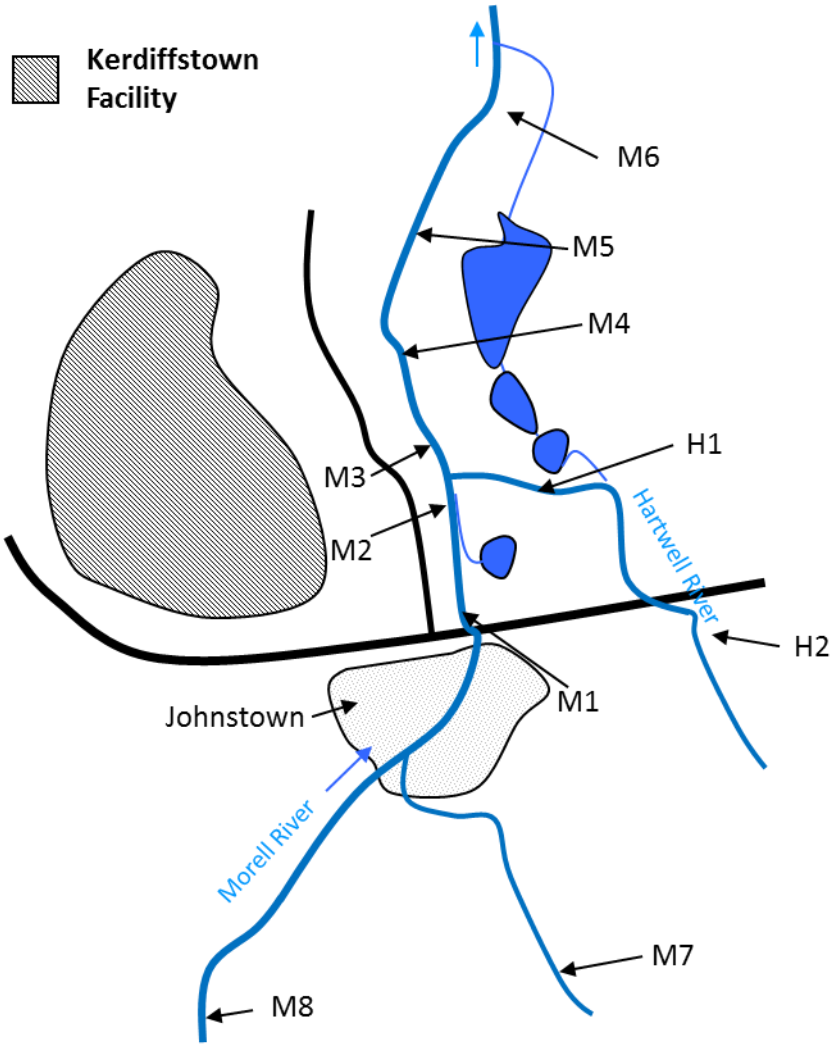


Figure 1: Schematic diagramme showing the location of sampling sites M1-8 on the Morell River and tributary and H1 & H2 on the Hartwell River in relation to the Kerdiffstown facility.



Plate 1: Sites assessed on the Morell River (M) adjacent to the Kerdiffstown facility. M7, tributary upstream, M8 Morel upstream, M1 upstream & downstream of Johnstown, M2 upstream of confluence with Hartwell River, M3 ~30m downstream of Hartwell River confluence, M4 further downstream.



Plate 2: Sites assessed on the Morell (M) and Hartwell (H) Rivers adjacent to the Kerdiffstown facility. M5 & M6 further downstream on Morell River. H1 50m before it joins the Morell River, H2 East of M7 motorway on the Hartwell River.

A range of physical (average depth and width, mesohabitat type and substrate composition) and chemical characteristics (dissolved oxygen, temperature, conductivity and pH) were determined on site using hand-held meters (Table 1).

RESULTS

Site Characteristics

As in the previous survey the banks of both rivers are disconnected from the adjacent habitat due to past flood relief/river redirection works. Most of the banks were at least >1m in height and steep sided. Flow was relatively fast at most of the sites with little in-stream vegetation, with the exception of *Fontinalis* sp., *Ranunculus* spp., liverworts and some filamentous algae (see Table 1).

Most of the substrates were relatively clean but largely consolidated through calcification leaving little loose cobble and coarse gravel available for invertebrates. Sites did have accumulations of fine sand and sediments. Very few boulders were present and most sites appeared scoured. The water chemistry is indicative of the soil and geology in the area with alkaline pH and high conductivities (Table 1). Oxygen levels were within normal ranges (80-120%) with the exception of Site M2 & M6 (>120%).

Benthic Invertebrates

A total of 42 taxa were recorded during the survey, with individual sites recording between 19 and 30 taxa in the single, 2-minute kick sample taken at each site (Table 2). Overall the list of taxa was dominated in diversity by the less sensitive species, with only 17 taxa belonging to the Ephemeroptera, Plecoptera and Trichoptera (EPT) groups considered more pollution sensitive. In terms of abundance EPT made up the majority of the taxa at only four of the seven sites.

One of the notable absences were the cased caddis (Trichoptera) as had been noted in the previous assessment (Baars and Kelly-Quinn, 2012), again probably as a result of the fast flow, embedded substrates and limited marginal vegetation (steep disconnected river banks) that usually offer sheltered microhabitats.

Water Quality

The taxa recorded and their abundances at each site are presented in Table 2. Several metrics were applied to the benthic invertebrate taxa collected at each site. The Q-values were assigned on the basis of the sensitivity groups present in abundance, % representation and taxon richness (Table 3). The majority of the sites on both the Morell and Hartwell Rivers have either few or no Group A taxa, a small percentage of group B taxa present and a dominance of Group C. As a result the sites were assigned either a Q3 or Q3-4 indicating moderate to slight pollution.

Sites M1, M2 & M3 were assigned a Q3 and are thus moderately polluted. These three sites were dominated by Group C taxa, no Group A taxa present and a low percentage representation and diversity of Group B (Table 3 & Table 4). The two upstream sites (M7 & M8) about 1km above M1 on the Morell River were assigned a Q3-4 indicating slight pollution. These indicate that the Morell River deteriorates either directly above Johnstown or as a result of inputs coming from Johnstown. The Q3 status at M1 indicates that the river is moderately impacted before any potential impact arising from the Kerdiffstown facility.

The sampling sites on the Hartwell River were both assigned a Q3-4, on the basis of the high proportion of Group C and relatively higher proportion of Group B with some Group A taxa present. The Hartwell River before entering the Morell River is therefore considered slightly polluted, but has better water quality than the upstream sites on the Morell River including M2 (directly above the confluence of the Morell and Hartwell Rivers) which was assigned a Q3. Directly below the confluence the Morell River (site M3) was still assigned a Q3 (Table 4) but all the other sites further downstream on the Morell River were assigned a Q 3-4 and are considered slightly polluted. The Hartwell River is diluting pollutants in the Morell River and improving the status downstream. The other metrics including the ASPT and EPT are in line with the Q values assigned but indicate that M7 & M8 are on the low side of Q3-4 possibly indicating that the Hartwell is in a better ecological status than the upper stretches of the Morell River. The ASPT values of M7 and M8 were 5.67 and 5.5 respectively. The EPT were well represented in terms of their abundance, but were once again largely made up of those considered less sensitive, e.g. *Baetis rhodani*, *Seratella ignita* and *Hydropsyche* species.

Table 2: Benthic macroinvertebrate taxa recorded at each of the ten sampling sites.

Group	Family	Species/genus	M1	M2	M3	M4	M5	M6	H1	H2	M7	M8
Crustacea	Asellidae	*Asellus aquaticus* (L.)		4	3	4	3	3	1	3	4	2
	Gammaridae	*Gammarus duebeni* (Lilj.)	255	108	222	156	160	81	372	308	140	384
	Astacidae	*Austropotamobius pallipes* (L.)					1	1				
Ephemeroptera	Baetidae	*Baetis rhodani* (Pictet.)	17	1	37	14	4	4	11	73	3	63
		Alianites muticus (L.)				2	1		1			2
	Ephemerelliidae	*Seratella ignita* (Poda)	313	171	534	290	303	295	221	767	99	231
	Eohemeridae	*Ephemera danica* Muller					1	2			2	
	Heptageniidae	*Rhithrogena semicolorata* (Curtis)							1			
	Leptophlebidae	*Paraleptophlebia* spp.				1						
Plecoptera	Leuctridae	*Leuctra fusca* (L.)					1		3	2		
Trichoptera	Hydropsychidae	*Hydropsyche instabilis* (Curtis)	5	15	10	28	18	8	15	7	37	
		Hydropsyche fulvipes (Curtis)	3	9	6	15	6	4	4	3	19	
	Rhyacophilidae	*Rhyacophila dorsalis* (Curtis)		1	3	5	1	1		2	4	
	Limnephilidae	*Micropterna sequax* McLachlan	1			1	1			2	1	2
		Drusus annulatus (Stephens)				2	1		4	31	5	14
		Chaetopteryx villosa (Fab.)	1									
	Sericostomatidae	*Sericostoma personatum* (Spence in K & S)		2			3	3			4	1
Coleoptera	Elmidae	*Elmis aenea* (Müller)			4	2	1		4	4	8	
		Limnius volckmari (Panzer)			3				3	2	4	
		Esolus parallelepipedus (Müller)									2	
Mollusca	Sphaeriidae	*Sphaerium/Pisidium* spp.					1					
	Lymnaeidae	*Lymnaea peregra* (Müller)		1							1	
Hirudinea	Erpobdellidae	*Erpobdella octoculata* (L.)	1	4						5	4	3
Diptera	Chironomidae	spp. indet.	8	2	45	35	40	13	7	14	30	15
	Simuliidae	spp. indet.	57	40	177	45	4	54	126	324	68	36
	Pedicidae	*Dicranota* spp.	1		1		2			1	1	2
	Empedidae	spp. indet.		1							1	
Oligochaeta	Oligochaeta	spp. indet.	1	9	3			3	1			3
		Eiseniella spp.				4	4					

Table 3: The representation of each invertebrate group as separated by the Q-value system in each of the sampling sites on Morell (M1-6) and Hartwell (H1) Rivers.

Sensitivity grouping	M1	M2	M3	M4	M5	M6	H1	H2	M7	M8
Total Abundance										
Group A	0	0	0	3	3	3	2	0	2	2
Group B	2	2	0	3	6	3	7	35	10	17
Group C	659	348	1042	590	539	460	763	1505	416	731
Group D	2	18	6	8	8	6	2	8	9	8
Group E	0	0	0	0	0	0	0	0	0	0
Percentage Abundance										
Group A	0.0	0.0	0.0	0.5	0.5	0.6	0.3	0.0	0.5	0.3
Group B	0.3	0.5	0.0	0.5	1.1	0.6	0.9	2.3	2.3	2.2
Group C	99.4	94.6	99.4	97.7	96.9	97.5	98.6	97.2	95.2	96.4
Group D	0.3	4.9	0.6	1.3	1.4	1.3	0.3	0.5	2.1	1.1
Group E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of Taxa										
Group A	0	0	0	2	3	2	2	0	1	1
Group B	2	1	0	2	4	1	2	3	3	3
Group C	8	9	11	9	10	8	9	11	13	6
Group D	2	4	2	2	3	2	2	2	3	3
Group E	0	0	0	0	0	0	0	0	0	0

Table 4: Water quality scores, metric scores and invertebrate richness and abundances for 8 sampling sites on Morell (M1-8) and two on Hartwell (H1 & H2) Rivers respectively.

	M1	M2	M3	M4	M5	M6	H1	H2	M7	M8
Q value	Q3	Q3	Q3	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4	Q3-4
BMWP	48	59	53	64	92	62	67	72	85	55
ASPT	4.8	4.92	4.82	5.82	6.13	6.2	6.09	5.54	5.67	5.5
Scoring	10	12	11	11	15	10	11	13	15	10
EPT Taxa (%)	51.3	54.1	56.3	59.3	61.2	67.2	33.6	57.3	39.8	41.3
Taxon Richness	14	17	15	17	19	16	17	17	22	15
Total Abundance	663	368	1048	604	556	472	774	1548	437	758

CONCLUDING COMMENTS

Both the Hartwell and Morell Rivers have been modified in the past (flood relief & urbanisation) and are quite disconnected from the riparian habitats and river banks. The steep banks, the lack of natural sinuosity as a result of past modification and the rhithral nature of these rivers have resulted in very limited marginal habitats. The steep sides and linear nature are likely to have increased the flow which has led to the stretches under investigation being scoured leaving small amounts of cobbles and boulders within the river channel available for invertebrate colonisation. Both rivers are also high in calcium carbonate which has led to the substrates being embedded through calcium carbonate precipitation. It would be expected that as a result of these factors the community would be under stress and highly heterogeneous in spatial distribution.

However, there are patches of suitable substrates and in-stream habitat (fast and slow flowing riffles) that should support a range of invertebrate species, and in the past both the Morell and Hartwell Rivers have supported a high density and diversity of sensitive taxa as indicated by the 2012 survey and earlier surveys conducted by the EPA (Hartwell Q4-5 in 2002/5 and Q5 in 1980, and Morell Q4 in 1982-1991 & 2005)(see Figure 2, page 13).

The results of this assessment indicate that both rivers are impacted. The Morell River is slightly polluted in the upper stretches (M7 & 8) but is moderately polluted directly upstream of the Kerdiffstown facility (M1). As the Morell River flows alongside the facility the status remains as a Q3 until the Hartwell River joins and appears to dilute the Morell River. The two sampling sites on the Hartwell River indicate that the biological quality is slightly better than that of the Morell River and therefore is improving the quality of the Morell River. Based on the other metrics (slightly higher ASPT) the community does have more sensitive taxa present and from past observations on the Hartwell River (site H2) there are sensitive taxa that occur in Spring in the Hartwell River including several Plecoptera (e.g. *Isoperla grammatical*, *Brachyoptera risi*, *Siphonoperla torrentium, Leuctra inermis* and *L. hippopus*).

The present survey indicates that the Hartwell River only has a diluting effect on the Morell River by site M4 where Q3-4 rating was assigned. The Morell River was slightly polluted from this point on including both sites M5 and M6. Because the water quality improved to a Q3-4 after the Hartwell River joined the Morell River there is no evidence from the benthic invertebrates that the Kerdiffstown facility is significantly affecting the community composition in the Morell River.

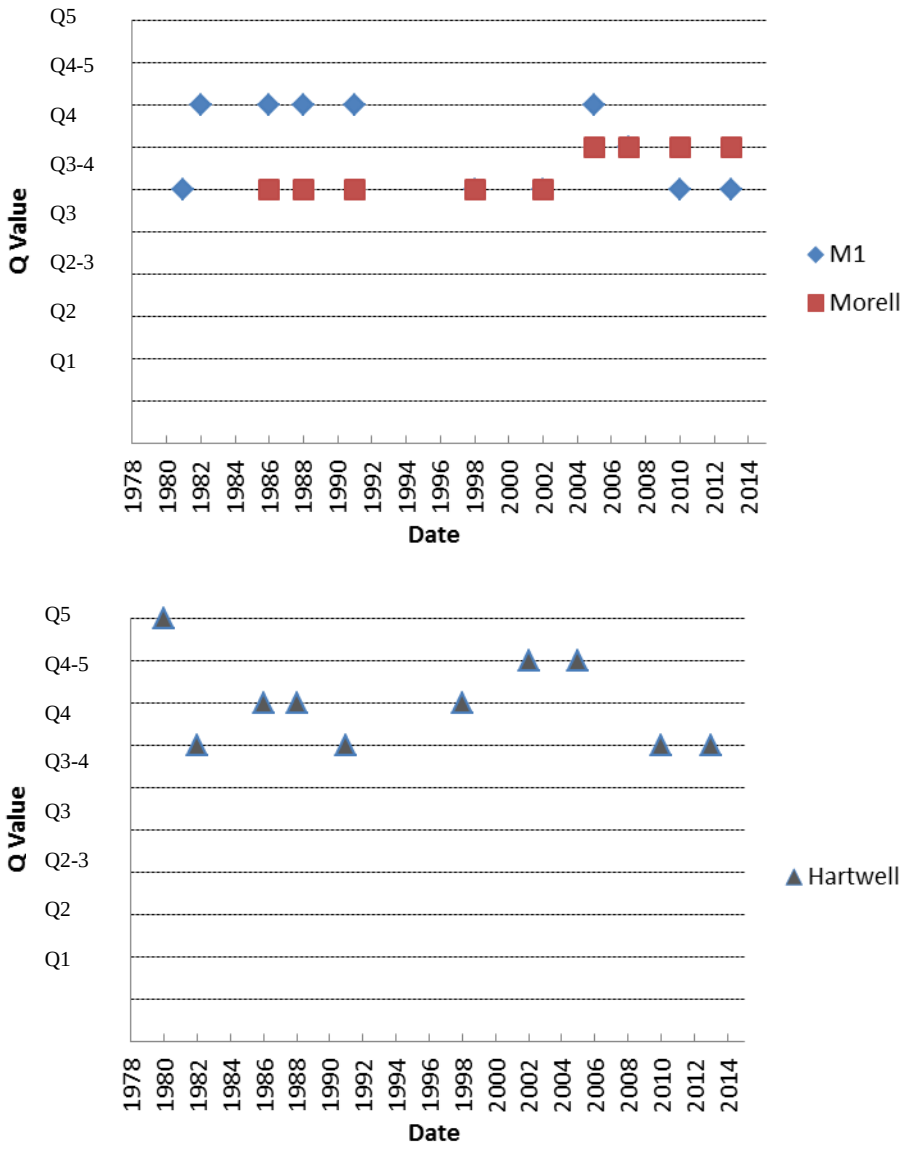


Figure 2: Historical EPA water quality data on the Morell and Hartwell rivers. Sites on Morell refer to same upstream site as one assessed in present survey and Morell refers to site 1.5km downstream of the facility. Site on Hartwell River about 500m upstream of H1 and 150m downstream of H2 in the present study.

The present survey (2016) indicates that the recent deterioration observed in the Morell and Hartwell Rivers since 2012 (Baars and Kelly-Quinn, 2012) is still maintained. The upstream stretches of both rivers, particularly on the Morell River are slightly impacted indicating that there are multiple sources of pressures that need to be addressed in order to improve the quality of these rivers. The present survey indicates that there is a significant pollution pressure either directly above or arising from Johnstown lowering the ecological quality of the Morell River before it gets to the Kerdiffstown facility. Water quality in both of these rivers has been fluctuating over many years according to the data available from the EPA river monitoring programme. As indicated in Figure 2 the Morell has fluctuated between Q3 and Q4 and Hartwell between Q3-4 and Q5 over the last 30 years. Due to their low water volume it is likely these rivers are vulnerable to even low volume of pollution inputs.

Based on the results of the survey conducted, there is no indication that the Kerdiffstown facility is causing a discernible impact on the Morell River as it passes the area. With an upstream status of moderately polluted (Q3) and a slightly polluted status along the lower stretches small changes in water quality that may be arising from the Kerdiffstown facility would theoretically be difficult to detect. Regular monitoring would be advisable, particularly timed to coincide with late spring or early summer (April-June). To assess any likely specific pollutants arising from the facility, if indicated by the water chemistry of the boreholes, other additional monitoring may be considered (given that the Morell River is moderately-slightly polluted upstream) that include 1) a population density assessment of key taxa (to include sensitive and less sensitive taxa), 2) heavy metal bioaccumulation in the freshwater shrimp *Gammarus deubeni*, 3) assessment of the fish tissues for bioaccumulation of heavy metals (although fish are highly mobile).

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Appendix A: Macroinvertebrates grouped according to their sensitivity to organic pollution (taken from McGarrigle *et al.*, 2002).

Biological Assessment of Water Quality in Eroding Reaches (Riffles & Glides) of Rivers and Streams*						
Biotic Indices (Q Values) and typical associated macroinvertebrate community structure. See overleaf for details of the Faunal Groups.						
Macroinvertebrate Faunal Groups**	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Group A	At least 3 taxa well represented	At least 1 taxon in reasonable numbers	At least 1 taxon Few - Common	Absent	Absent	Absent
Group B	Few to Numerous	Few to Numerous	Few/Absent to Numerous	Few/Absent	Absent	Absent
Group C	Few	Common to Numerous *Baetis rhodani* often Abundant Others: never Excessive	Common to Excessive (usually Dominant or Excessive)	Dominant to Excessive	Few or Absent	Absent
Group D	Few or Absent	Few or Absent	Few/Absent to Common	Few/Absent to Common	Dominant to Excessive	Few or Absent
Group E	Few or Absent	Few or Absent	Few or Absent	Few or Absent	Few / Absent to Common	Dominant
Additional Qualifying Criteria						
Cladophora spp. Abundance	Trace only or None	Moderate growths (if present)	May be Abundant to Excessive growths	May be Excessive growths	Few or Absent	None
Macrophytes (Typical abundance)	Normal growths or absent	Enhanced growths	May be Luxuriant growths	May be Excessive growths	Absent to Abundant	Present/Absent
Slime Growths (Sewage Fungus)	Never	Never	Trace or None	May be Abundant	May be Abundant	None
Dissolved Oxygen Saturation	Close to 100% at all times	80% - 120%	Fluctuates from < 80% to >120%	Very unstable. Potential fish-kills	Low (but > 20%)	Very low, sometimes zero
Substratum Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
Note occurrence/abundance of groups in above table refers to some but not necessarily all of the constituents of the group. The Additional Qualifying Criteria apply in virtually all circumstances. Single specimens may be ignored. Seasonal and other relevant factors (i.e., drought, floods) must be taken into account.						
* Macroinvertebrate criteria do not apply to rivers with mud, bedrock or sand substrata, very sluggish or torrential flow, head-water or high altitude streams and those affected by significant ground water input, excessive calcification, drainage, canalisation, culverting, marked shading etc.						
** See Further Observations overleaf.						

Appendix A cont.: Abundance categories and interpretation of macroinvertebrate survey results.

Macroinvertebrates grouped according to their sensitivity to organic pollution					
TAXA	**Group A**	**Group B**	**Group C**	**Group D**	**Group E**
	Sensitive	*Less Sensitive*	*Tolerant*	*Very Tolerant*	*Most Tolerant*
Plecoptera	All except *Leuctra* spp.	*Leuctra* spp.			
Ephemeroptera	Heptageniidae Siphlonuriidae *Ephemera danica*	Baetidae (excl. *Baetis rhodani*) Leptophlebidae	*Baetis rhodani* Caenidae Ephemerellidae		
Trichoptera		Cased spp.	Uncased spp.		
Odonata		All taxa			
Megaloptera				Sialidae	
Hemiptera		***Aphelocheirus aestivalis***	All except *A. aestivalis*		
Coleoptera			Coleoptera		
Diptera			Chironomidae (excl. *Chironomus* spp.) Simuliidae Tipulidae		*Chironomus* spp. *Eristalis* sp.
Hydracarina			Hydracarina		
Crustacea			*Gammarus* spp. *Austropotamobius pallipes*	*Asellus* spp. *Crangonyx* spp.	
Gastropoda			Gastropoda (excl. *Lymnaea peregra* & *Physa* sp.)	*Lymnaea peregra* *Physa* sp.	
Lamellibranchiata	***Margaritifera margaritifera***		*Anodonta* spp.	Sphaeriidae	
Hirudinea			*Piscicola* sp.	All except *Piscicola* sp.	
Oligochaeta					Tubificidae
Platyhelminthes			All		

Table 3 Abundance categories and relationship to percentage frequency of occurrence (After McGarrigle *et al*., 2002).

Abundance Category	Approx. percentage frequency of occurrence
Absent	no specimens
Present	1 or 2 individuals
Scarce/few	<1% of the total fauna
Small numbers	<5%
Fair Numbers	5-10%
Common	10-20%
Numerous	25 -50%
Dominant	50 -75%
Excessive	>75%

Table 4 Interpretation of quality ratings (After McGarrigle *et al.,* 2002).

Quality ratings	Pollution status
Q5, Q4-5 and Q4	Unpolluted
Q3-4,	Slightly polluted
Q3 and Q2-3	Moderately polluted
Q2, Q1-2 and Q1	Serious pollution

APPENDIX B: BMWP (Biological Monitoring Working Party) Score (after Armitage *et al.*, 1983).

Families	Score
Siphlonuridae, Heptageniidae, Ephemerellidae, Leptophlebiidae, Potamanthidae, Ephemeridae, Taeniopterygidae, Leuctridae, Capniidae, Perlididae, Chloroplidae, Aphelocheiridae, Phyrganidae, Molannidae, Beraeidae, Odontoceridae, Leptoceridae, Goeridae, Lepidostomatidae, Brachycentridae, Sericostomatidae, Perlodidae	10
Astacidae, Lestidae, Agriidae, Gomphidae, Cordulegarsteridae, Aeshnidae, Cordulliidae, Libellulidae, Psychomyidae, Philopotamidae	8
Caenidae, Nemouridae, Rhyacophilidae, Polycentropodidae, Limnephilidae	7
Neritidae, Viviparidae, Ancylidae, Hydroptilidae, Unionidae, Corophidae, Gammaridae, Platycnemididae, Coenagriidae	6
Mesovelidae, Hydrometridae, Gerridae, Nepidae, Naurcoridae, Notonectidae, Pleidae, Corixidae, Halipildae, Hygrobiidae, Dytiscidae, Gyrinidae, Hydrophilidae Clambeidae, Helodidae, Dryopidae, Elmidae, Chrysomelidae, Curculonidae, Hydropschyidae, Tipulidae, Simuliidae, Planariidae, Dendrocoelidae	5
Baetidae, Sialidae, Piscicolidae	4
Valvatidae, Hydrobiidae, Lymnaeidae, Physidae, Planorbidae, Sphaeridae, Glossophoniidae, Hirudinidae, Eropbellidae, Asellidae	3
Chironomidae	2
Oligochaeta	1

Appendix A13.4 EPA Hydrotool Report for the Morell River

Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

River Name	Morell(09_1558)
XY Location	291648,222149 (ING)

River Segment Map



Disclaimer
The source hydrometric data used to estimate the flow duration curve ordinates for ungauged catchments was obtained from (1) water level data and (2) the rating curve(s) generated for each hydrometric station. The Environmental Protection Agency and the Office of Public Works used these data, respectively, to calculate daily mean flows. The daily mean flows were then used by the Environmental Protection Agency to prepare flow duration curves for each station. Neither body accepts any liability for the subsequent handling of the data.

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The user should familiarise himself/herself with the catchment being studied and confirm that the ungauged site is in a natural catchment where flows conditions are suitable for the use of the model.

It is strongly recommended that the user examine the catchment descriptors contained in the report produced and confirm that the percentages of the various constituent elements are comparable to a natural catchment.

If the flow in a catchment is not entirely natural, the estimation of flows using the model in these catchments could be affected due to:

- existence of local conduit karst within the catchment;
- the selected location itself is on local conduit karst;
- regulation of the river flow on the river channel (e.g. power station, sluice gates etc)
- impacts of abstractions upstream of the selected location or the impact of the discharge associated with the abstraction into the same/different catchment;
- estimates of flow being sought at locations effected by storage effects at, or near, lake outfalls;
- lack of similar catchments with observed flows, ie where catchment descriptors lie outside the range of available gauging station catchments (e.g. the catchment area is under 5 km^2);
- any other special circumstances that may affect river flows.

Expert judgement will be required to ensure that the estimate of flow is not unduly affected by any of these influences.

Please note that the model does not provide estimates of flood peaks and, specifically, should not be used for that purpose.

The EPA has also prepared estimates of DWF and long term 95 percentile flows which are also presented on the EPA web site. These data are presented at http://www.epa.ie/whatwedo/monitoring/water/hydrometrics/data/

The data produced by the model for specific stations should be compared to the data contained in this file of DWF and long term 95percentile flows.

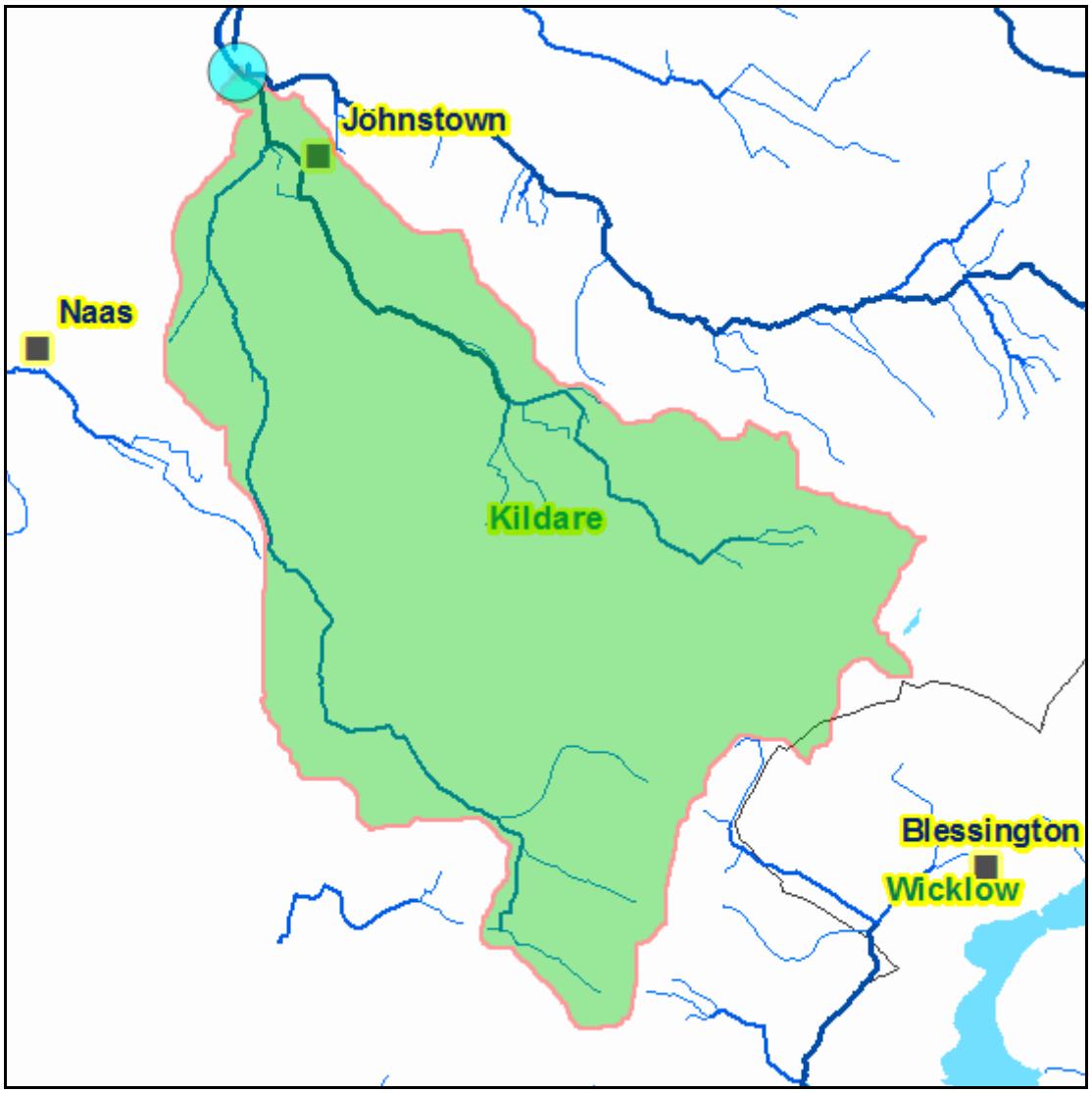
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Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

River Name	Morell(09_1558)
XY Location	291648,222149 (ING)

Nested Catchment Map

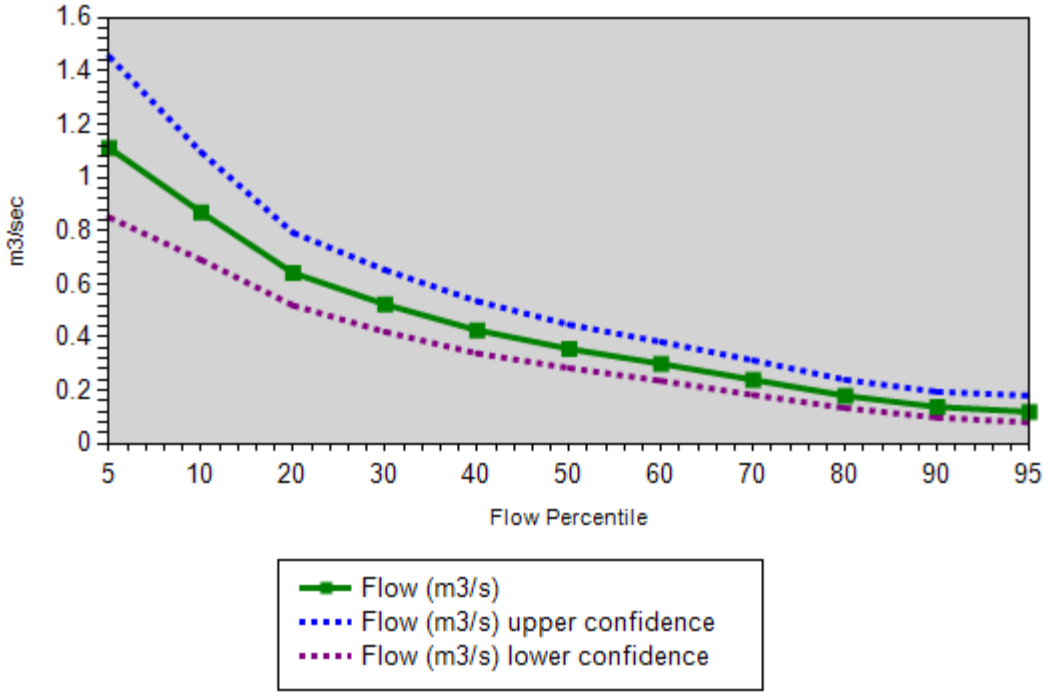


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Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Flow Duration Curve (Flow in m3/sec)



%ile	flow(m3/sec)	upper 95% confidence limit m3/sec	lower 95% confidence limit m3/sec
5	1.111	1.454	0.85
10	0.869	1.095	0.69
20	0.641	0.792	0.519
30	0.523	0.652	0.42
40	0.426	0.535	0.339
50	0.356	0.447	0.284
60	0.3	0.382	0.236
70	0.24	0.313	0.183
80	0.18	0.24	0.134
90	0.138	0.195	0.098
95	0.12	0.18	0.08

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Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Catchment Descriptors		
General		
Descriptor	**Unit**	**Value**
Area	sq km	28.3
Average Annual Rainfall (61-90)	mm/yr	956
Stream Length	km	28.7
Drainage Density	Channel length (km)/catchment area (sqkm)	1
Slope	Percent Slope	5.5
FARL	Index (range 0:1)	1

Soil	
Code	**% of Catchment**
Poorly Drained	21.4
Well Drained	75.1
Alluvmin	2.5
Peat	0
Water	0
Made	1

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Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Subsoil Permeability		
Code	**Explanation**	**% of Catchment**
H	High	37
M	Moderate	25.5
L	Low	18.5
ML	Moderate/Low	0
NA	No Subsoil/Bare Rock	19

Aquifer		
Code	**Explanation**	**% of Catchment**
LG_RG	LG:Locally important sand-gravel aquifer RG: Regionally important sand-gravel aquifer	16.2
LL	Locally important aquifer which is moderately productive only in local zones	14.5
LM_RF	LM: Locally important aquifer which is generally moderately productive RF: Regionally important fissured bedrock aquifer	0
PU_PL	PU: Poor aquifer which is generally unproductive PL: Poor aquifer which is generally unproductive except for local zones	69.3
RKC_RK	Regionally important karstified aquifer dominated by conduit flow	0
RKD_LK	Regionally important karstified aquifer dominated by diffuse flow	0

Stations in Pooling group			
%ile Flow	**Station 1**	**Station 2**	**Station 3**
5	10038	14104	14057
10	10038	14104	14057
20	10038	14104	14057
30	10038	14104	14057
40	10038	14104	14057
50	10038	14104	14057
60	10038	14104	14057
70	10038	14104	14057
80	10038	14104	14057

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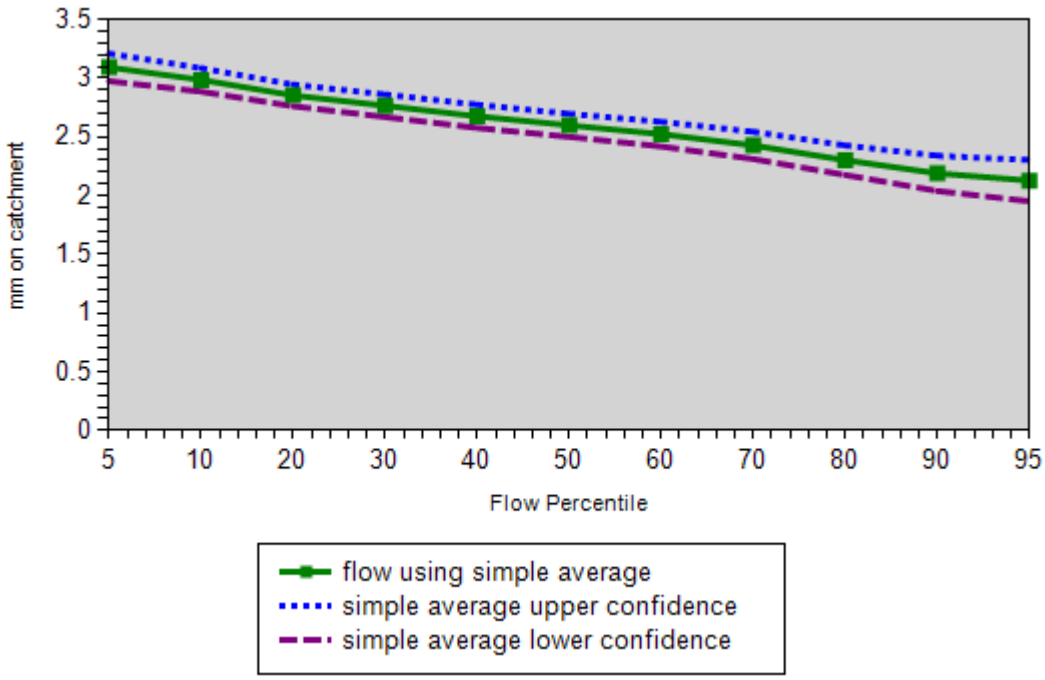
90	10038	14104	14057
95	10038	14104	14057

Disclaimer
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Environmental Protection Agency

Estimation of Flow Duration Curve for Ungauged Catchment

Flow Duration Curve (mm on catchment)



Log Flow (mm on catchment)			
%ile	mm	upper 95% confidence limit	lower 95% confidence limit
5	3.093	3.21	2.976
10	2.986	3.086	2.886
20	2.854	2.946	2.762
30	2.766	2.862	2.67
40	2.676	2.775	2.577
50	2.599	2.697	2.501
60	2.524	2.629	2.419
70	2.428	2.544	2.312
80	2.302	2.428	2.176
90	2.19	2.34	2.04
95	2.128	2.304	1.952

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Appendix A14.1 Traffic and Transport Assessment

Kerdiffstown Landfill Remediation Project

Kildare County Council

Environmental Impact Assessment Report (EIAR) - Appendix 14.1 - Traffic & Transport Assessment

32EW5604/DOC/0048 | 1.4

15 Aug 2017

JACOBS

Kerdiffstown Landfill Remediation Project

Project No:	32EW5604
Document Title:	Environmental Impact Assessment Report (EIAR) - Appendix 14.1 - Traffic & Transport Assessment
Document No.:	32EW5604/DOC/0048
Revision:	1.44
Date:	30 June 2017
Client Name:	Kildare County Council
Client No:	
Project Manager:	Rhianna Rose
Author:	David Peterson
File Name:	\\ledub1-fil001\ji\Sustainable Solutions\Kerdiffstown Landfill\4 - Documents\4.3 - Draft Documents\32EW5604 E EIA IED Planning\EIA\EIAR Chapters\15-Traffic\A14.1 Traffic and Transport Assessment_AUG 150817.docx

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Document history and status

Revision	Date	Description	By	Review	Approved
1.0	21/03/2017	Submission of working document to project team prior to technical review	DP	-	-
1.1	06/04/2017	Submission of final draft to project team following technical review	DP	JC	CW
1.2	26/04/2017	Revisions following CRAV	DP	JC	CW
1.3	08/05/2017	Preliminary Draft for KCC Review	DP	JC	RR
1.4	30/06/2017	Draft Incorporating KCC Review Comments	DP	JC	RR
1.5	15/08/2017	Final	PW	RK	RR

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1. Introduction

1.1 Background

The proposed Project comprises the remediation of the site to reduce the risks posed by the site in its current condition to public health and safety and the environment (the Remediation Phase), whilst developing the site to provide an amenity to the local community, comprising a public park with multi-use sports pitches (the Operational Phase).

As stated in Chapter 15 Traffic and Transport of the Environmental Impact Statement (EIS) for Kerdiffstown Landfill Remediation Project (the proposed Project) initial assessment of predicted traffic volumes suggested that a standalone Traffic and Transport Assessment (TTA) may not be required. However, in order to ensure a robust assessment of impacts on the road network for both the Remediation Phase and Operational Phase a TTA was undertaken for the proposed Project.

This report considers the traffic and transportation impacts relating to existing, remediation and operational phases of the proposed Project.

1.2 Outline Methodology

Traffic count data has been collected at key locations on the road network, adjacent to the proposed project site in agreement with KCC. This is discussed further in Section 6 inlcuding details of locations and dates of surveys. This data along with traffic projections relating to the proposed Project have been used to develop an understanding of the existing traffic conditions and worst case traffic scenario for development.

The development methodology is as follows:

- Review existing conditions on the local road network;
- Establish the traffic baseline considering observed traffic conditions and the effect of
- consented development proposals;
- Establish trip generation and distribution relating to the proposed development; and
- Assess network operation and identify any mitigation requirements.

In order to ensure a robust assessment of impacts for both the Remediation Phase and Operational Phase an assessment of peak impacts has been undertaken and based on an assumed remediation start of 2018, with intensive Remediation Phase works expected to last approximately 3.5 years.

The operation of the road network and key junction capacity in the vicinity of the proposed Project has been modelled using a VISSIM microsimulation model. The model evaluates the potential impacts on the local road network due to the Remediation Phase and Operational Phase activities associated with the proposed Project.

The Remediation Phase will comprise construction works, with site staff and contractor's personnel parking at site offices. Car parking provision for the Operational Phase was primarily determined according to the number of users of the multi-use sports pitches. An assessment of car parking provision has been undertaken to ensure that the proposed Project has sufficient car parking capacity as detailed herein.

1.3 Report Structure

Section 2 of this report describes the development proposals for the proposed Project. **Section 3** provides an assessment of the proposed Project in relation to current national and local transport planning policies. **Section 4** reviews the accessibility of the existing site, considering non-motorised transport, public transport and the existing road network. **Section 5** provides details on trip generation associated with the development proposals. **Section 6** details the key findings of the traffic impact assessment. Summary and conclusions of the study are presented in **Section 7**.

2. Accessibility Review to Existing Site

2.1 Introduction

A baseline accessibility assessment was undertaken to establish existing transport provision relevant to the development. The assessment considers travel by relevant modes of transport and provides details of available infrastructure and service provision.

The assessment recognises the need for both local and regional travel. It also recognises that walking and cycling are main modes of transport but are also secondary modes of travel for public transport users.

2.2 Walking and Cycling

2.2.1 Walking

The site is located close to Johnstown, Sallins, Kill and Naas. Much of Johnstown is within walking distance of the site. Sallins, Kill and Naas are within an approximate walking time of 20 minutes (1.6km radius). High quality footways exist in Johnstown and along the frontage roads to the N7. A footbridge provides access over the N7 between Johnstown and L2005 Kerdiffstown Road south of the proposed Project. The existing L2005 Kerdiffstown Road to the north of the pedestrian bridge currently has no dedicated pedestrian facilities, with pedestrians sharing the existing narrow carriageway with vehicular traffic. The walking catchment is shown below as Figure 2.A.

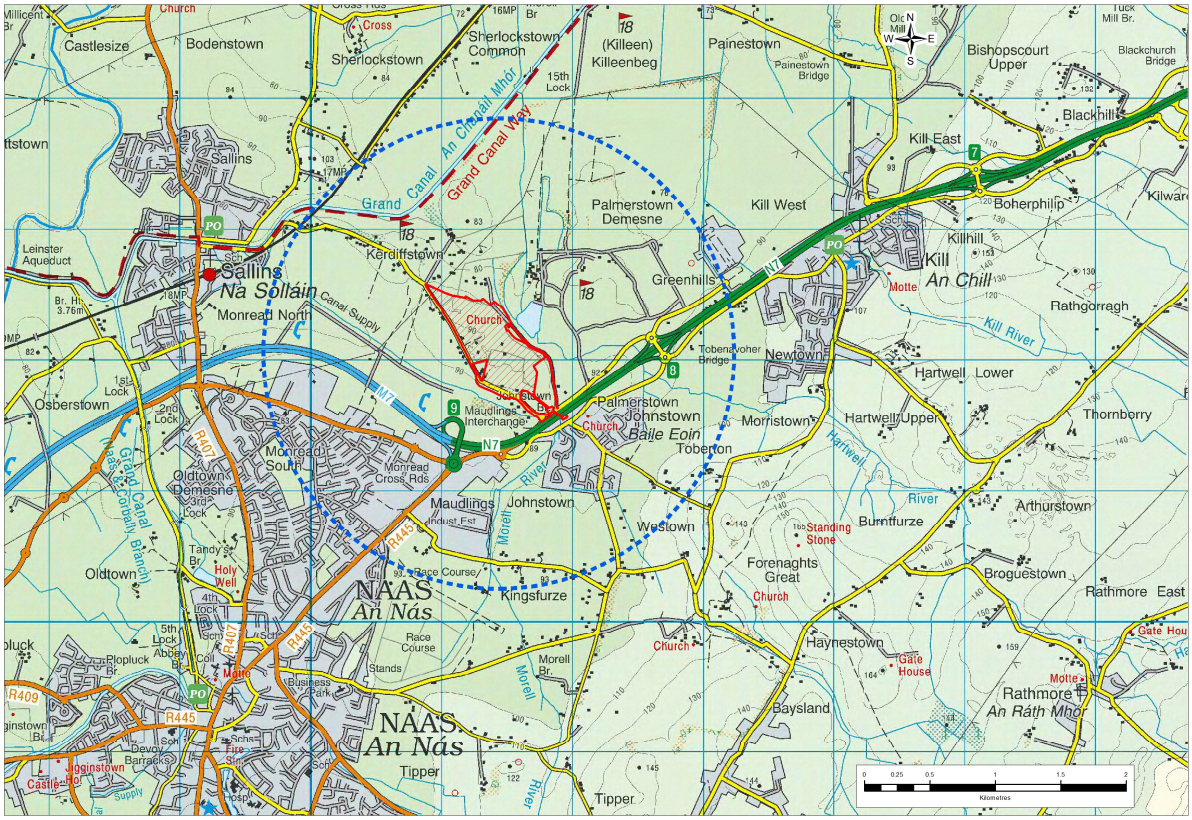


Figure 2.A: 20 minute walking catchment from proposed site entrance

2.2.2 Cycling

Figure 2.B shows that nearby residential areas such as Johnstown, Sallins, Kill and Naas are within a reasonable distance to cycle to the site. Segregated shared use paths exist both north and south of the N7 directly south of the site and eastward. A pedestrian bridge provides access over the N7 to Johnstown. Due to the parapet height which appears applicable to pedestrians only cyclists must walk bicycles across the bridge. Many roads in the vicinity do not have segregated facilities or marked cycle lanes; cyclists share the carriageways with vehicular traffic.

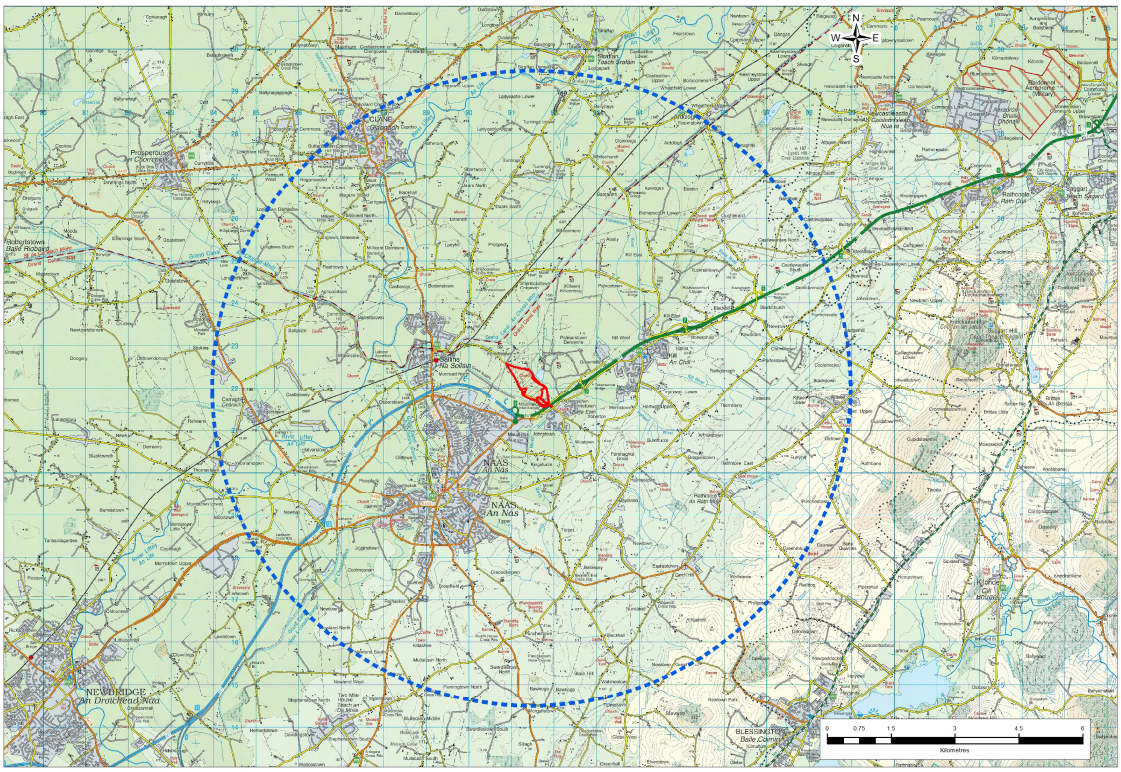


Figure 2.B: 30 minute cycle catchment from site entrance

Figure 2.B illustrates a 30 minute cycling catchment (7.5km radius at 15km/h), which is assumed as a reasonable cycle journey time and distance.

2.3 Public Transport

2.3.1 Rail Provision

There is no rail station in walking proximity to the proposed Project. However, the main railway station for Naas/Sallins lies approximately 3.2km west of the site. This station has frequent services toward Dublin and to points west and south (e.g. Limerick, Galway, Portlaoise, Kildare and Waterford).

2.3.2 Bus Provision

There is currently no bus provision adjacent to the proposed Project along L2005 Kerdiffstown Road. The nearest bus stops are in Johnstown to the south of the pedestrian bridge over the N7, within a 20 minute walk of the proposed site entrance. These stops currently include services 126 and 130 (see Table 2.1), with regular services between Dublin and Kildare.

Table 2.1: Bus Services serving Johnstown in the vicinity of the proposed Project

Service	Route	Service Frequencies				Journey Time	Operator
		Weekday AM	Weekday PM	Sat	Sun		
126	Johnstown > Dublin Connelly LUAS Stop	15 mins	45 mins	50 mins	70 mins	~45 mins	Bus Eireann
	Dublin Connelly LUAS Stop > Johnstown	50 mins	30 mins	75 mins	50 mins	~45 mins	
130	Johnstown > Dublin Busaras	2 buses (0822, 1007)	n/a	2 buses (0827, 1007)	n/a	~45 mins	Bus Eireann
	Dublin Busaras > Johnstown	n/a	1 bus (1840)	n/a	1 bus (1840)	~45 mins	

2.3.3 Existing Road Network

Kerdiffstown Road is a local road immediately adjacent to the proposed project site. It connects the N7 Junction 8 to Sallins and provides the only road access to the site. The road includes many private access locations along its length, as well as access to the Naas Golf Club just to the north of the proposed project site. The speed limit for Kerdiffstown Road is 60 kph.

The N7 separates the project site vicinity from the village of Johnstown. Junction 8 is the nearest access to the proposed site, approximately 0.75 km east of Johnstown. Junction 8 consists of two roundabouts north and south of the N7 and access on and off ramps to the motorway.

A private road to Kerdiffstown House runs along the eastern boundary of the proposed project area, following the River Morell. There is a controlled access gate to the south of the site where this private road meets Kerdiffstown Road.

Frontage roads lie north and south of the N7 between the proposed project area, Junction 8 and Kill. These are generally single carriageway routes with shared use cycle/pedestrian paths adjacent to the carriageway separated by a grassy verge and wooden bollards.

3. The Proposed Project

3.1 Site Location and Development Context

The site of the proposed Project, is located in County Kildare, approximately 3km north-east of central Naas to the south-west of Dublin, approximately 400m north-west of Johnstown village and in close proximity to the strategically important M7/N7 corridor as shown on Figure 3.1 of the EIS. An extract of the site location showing existing access is shown below as Figure 3.A. The land uses in the immediate vicinity of the proposed Project are parkland associated with Kerdiffstown House to the north-east, golf courses to the north and north-east, and a mixture of land uses including residential, agricultural and worked out quarries to the south-east, south-west and west.

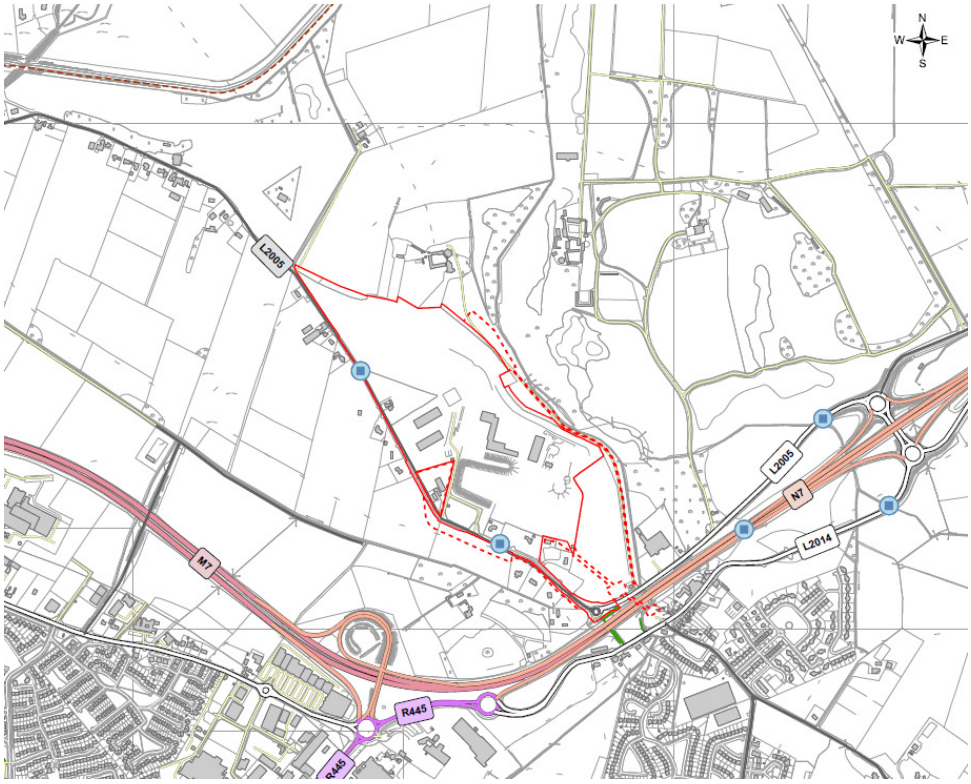


Figure 3.A: Location Plan of Proposed Project

Vehicular access to the existing site is via a priority junction on L2005 Kerdiffstown Road, which links Johnstown at N7 Junction 8 in the south-east, to the settlement of Sallins (via Church Ave) to the north-west. A pedestrian footbridge connects L2005 Kerdiffstown Road with the local road network in Johnstown.

3.2 Site Access Proposals

As part of the proposed Project preliminary design phase an assessment of the existing access arrangements for the site was undertaken. This confirmed that the existing access would not be fit for purpose in terms of accommodating HGV traffic associated with the Remediation Phase of the proposed Project, given poor levels of visibility on egress from the site. Assessment of alternatives was therefore undertaken, embracing the following activities:

- A high level desk study of potential site access options;

- A comprehensive site visit to assess the strength and weaknesses of all potential site access options, consideration of additional options not identified from the desk study activity. The site visit eliminated non feasible access options and identified options to be taken forward to feasibility design stage;
- Preparation of feasibility design drawings of potential access options determined from the site visit; and
- Design of the preferred access option.

The assessment identified that a new site access would comprise a roundabout, in close proximity to the existing site access. The location and make-up of the proposed access represents the most appropriate to enable safe access to the site for both the Remediation Phase and Operational Phase. The roundabout has been designed in accordance with the National Road Authority Design Manual for Roads and Bridges (NRA DMRB) (DN-GEO-TD16 Geometric Design of Roundabouts) (refer to Appendix A4.1 of the EIS). To accommodate the revised site access realignment and widening of the L2005 Kerdiffstown Road is required. This comprises works to the immediate west of the existing site access and to the east, adjoining to an existing roundabout on the L2005 Kerdiffstown Road located to the south-east of the site. The geometric design parameters for all other roads are set out in the Design Manual for Urban Roads and Streets (DMURS) (Section 4.4.6 Alignment and Curvature).

Furthermore, while providing a safe access arrangement for all road users during the Remediation and Operational Phases the proposed access design includes provision of pedestrian and cycle infrastructure. This will be of particular benefit during the Operational Phase. This provision of a new shared use pathway alongside the L2005 Kerdiffstown Road comprises:

- linkage of the site via the existing footbridge to Johnstown to the south (and onward to Naas);
- linkage of the site via the N7 Junction 8 to the east, towards Kill;
- several uncontrolled crossings;
- a section of shared use pathway linking to L2005 Kerdiffstown Road to the north-west of the new site access; and
- a ramp providing cyclists access to the shared use trail south of the proposed site access roundabout.

Details of the new access, road realignment and pedestrian/ cyleway provision are shown on Figures 4.12 to 4.14 of the EIS.

The design has been subject to a Stage 1 Road Safety Audit (RSA). Feedback on the RSA was provided by the design team and approved by Kildare County Council project team, and the design revised accordingly. This is provided in the Traffic and Transport chapter of the EIAR.

The new site access and realignment of L2005 Kerdiffstown Road are proposed to be undertaken as part of the first phase of remediation works.

3.3 Parking

3.3.1 Remediation Phase Parking

It is proposed that throughout the Remediation Phase, project site staff and construction personnel will park on-site using the existing informal staff parking spaces accessed via the new proposed site access off the L2005 Kerdiffstown Road. During the busiest phase of remediation, it is predicted that approximately 40 staff will be required on site. On the basis of a robust estimate of single occupancy car trips for all staff, these 40 vehicles can be comfortably accommodated within the existing staff car park and adjacent hardstanding areas. Additional overflow parking areas will be made available elsewhere within the site should the need arise.

Furthermore, given the entire site will be subject to construction activities at some time during the Remediation Phase staff parking will require to be moved to other locations within the bounds of the site.

In addition to cars a number of HGVs associated with the Remediation Phase may be parked on site during the project. An estimated 140 two-way HGV movements are anticipated daily during peak periods of the remediation works which equates to an average of 14 per hour over the course of a 10-hour workday. Assuming that each hourly movement is a separate vehicle, it is conservatively assumed that 14 HGVs may be parked on site at any one time. In addition to HGVs, other construction equipment, plant and vehicles will likely be needed on site to enact the remediation activities. Sufficient areas are available on site to accommodate parking of site plant and vehicles.

The proposals for such will be detailed in the contractor's Construction Traffic Management Plan supporting the Construction Environmental Management Plan.

3.3.2 Operational Parking

The Kildare County Development Plan 2017-2023 references maximum car and cycle parking standards for various land use developments. The parking provision on the basis of the three multi-use sports pitches to be developed for the proposed Project as calculated from the relevant parking standards are shown below in Table 2.1 below.

Table 3.1: Car and Cycle Parking Standards and Provision (Kildare County Development Plan 2017-2023, Table 17.9 and 17.10)

	Cars		Cycle	
Land Use	**Maximum Parking Standard**	**Provision for the proposed Project**	**Parking Standard**	**Provision for the proposed Project**
Playing fields	15 spaces per pitch	45 spaces	20 spaces per pitch	60 spaces
Public Park	Not specified	Not specified	Not specified	Not specified
Playground	Not specified	Not specified	Not specified	Not specified

For three multi-use pitches a total of 45 car parking spaces would be the maximum permitted under the guidance of the Kildare County Development Plan (2017-2023). However, as the pitches will be primarily utilised for training purposes there is a need to provide adequate space for frequent changeover between training sessions. This could be estimated to comprise a need for a total of 90 car parking spaces, facilitating a short turnover.

Car parking provision is also necessary for use of the site as a public park and playground. There are no car parking standards directly associated with this land use. The car parking provision will have capacity for a further 110 car parking spaces or use by coach/mini-bus parking.. However, as per the Development Management Standards in the County Development Plan 5% of the parking provision should be set aside for disabled parking bays. Up to 10% of spaces shall include electric charging facilities in order to meet the targets of the Government's Electric Transport Programme and in response to 'Climate Change the Government's National Policy Position on Climate Action and Low Carbon Development'. Overall the car parking provision is considered sufficient in capacity for the needs of the proposed Project.

For the multi-use pitches a total of 60 cycle parking spaces would be the standard provision under the guidance of the Kildare County Development Plan (2017-2023). Cycle parking provision is also to be available for use at the site of the public park and playground, However there are no cycle parking standards directly associated with these land uses.

As such, the identified parking provision is considered appropriate for the Operational Phase of the proposed Project, and is robust given assumption that most travel by single occupancy car, whereas it is expected that users may arrive by walking, cycling or car sharing.

4. Policy Context

4.1 Introduction

In order to demonstrate that the development of the site complies with current national and local transport planning policies, a review was undertaken of the following documents:

- Planning Policy Statement 2015;
- National Development Plan 2007-2013;
- National Spatial Strategy 2002-2020;
- Urban Design Manual, A Best Practice Guide (May 2009);
- National Climate Change Strategy 2007-2012;
- National Cycle Manual 2011;
- Smarter Travel – A sustainable transport future – A new transport policy for Ireland 2009-2020;
- Transport Strategy for the Greater Dublin Area 2016-2035;
- Kildare County Development Plan 2017-2023;
- Naas Town Development Plan 2011-2017; and
- Naas Neighbourhood Greenways.

In undertaking this traffic and transport assessment, the following guidance documents have been taken into account:

- Traffic and Transport Assessment Guidelines (Transport Infrastructure Ireland, 2014) (NRA Guidelines);
- Design Manual for Urban Roads and Streets (DMURS), Department of Environment, Community and Local Government, 2013;
- Guidelines for Traffic Impact Assessment, The Institution of Highways and Transportation, September 1994; and
- Design Manual for Roads and Bridges, Traffic Infrastructure Ireland.

4.1.1 Planning Policy Statement 2015

The purpose of Ireland's planning policy is to assist with decisions on competing development options in the future and aims to deliver a planning process that will:

> *"ensure the right development takes place in the right locations and at the right time in providing the social, economic and physical infrastructure necessary to meet the needs of our people in a way that protects the many qualities of our natural and built environment"*

National, regional and local officials aim to implement the ten principles the Planning Policy Statement is built upon (as listed below):

1. Planning must be plan-led and evidence based;
2. Planning must proactively drive and support sustainable development;
3. Planning is about creating communities and further developing existing communities in a sustainable manner;
4. Planning must support the transition to a low carbon future and adapt to a changing climate;
5. Planning must ensure that development facilitates and encourages greater use of public transport as well as making walking and cycling more attractive for people;

6. Planning will encourage the most efficient and effective use of previously developed (brownfield) land;
7. Planning will enhance sense of place;
8. Planning will conserve and enhance the rich qualities of natural and cultural heritage;
9. Planning will support the protection and enhancement of environmental quality; and
10. Planning will be conducted in a manner that affords a high level of confidence.

The proposed Project complies with the criteria set out in the Planning Policy Statement 2015, according to the key principles of the overall development:

- by creating high quality cycle and pedestrian access to the site to aid in the transition to a low carbon future;
- efficiently using a brownfield site;
- enhancing the sense of place related to Naas and surrounding towns; and
- supporting environmental quality and protection.

4.1.2 National Development Plan 2007-2013

The National Development Plan 2007 – 2013 is characterised by its focus on 'a better quality of life for all' and sets out the following goals in order to achieve this:

- A strong, competitive economy, delivering quality, sustainable employment in a more regionally balanced manner;
- Affordable, quality housing, complemented by efficient access to facilities and services for work, education, healthcare, childcare, sports, recreation and culture;
- A sustainable, high quality environment; and
- A greater level of participation in society by all.

The proposed development complies with the criteria set out in the National Development Plan 2007-2013 as it creates a new community-serving recreational facility that may be accessed efficiently and sustainably. It also encourages greater social participation, and the planning underway for the site would produce a sustainable and environmentally sensitive development to remediate a former brownfield site.

4.1.3 National Spatial Strategy 2002-2020

The National Spatial Strategy (NSS) offers a 'broad, long-term, comprehensive twenty-year view for achieving more balanced patterns of development' in Ireland. The NSS identifies Naas as a *Primary Development Centre*, designated as the main focus areas for growth in the Greater Dublin Area hinterland. This suggests that Naas and its environs should be considered centres of continued development in the future for a variety of land uses, particularly in a way that energises its own catchment.

This overall vision of the NSS is to be achieved by strategically influencing Ireland's spatial structure to develop 'gateways' and 'hubs' to:

> *'…achieve more balanced regional development in order to reduce the disparities between and within the two Regions (Border, Midlands and West and South and East) and to develop the potential of both to contribute to the greatest possible extent to the continuing prosperity of the country. Policies to secure such development must be advanced in parallel with policies to ensure that this development is sustainable with full regard to quality of life, social cohesion, and conservation of the environment and the natural and cultural heritage'.*

The Kerdiffstown Landfill site contributes to the aims of the National Spatial Strategy by providing community-serving recreational facilities in close proximity to a designated Primary Development Centre (Naas). In addition,

transportation considerations for the site will be implemented with sustainable transport in mind, contributing to the sustainable development goals of the strategy.

4.1.4 Urban Design Manual – A Best Practice Guide (May 2009)

The *Urban Design Manual – A Best Practice Guide* focuses on creating well-designed, sustainable neighbourhoods that will stand the test of time'. It is primarily concerned with issues related to housing development, but also promotes sustainable development more broadly. As such, it provides a strong foundation for the design of development sites in relation to their accessibility, particularly walking and cycling. The manual follows a set of 12 criteria and sub-indicators of which the following are linked to this Transport Assessment:

- Connections: How well connected is the new neighbourhood?
  - There are attractive routes in and out for pedestrians and cyclists.
  - The development's layout makes it easy for a bus to serve the scheme.
  - The layout links to existing movement routes and the places people will want to get to.
- Inclusivity: How easily can people use and access the development?
  - Design and layout enables easy access by all.
  - Areas defined as public open space that have either been taken in charge or privately managed will be clearly defined, accessible and open to all.
- Layout: How does the proposal create people friendly streets and spaces?
  - Layout aligns routes with desire lines to create a permeable interconnected series of routes that are easy and logical to navigate around.
  - The streets designed as places instead of roads for cars, helping to create a hierarchy of space with less busy routes having surfaces shared by pedestrians, cyclists and drivers.
  - Traffic speeds are controlled by design and layout rather than by speed humps.
- Public Realm: How safe, secure and enjoyable are the public areas?
  - Roads and parking areas are considered as an integral landscaped element in the design of the public realm.
- Parking: How will the parking be secure and attractive?
  - Parking is provided communally to maximise efficiency and accommodate visitors without the need to provide additional dedicated spaces.
  - Adequate secure facilities are provided for bicycle storage.

This TTA was prepared in accordance with the *Urban Design Manual, A Best Practice Guide*. In particular, the guidance on walking and cycling and accessibility was followed during the preparation of this TTA.

4.1.5 National Climate Change Strategy 2007-2012

The *National Climate Strategy 2007-2012* outlines Ireland's commitment to reducing emissions to no more than 13% above 1990 levels over the five year period from 2007-2012. Chapter 4 of the Strategy is dedicated to Transport and highlights the need for applying measures to reduce transport emissions, particularly modal shift. The proposed Action Plan aims to employ:

- In-depth modelling of emissions for future transport developments;
- Intelligent Transport Systems (ITS) to manage and optimise the transport network to increase efficiency;
- Fiscal measures, such as road pricing, congestion charges and car parking fees to reduce private car usage.

The proposed Kerdiffstown Landfill project seeks to satisfy a portion of its travel demand through zero-carbon travel, including walking and cycling. The management plan for the operational site has not yet been developed, however car parking fees would be an option available to KCC to discourage private car use. ITS does not apply in the context of this area.

4.1.6 Smarter Travel – A Sustainable Transport Future – A New Transport Policy for Ireland 2009-2020

Smarter Travel – A Sustainable Transport Future is 'designed to show how Ireland can reverse current unsustainable transport and travel patterns and reduce the health and environmental impacts of current trends and improve our quality of life'. The plan outlines the current transport trends and statistics in Ireland and focusses on policies which aim to increase transport sustainability by 2020:

Key Goals:

- Improve quality of life and accessibility to transport for all and, in particular, for people with reduced mobility and those who may experience isolation due to lack of transport;
- Minimise the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions;
- Reduce overall travel demand and commuting distances travelled by the private car; and
- Improve security of energy supply by reducing dependency on imported fossil fuels.

The proposed development complies with the criteria set out in *Smarter Travel* as it will create high quality non-motorised and fully accessible linkage to the site, thereby reducing the potential need for use of fossil fuels and resultant green gas emissions / other localised air pollutants.

4.1.7 National Cycle Manual 2011

The National Transport Authority (NTA) published the *National Cycle Manual* in 2011 to provide guidance on integrating cycling into the design of urban areas. It offers basic strategy, network planning and design guidelines for cycle facilities and other details. The *National Cycle Manual* is the primary design guidance document for cycling in Ireland.

The overall aim of the manual is to contribute to improvements that encourage more people to cycle, including those who are risk-averse, and ultimately to upgrade the cycling offer in urban areas to provide a safe and stress free cycling environment.

4.1.8 Transport Strategy for the Greater Dublin Area 2016-2035

The Transport Strategy for the Greater Dublin Area is a framework for the planning and delivery of transport infrastructure and services in the Greater Dublin Area (an area that includes the region around Naas and the proposed project area). It provides transport planning policy around which other agencies involved in land use planning, environmental protection, and delivery of other infrastructure can align their investment priorities.

The Strategy has an overarching purpose to:

> *"contribute to the economic, social and cultural progress of the Greater Dublin Area by providing for the efficient, effective and sustainable movement of people and goods."*

The document includes the following key messages:

- Transport must be a key consideration in land use planning;
- In the short term, funding for large-scale transport projects will be limited;
- Addressing urban congestion is a priority;
- The capacity of the strategic road network must be protected;

- A significant reduction in the share of trips undertaken by car is required, particularly in relation to short trips and commuter trips;
- An associated increase in walking, cycling and public transport is also required;
- A safe cycle network, with extensive coverage in metropolitan Dublin and in other towns, is needed to cater for the increased use of cycling that is already occurring and to reduce the dominance of the private car in meeting travel needs.
- The enhancement of the pedestrian environment, including measures to overcome severance and to increase permeability, is a priority; and
- All-day travel demand from all groups in society must be taken into account – the strategy cannot merely take a peak-hour approach to transport issues.

The proposed development is within the radial planning corridor D (Newbridge-Naas-Clondalkin-North Tallaght-to Dublin City Centre). It fits well within the parameters of the Greater Dublin Area Transport Strategy as it will seek to enhance/improve cycle and pedestrian links to the site from Johnstown/Naas, thereby negating the need for short car trips. In addition, the access road to the site will be designed to accommodate large vehicles such as buses, though no public transport buses currently serve the area.

4.1.9 Kildare County Development Plan 2017-2023

Kildare County Development Plan 2017 – 2023 currently has modal shift and sustainable travel featuring prominently throughout the chapter. Key policies relating to the proposed Project include:

> *"*MT1: *Promote the sustainable development of the county through the creation of an appropriately phased integrated transport network that services the needs of communities and businesses."*
>
> "MT11: *Focus on improvements to the local road and street network that better utilise existing road space and encourage a transition toward more sustainable modes of transport, while ensuring sufficient road capacity exists for trips which will continue to be taken by private vehicle."*
>
> "WC1: *Prioritise sustainable modes of travel by the development of high quality walking and cycling facilities within a safe street environment."*
>
> "WC3: *Ensure that connectivity for pedestrians and cyclists is maximised in new communities and improved within the existing areas in order to maximise access to town centres, local shops, schools, public transport services and other amenities."*
>
> "LR1: *Ensure that the safety and capacity of the local road network is maintained and improved where funding allows and to ensure that local streets and roads within the county are designed to a suitable standard to accommodate the future needs of the county. The design of these roads and streets should balance the needs of place and movement with providing a safe street environment for all road users."*

These policies focus largely on sustainability within the community and encouraging sustainable travel choices to be made. Sustainable travel will be integrated into both the Remediation and Operational Phases of the proposed Project.

The Development Plan also includes Development Standards for the provision of parking and cycle parking.

Furthermore, use of the remediated site as a multi-use public park would encourage active travel choices to be made, given the improved footpath and cycleway provision. This includes the village settlements of Johnstown and Kill. These factors would have a positive influence on the local community and its businesses, through the economic benefits of developing the site and infrastructure; social and health benefits of a new recreational space which encourages active lifestyles (e.g. walking and cycling); and the environmental benefit of

remediating the former landfill site and developing it into a multi-use public park which would ideally be accessed through means of active travel.

4.1.10 Naas Town Development Plan 2011-2017

Chapter 7 of the Naas Town Development Plan – 'Movement and Transport' - sets out a strategy to:

> *"improve the safety, capacity and efficiency of an integrated transportation infrastructure in Naas in accordance with national, regional, county and local policy. It also involves recognition of the shifts towards public transportation, walking and cycling, and of the land use responses needed to ensure efficiency, economic returns on investment, minimal environmental impact and strengthening the quality of life in the town."*

The proposed Project strongly aligns with the Naas Town Development Plan on the basis that it reduces the environmental impact of the former landfill site and encourages active travel. Firstly, the remediation of the site will reduce the environmental impact the landfill site currently has on the surrounding environment. Remediation Phase related traffic in the form of Heavy Goods Vehicles (HGVs) and general traffic would have a temporary impact on the local road network and environment, however the longer term benefits would outweigh this temporary impact. Proposals for the remediation outline design have reduced the volume of material required for importation to the site, reducing the impacts on the local road network and community. Secondly, the site would encourage and facilitate active travel with bicycle and pedestrian access implemented; and the 'active' nature of the park which has dedicated footways, pathways and areas for exercise. Active travel has a positive environmental impact and can increase the quality of life of users and participants.

4.2 Assessment of the proposed Project in relation to policy context

The assessment demonstrates that the site conforms to the key land use and transport planning objectives. The various policies identify the criteria against which planning applications should be assessed; the site can comply with these criteria as demonstrated below:

- Direct improvement to cycling and walking infrastructure linking the proposed site with existing resources;
- Reduction in car-related adverse effects of increased trips to/from the site such as carbon and other pollutant emissions;
- Creation of a community-serving recreational site within close proximity to a designated Primary Development Centre (Naas).

The TTA was prepared in accordance with the Urban Design Manual, A Best Practice Guide (May 2009). In particular, the guidance on walking and cycling journey times was followed during the preparation of this TTA.

The proposals comply with the National Development Plan 2007-2013, Urban Design Manual – A Best Practice Guide (2009), National Climate Change Strategy 2007-2012, Smarter Travel – A Sustainable Transport Future – A New Transport Policy for Ireland 2009-2020, Greater Dublin Area Transport Strategy 2016-2035, and the South Dublin County Council Development Plan 2010-2016.

5. Trip Generation and Assignment

5.1 Remediation Phase Traffic

5.1.1 General Assumptions

For traffic associated with the Remediation Phase accessing to and from the site, it is proposed that all HGV traffic will route via Junction 8 of the N7. Given that the origin of remediation traffic is unknown at this stage, in order to ensure that a robust assessment is undertaken, the assessment considers 100% of HGV related remediation traffic travelling to / from the N7 east and N7 west.

During the busiest phase of remediation, the site is expected to generate a an average of 90 arrivals (180 two way trips) per day. Of the 90 arrivals to the site, 70 are HGVs. On the busiest days of remediation (during the peak phase), the number of trips may be higher and in order to account for this and ensure that this assessment undertakes a robust assessment of remediation impacts, it has been assumed that on the busiest day of remediation, 180 vehicles will arrive from the site (including 140 HGVs) and 180 vehicles will depart from the site.

As such, the following worst case remediation phase assessment scenarios have been considered within the assessment:

- 30% of the maximum 360 remediation trips (108) will travel to/from site within the AM (07:00 – 10:00) and PM (16:00 -19:00) peak hours. This will result in 54 vehicles (42 HGVs / 12 Cars) cars travelling to site within the 07:00-10:00 morning peak and from the site in the evening peak of 16:00-19:00; and
- 100% of remediation related traffic (180 arrival and 180 departures) arrives and departs during the AM and PM peak periods, respectively.

While this report assesses the worst case impacts of the remediation phase of the proposed development, in order to cater for every eventuality and ensure that a robust assessment has been undertaken, it is extremely unlikely that either of the scenarios outlined above will occur in reality given that the appointed remediation contractors will be bound by a Construction Traffic Management Plan (CTMP). The CTMP will include details of the routes that HGV remediation traffic must take when travelling to the site, along with details of delivery windows confirming when HGV traffic may arrive on-site, which is most likely to be outside of the AM and PM peak periods. The CTMP, which will be completed post-planning and in conjunction with KCC, will be binding to the contractors. Notwithstanding this, a worst case assessment of potential remediation impacts has been undertaken.

While the remediation phase traffic includes for up to 40 additional non-HGV movements which could route to the site via Sallins and may occur during peak periods the Operational Phase assessment has shown that this increase can be accommodated within the local road network with no detrimental impacts observed.

The remediation trip distribution for the proposed development is contained within Figure 5.1, while the AM and PM trip generation for all remediation scenarios is contained within Figures 5.2 to 5.5 in Appendix A. TRICS data is provided as an appendix to Chapter 15 of the EIAR.

5.2 Operational Phase Traffic

5.2.1 General Assumptions

In order to determine trip generations associated with the proposed Project operational phase, reference has been made to the Trics 2016 database, in which hourly vehicle trip rates were established. Trip rates for the following leisure land use have been considered:

- Country Park

Given that the Country Park land use in Trics can include facilities such as a nine hole golf course, café and visitor centre, it is assumed that the trip rates provided are robust in relation to the proposed end-use of the proposed Project. Furthermore for robustness, the trip rates have assumed that the public park will comprise a larger area (30 hectres) then is proposed.

Table 5.1 illustrates trip rates and subsequent vehicle trip generations for the proposed development operational phase.

Table 5.1: Proposed Development Operational Phase Trip Generation

	Morning Peak 0700 – 1000 (Trip rate per hectare)		Evening Peak 1600 – 1900 (Trip rate per hectare)	
	IN	OUT	IN	OUT
Trip Rate	0.356	0.182	0.368	0.815
Trip Generation	11	5	11	24

Table 5.1 therefore illustrates a robust trip generation of:

- **16** two-way vehicles during the AM peak; and
- **35** two-way vehicles during the PM peak.

It is predicted that the two way flows denoted above can be adequately accommodated within the existing local road network and at the proposed new access junction. The junction analysis in Section 6 provides further detail. It is further observed that the above assessment will be positively mitigated by the proposed opening hours of the facilities, to include the park and multi-use sports pitches which are subject to other restrictions such as daylight hours, health and safety considerations and Industrial Emissions Licence compliance (regulated by the EPA).

5.2.2 Operational Traffic Assignment

The operational traffic has been assigned based on existing turning movements, with AM and PM peak trip distributions detailed in Figures 5.6 to 5.7 in Appendix A. While the proposed Project will represent a destination for additional traffic which may occur during peak periods the robust Remediation Phase assessment scenarios have shown that significant increases in traffic movements can be accommodated within the local road network with no detrimental impacts observed.

The proposed Sallins Bypass is anticipated to open by 2020, which will re-distribute traffic on the local road network around Sallins, with traffic routing to the N7 most likely to route via the Bypass than via Kerdiffstown Road. As such, in order to ensure that a robust assessment is undertaken, traffic associated with the projected base scenarios has not been re-routed via the bypass and continues to route via Kerdiffstown Road, which ensures that a worst case assessment of the impacts on Kerdiffstown Road have been undertaken.

The proposed operational phase trip generation is contained within Figures 5.8 to 5.9 in Appendix A.

6. Traffic Impact Assessment

6.1 General Approach

This section describes the methodology employed to assess the impact of the traffic generated by the proposed Project during the Remediation Phase and Operational Phase on the local road network. The results of the analysis are also discussed.

A microsimulation model was developed by Jacobs in February 2017 using VISSIM, with the approach, methodology and extents of the assessment agreed with the KCC Roads Department following the submission of a scoping report. The model was developed to assess the impacts of the proposed development remediation and operational phases in support of the development proposals. The model extends from Junction 8 of the N7, to the southeast of the site, to the R407 / Church Avenue junction in Sallins, to the north-west of the site. The extents of the model network are shown in the Traffic Flow Diagrams in Appendix A.

The baseline models, which represent two 3 hour periods; 7am to 10am (AM Peak) and 4pm to 7pm (PM Peak), were developed using 2017 traffic survey data and is calibrated and validated in accordance with TII PAG guidance. As such, the model is deemed appropriate for use in assessing the impacts that may result from the proposed Project during the Remediation Phase and Operational Phase. Further detailed calibration and validation results are presented in Appendix B.

6.2 Base Traffic Flows

Classified junction traffic count and queue length surveys were undertaken by Nationwide Data Collection on 26th January 2017 between 0700 and 1900 at the following junctions:

1. R407 / Church Avenue, Sallins;
2. R407 / Church Avenue (E), Sallins;
3. Church Avenue (W) / Church Avenue (S), Sallins;
4. L2005 Kerdiffstown Road Roundabout;
5. N7 Junction 8 North Roundabout; and
6. N7 Junction 8 South Roundabout.

Automatic Traffic Counters (ATCs) were installed at the following locations on the local road network:

7. Church Avenue Railway Bridge, Sallins (January 2017);
8. L2005 Kerdiffstown Road, North of Existing Landfill Access (September 2016); and
9. L2005 Kerdiffstown Road, South of Existing Landfill Access (September 2016).

Location of surveys and ATCs are shown on Figures 6.A and 6.B below.

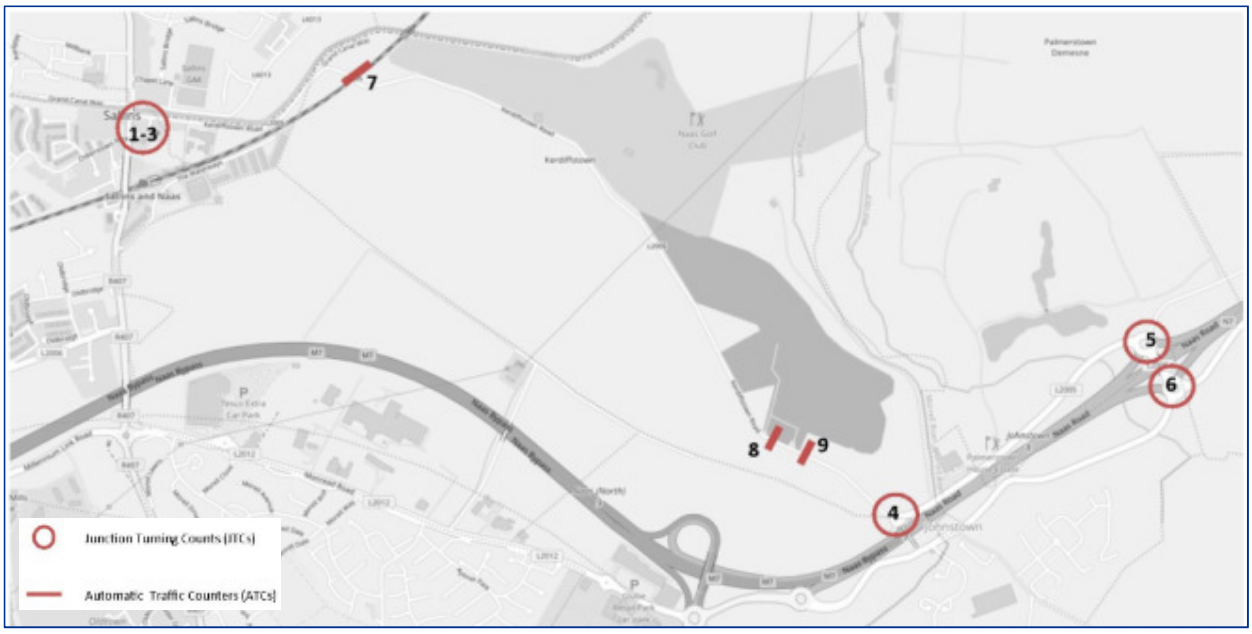


Figure 6.A: Location of all traffic surveys



Figure 6.B: Focus on Locations 1-3

From these traffic counts the network peak hours on the local road network were established as follows:

- AM peak – 09:00 to 10:00
- PM peak – 17:00 to 18:00

The AM network peak, detailed above, is later than the recorded peak in and around the N7, possibly due to the high prevalence of school traffic in Sallins. In order to ensure that the peak impacts are assessed on the entire modelled network, a 3 hour peak period (07:00 – 10:00) has been assessed, with localised flow profiles across the three hour period determined through analysis of the traffic survey data.

Demand matrices were developed to represent the various zone to zone traffic movements in the study area based on the observed traffic patterns across the defined AM (07:00 – 10:00) and PM (16:00 – 19:00) peak periods. The demand matrices allow for differing vehicle classes to be assigned to the network and are profiled at fifteen minute time intervals.

6.3 Traffic Growth

Traffic growth for the surrounding road network is based on the medium growth rates for East Ireland obtained from NRA Project Appraisal Guidelines, Unit 5.5 Link-Based Traffic Growth Forecasting.

The commencement of the Remediation Phase is subject to the determination of the planning process, the period for which is not defined. As a result a start date of remediation works for the purposes of this traffic and transport assessment has been assumed as 2018. This ensures a robust assessment of the Remediation Phase impacts.

By assuming that the peak traffic volumes relating to the remediation works occur in the first year of the Remediation Phase, i.e. 2018, baseline traffic is projected to an earlier year and thus utilises a lower projected baseline. The addition of the associated percentage increase to this baseline, taking cognisance of the estimated total daily construction traffic volumes, would be higher than use of a later start date (this would see a higher projected baseline but lower percentage increase). It is therefore considered that this assumed start date of 2018 represents a more robust approach.

Furthermore, with the proposed Remediation Phase estimated to last between three and four years, the Operational Phase of the proposed Project is anticipated to commence (at the earliest) in 2022. As a result, and in a similar approach to that above, baseline traffic has been projected to this year for the purposes of a robust Operational Phase assessment.

The following medium growth rates, from NRA Project Appraisal Guidelines, Unit 5.5 Link-Based Traffic Growth Forecasting, have been applied to the base flows for the following scenarios:

- Medium growth rate of 1.022 (All Traffic) and 1.016 (HGVs) for peak remediation year of 2018;
- Medium growth rate of 1.055 (All Traffic) and 1.048 (HGVs) for operational year of 2022;
- Medium growth rate of 1.097 (All Traffic) and 1.048 (HGVs) for operational year of 2027; and
- Medium growth rate of 1.187 (All Traffic) and 1.048 (HGVs) for operational year of 2037; and

The demand associated with the development (during remediation and operation) are then added to the background traffic growth levels as detailed in Chapter 5 (Section 5.2.1).

6.4 Assessment Scenarios

The scenarios considered within the traffic impact assessment for the AM and PM peak periods are:

- 2017 Base;
- 2018 Projected Do Minimum (assumed remediation start);
- 2022 Projected Do Minimum (assumed operational start);

- 2027 Projected Do Minimum (assumed operational start);
- 2037 Projected Do Minimum (assumed operational start);
- 2018 Projected + Remediation Traffic;
- 2018 Projected + Remediation Traffic (Sensitivity Test);
- 2022 Projected + Operational Traffic;
- 2027 Projected + Operational Traffic; and
- 2037 Projected + Operational Traffic.

The traffic flows for each of the above scenarios are illustrated in Figures 6.1 to 6.20 in Appendix A.

6.5 Model Reporting and Key Points

Impacts on forecast maximum queue lengths were considered in both the remediation and operational assessments. The maximum queue lengths are summarised in the report for comparison between the model scenarios and the forecasts represent the predicted maximum levels of queuing across the busiest 15 minute periods on each junction approach, which provide a more robust view of the likely queuing levels at peak times. It should also be noted that the forecast maximum queues, represent the maximum expected during the three hour period and do not reflect queuing levels for the full three hours.

Model queue lengths are reported in vehicles based on a standard length of around 5.5m to 6m per vehicle.

Vehicle Delay (seconds) was also considered in the assessment of the model scenarios and these present forecast average delay estimates during the peak periods.

Traffic on the N7, constituting use of Junction 8, was considered as part of the model assessment, in addition to traffic using the local roads that interact at the interchange. Increases in traffic associated with the proposed Project experienced on the mainline N7 are considered to have a negligible impact due to the high carrying capacity of the strategic road network.

6.6 Model Results and Analysis

6.6.1 2017 Base Network

As discussed in Section 6.1, a 2017 microsimulation model was developed, which was calibrated and validated against 2017 base traffic surveys and queue length surveys, in order to robustly assess the remediation and operational impacts of the proposed development. Full details of the calibration and validation of the model are contained within Appendix B.

Table 6.1 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all junctions within the base AM and PM peak models with commentary on the results below.

Table 6.1: AM and PM Peak Period 2017 Base

2017 (Base Network)						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	**R407 / Church Ave, Sallins**	**R407 North**	7	2	5	2
		R407 South	11	5	6	3

2017 (Base Network)						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
		Church Avenue East	2	9	6	13
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	0	0	1
		Church Avenue North	2	1	1	1
		Church Avenue West	1	1	1	1
3	R407 / Church Ave (E)	Church Avenue East	8	17	18	37
		R407 North	11	2	13	2
		R407 South	31	9	30	8
4	Church Ave / Sallins National School	Church Avenue East	0	2	0	6
		Church Avenue West	0	2	0	2
		School	5	1	5	3
5	Church Ave Railway Bridge	Church Avenue East	0	1	0	5
		Church Avenue West	0	1	0	1
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	6
		Kerdiffstown Road West	0	2	0	1
		Golf Club	1	1	0	0
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	0	1	1	5
		Kerdiffstown Road west	0	3	0	2
		Landfill	0	1	1	1
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	1	1	1	4
		Johnstown Garden	0	0	1	1
		N7 Access Road West	0	3	0	1
9	N7 North Roundabout	The Paddocks	1	5	2	4
		N7 off-slip EB	3	6	3	6
		Greenhill Overbridge	0	2	1	1
		N7 Access Road	3	7	2	3
10	N7 South Roundabout	Palmerstown	3	4	4	3
		Kill West	2	1	4	3
		Greenhill Overbridge	2	2	2	3
		N7 off-slip WB	4	3	5	4

During the AM peak period, the greatest level of queuing is reported on the R407 (N) arm of the R407 / Church Avenue junction in Sallins, with a maximum queue length of 30 vehicles. At this junction a queue of 13 vehicles is also noted on the R407 (S) arm. Other locations experiencing queuing of note are also in Sallins, at the R407/ Church Avenue junction, where a maximum queue of 7 vehicles is noted on the R407 (N) arm and 11 vehicles on the R407 (S) arm. Queueing elsewhere on the network is relatively minor during the AM peak.

During the PM peak, the R407/Church Avenue East junction again experiences the longest queues in the network, with 26 vehicles southbound, 17 vehicles for Church Avenue eastbound and 12 vehicles for R407 northbound. The other R407/Church Avenue junction in Sallins experiences some degree of queuing in the PM, ranging from 4 to 6 vehicles, with minor levels of queuing at other locations.

There are no predicted queuing issues at any other assessed location on the network.

6.6.2 2018 / 2022 / 2027 / 2037 Projected Network

The 2018 (assumed Remediation Phase start) and 2022 (earliest assumed Operational Phase start) projected scenarios were developed to provide a robust comparative traffic scenario with the existing road network. Furthermore, future year scenarios (5 years and 15 years after estimated park opening/ commencement of Operational Phase) have been modelled to comply with requirements of a TTA.

Tables 6.2 to 6.5 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all relevant locations within the projected AM and PM peak models with commentary on the results below. In relation to the Remediation Phase specific scenarios (2018), given that no HGV traffic associated with the remediation works will be permitted to route via Sallins, these junctions have been omitted from the Remediation Phase analysis.

Table 6.2: AM and PM Peak Period 2018 Projected

2018 (Projected Network)						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	2	2	4	1
		Kerdiffstown Road west	2	3	2	0
		Landfill	0	1	0	0
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	2	1	0	1
		Johnstown Garden	0	0	1	0
		N7 Access Road West	1	3	0	0
9	N7 North Roundabout	The Paddocks	1	4	1	1
		N7 off-slip EB	3	6	4	1
		Greenhill Overbridge	0	1	1	0
		N7 Access Road	4	6	2	1
10	N7 South Roundabout	Palmerstown	3	2	3	1
		Kill West	2	1	5	1
		Greenhill Overbridge	2	2	3	0
		N7 off-slip WB	3	3	7	1

Table 6.3: AM and PM Peak Period 2022 Projected

2022 (Projected Network)						
Junction / Locations		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	R407 / Church Ave, Sallins	R407 North	7	2	3	2
		R407 South	13	6	7	3
		Church Avenue East	2	12	6	17
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	1	0	1
		Church Avenue North	2	1	1	1
		Church Avenue West	2.3	1	1	2
3	R407 / Church Ave (E)	Church Avenue East	7	17	17	38
		R407 North	13	2	12	2
		R407 South	30	9	26	8
4	Church Ave / Sallins National School	Church Avenue East	0	3	0	6
		Church Avenue West	1	2	0	1
		School	4	1	4	3
5	Church Ave Railway Bridge	Church Avenue East	0	1	0	5
		Church Avenue West	0	1	0	0
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	7
		Kerdiffstown Road West	0	2	0	1
		Golf Club	1	1	0	0
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	2	2	2	4
		Kerdiffstown Road West	1	3	3	2
		Landfill	0	1	1	0
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	2	1	1	4
		Johnstown Garden	0	0	1	1
		N7 Access Road West	2	4	0	1
9	N7 North Roundabout	The Paddocks	1	4	1	4
		N7 off-slip EB	3	6	3	6
		Greenhill Overbridge	0	1	1	1
		N7 Access Road	3	6	2	4
10	N7 South Roundabout	Palmerstown	2	2	3	4
		Kill West	1	1	3	3
		Greenhill Overbridge	3	2	1	2
		N7 off-slip WB	3	3	7	5

Table 6.4: AM and PM Peak Period 2027 Projected

2027 (Projected Network)						
Junction / Locations		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	R407 / Church Ave, Sallins	R407 North	11	2	4	2
		R407 South	11	6	6	3
		Church Avenue East	3	10	6	16
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	0	0	1
		Church Avenue North	2	1	1	1
		Church Avenue West	0	1	1	1
3	R407 / Church Ave (E)	Church Avenue East	7	17	16	39
		R407 North	13	2	13	2
		R407 South	30	10	26	7
4	Church Ave / Sallins National School	Church Avenue East	0	3	2	7
		Church Avenue West	0	2	0	2
		School	4	1	4	2
5	Church Ave Railway Bridge	Church Avenue East	0	1	0	5
		Church Avenue West	0	1	0	1
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	1
		Kerdiffstown Road West	1	1	0	1
		Golf Club	0	2	0	7
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	2	1	3	4
		Kerdiffstown Road West	1	3	2	2
		Landfill	0	0	0	0
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	1	1	2	4
		Johnstown Garden	0	0	1	1
		N7 Access Road West	3	4	0	1
9	N7 North Roundabout	The Paddocks	1	5	1	4
		N7 off-slip EB	3	6	4	6
		Greenhill Overbridge	1	1	1	1
		N7 Access Road	4	6	2	3
10	N7 South Roundabout	Palmerstown	3	2	3	3
		Kill West	2	1	4	3
		Greenhill Overbridge	2	2	2	2
		N7 off-slip WB	3	3	8	5

Table 6.5: AM and PM Peak Period 2037 Projected

2037 (Projected Network)						
Junction / Locations		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	R407 / Church Ave, Sallins	R407 North	12	2	11	2
		R407 South	12	7	11	6
		Church Avenue East	2	16	8	21
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	1	6	3
		Church Avenue North	1	2	1	1
		Church Avenue West	1	1	2	1
3	R407 / Church Ave (E)	Church Avenue East	10	26	22	69
		R407 North	14	2	13	2
		R407 South	35	14	31	8
4	Church Ave / Sallins National School	Church Avenue East	0	4	2	7
		Church Avenue West	1	2	0	1
		School	4	1	4	3
5	Church Ave Railway Bridge	Church Avenue East	0	2	0	5
		Church Avenue West	0	1	0	0
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	1
		Kerdiffstown Road West	1	1	0	1
		Golf Club	0	2	1	7
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	2	1	3	4
		Kerdiffstown Road West	2	4	2	2
		Landfill	0	0	0	0
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	2	1	3	9
		Johnstown Garden	0	0	1	1
		N7 Access Road West	4	4	0	1
9	N7 North Roundabout	The Paddocks	1	5	2	4
		N7 off-slip EB	3	6	4	7
		Greenhill Overbridge	0	2	1	1
		N7 Access Road	5	6	3	3
10	N7 South Roundabout	Palmerstown	3	4	4	3
		Kill West	2	1	6	3
		Greenhill Overbridge	4	2	2	2
		N7 off-slip WB	3	3	10	5

For future year projections, minor increases are anticipated in relation to maximum queuing and delay at a number of locations on the network, but overall delay and maxiumum queuing remain negligible. A similar pattern is reflected for Junction 8.

No HGVs will be permitted to route via Sallins during the Remediation Phase hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for Sallins junctions (1-6).

6.6.3 2018 Projected + Remediation Phase Traffic Network

The 2018 projected plus Remediation Phase traffic scenario (assuming 30% of Remediation Phase traffic arrives / departs in the peak periods) were developed to provide a comparative traffic scenario with base / projected road network performance.

Table 6.6 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all relevant junctions within the projected 2018 + Remediation Phase AM and PM peak models with commentary on the results below. In relation to the Remediation Phase specific scenarios (2018), given that no HGV traffic will be permitted to route via Sallins during the Remediation Phase, and with only a small number of site personnel trips anticipated, these junctions have been omitted from the Remediation Phase analysis.

Table 6.6: AM and PM Peak Period 2018 Projected + Remediation Phase

2018 Projected + Remediation						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	2	2	3	5
		Kerdiffstown Road West	3	3	4	2
		Landfill	2	1	1	1
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	1	1	1	6
		Johnstown Garden	0	0	1	2
		N7 Access Road West	1	3	1	1
9	N7 North Roundabout	The Paddocks	1	1	2	4
		N7 off-slip EB	3	6	4	6
		Greenhill Overbridge	0	1	1	1
		N7 Access Road	3	8	2	3
10	N7 South Roundabout	Palmerstown	3	3	3	5
		Kill West	2	1	6	3
		Greenhill Overbridge	2	2	2	2
		N7 off-slip WB	3	3	7	5

Locations where projected 2018 + Remediation Phase traffic is anticipated to increase by 1 vehicle length or more include the following:

AM Peak (level of increase in queuing)

- J7 (Kerdiffstown Road west at landfill site) –1 vehicle

PM Peak (level of increase in queuing)

- J7 (Kerdiffstown Road westbound at landfill site) –1 vehicle

The overall impact of these additional vehicles in relation to maximum queuing and delay is negligible.

It is recorded that HGV traffic (which comprises the majority of Remediation Phase traffic) will not be permitted to route via Sallins, hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for Sallins junctions (1-6).

6.6.4 2018 Projected + Remediation Phase (Sensitivity Test) Traffic Network

The 2018 projected plus Remediation Phase traffic sensitivity test scenario (assuming 100% of Remediation Phase traffic arrives / departs in both peak periods) was developed to provide a comparative traffic scenario with base / projected road network performance.

Table 6.7 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all relevant junctions within the projected 2018 + Remediation Phase sensitivity test AM and PM peak models with commentary on the results below. In relation to the Remediation Phase specific scenarios (2018), given that no HGV traffic will be permitted to route via Sallins during the Remediation Phase, and with only a small number of site personnel trips anticipated, these junctions have been omitted from the Remediation Phase analysis.

Table 6.7: AM and PM Peak Period 2018 Projected + Remediation Phase (Sensitivity Test)

2018 Projected + Remediation (sensitivity test)						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
7	**Kerdiffstown Road / Landfill Site**	**Kerdiffstown Road East**	5	2	4	5
		Kerdiffstown Road West	3	3	4	2
		Landfill	3	1	2	1
8	**N7 Access Road / Johnstown Garden Centre**	**N7 Access Road East**	2	3	3	4
		Johnstown Garden	0	0	1	2
		N7 Access Road West	2	3	1	1
9	**N7 North Roundabout**	**The Paddocks**	1	4	2	4
		N7 off-slip EB	4	6	4	6
		Greenhill Overbridge	0	2	1	1
		N7 Access Road	7	6	3	3
10	**N7 South Roundabout**	**Palmerstown**	3	2	3	3
		Kill West	2	1	5	3
		Greenhill Overbridge	3	2	2	2
		N7 off-slip WB	4	3	7	5

The sensitivity test scenario shows more acute growth in queue lengths, though delay time remains relatively minor. For the landfill site entrance (junction 7), a maximum potential AM peak queue increase of 4 vehicles for eastbound Kerdiffstown Road is predicted. At the same junction in the PM peak, an increased queue length of 4 vehicles would be anticipated for westbound Kerdiffstown Road.

Some minor growth in queue lengths and time delay would be predicted for junctions 8, 9 and 10. The largest single location for potential growth aside from the site entrance is shown to be at the N7 north roundabout

junction with N7 Access Road, where queuing would increase by 3 vehicles in the AM peak. During the PM peak, the largest potential area for queuing growth is at the N7 south roundabout junction with the N7 westbound off slip, a growth of 2 vehicles.

It is recorded that HGV traffic (which comprises the majority of Remediation Phase traffic) will not be permitted to route via Sallins, hence no impacts to future traffic flows from Remediation Phase traffic is anticipated for Sallins junctions (1-6).

6.6.5 2022 Projected + Operational Phase Traffic Network

The 2022 (assumed Operational Phase start) projected plus Operational Phase traffic scenarios were developed to provide a comparative traffic scenario with the base / projected road network performance.

Table 6.8 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all locations within the projected 2022 + Operational Phase Traffic AM and PM peak models with commentary on the results below.

Table 6.8: AM and PM Peak Period 2022 Projected + Operational Phase Traffic

2022 Projected + Operational						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	R407 / Church Ave, Sallins	R407 North	7	2	4	2
		R407 South	11	6	8	3
		Church Avenue East	2	10	7	17
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	0	1	2
		Church Avenue North	2	1	1	1
		Church Avenue West	0	1	1	2
3	R407 / Church Ave (E)	Church Avenue East	8	18	19	40
		R407 North	13	2	13	2
		R407 South	34	10	32	10
4	Church Ave / Sallins National School	Church Avenue East	0	3	0	6
		Church Avenue West	1	2	0	1
		School	5	1	5	3
5	Church Ave Railway Bridge	Church Avenue East	0	1	0	5
		Church Avenue West	0	1	0	0
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	6
		Kerdiffstown Road West	0	2	0	1
		Golf Club	1	1	0	0
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	3	2	3	5
		Kerdiffstown Road West	1	3	3	2
		Landfill	1	1	1	1
8	N7 Access Road /	N7 Access Road East	1	1	1	4

2022 Projected + Operational						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
	Johnstown Garden Centre	**Johnstown Garden**	0	0	1	1
		N7 Access Road West	2	3	1	1
9	**N7 North Roundabout**	**The Paddocks**	1	5	2	4
		N7 off-slip EB	3	6	4	6
		Greenhill Overbridge	0	1	1	1
		N7 Access Road	4	6	2	3
10	**N7 South Roundabout**	**Palmerstown**	2	3	3	4
		Kill West	2	1	4	3
		Greenhill Overbridge	2	2	2	2
		N7 off-slip WB	3	3	7	5

All 10 junctions will potentially be impacted by Operational Phase traffic. Locations where projected 2022 + Operational Phase traffic is anticipated to increase by more than 1 vehicle length include the following:

AM Peak (level of increase in queuing)

- J3 (R407 southbound at Church Avenue East) – 3 vehicles
- J7 (Kerdiffstown Road eastbound at landfill site) – 2 vehicles

PM Peak (level of increase in queuing)

- J1 (R407 southbound at Church Avenue) – 2 vehicles
- J7 (Kerdiffstown Road westbound at landfill site) – 2 vehicles

The overall impact of these additional vehicles in relation to maximum queuing and delay is negligible with only minor increases in queueing predicted at a small number of locations on the network.

6.6.6 2027 Projected + Operational Phase Traffic Network

The 2027 (5 years post Operational Phase start) projected plus Operational Phase traffic scenarios were developed to provide a comparative traffic scenario with the base / projected road network performance.

Table 6.9 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all locations within the projected 2027 + Operational Phase Traffic AM and PM peak models with commentary on the results below.

Table 6.9: AM and PM Peak Period 2027 Projected + Operational Phase Traffic

2027 Projected + Operational						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	R407 / Church Ave, Sallins	R407 North	7	2	4	2
		R407 South	12	6	8	3
		Church Avenue East	8	15	6	14
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	0	0	1
		Church Avenue North	2	2	1	1
		Church Avenue West	3	1	1	1
3	R407 / Church Ave (E)	Church Avenue East	6	19	18	39
		R407 North	13	2	13	2
		R407 South	30	11	25	7
4	Church Ave / Sallins National School	Church Avenue East	0	3	1	7
		Church Avenue West	0	2	1	2
		School	4	1	4	2
5	Church Ave Railway Bridge	Church Avenue East	0	1	0	5
		Church Avenue West	0	1	0	1
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	1
		Kerdiffstown Road West	1	1	0	0
		Golf Club	0	2	1	7
7	Kerdiffstown Road / Landfill Site	Kerdiffstown Road East	2	1	3	4
		Kerdiffstown Road West	2	3	3	2
		Landfill	0	1	0	0
8	N7 Access Road / Johnstown Garden Centre	N7 Access Road East	0	1	1	6
		Johnstown Garden	0	0	0	1
		N7 Access Road West	0	3	1	1
9	N7 North Roundabout	The Paddocks	1	5	1	4
		N7 off-slip EB	2	6	4	6
		Greenhill Overbridge	0	1	1	1
		N7 Access Road	5	6	2	3
10	N7 South Roundabout	Palmerstown	3	2	4	3
		Kill West	1	1	6	3
		Greenhill Overbridge	2	2	2	2
		N7 off-slip WB	3	3	7	5

All 10 junctions will potentially be impacted by Operational Phase traffic. Locations where projected 2027 + Operational Phase traffic is anticipated to increase by more than 1 vehicle length against the 2027 projected scenario include the following:

AM Peak (level of increase in queuing)

- J1 (R407 / Church Ave, Sallins at Church Avenue East) – 5 vehicles
- J2 (Church Ave (W) / Church Ave (S), Sallins at Church Avenue West) – 2 vehicles
- J9 (N7 North Roundabout at N7 Access Road) – 2 vehicles

PM Peak (level of increase in queuing)

- J1 (R407 southbound at Church Avenue) – 2 vehicles

The overall impact of these additional vehicles in relation to maximum queuing and delay is negligible.

6.6.7 2037 Projected + Operational Phase Traffic Network

The 2037 (15 years post Operational Phase start) projected plus Operational Phase traffic scenarios were developed to provide a comparative traffic scenario with the base / projected road network performance.

Table 6.10 below presents maximum queue lengths (vehicles) and Vehicle Delay (seconds) for all locations within the projected 2037 + Operational Phase Traffic AM and PM peak models with commentary on the results below.

Table 6.10: AM and PM Peak Period 2037 Projected + Operational Phase Traffic

2037 Projected + Operational						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
1	R407 / Church Ave, Sallins	R407 North	14	2	8	2
		R407 South	12	7	12	4
		Church Avenue East	2	18	7	25
2	Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0	0	4	2
		Church Avenue North	2	2	1	1
		Church Avenue West	1	1	1	2
3	R407 / Church Ave (E)	Church Avenue East	9	25	23	64
		R407 North	13	2	13	2
		R407 South	35	13	29	8
4	Church Ave / Sallins National School	Church Avenue East	0	3	2	7
		Church Avenue West	1	2	1	3
		School	4	1	4	3
5	Church Ave Railway Bridge	Church Avenue East	0	1	0	6
		Church Avenue West	0	1	0	1
6	Kerdiffstown Road / Naas Golf Club	Kerdiffstown Road East	0	2	0	1
		Kerdiffstown Road West	1	1	0	0
		Golf Club	0	2	0	7

2037 Projected + Operational						
Junction / Location		Approach	AM Peak Period (07:00-10:00)		PM Peak Period (16:00-19:00)	
			Maximum Queue Length (vehicles)	Delay (seconds)	Maximum Queue Length (vehicles)	Delay (seconds)
7	**Kerdiffstown Road / Landfill Site**	**Kerdiffstown Road East**	2	2	4	5
		Kerdiffstown Road West	2	4	3	2
		Landfill	1	1	1	1
8	**N7 Access Road / Johnstown Garden Centre**	**N7 Access Road East**	1	1	1	4
		Johnstown Garden	0	0	1	2
		N7 Access Road West	1	4	0	1
9	**N7 North Roundabout**	**The Paddocks**	1	5	1	4
		N7 off-slip EB	4	6	4	7
		Greenhill Overbridge	0	2	2	1
		N7 Access Road	4	8	2	6
10	**N7 South Roundabout**	**Palmerstown**	3	2	5	3
		Kill West	2	1	5	3
		Greenhill Overbridge	2	2	2	2
		N7 off-slip WB	3	3	8	5

All 10 junctions will potentially be impacted by Operational Phase traffic. Locations where projected 2037 + Operational Phase traffic is anticipated to increase by more than 1 vehicle length include the following:

AM Peak (level of increase in queuing)

- J1 (R407 / Church Ave, Sallins at R407 North Arm) – 2 vehicles

The overall impact of these additional vehicles in relation to maximum queuing and delay is negligible.

7. Summary and Conclusion

7.1 Summary

The scope of the assessment and related assumptions used in this Traffic and Transport Assessment have been discussed and agreed with Kildare County Council (KCC) Roads Department.

Reference has been made to national, regional and local planning policy. The policies at all levels aim to promote sustainable travel, provide a choice of transport mode and reduce the impact of private car use. The proposed development has been designed in accordance with these policies.

Vehicular access to the site will be via a new roundabout, located in close proximity to the existing site access off L2005 Kerdiffstown Road, to be constructed in order to provide an access arrangement that can safely accommodate all traffic associated with all phases of the proposed Project. The location and form of the proposed access, selected following an appraisal of options through a desk study and site visit, represents the safest and most appropriate location for the access. The roundabout and associated realignment of the L2005 Kerdiffstown Road, which has been designed in accordance with DMURS standards, maximises visibility despite the constrained environment and improves the condition of the existing road as well as providing a safe access arrangement for the proposed Project.

Pedestrians and cyclists are given due consideration within the internal site layout with appropriate walking and cycling facilities provided. Furthermore, a shared footway / cycleway is proposed along the realigned extents of the L2005 Kerdiffstown Road, which will link the site with the existing pedestrian / cycle infrastructure to the south of the L2005 Kerdiffstown Road.

The operation of the road network and key junction capacity in the vicinity of the proposed Project has been modelled using a VISSIM microsimulation model. The model evaluates the potential impacts on the local road network during Remediation and Operational Phases for the proposed Project. Through undertaking a robust assessment of construction and operational traffic impacts, it is predicted that the existing road network can accommodate all additional traffic associated with the proposed Project.

7.2 Conclusions

The assessment of construction and operational traffic generated by the proposed Project indicates that the existing road network can accommodate the additional traffic during the peak hours. Traffic associated with the Remediation Phase and Operational Phase is not predicted to significantly increase traffic levels at the junctions studied and therefore it can be concluded that the proposed Project will not have a detrimental impact on the road network.

The provision of a Construction Traffic Management Plan will mitigate and reduce the environmental impacts of the Remediation Phase. In conjunction with appropriate parking provision this will encourage staff to travel by sustainable modes to the work site as well as ensure that traffic, equipment and materials associated with the Remediation Phase can reasonably be accommodated within the site or at a designated off-site space.

For the Operational Phase adequate provision for both car and cycle parking is included within the proposed Project, aligning with the requirements of the County Development Plan. The promotion of cycle and pedestrian access also aligns with the objectives of current policy documents.

Appendix A. Traffic Flow Diagrams

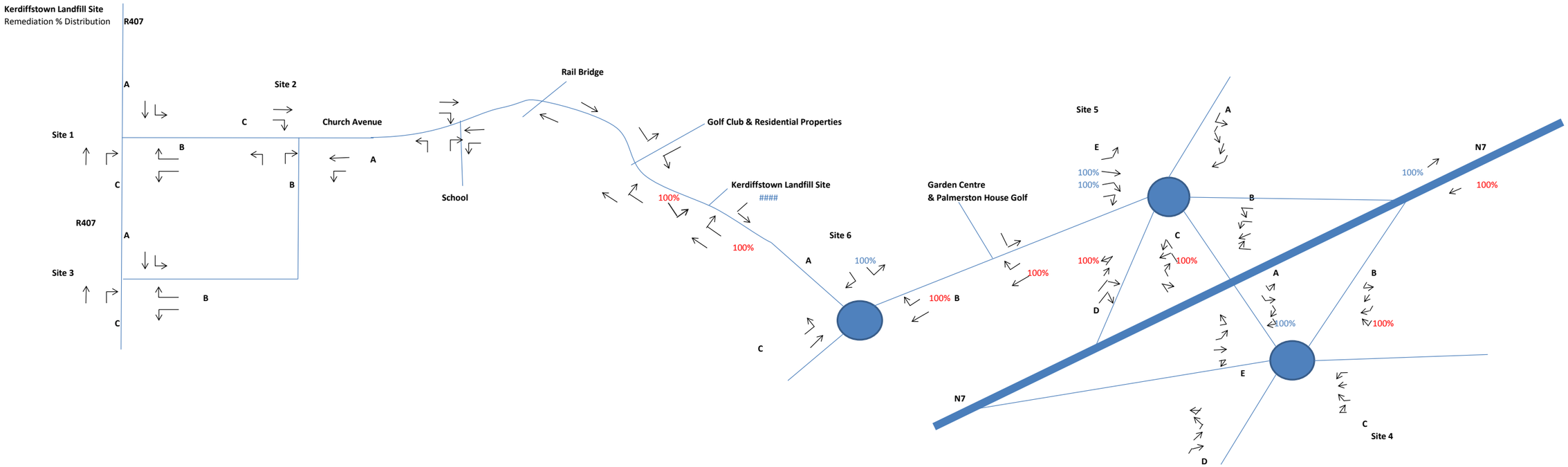

Kerdiffstown Landfill Site
Remediation % Distribution
R407
A
Site 1
B
C
Site 2
C
Church Avenue
B
A
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
####
100%
100%
Site 6
A
100%
C
100% B
Garden Centre
& Palmerston House Golf
100%
R407
A
Site 3
B
C
Site 5
E
100%
100%
A
B
C
100%
100%
D
N7
100%
100%
A
B
100%
100%
E
C
Site 4
D
N7

Figure 5.1

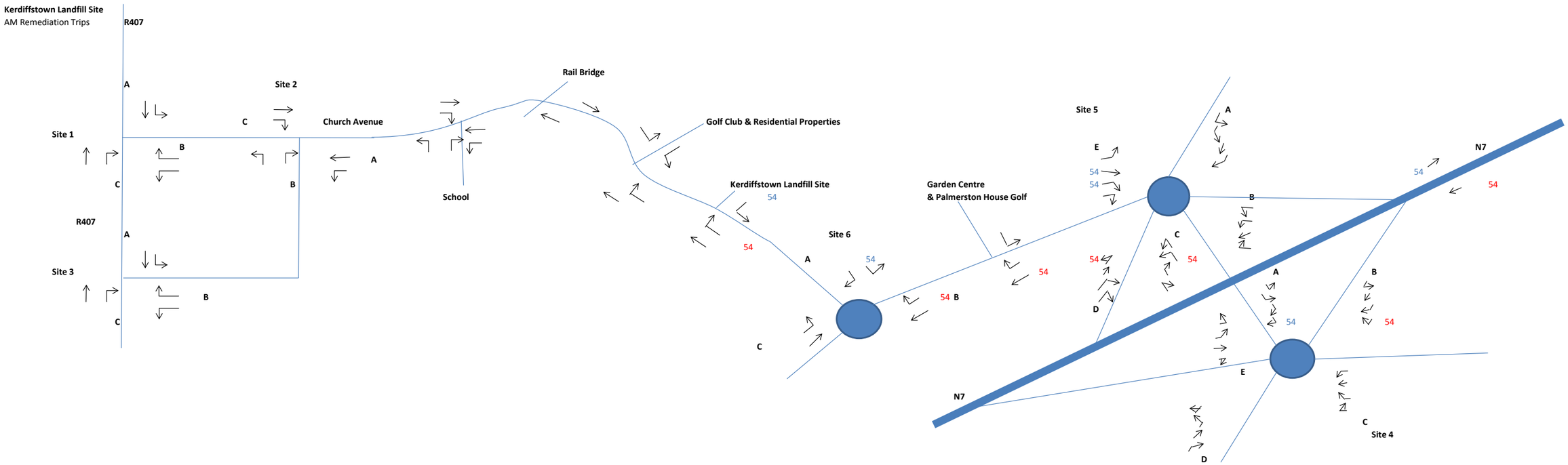

Kerdiffstown Landfill Site
AM Remediation Trips
R407
A
Site 2
Site 1
C
Church Avenue
B
A
C
B
R407
A
Site 3
B
C
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
54
54
Site 6
A
54
C
Garden Centre
& Palmerston House Golf
54
54 B
Site 5
A
E
54
54
B
C
54
54
D
N7
54
54
A
B
54
54
E
C
Site 4
D
N7

Figure 5.2

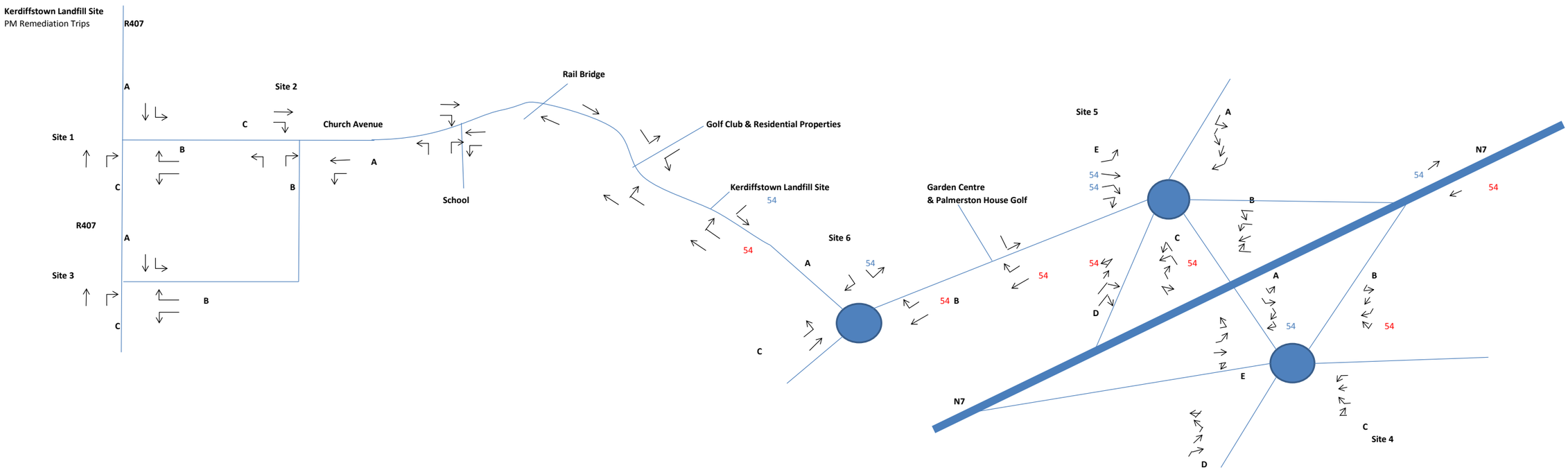

Kerdiffstown Landfill Site
PM Remediation Trips
R407
A
Site 1
B
C
Site 2
C
Church Avenue
A
B
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
54
54
R407
A
Site 3
B
C
Site 6
A
54
54
B
C
Garden Centre
& Palmerston House Golf
54
Site 5
A
E
54
54
B
C
54
54
D
N7
54
54
A
54
B
54
54
E
C
Site 4
D
N7

Figure 5.3

Kerdiffstown Landfill Site
AM Remediation Trips
Sensitivity Test

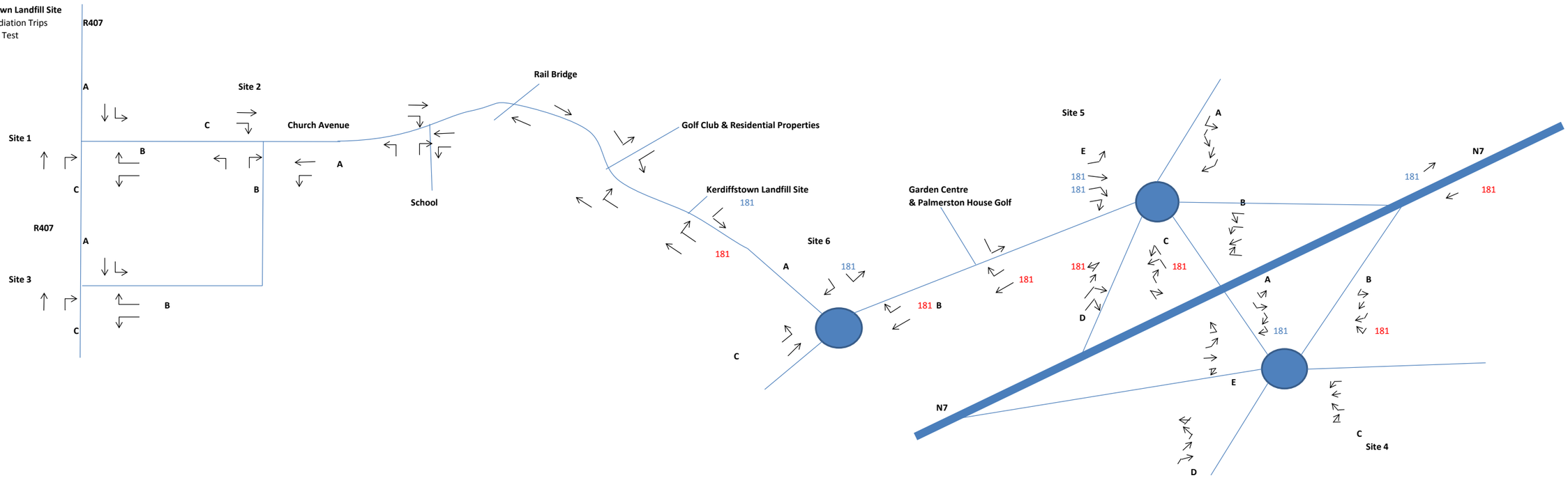


Figure 5.4

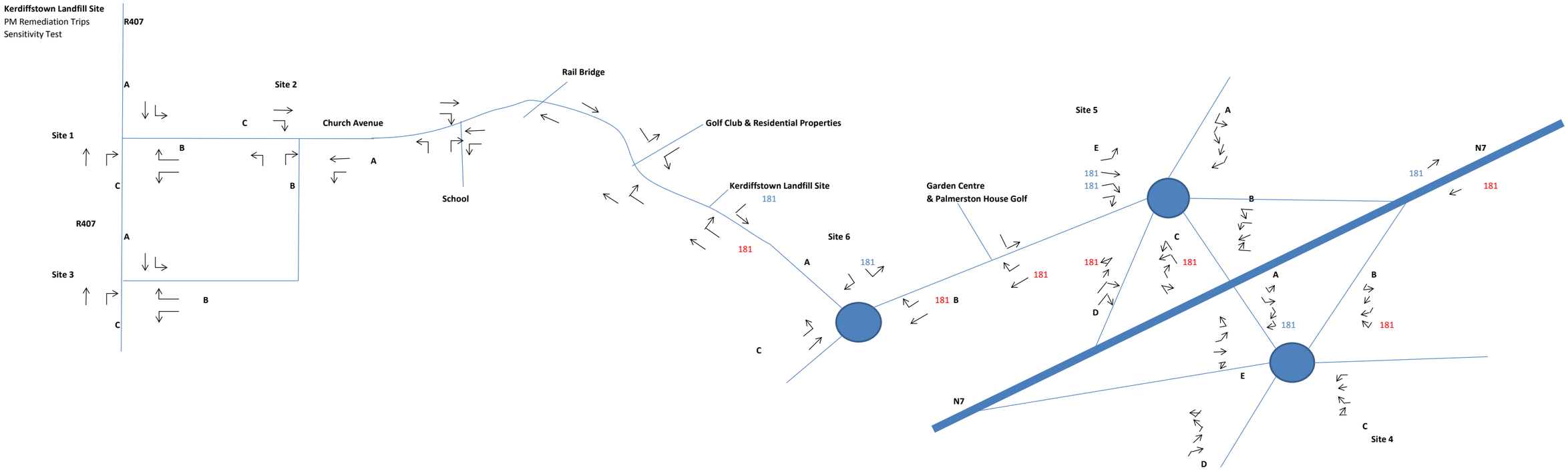

Kerdiffstown Landfill Site
PM Remediation Trips
Sensitivity Test
R407
A
Site 1
B
C
Site 2
C
B
Church Avenue
A
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
181
Site 6
A
181
181
B
C
Garden Centre
& Palmerston House Golf
181
R407
A
Site 3
B
C
Site 5
A
E
181
181
B
C
181
181
D
N7
181
181
A
B
181
181
E
N7
C
Site 4
D

Figure 5.5

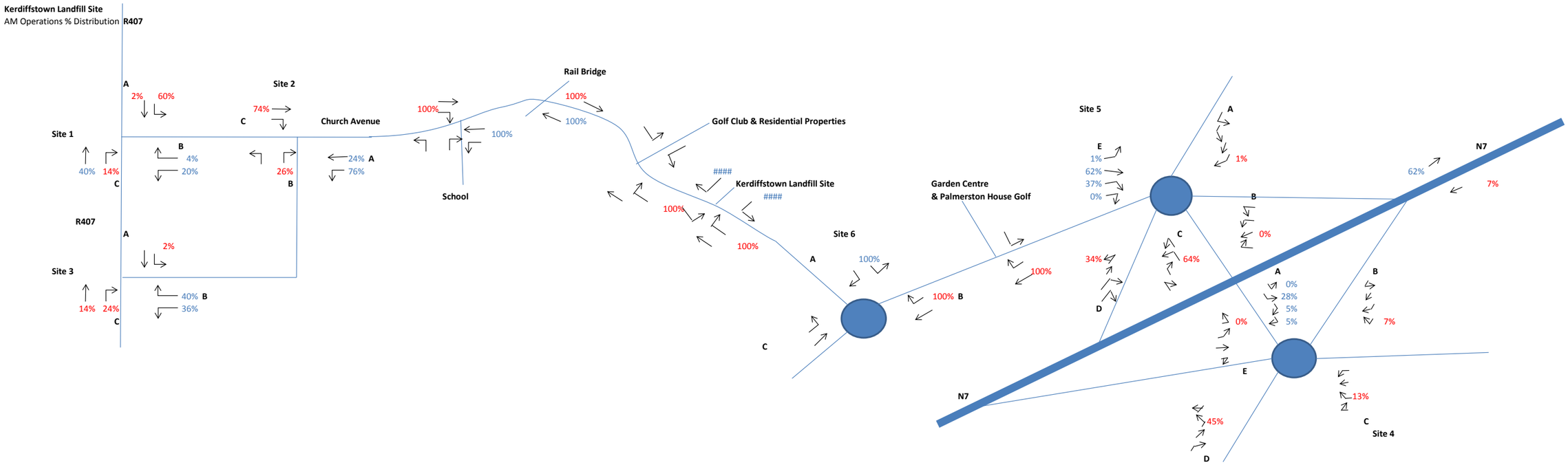

Kerdiffstown Landfill Site
AM Operations % Distribution
R407
A
2%
60%
Site 2
74%
C
Church Avenue
Site 1
B
4%
20%
40%
14%
C
26%
B
24%
A
76%
100%
100%
Rail Bridge
100%
100%
Golf Club & Residential Properties
School
####
Kerdiffstown Landfill Site
####
100%
100%
R407
A
2%
Site 3
14%
24%
C
40%
B
36%
Site 6
A
100%
100%
B
C
Garden Centre
& Palmerston House Golf
100%
Site 5
E
1%
62%
37%
0%
A
1%
B
0%
C
34%
64%
D
N7
62%
7%
A
0%
28%
5%
5%
B
7%
0%
E
13%
C
Site 4
45%
D
N7

Figure 5.6

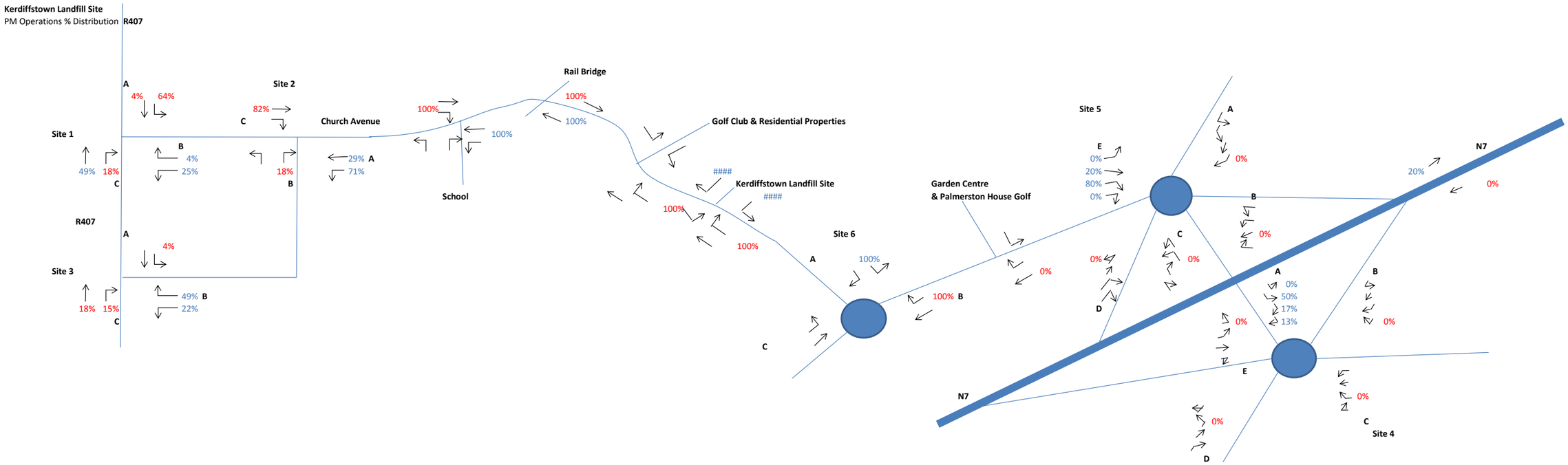

Kerdiffstown Landfill Site
PM Operations % Distribution
R407
Site 1
Site 2
Site 3
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Site 6
Garden Centre
& Palmerston House Golf
Site 5
Site 4
N7
A
B
C
D
E
4%
64%
82%
18%
49%
25%
29%
71%
100%
####
0%
20%
80%
50%
17%
13%
22%
15%

Figure 5.7

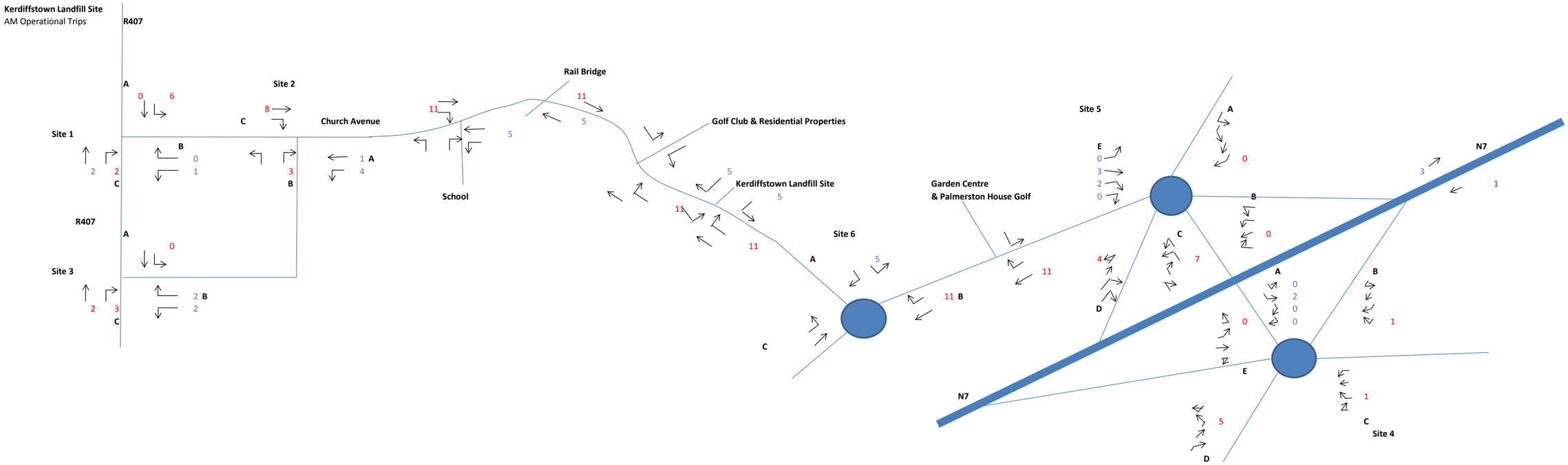

Kerdiffstown Landfill Site
AM Operational Trips
R407
Site 1
Site 2
Site 3
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Site 6
Garden Centre
& Palmerston House Golf
Site 5
N7
Site 4

Figure 5.8

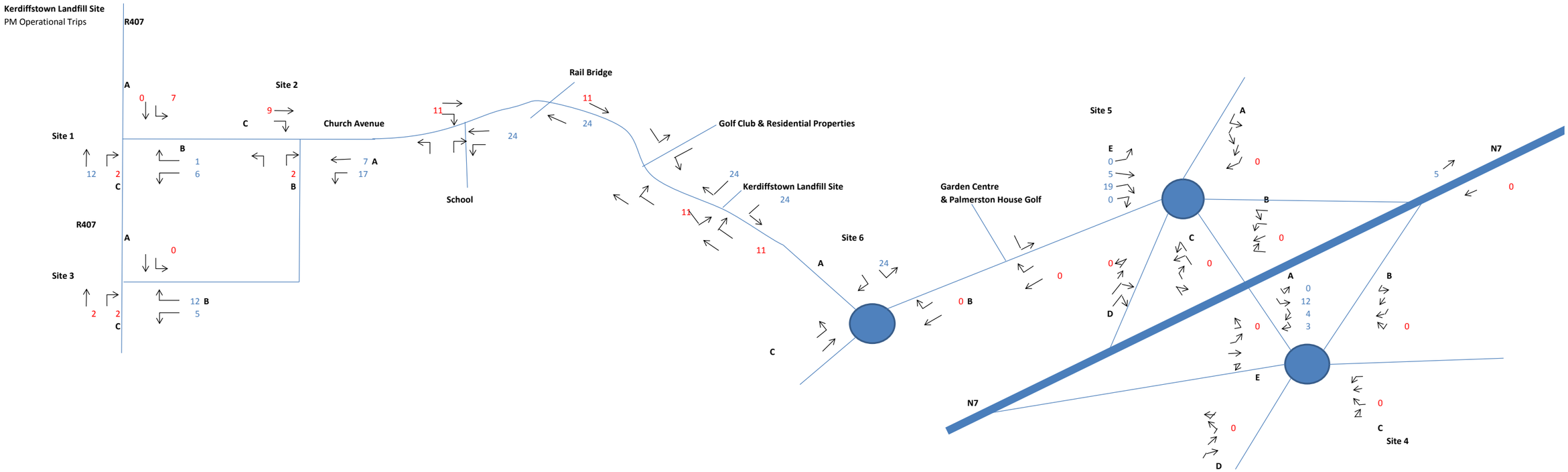

Kerdiffstown Landfill Site
PM Operational Trips
R407
Site 1
Site 2
Site 3
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Site 6
Garden Centre
& Palmerston House Golf
Site 5
Site 4
N7
A
B
C
D
E

Figure 5.9

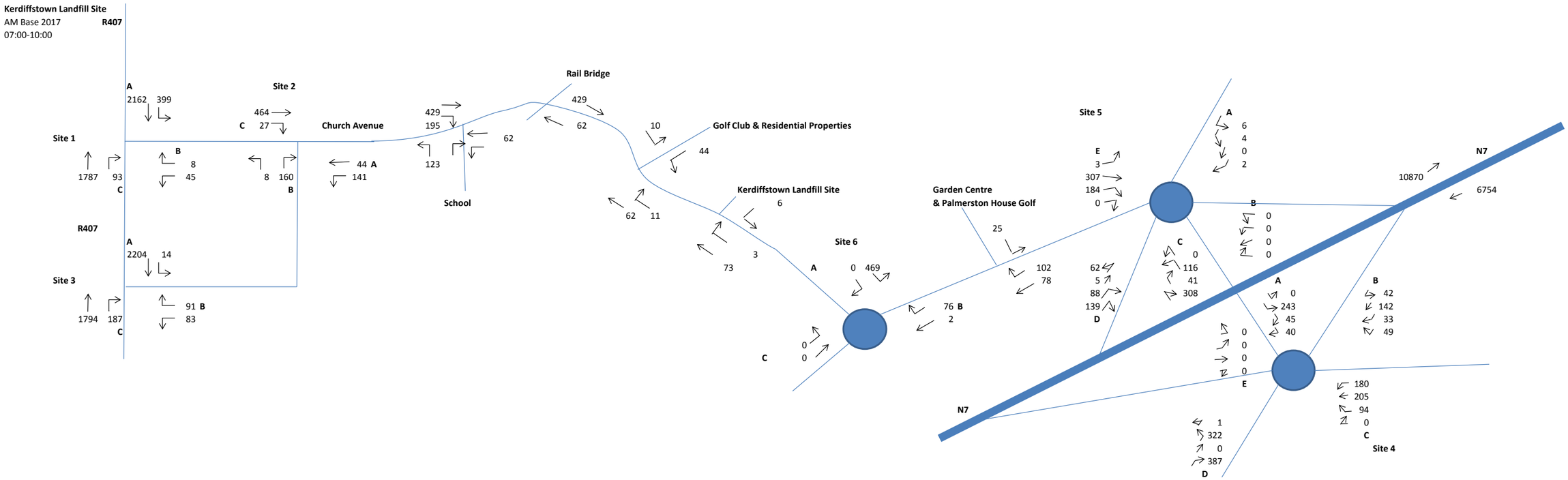

Kerdiffstown Landfill Site
AM Base 2017
07:00-10:00
R407
Site 1
A
2162 399
B
8
45
1787 93
C
Site 2
464
C 27
8 160
B
Church Avenue
44 A
141
429
195
123
62
School
Rail Bridge
429
62
10
44
Golf Club & Residential Properties
62 11
Kerdiffstown Landfill Site
6
73 3
Site 6
A 0 469
76 B
2
C
0
0
Garden Centre
& Palmerston House Golf
25
102
78
R407
A
2204 14
Site 3
91 B
83
1794 187
C
Site 5
E
3
307
184
0
62
5
88
139
D
A
6
4
0
2
B
0
0
0
0
C
0
116
41
308
A
0
243
45
40
B
42
142
33
49
0
0
0
0
E
1
322
0
387
D
180
205
94
0
C
Site 4
N7
10870
6754
N7

Figure 6.1

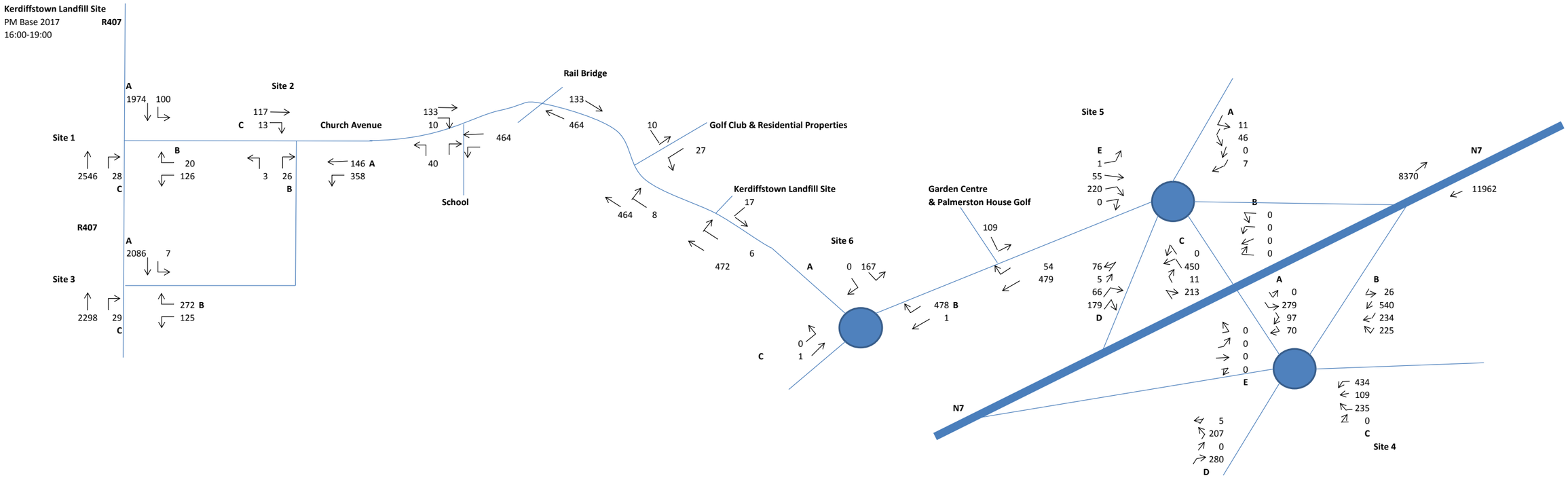

Kerdiffstown Landfill Site
PM Base 2017
16:00-19:00
R407
Site 1
A
1974 100
B
20
126
2546 28
C
R407
A
2086 7
Site 3
272 B
125
2298 29
C
Site 2
117
C 13
3 26
B
Church Avenue
146 A
358
133
10
40
464
School
Rail Bridge
133
464
10
Golf Club & Residential Properties
27
464 8
Kerdiffstown Landfill Site
17
6
472
Site 6
A 0 167
478 B
1
0
C 1
Garden Centre
& Palmerston House Golf
109
54
479
Site 5
E
1
55
220
0
76
5
66
179
D
A
11
46
0
7
B
0
0
0
0
C
0
450
11
213
N7
8370
11962
A
0
279
97
70
B
26
540
234
225
0
0
0
0
E
434
109
235
0
C
Site 4
5
207
0
280
D
N7

Figure 6.2

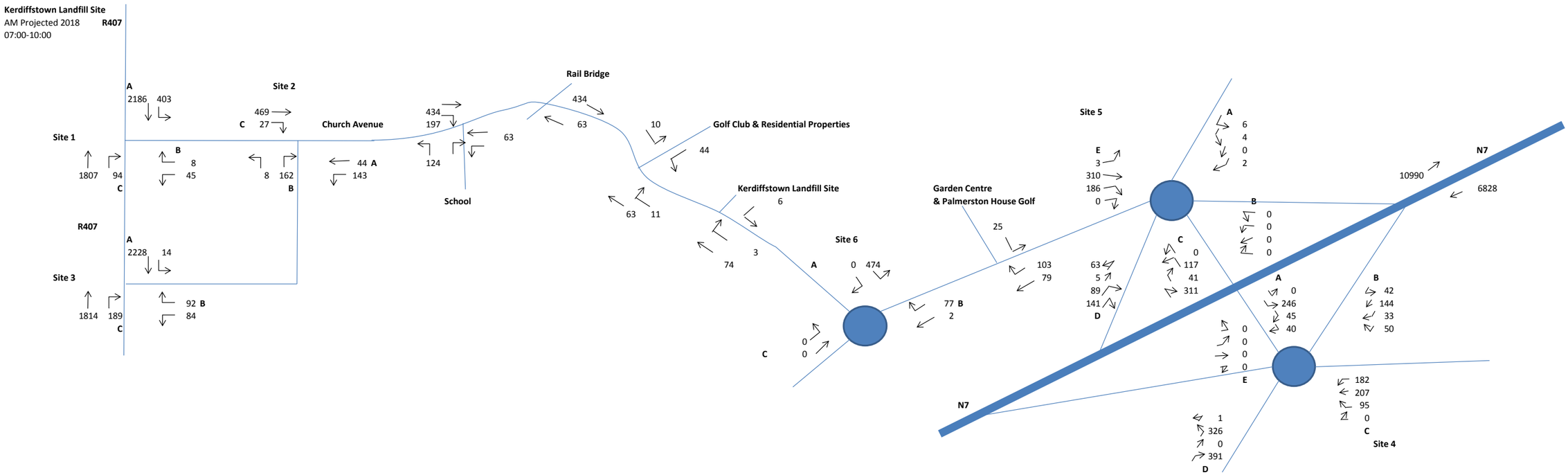

Kerdiffstown Landfill Site
AM Projected 2018
07:00-10:00
R407
Site 1
A
2186
403
1807
94
C
B
8
45
Site 2
469
C
27
8
162
B
Church Avenue
44 A
143
434
197
124
School
63
Rail Bridge
434
63
10
44
Golf Club & Residential Properties
63
11
Kerdiffstown Landfill Site
6
74
3
Site 6
A
0
474
0
0
C
77 B
2
Garden Centre
& Palmerston House Golf
25
103
79
R407
A
2228
14
Site 3
1814
189
C
92 B
84
Site 5
E
3
310
186
0
63
5
89
141
D
A
6
4
0
2
C
0
117
41
311
B
0
0
0
0
A
0
246
45
40
B
42
144
33
50
0
0
0
0
E
182
207
95
0
C
Site 4
1
326
0
391
D
N7
10990
6828
N7

Figure 6.3

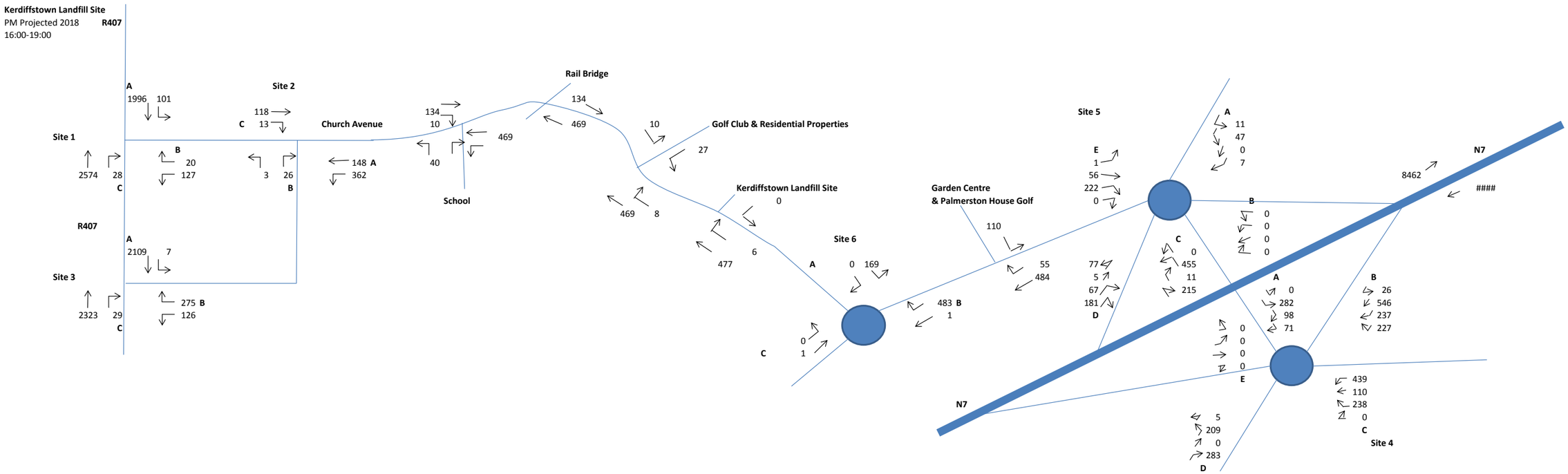

Kerdiffstown Landfill Site
PM Projected 2018
16:00-19:00
R407
A
1996
101
Site 1
2574
28
C
B
20
127
R407
A
2109
7
Site 3
2323
29
C
275 B
126
Site 2
118
C
13
3
26
B
Church Avenue
148 A
362
134
10
40
469
School
Rail Bridge
134
469
10
27
Golf Club & Residential Properties
469
8
Kerdiffstown Landfill Site
0
6
477
Site 6
A
0
169
C
0
1
483 B
1
Garden Centre
& Palmerston House Golf
110
55
484
Site 5
E
1
56
222
0
77
5
67
181
D
A
11
47
0
7
C
0
455
11
215
B
0
0
0
0
A
0
282
98
71
0
0
0
0
E
5
209
0
283
D
B
26
546
237
227
439
110
238
0
C
Site 4
N7
8462
####
N7

Figure 6.4

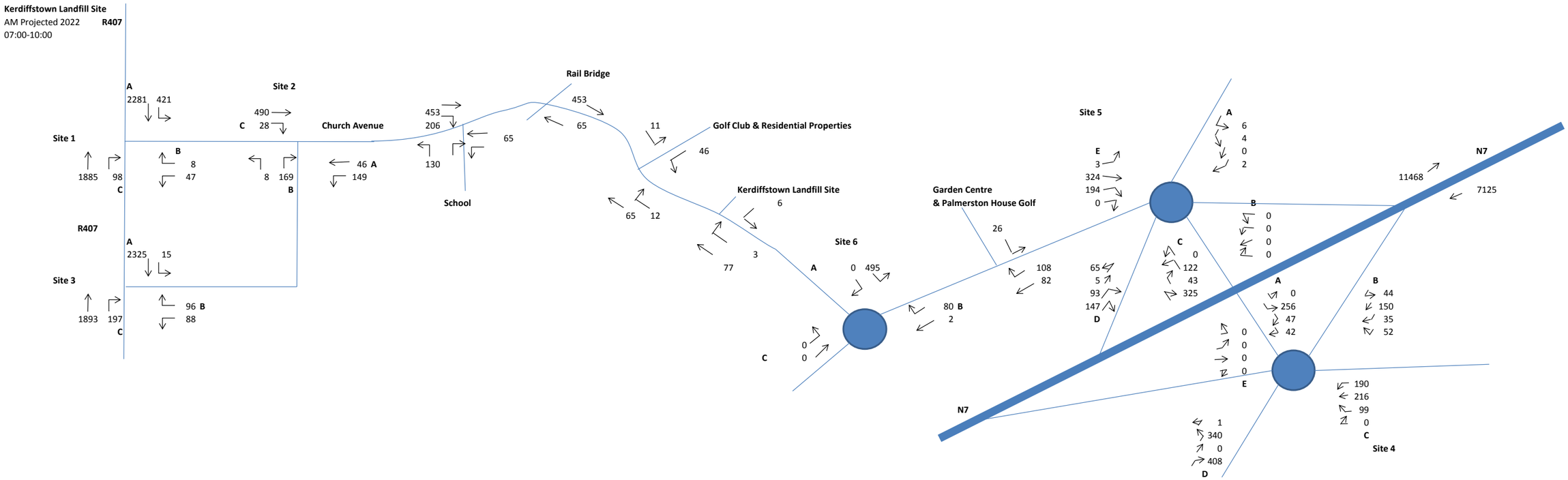

Kerdiffstown Landfill Site
AM Projected 2022
07:00-10:00
R407
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Garden Centre
& Palmerston House Golf
N7

Figure 6.5

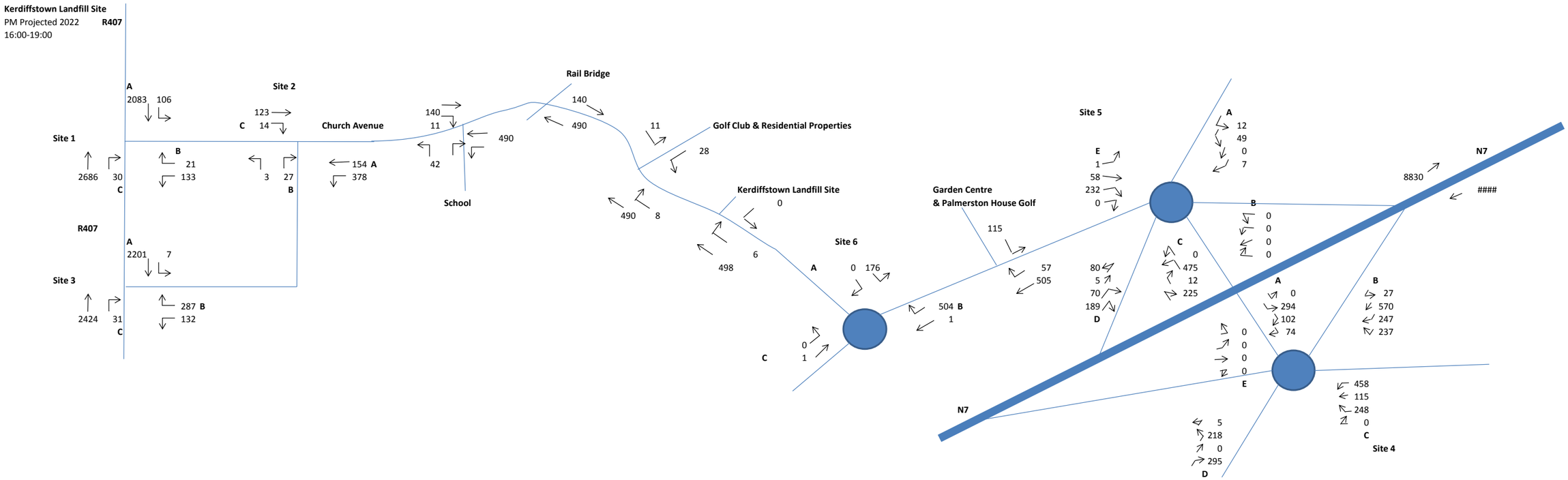

Kerdiffstown Landfill Site
PM Projected 2022
16:00-19:00
R407
Site 1
A
2083 106
B
21
133
2686 30
C
C 14
Site 2
123
3 27
B
Church Avenue
154 A
378
140
11
42
490
School
Rail Bridge
140
490
11
Golf Club & Residential Properties
28
490 8
Kerdiffstown Landfill Site
0
498 6
Site 6
A 0 176
C
0
1
504 B
1
Garden Centre
& Palmerston House Golf
115
57
505
R407
A
2201 7
Site 3
287 B
132
2424 31
C
Site 5
E
1
58
232
0
80
5
70
189
D
A
12
49
0
7
B
0
0
0
0
C
0
475
12
225
A
0
294
102
74
B
27
570
247
237
0
0
0
0
E
5
218
0
295
D
458
115
248
0
C
Site 4
N7
8830
####
N7

Figure 6.6

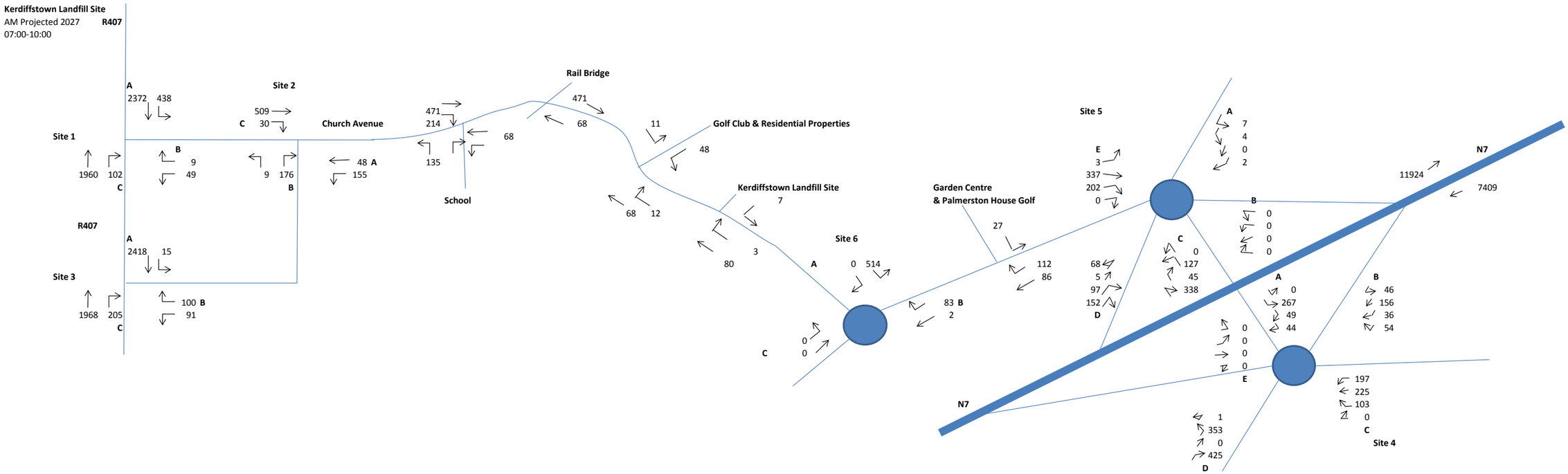

Kerdiffstown Landfill Site
AM Projected 2027
07:00-10:00
R407
Site 1
A
2372
438
1960
102
C
B
9
49
Site 2
509
C
30
9
176
B
Church Avenue
48
A
155
471
214
135
School
68
Rail Bridge
471
68
11
Golf Club & Residential Properties
48
68
12
Kerdiffstown Landfill Site
7
80
3
Site 6
A
0
514
C
0
0
83
B
2
Garden Centre
& Palmerston House Golf
27
112
86
Site 5
E
3
337
202
0
68
5
97
152
D
A
7
4
0
2
C
0
127
45
338
B
0
0
0
0
A
0
267
49
44
B
46
156
36
54
0
0
0
0
E
1
353
0
425
D
197
225
103
0
C
Site 4
N7
11924
7409
N7
R407
Site 3
A
2418
15
1968
205
C
100
B
91

Figure 6.7

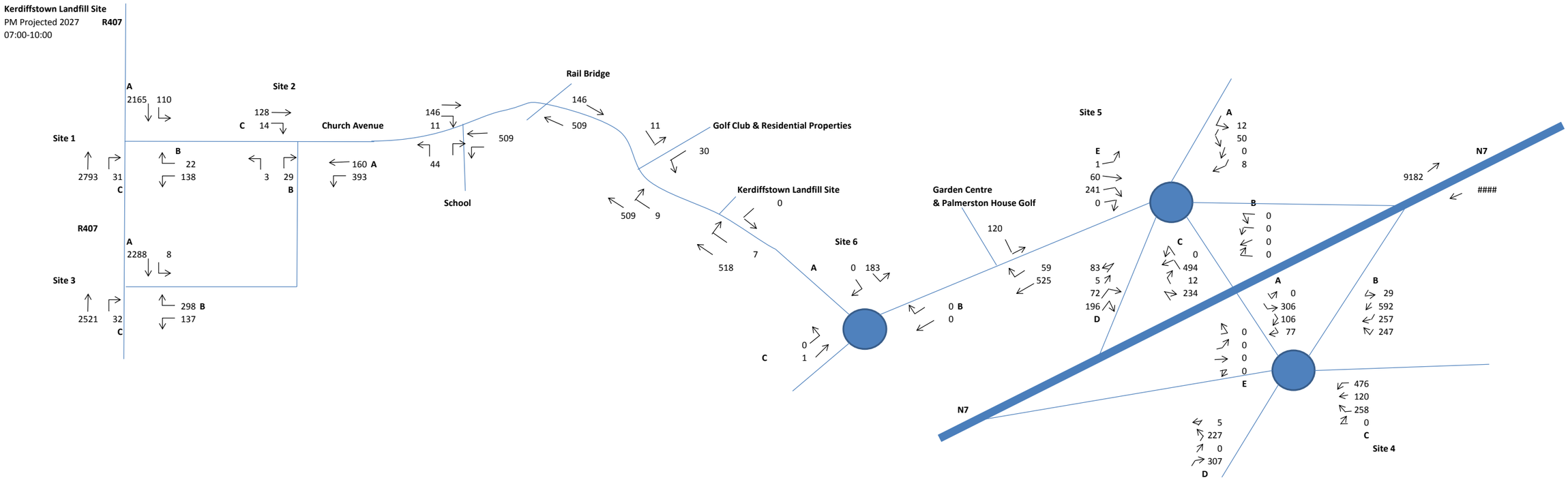

Kerdiffstown Landfill Site
PM Projected 2027
07:00-10:00
R407
Site 1
Site 2
Church Avenue
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
School
Site 3
Site 6
Garden Centre
& Palmerston House Golf
Site 5
Site 4
N7

Figure 6.8

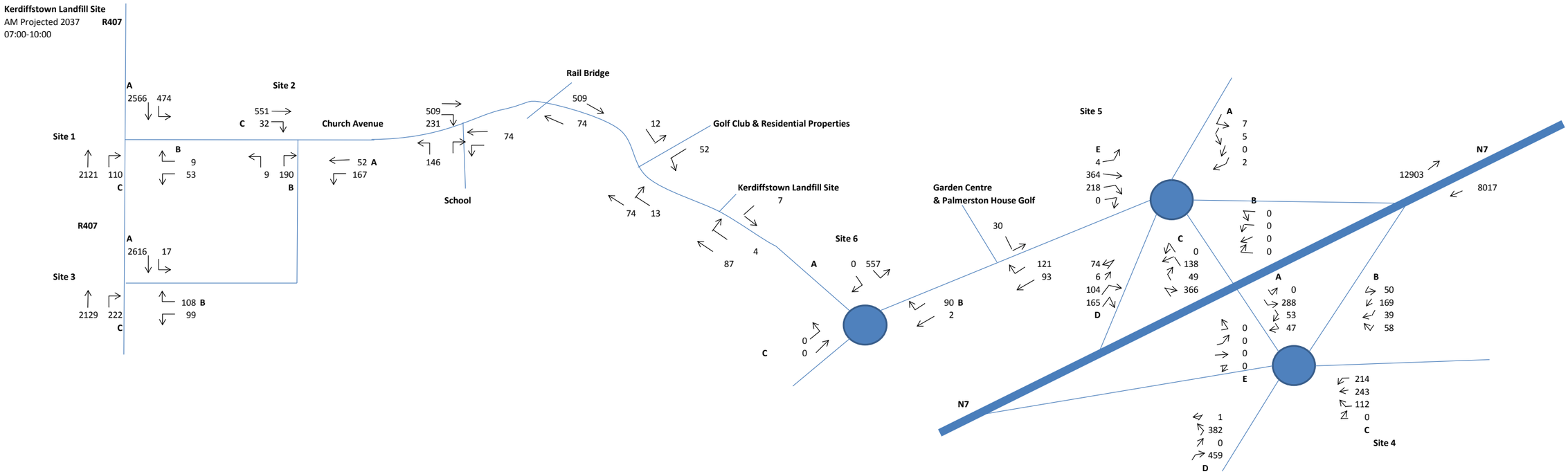

Kerdiffstown Landfill Site
AM Projected 2037
07:00-10:00
R407
Site 1
A
2566 474
B
9
53
2121 110
C
R407
A
2616 17
Site 3
2129 222
C
108 B
99
Site 2
551
C 32
9 190
B
Church Avenue
52 A
167
509
231
146
School
74
Rail Bridge
509
74
12
52
Golf Club & Residential Properties
74 13
Kerdiffstown Landfill Site
7
87 4
Site 6
A 0 557
C
0
0
90 B
2
Garden Centre
& Palmerston House Golf
30
121
93
Site 5
E
4
364
218
0
74
6
104
165
D
A
7
5
0
2
B
0
0
0
0
C
0
138
49
366
N7
12903
8017
A
0
288
53
47
B
50
169
39
58
0
0
0
0
E
214
243
112
0
C
Site 4
1
382
0
459
D
N7

Figure 6.9

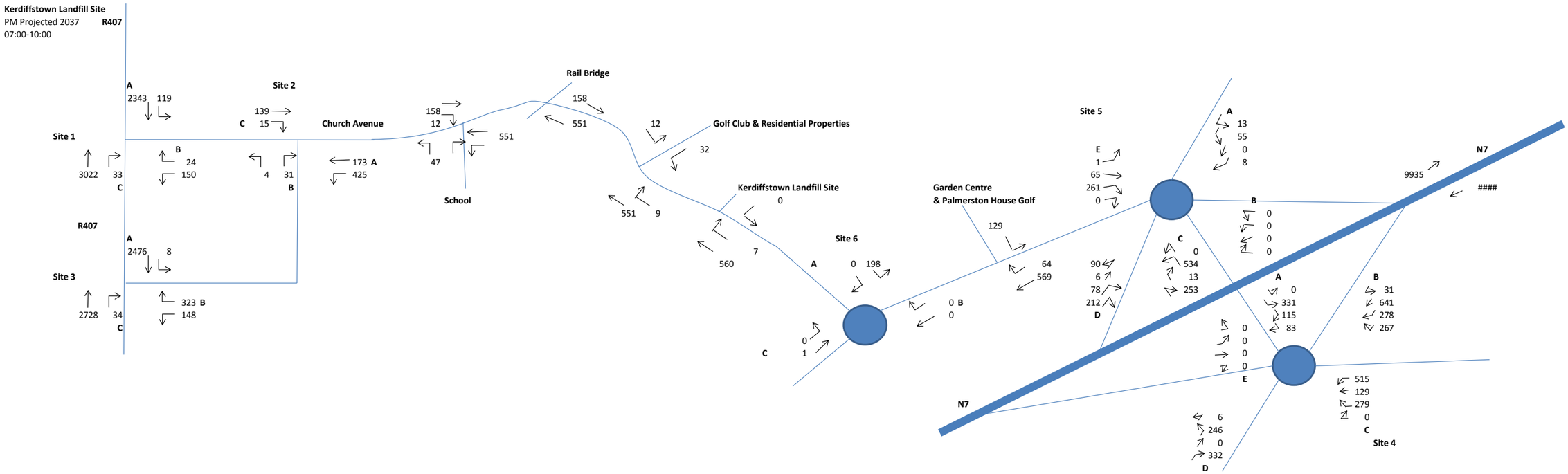

Kerdiffstown Landfill Site
PM Projected 2037
07:00-10:00
R407
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Garden Centre
& Palmerston House Golf
N7
A
B
C
D
E
2343 119
3022 33
24 150
139 15
4 31
173 425
158 12
47 551
158 551
12 32
551 9
0 7
560
0 198
0 0 B
64 569
129
0 1
2476 8
2728 34
323 148
90 6 78 212
13 253
534 0
13 55 0 8
0 0 0 0
0 331 115 83
0 0 0 0
6 246 0 332
515 129 279 0
31 641 278 267
9935
####

Figure 6.10

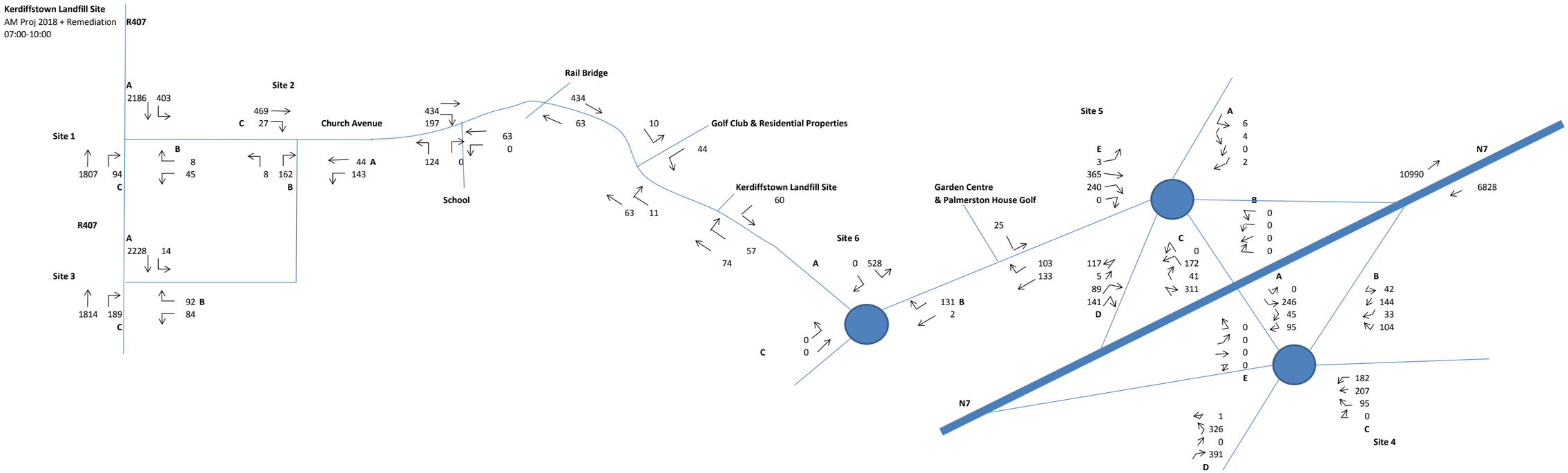

Kerdiffstown Landfill Site
AM Proj 2018 + Remediation
07:00-10:00
R407
Site 1
Site 2
Church Avenue
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
School
Site 3
Site 6
Garden Centre
& Palmerston House Golf
Site 5
Site 4
N7
A
B
C
D
E

Figure 6.11

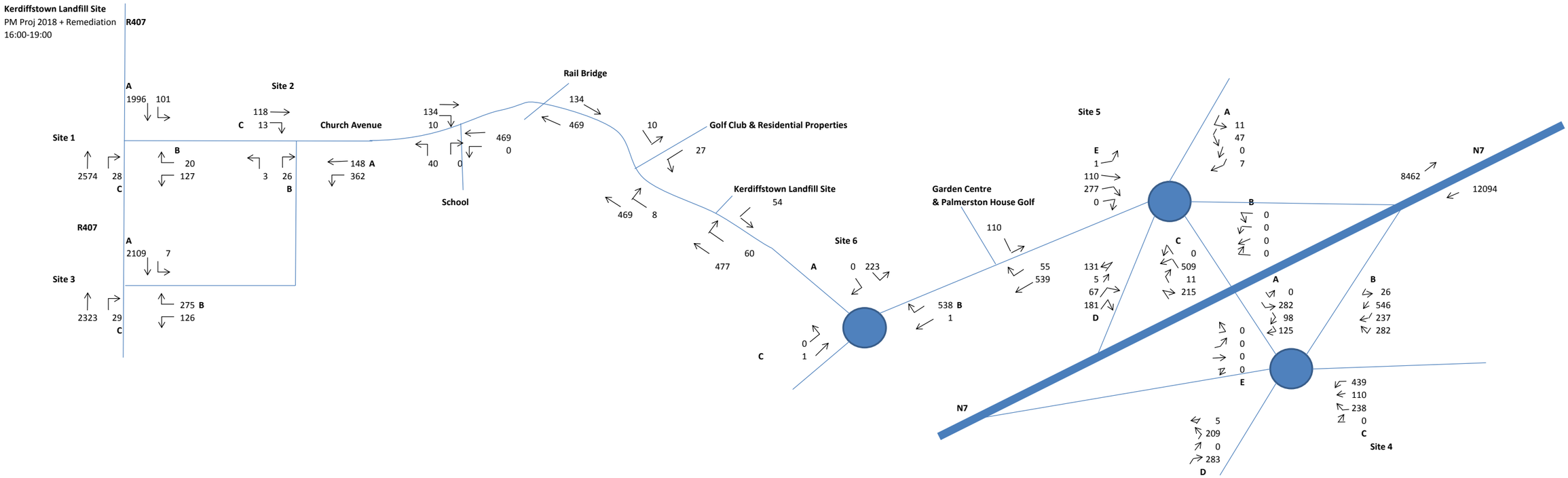

Kerdiffstown Landfill Site
PM Proj 2018 + Remediation
16:00-19:00
R407
Site 1
Site 2
Site 3
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Site 6
Garden Centre
& Palmerston House Golf
Site 5
N7
Site 4

Figure 6.12

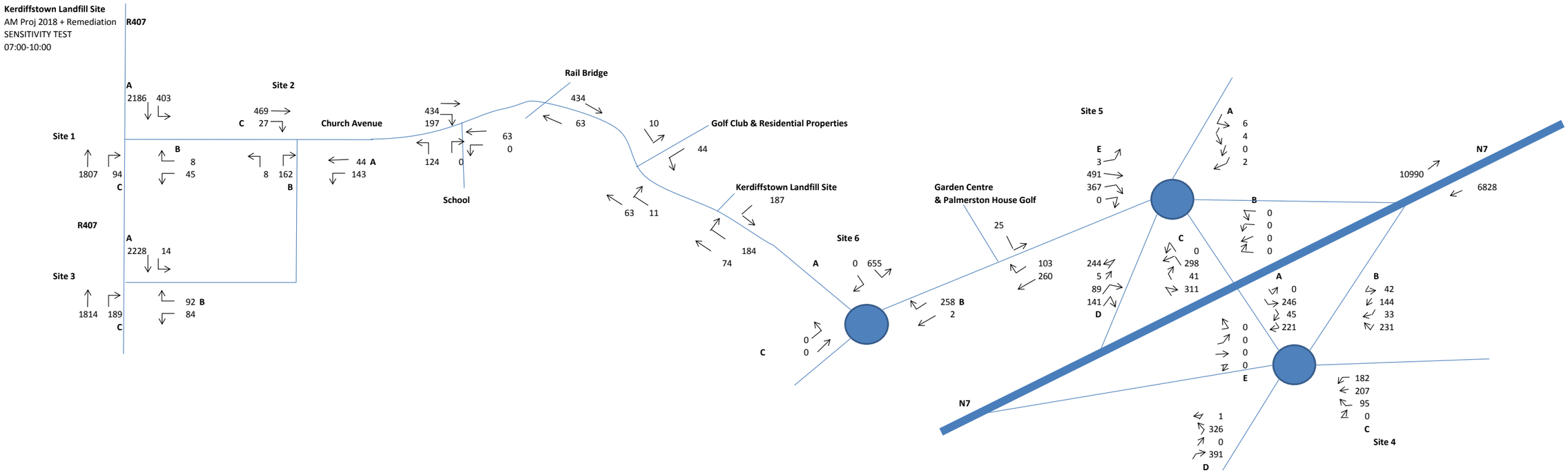

Kerdiffstown Landfill Site
AM Proj 2018 + Remediation
SENSITIVITY TEST
07:00-10:00
R407
Site 1
A
2186
403
1807
94
B
8
45
C
Site 2
469
C
27
8
162
B
Church Avenue
44
A
143
434
197
124
0
School
63
0
Rail Bridge
434
63
10
44
Golf Club & Residential Properties
63
11
Kerdiffstown Landfill Site
187
184
74
Site 6
A
0
655
0
0
C
Garden Centre
& Palmerston House Golf
25
103
260
258
B
2
Site 5
E
3
491
367
0
244
5
89
141
D
A
6
4
0
2
B
0
0
0
0
C
0
298
41
311
A
0
246
45
221
B
42
144
33
231
0
0
0
0
E
182
207
95
0
C
Site 4
1
326
0
391
D
N7
10990
6828
N7
R407
Site 3
A
2228
14
1814
189
C
92
B
84

Figure 6.13

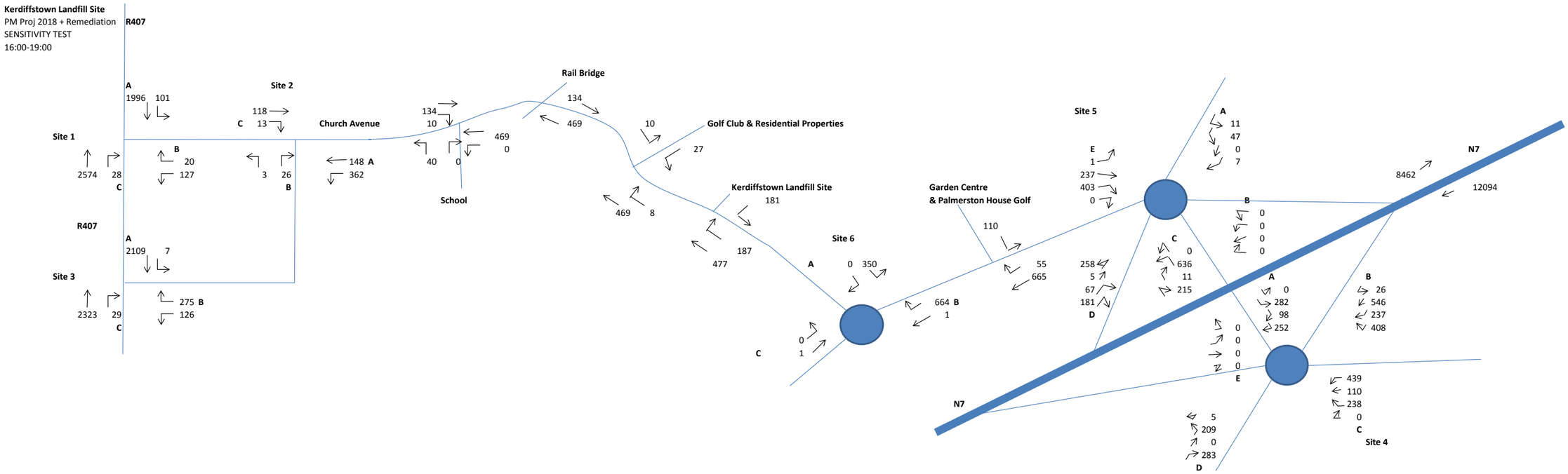

Kerdiffstown Landfill Site
PM Proj 2018 + Remediation
SENSITIVITY TEST
16:00-19:00
R407
Site 1
A
1996
101
2574
28
C
B
20
127
Site 2
118
C
13
3
26
B
Church Avenue
148 A
362
134
10
40
0
469
0
School
Rail Bridge
134
469
10
27
Golf Club & Residential Properties
469
8
Kerdiffstown Landfill Site
181
187
477
Site 6
A
0
350
0
1
C
664 B
1
Garden Centre
& Palmerston House Golf
110
55
665
R407
A
2109
7
Site 3
2323
29
C
275 B
126
Site 5
E
1
237
403
0
258
5
67
181
D
A
11
47
0
7
C
0
636
11
215
B
0
0
0
0
A
0
282
98
252
B
26
546
237
408
0
0
0
0
E
N7
8462
12094
439
110
238
0
C
Site 4
5
209
0
283
D
N7

Figure 6.14

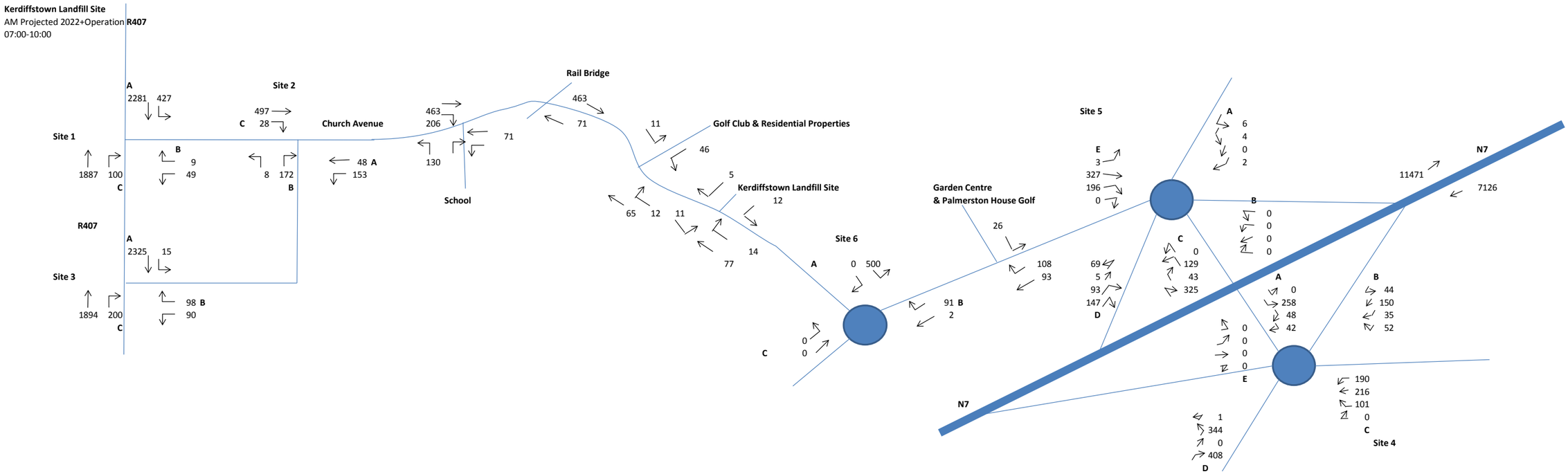

Kerdiffstown Landfill Site
AM Projected 2022+Operation
07:00-10:00
R407
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Garden Centre
& Palmerston House Golf
N7
A
B
C
D
E
2281 427
1887 100
9 49
497 28
8 172
48 153
463 206
130
71
463
71
11
46
5
12
65 12 11
77 14
0 500
0 0
91 2
26
108 93
2325 15
1894 200
98 90
6 4 0 2
3 327 196 0
69 5 93 147
0 0 0 0
0 129 43 325
0 0 0 0
0 258 48 42
44 150 35 52
0 0 0 0
1 344 0 408
190 216 101 0
11471
7126

Figure 6.15

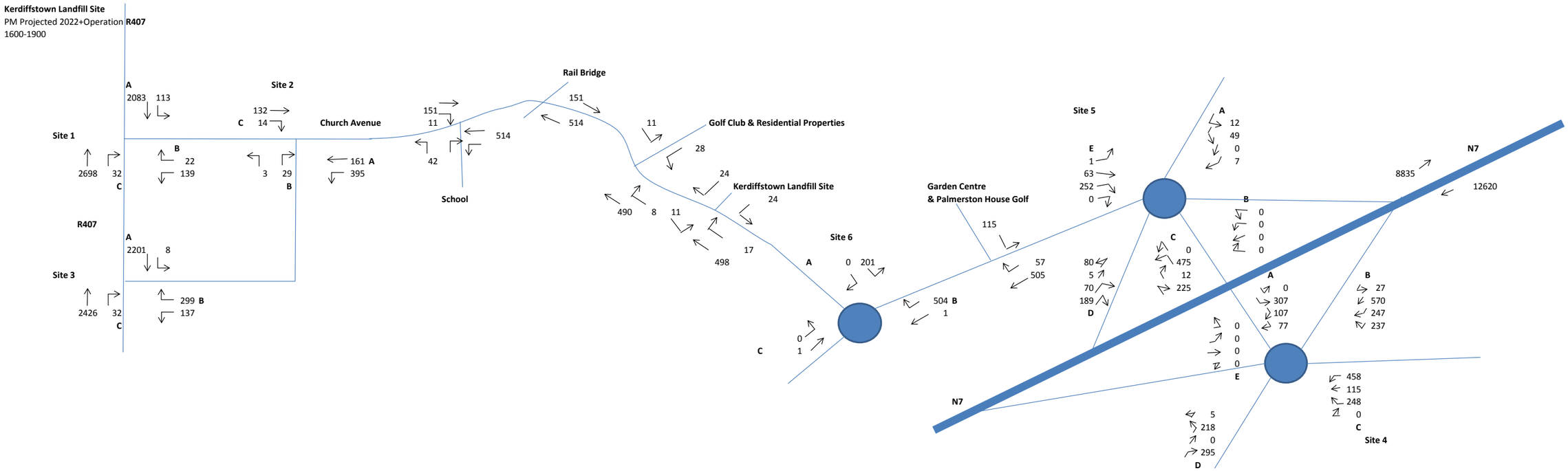

Kerdiffstown Landfill Site
PM Projected 2022+Operation
1600-1900
R407
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Garden Centre
& Palmerston House Golf
N7

Figure 6.16

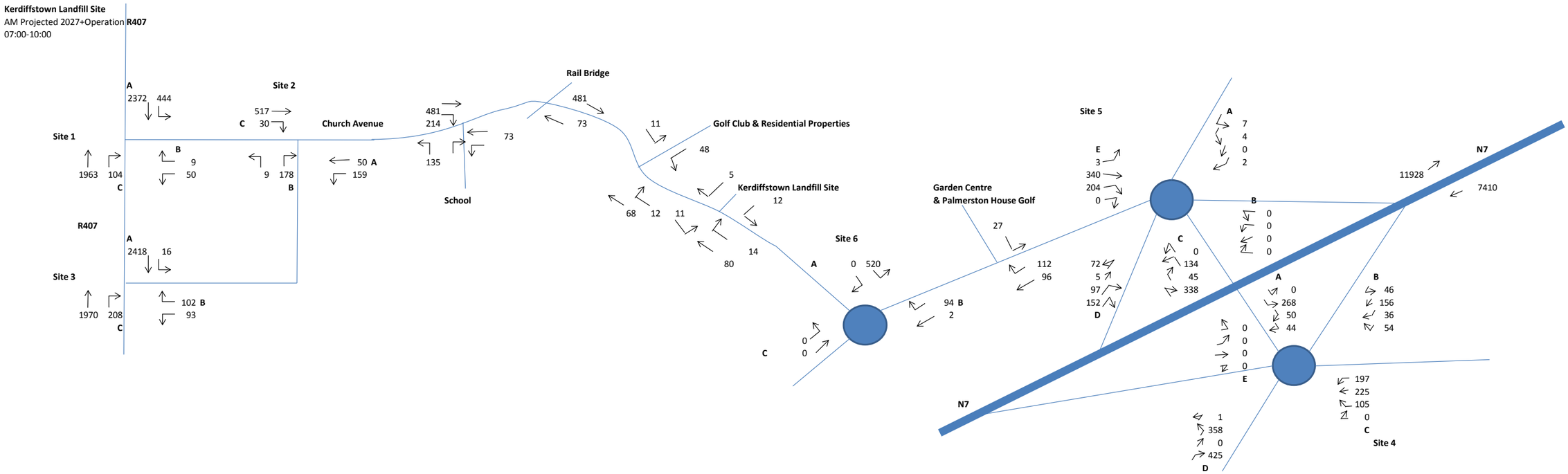

Kerdiffstown Landfill Site
AM Projected 2027+Operation
07:00-10:00
R407
Site 1
A
2372
444
1963
104
C
B
9
50
Site 2
517
C
30
9
178
B
Church Avenue
50 A
159
481
214
135
School
73
Rail Bridge
481
73
11
48
Golf Club & Residential Properties
5
Kerdiffstown Landfill Site
12
14
80
68
12
11
Site 6
A
0
520
C
0
0
Garden Centre
& Palmerston House Golf
27
112
96
94 B
2
R407
A
2418
16
Site 3
1970
208
C
102 B
93
Site 5
E
3
340
204
0
72
5
97
152
D
A
7
4
0
2
C
0
134
45
338
B
0
0
0
0
A
0
268
50
44
B
46
156
36
54
0
0
0
0
E
1
358
0
425
D
197
225
105
0
C
Site 4
N7
11928
7410
N7

Figure 6.17

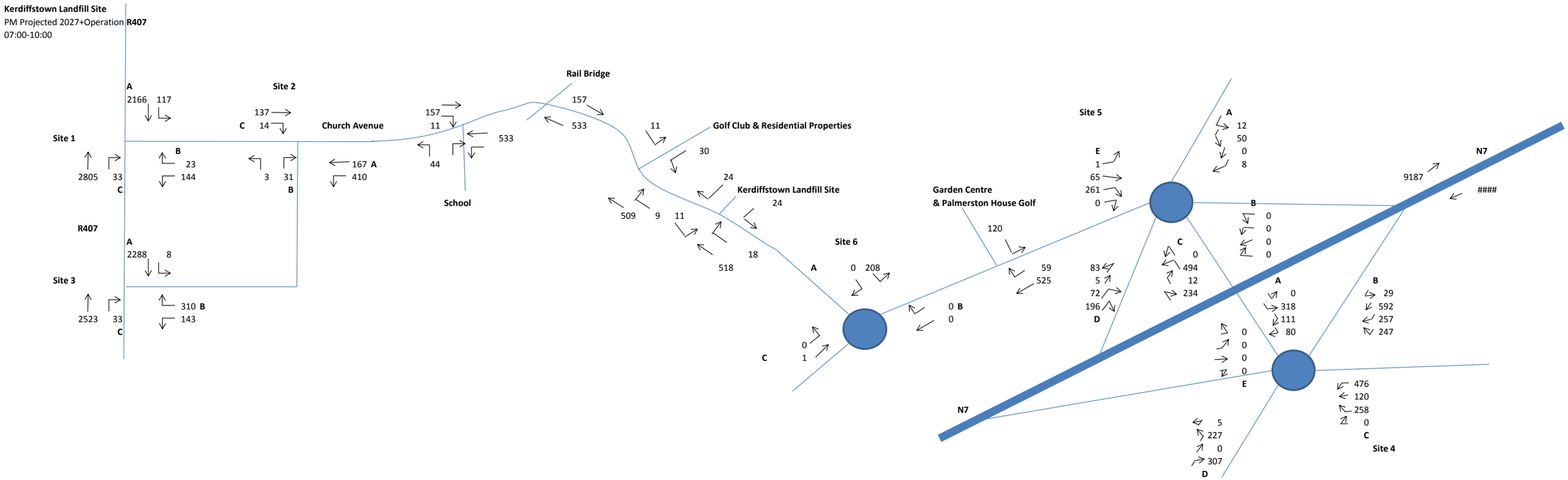

Kerdiffstown Landfill Site
PM Projected 2027+Operation
07:00-10:00
R407
Site 1
Site 2
Church Avenue
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
School
Site 3
Site 6
Garden Centre
& Palmerston House Golf
Site 5
Site 4
N7

Figure 6.18

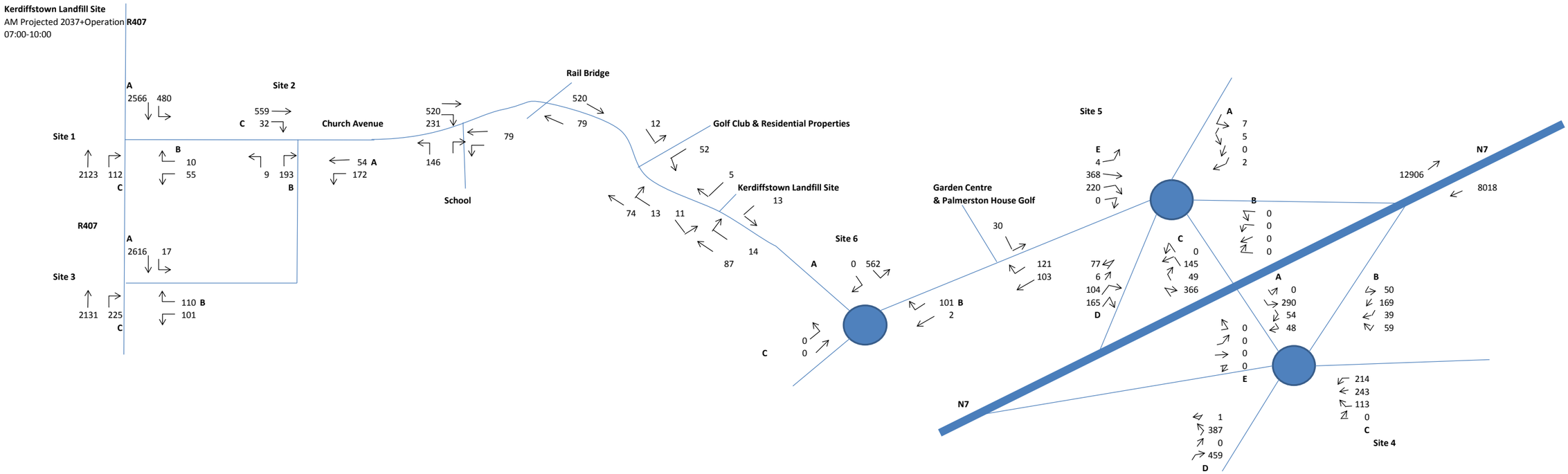

Kerdiffstown Landfill Site
AM Projected 2037+Operation
07:00-10:00
R407
Site 1
Site 2
Site 3
Site 4
Site 5
Site 6
Church Avenue
School
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
Garden Centre
& Palmerston House Golf
N7
A
B
C
D
E
2566 480
2123 112
10 55
559 32
9 193
54 A 172
520 231
146
79
520
79
12
52
5
13
74 13 11
87 14
0 562
101 B 2
0 0
30
121 103
2616 17
2131 225
110 B 101
E 4 368 220 0
77 6 104 165
A 7 5 0 2
B 0 0 0 0
C 0 145 49 366
A 0 290 54 48
B 50 169 39 59
0 0 0 0
214 243 113 0
1 387 0 459
12906
8018

Figure 6.19

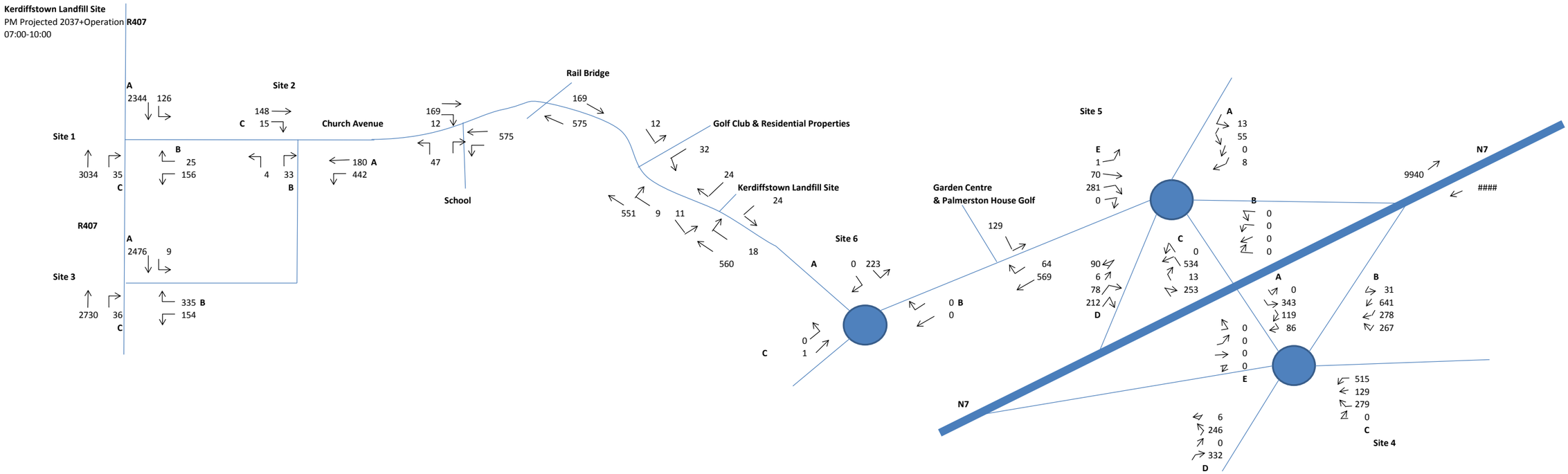

Kerdiffstown Landfill Site
PM Projected 2037+Operation
07:00-10:00
R407
Site 1
Site 2
Church Avenue
Rail Bridge
Golf Club & Residential Properties
Kerdiffstown Landfill Site
School
Site 6
Garden Centre
& Palmerston House Golf
Site 5
N7
Site 4
Site 3
A
B
C
D
E

Figure 6.20

Appendix B. Modelling Results

AM Peak

Site/ Junction Name	Link	2018 Do Minimum		2018 Remediation Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	13.3	1.5	13.3	1.7	0.1	0.3
	Church Avenue west	8.2	3.0	13.9	3.1	5.7	0.1
	Landfill	2.6	0.9	9.7	1.1	7.1	0.3
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	9.1	1.1	7.7	1.2	-1.3	0.1
	Johnstown Garden	0.0	0.0	0.0	0.0	0.0	0.0
	Church Avenue West	4.2	3.1	4.0	2.9	-0.2	-0.1
Site 9 N7 North Roundabout	The Paddocks	3.4	4.2	6.0	4.3	2.6	0.2
	N7 off-slip EB	17.5	5.7	16.4	6.1	-1.1	0.4
	Greenhill Overbridge	0.0	1.4	2.1	1.4	2.1	0.0
	N7 Access Road	19.3	5.7	18.0	8.1	-1.3	2.4
Site 10 N7 South Roundabout	Palmerstown	14.6	2.3	17.9	3.0	3.3	0.7
	Kill West	9.1	1.1	10.1	1.1	1.1	0.0
	Greenhill Overbridge	11.6	1.5	11.6	1.7	0.0	0.2
	N7 off-slip WB	14.8	3.1	14.1	3.2	-0.7	0.1
Site 4 Church Ave / Sallins National School	Church Avenue East	0.0	2.7	0.0	2.8	0.0	0.0
	Church Avenue West	7.1	1.7	2.2	1.7	-5.0	0.0
	School	24.7	0.7	24.7	0.8	0.0	0.1
Site 1 R407 / Church Ave, Sallins	R407 North	41.2	2.0	41.2	2.0	0.0	0.0
	R407 South	65.9	5.5	66.3	6.0	0.3	0.5
	Church Avenue East	11.3	11.3	11.0	8.1	-0.3	-3.2
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	0.5	0.0	0.5	0.0	0.0
	Church Avenue North	9.5	1.3	9.5	1.3	0.1	0.0
	Church Avenue West	2.3	0.5	3.7	0.5	1.3	0.0
Site 3 R407 / Church Ave (E)	Church Avenue East	39.7	16.6	41.9	19.2	2.2	2.6
	R407 North	70.5	1.9	70.2	1.9	-0.3	0.0
	R407 South	167.6	9.5	170.9	9.6	3.3	0.0
Site 5 Church Ave Railway Bridge	Church Avenue East	0.0	1.5	0.0	1.4	0.0	0.0
	Church Avenue West	0.0	1.0	0.0	0.9	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	1.1	2.0	3.8	1.8	2.7	-0.2
	Church Avenue west	0.0	2.2	0.0	2.1	0.0	0.0
	Golf Club	3.8	0.6	5.1	0.7	1.3	0.2
Garden Centre	Church Avenue East	10.5	1.5	18.2	1.8	7.7	0.3
	Church Avenue west	0.0	2.4	0.0	2.3	0.0	-0.1
	Garden Centre	6.3	1.0	6.3	0.8	0.1	-0.2

Site/ Junction Name	Link	2018 Do Minimum		2018 Remediation + Sensitivity Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	13.3	1.5	24.7	2.3	11.4	0.8
	Church Avenue west	8.2	3.0	16.8	3.3	8.6	0.2
	Landfill	2.6	0.9	18.4	1.4	15.8	0.6
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	9.1	1.1	12.2	2.8	3.2	1.7
	Johnstown Garden	0.0	0.0	0.0	0.0	0.0	0.0
	Church Avenue West	4.2	3.1	13.4	2.8	9.3	-0.3
Site 9 N7 North Roundabout	The Paddocks	3.4	4.2	3.6	4.0	0.2	-0.2
	N7 off-slip EB	17.5	5.7	20.7	6.3	3.2	0.6
	Greenhill Overbridge	0.0	1.4	1.6	1.5	1.6	0.1
	N7 Access Road	19.3	5.7	36.2	6.4	17.0	0.7
Site 10 N7 South Roundabout	Palmerstown	14.6	2.3	15.6	2.4	0.9	0.1
	Kill West	9.1	1.1	13.5	1.2	4.5	0.1
	Greenhill Overbridge	11.6	1.5	16.2	2.1	4.6	0.6
	N7 off-slip WB	14.8	3.1	22.2	3.3	7.5	0.2
Site 4 Church Ave / Sallins National School	Church Avenue East	0.0	2.7	0.0	2.7	0.0	-0.1
	Church Avenue West	7.1	1.7	2.0	1.6	-5.1	0.0
	School	24.7	0.7	24.7	0.8	0.0	0.1
Site 1 R407 / Church Ave, Sallins	R407 North	41.2	2.0	41.3	2.0	0.2	0.0
	R407 South	65.9	5.5	68.7	6.0	2.8	0.5
	Church Avenue East	11.3	11.3	11.2	7.8	-0.1	-3.6
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	0.5	0.0	0.5	0.0	0.0
	Church Avenue North	9.5	1.3	9.6	1.3	0.1	0.0
	Church Avenue West	2.3	0.5	1.1	0.5	-1.2	0.0
Site 3 R407 / Church Ave (E)	Church Avenue East	39.7	16.6	56.6	20.4	16.9	3.7
	R407 North	70.5	1.9	70.2	1.9	-0.2	0.0
	R407 South	167.6	9.5	174.5	9.6	7.0	0.1
Site 5 Church Ave Railway Bridge	Church Avenue East	0.0	1.5	0.0	1.3	0.0	-0.2
	Church Avenue West	0.0	1.0	0.0	0.9	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	1.1	2.0	5.1	1.7	4.0	-0.3
	Church Avenue west	0.0	2.2	0.0	2.1	0.0	0.0
	Golf Club	3.8	0.6	4.0	0.7	0.2	0.1
Garden Centre	Church Avenue East	10.5	1.5	18.2	2.0	7.8	0.5
	Church Avenue west	0.0	2.4	0.0	2.2	0.0	-0.2
	Garden Centre	6.3	1.0	6.5	1.2	0.2	0.2

Site/ Junction Name	Link	2022 Do Minimum		2022 Operational Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	8.4	2.1	15.3	1.7	6.8	-0.4
	Church Avenue west	6.6	3.0	7.2	3.0	0.7	0.0
	Landfill	2.5	0.5	4.8	0.8	2.4	0.3
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	9.9	1.3	5.7	1.4	-4.2	0.1
	Johnstown Garden	0.0	0.0	0.0	0.0	0.0	0.0
	Church Avenue West	11.1	3.5	9.2	3.3	-1.9	-0.2
Site 9 N7 North Roundabout	The Paddocks	4.2	4.3	4.1	4.6	-0.1	0.3
	N7 off-slip EB	17.3	5.9	16.7	5.7	-0.6	-0.2
	Greenhill Overbridge	1.4	1.4	2.5	1.4	1.1	0.0
	N7 Access Road	18.1	5.8	19.8	5.7	1.7	-0.1
Site 10 N7 South Roundabout	Palmerstown	13.7	2.1	12.8	3.0	-0.9	0.9
	Kill West	9.1	1.1	9.1	1.1	0.0	-0.1
	Greenhill Overbridge	15.1	1.7	13.0	1.7	-2.1	0.0
	N7 off-slip WB	16.4	3.0	14.9	3.1	-1.4	0.1
Site 4 Church Ave / Sallins National School	Church Avenue East	0.0	2.7	0.0	2.7	0.0	0.0
	Church Avenue West	6.1	1.6	4.3	1.6	-1.7	0.0
	School	24.7	0.7	24.7	0.7	0.0	0.0
Site 1 R407 / Church Ave, Sallins	R407 North	41.1	2.1	37.0	2.0	-4.1	0.0
	R407 South	69.2	5.8	62.5	5.6	-6.7	-0.2
	Church Avenue East	12.0	12.3	12.2	9.7	0.2	-2.6
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	0.5	0.0	0.4	0.0	0.0
	Church Avenue North	8.2	1.2	10.4	1.4	2.2	0.1
	Church Avenue West	2.3	0.5	1.3	0.5	-1.0	0.0
Site 3 R407 / Church Ave (E)	Church Avenue East	39.9	16.6	45.8	17.9	5.9	1.3
	R407 North	70.3	1.9	71.0	1.9	0.8	0.0
	R407 South	166.1	9.4	187.3	10.0	21.2	0.5
Site 5 Church Ave Railway Bridge	Church Avenue East	0.0	1.3	0.0	1.2	0.0	-0.1
	Church Avenue West	0.0	1.0	0.0	0.9	0.0	-0.1
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	0.0	1.6	0.0	1.8	0.0	0.2
	Church Avenue west	0.0	2.2	0.0	2.1	0.0	-0.1
	Golf Club	6.1	0.7	6.1	0.8	0.0	0.1
Garden Centre	Church Avenue East	10.8	1.4	14.2	1.6	3.4	0.2
	Church Avenue west	0.0	2.3	0.0	2.3	0.0	0.0
	Garden Centre	6.4	1.2	6.4	1.1	0.0	-0.1

PM Peak

Site/ Junction Name	Link	2018 Do Minimum		2018 Remediation Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	20.7	4.2	16.2	4.9	-4.5	0.6
	Church Avenue west	11.0	1.5	20.5	1.8	9.5	0.3
	Landfill	0.0	0.4	4.8	0.5	4.8	0.1
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	1.1	3.7	6.0	6.3	4.8	2.5
	Johnstown Garden	5.0	1.2	6.4	2.1	1.4	0.9
	Church Avenue West	1.1	1.3	5.5	1.2	4.4	-0.1
Site 9 N7 North Roundabout	The Paddocks	6.7	4.2	9.2	4.1	2.5	-0.1
	N7 off-slip EB	19.6	5.9	19.7	6.0	0.2	0.1
	Greenhill Overbridge	2.8	1.0	3.5	1.0	0.6	0.0
	N7 Access Road	11.5	4.7	13.0	2.5	1.5	-2.2
Site 10 N7 South Roundabout	Palmerstown	16.1	2.8	16.2	4.6	0.1	1.8
	Kill West	27.1	3.0	31.0	2.9	3.8	-0.1
	Greenhill Overbridge	16.7	1.9	11.4	1.8	-5.4	0.0
	N7 off-slip WB	38.3	4.6	40.9	4.8	2.6	0.2
Site 4 Church Ave / Sallins National School	Church Avenue East	2.3	6.2	3.8	6.1	1.5	-0.1
	Church Avenue West	1.9	2.1	0.0	2.2	-1.9	0.1
	School	24.7	3.7	24.7	3.2	0.0	-0.4
Site 1 R407 / Church Ave, Sallins	R407 North	14.5	1.7	25.2	1.8	10.7	0.0
	R407 South	42.9	2.8	41.9	2.7	-1.0	-0.1
	Church Avenue East	32.6	16.2	31.7	16.4	-0.9	0.2
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	1.5	0.0	1.5	0.0	0.0
	Church Avenue North	5.1	1.1	3.7	0.9	-1.4	-0.2
	Church Avenue West	2.7	0.9	5.3	2.3	2.6	1.4
Site 3 R407 / Church Ave (E)	Church Avenue East	105.5	38.5	98.2	39.3	-7.3	0.7
	R407 North	67.6	1.9	68.4	1.9	0.8	0.0
	R407 South	130.9	7.4	129.9	7.4	-1.0	0.1
Site 5 Church Ave Railway Bridge	Church Avenue East	0.0	5.2	0.0	5.2	0.0	0.1
	Church Avenue West	0.0	0.4	0.0	0.4	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	1.0	6.9	0.0	6.6	-1.0	-0.3
	Church Avenue west	0.0	1.1	0.0	1.1	0.0	0.0
	Golf Club	0.0	0.5	0.0	0.4	0.0	0.0
Garden Centre	Church Avenue East	6.3	3.5	5.2	3.7	-1.1	0.2
	Church Avenue west	0.0	1.3	0.0	1.2	0.0	-0.1
	Garden Centre	4.8	0.5	6.2	0.6	1.5	0.1

Site/ Junction Name	Link	2018 Do Minimum		2018 Remediation + Sensitivity Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	20.7	4.2	23.6	5.2	2.9	1.0
	Church Avenue west	11.0	1.5	23.4	2.1	12.4	0.6
	Landfill	0.0	0.4	10.8	0.7	10.8	0.3
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	1.1	3.7	14.2	4.1	13.1	0.4
	Johnstown Garden	5.0	1.2	6.1	2.1	1.0	0.8
	Church Avenue West	1.1	1.3	6.7	1.1	5.6	-0.1
Site 9 N7 North Roundabout	The Paddocks	6.7	4.2	8.7	4.3	2.0	0.1
	N7 off-slip EB	19.6	5.9	23.1	6.1	3.5	0.2
	Greenhill Overbridge	2.8	1.0	4.6	1.1	1.7	0.1
	N7 Access Road	11.5	4.7	14.4	3.0	2.9	-1.7
Site 10 N7 South Roundabout	Palmerstown	16.1	2.8	15.0	3.0	-1.1	0.3
	Kill West	27.1	3.0	26.7	3.2	-0.4	0.3
	Greenhill Overbridge	16.7	1.9	12.6	1.9	-4.2	0.1
	N7 off-slip WB	38.3	4.6	39.5	4.9	1.2	0.3
Site 4 Church Ave / Sallins National School	Church Avenue East	2.3	6.2	4.8	6.2	2.5	0.0
	Church Avenue West	1.9	2.1	0.0	1.7	-1.9	-0.5
	School	24.7	3.7	24.7	2.3	0.0	-1.3
Site 1 R407 / Church Ave, Sallins	R407 North	14.5	1.7	19.7	1.8	5.2	0.0
	R407 South	42.9	2.8	35.0	2.4	-7.9	-0.4
	Church Avenue East	32.6	16.2	32.1	14.1	-0.5	-2.1
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	1.5	0.0	1.5	0.0	0.0
	Church Avenue North	5.1	1.1	5.1	1.1	0.0	0.0
	Church Avenue West	2.7	0.9	5.1	0.6	2.4	-0.3
Site 3 R407 / Church Ave (E)	Church Avenue East	105.5	38.5	99.7	37.6	-5.8	-0.9
	R407 North	67.6	1.9	68.3	1.9	0.7	0.0
	R407 South	130.9	7.4	146.8	7.8	15.9	0.5
Site 5 Church Ave Railway Bridge	Church Avenue East	0.0	5.2	0.0	5.2	0.0	0.1
	Church Avenue West	0.0	0.4	0.0	0.4	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	1.0	6.9	1.0	6.5	0.0	-0.4
	Church Avenue west	0.0	1.1	0.0	1.0	0.0	-0.1
	Golf Club	0.0	0.5	0.0	0.5	0.0	0.0
Garden Centre	Church Avenue East	6.3	3.5	8.4	3.8	2.1	0.4
	Church Avenue west	0.0	1.3	0.0	1.2	0.0	-0.1
	Garden Centre	4.8	0.5	6.3	0.6	1.6	0.1

Site/ Junction Name	Link	2022 Do Minimum		2022 Operational Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	12.3	4.2	16.1	4.7	3.8	0.5
	Church Avenue west	15.7	1.6	14.6	1.7	-1.1	0.1
	Landfill	1.3	0.4	3.9	0.6	2.6	0.1
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	7.1	3.8	7.9	3.8	0.8	0.1
	Johnstown Garden	3.7	1.0	3.8	1.2	0.1	0.3
	Church Avenue West	2.6	1.3	3.1	1.1	0.5	-0.2
Site 9 N7 North Roundabout	The Paddocks	6.7	4.0	8.2	4.3	1.5	0.3
	N7 off-slip EB	18.9	6.0	21.1	6.1	2.3	0.2
	Greenhill Overbridge	3.5	1.0	3.0	1.1	-0.6	0.1
	N7 Access Road	9.0	4.4	11.2	2.7	2.3	-1.7
Site 10 N7 South Roundabout	Palmerstown	18.6	4.3	14.5	4.1	-4.1	-0.2
	Kill West	17.5	2.8	21.5	2.9	4.0	0.1
	Greenhill Overbridge	8.1	1.8	9.2	1.6	1.0	-0.2
	N7 off-slip WB	37.7	4.8	35.8	4.7	-1.9	0.0
Site 4 Church Ave / Sallins National School	Church Avenue East	1.3	6.1	2.6	6.1	1.3	0.0
	Church Avenue West	0.0	0.8	2.4	1.2	2.4	0.4
	School	24.7	2.8	24.7	2.8	0.0	0.0
Site 1 R407 / Church Ave, Sallins	R407 North	18.8	1.8	21.5	1.8	2.7	0.1
	R407 South	39.8	2.5	46.4	3.1	6.6	0.7
	Church Avenue East	32.4	17.0	37.7	17.3	5.3	0.4
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	1.4	7.3	1.5	7.3	0.1
	Church Avenue North	3.8	1.1	6.5	1.1	2.7	0.0
	Church Avenue West	6.5	1.5	6.5	2.0	0.0	0.6
Site 3 R407 / Church Ave (E)	Church Avenue East	94.9	38.4	103.0	39.7	8.1	1.3
	R407 North	67.8	2.1	69.9	2.0	2.2	-0.1
	R407 South	145.3	7.5	174.7	9.7	29.4	2.3
Site 5 Church Ave Railway Bridge	Church Avenue East	0.0	5.0	0.0	5.1	0.0	0.1
	Church Avenue West	0.0	0.4	0.0	0.4	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	0.0	7.0	0.0	6.4	0.0	-0.6
	Church Avenue west	0.0	1.1	0.0	1.1	0.0	-0.1
	Golf Club	0.0	0.4	0.0	0.4	0.0	0.0
Garden Centre	Church Avenue East	8.3	3.5	2.5	3.6	-5.7	0.1
	Church Avenue west	0.0	1.3	0.0	1.2	0.0	-0.1
	Garden Centre	6.2	0.5	6.2	0.5	0.1	0.0

DM 2018 AM Peak

Location		Observed DM 2018				Model DM 2018				Difference				Difference			
From	To	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Difference	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2064**	1779	113	172	**2061**	1769	109	183	**-3**	-10	-4	11	3	0.1	Pass	Pass
R407 North	Church Avenue East	**400**	383	2	15	**407**	394	1	11	**7**	11	-1	-4	-7	0.3	Pass	Pass
R407 South	R407 North	**1687**	1375	112	200	**1715**	1397	108	210	**28**	22	-4	10	-28	0.7	Pass	Pass
R407 South	Church Avenue East	**94**	89	0	5	**95**	90	0	5	**1**	1	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 South	**45**	44	0	1	**46**	46	0	1	**1**	2	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 North	**8**	8	0	0	**7**	7	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**44**	44	0	0	**43**	43	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	Church Avenue South	**140**	133	2	5	**145**	122	0	23	**5**	-11	-2	18	-5	0.4	Pass	Pass
Church Avenue North	Church Avenue West	**8**	7	0	1	**10**	9	0	1	**2**	2	0	0	-2	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**161**	149	1	10	**193**	178	2	13	**32**	29	1	3	-32	2.4	Pass	Pass
Church Avenue West	Church Avenue South	**27**	26	0	1	**27**	26	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**465**	444	2	18	**484**	467	2	15	**19**	23	0	-3	-19	0.9	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**83**	80	1	2	**80**	73	0	7	**-3**	-7	-1	5	3	0.3	Pass	Pass
Church Avenue East	R407 North	**91**	84	1	6	**92**	76	0	16	**1**	-8	-1	10	-1	0.1	Pass	Pass
R407 North	Church Avenue East	**14**	13	0	1	**17**	15	0	2	**3**	2	0	1	-3	0.7	Pass	Pass
R407 North	R407 South	**2101**	1814	113	174	**2128**	1831	112	185	**27**	17	-1	11	-27	0.6	Pass	Pass
R407 South	Church Avenue East	**188**	174	1	13	**186**	172	2	12	**-2**	-2	1	-1	2	0.1	Pass	Pass
R407 South	R407 North	**1698**	1396	108	194	**1718**	1411	108	199	**20**	15	0	5	-20	0.5	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**324**	302	1	21	**327**	306	1	20	**3**	4	0	-1	-3	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**377**	341	14	21	**378**	344	13	21	**1**	3	-1	0	-1	0.1	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**94**	82	1	11	**97**	84	1	12	**3**	2	0	1	-3	0.3	Pass	Pass
Kill West	N7 on-slip WB	**206**	190	1	15	**214**	198	1	15	**8**	8	0	0	-8	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**169**	146	13	9	**164**	142	12	9	**-5**	-4	-1	0	5	0.4	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**36**	28	4	4	**30**	25	2	3	**-6**	-3	-2	-1	6	1.1	Pass	Pass
Greenhill Overbridge	Kill West	**238**	200	7	31	**225**	200	0	24	**-13**	0	-7	-7	13	0.9	Pass	Pass
Greenhill Overbridge	Palmerstown	**45**	40	0	5	**47**	44	0	3	**2**	4	0	-2	-2	0.2	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**42**	27	6	9	**41**	25	6	10	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**33**	29	0	4	**36**	31	0	6	**3**	2	0	2	-3	0.5	Pass	Pass
N7 off-slip WB	Kill West	**42**	35	0	7	**41**	33	0	8	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**140**	117	3	20	**141**	120	0	21	**1**	3	-3	1	-1	0.1	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**1**	1	0	0	**-1**	0	0	-1	1	0.8	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**5**	3	0	2	**-1**	0	0	-1	1	0.5	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**4**	2	0	2	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**63**	53	0	10	**61**	48	3	11	**-2**	-5	3	1	2	0.2	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**89**	78	0	11	**82**	72	0	9	**-7**	-6	0	-2	7	0.7	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**133**	114	7	12	**117**	105	0	11	**-16**	-9	-7	-1	16	1.5	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**112**	97	4	11	**120**	99	8	13	**8**	2	4	2	-8	0.7	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**309**	281	2	26	**308**	284	0	25	**-1**	3	-2	-1	1	0.1	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**39**	31	2	6	**37**	32	0	5	**-2**	1	-2	-1	2	0.4	Pass	Pass
N7 Access Road	N7 Access Road	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**308**	290	1	17	**331**	320	1	10	**23**	30	0	-7	-23	1.3	Pass	Pass
N7 Access Road	Greenhill Overbridge	**182**	153	4	25	**181**	163	2	16	**-1**	10	-2	-9	1	0.1	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**77**	69	0	8	**81**	47	11	23	**4**	-22	11	15	-4	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**2**	2	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**471**	431	2	37	**496**	464	3	28	**25**	33	1	-9	-25	1.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**424**	393	3	28	**463**	431	3	28	**39**	38	0	0	-39	1.9	Pass	Pass
Church Avenue East	Church Avenue West	**62**	54	0	8	**61**	38	0	23	**-1**	-16	0	15	1	0.1	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**463**	431	3	28	**448**	417	3	28	**-15**	-14	0	0	15	0.7	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	11	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**44**	44	0	0	**46**	46	0	0	**2**	2	0	0	-2	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**11**	11	0	0	**7**	7	0	0	**-4**	-4	0	0	4	1.4	Pass	Pass
Church Avenue East	Church Avenue west	**63**	55	0	8	**62**	39	0	23	**-1**	-16	0	15	1	0.1	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**3**	3	0	0	**12**	1	10	0	**9**	-2	10	0	-9	3.3	Pass	Pass
Church Avenue East	Church Avenue west	**74**	66	0	8	**69**	46	0	23	**-5**	-20	0	15	5	0.6	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**469**	437	3	28	**492**	460	3	28	**23**	23	0	0	-23	1.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**6**	6	0	0	**6**	6	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**75**	48	4	22	**82**	49	11	23	**7**	1	7	1	-7	0.8	Pass	Pass
Church Avenue East	Garden Centre	**103**	103	0	0	**100**	100	0	0	**-3**	-3	0	0	3	0.3	Pass	Pass
Church Avenue west	Church Avenue East	**471**	431	2	37	**495**	464	3	28	**24**	33	1	-9	-24	1.1	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**25**	25	0	0	**23**	23	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**63**	55	0	8	**60**	37	0	23	**-3**	-18	0	15	3	0.3	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**428**	397	3	28	**463**	432	3	28	**35**	35	0	0	-35	1.6	Pass	Pass
Church Avenue West	School	**197**	197	0	0	**213**	213	0	0	**16**	16	0	0	-16	1.1	Pass	Pass
School	Church Avenue West	**124**	124	0	0	**128**	128	0	0	**4**	4	0	0	-4	0.3	Pass	Pass
School	`	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		Observed				Model				Difference				Difference			
From	To	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Difference	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1926**	1676	61	190	**1924**	1664	59	200	**-2**	-12	-2	10	2	0.1	Pass	Pass
R407 North	Church Avenue East	**101**	94	0	7	**104**	99	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
R407 South	R407 North	**2479**	2202	84	193	**2469**	2170	94	205	**-10**	-32	10	12	10	0.2	Pass	Pass
R407 South	Church Avenue East	**28**	28	0	0	**27**	27	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**127**	111	0	16	**123**	105	0	18	**-4**	-6	0	2	4	0.4	Pass	Pass
Church Avenue East	R407 North	**20**	18	0	2	**21**	19	0	2	**1**	1	0	0	-1	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**147**	129	0	18	**141**	120	0	21	**-6**	-9	0	3	6	0.5	Pass	Pass
Church Avenue East	Church Avenue South	**359**	329	1	28	**352**	310	9	33	**-7**	-19	8	5	7	0.3	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**4**	4	0	0	**2**	2	0	0	-2	1.1	Pass	Pass
Church Avenue North	Church Avenue East	**26**	25	0	1	**28**	26	0	2	**2**	1	0	1	-2	0.3	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**118**	111	0	7	**121**	116	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**124**	116	0	8	**110**	103	0	7	**-14**	-13	0	-1	14	1.3	Pass	Pass
Church Avenue East	R407 North	**273**	242	1	29	**251**	216	9	27	**-22**	-26	8	-2	22	1.3	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	4	0	2	**-1**	-1	0	0	1	0.4	Pass	Pass
R407 North	R407 South	**2038**	1781	61	197	**2075**	1796	60	219	**37**	15	-1	22	-37	0.8	Pass	Pass
R407 South	Church Avenue East	**29**	29	0	0	**25**	25	0	0	**-4**	-4	0	0	4	0.8	Pass	Pass
R407 South	R407 North	**2228**	1970	85	174	**2246**	1983	85	178	**18**	13	0	4	-18	0.4	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**206**	188	3	15	**206**	187	4	15	**0**	-1	1	0	0	0.0	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**4**	4	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Palmerstown	Kill West	**275**	245	8	21	**278**	250	7	21	**3**	5	-1	0	-3	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**236**	214	1	21	**227**	206	1	20	**-9**	-8	0	-1	9	0.6	Pass	Pass
Kill West	N7 on-slip WB	**105**	90	4	11	**110**	93	4	13	**5**	3	0	2	-5	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**424**	377	13	34	**435**	389	13	34	**11**	12	0	0	-11	0.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**68**	62	2	4	**65**	61	1	3	**-3**	-1	-1	-1	3	0.3	Pass	Pass
Greenhill Overbridge	Kill West	**279**	253	3	23	**270**	247	3	20	**-9**	-6	0	-3	9	0.5	Pass	Pass
Greenhill Overbridge	Palmerstown	**98**	95	0	3	**102**	100	0	2	**4**	5	0	-1	-4	0.4	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**224**	189	1	34	**228**	194	2	33	**4**	5	1	-1	-4	0.2	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**234**	202	2	30	**237**	204	2	31	**3**	2	0	1	-3	0.2	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**28**	22	0	6	**2**	1	0	1	-2	0.3	Pass	Pass
N7 off-slip WB	Palmerstown	**542**	505	3	34	**530**	496	3	31	**-12**	-9	0	-3	12	0.5	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**7**	7	0	0	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**11**	9	0	2	**0**	1	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**45**	43	1	2	**1**	2	0	0	-1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**76**	72	1	3	**72**	68	1	3	**-4**	-4	0	0	4	0.4	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**65**	59	2	4	**61**	55	3	3	**-4**	-4	1	-1	4	0.5	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**178**	157	3	18	**163**	141	3	18	**-15**	-16	0	0	15	1.1	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	3	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**448**	393	4	52	**443**	389	3	51	**-5**	-4	-1	-1	5	0.3	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**213**	194	2	17	**210**	191	2	17	**-3**	-3	0	0	3	0.2	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**8**	6	1	0	**-2**	-2	0	-1	2	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**2**	1	0	0	**-1**	-1	0	-1	1	0.6	Pass	Pass
N7 Access Road	N7 on-slip EB	**55**	49	0	5	**49**	47	0	2	**-6**	-2	0	-3	6	0.8	Pass	Pass
N7 Access Road	Greenhill Overbridge	**222**	211	0	11	**230**	226	0	5	**8**	15	0	-6	-8	0.5	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**478**	427	3	47	**468**	410	4	54	**-10**	-17	1	7	10	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**5**	0	5	0	**5**	0	5	0	-5	3.2	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**3**	3	0	0	**2**	2	0	0	-2	1.4	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**169**	160	0	9	**172**	165	0	8	**3**	5	0	-1	-3	0.3	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**134**	126	8	0	**138**	131	0	8	**4**	5	-8	8	-4	0.3	Pass	Pass
Church Avenue East	Church Avenue West	**464**	413	47	3	**453**	390	9	54	**-11**	-23	-38	51	11	0.5	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**152**	143	0	8	**128**	120	0	8	**-24**	-23	0	0	24	2.0	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**29**	29	0	0	**2**	2	0	0	-2	0.3	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**6**	6	0	0	**-2**	-2	0	0	2	0.8	Pass	Pass
Church Avenue East	Church Avenue west	**464**	413	3	47	**454**	392	9	54	**-10**	-21	6	7	10	0.5	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**6**	6	0	0	**4**	4	0	0	**-2**	-2	0	0	2	0.9	Pass	Pass
Church Avenue East	Church Avenue west	**472**	421	3	47	**468**	405	9	54	**-4**	-16	6	7	4	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**169**	161	0	8	**155**	147	0	8	**-14**	-14	0	0	14	1.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**17**	17	0	0	**18**	18	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**480**	419	5	56	**469**	411	4	54	**-11**	-8	-1	-2	11	0.5	Pass	Pass
Church Avenue East	Garden Centre	**55**	55	0	0	**51**	51	0	0	**-4**	-4	0	0	4	0.5	Pass	Pass
Church Avenue west	Church Avenue East	**170**	161	0	9	**175**	167	0	8	**5**	6	0	-1	-5	0.4	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**110**	110	0	0	**109**	109	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**464**	413	3	47	**452**	389	9	54	**-12**	-24	6	7	12	0.5	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**139**	131	0	8	**5**	5	0	0	-5	0.4	Pass	Pass
Church Avenue West	School	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**41**	41	0	0	**1**	1	0	0	-1	0.1	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		2018 Remediation Observed				2018 Remediation Modeled				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2064**	1779	113	172	**2060**	1767	109	183	**-4**	-12	-4	11	4	0.1	Pass	Pass
R407 North	Church Avenue East	**400**	383	2	15	**407**	395	1	11	**7**	12	-1	-4	-7	0.3	Pass	Pass
R407 South	R407 North	**1687**	1375	112	200	**1717**	1399	108	210	**30**	24	-4	10	-30	0.7	Pass	Pass
R407 South	Church Avenue East	**94**	89	0	5	**95**	90	0	5	**1**	1	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 South	**45**	44	0	1	**47**	46	0	1	**2**	2	0	0	-2	0.2	Pass	Pass
Church Avenue East	R407 North	**8**	8	0	0	**7**	7	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**44**	44	0	0	**44**	44	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue East	Church Avenue South	**140**	133	2	5	**150**	128	0	23	**10**	-5	-2	18	-10	0.8	Pass	Pass
Church Avenue North	Church Avenue West	**8**	7	0	1	**10**	9	0	1	**2**	2	0	0	-2	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**161**	149	1	10	**193**	178	2	13	**32**	29	1	3	-32	2.4	Pass	Pass
Church Avenue West	Church Avenue South	**27**	26	0	1	**27**	26	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**465**	444	2	18	**485**	467	2	15	**20**	23	0	-3	-20	0.9	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**83**	80	1	2	**83**	76	0	7	**0**	-4	-1	5	0	0.0	Pass	Pass
Church Avenue East	R407 North	**91**	84	1	6	**95**	79	0	16	**4**	-5	-1	10	-4	0.4	Pass	Pass
R407 North	Church Avenue East	**14**	13	0	1	**17**	15	0	2	**3**	2	0	1	-3	0.7	Pass	Pass
R407 North	R407 South	**2101**	1814	113	174	**2129**	1831	112	185	**28**	17	-1	11	-28	0.6	Pass	Pass
R407 South	Church Avenue East	**188**	174	1	13	**186**	172	2	12	**-2**	-2	1	-1	2	0.1	Pass	Pass
R407 South	R407 North	**1698**	1396	108	194	**1718**	1411	108	199	**20**	15	0	5	-20	0.5	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**324**	302	1	21	**327**	306	1	20	**3**	4	0	-1	-3	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**377**	341	14	21	**379**	345	13	21	**2**	4	-1	0	-2	0.1	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**94**	82	1	11	**97**	84	1	12	**3**	2	0	1	-3	0.3	Pass	Pass
Kill West	N7 on-slip WB	**206**	190	1	15	**214**	198	1	15	**8**	8	0	0	-8	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**169**	146	13	9	**164**	142	12	9	**-5**	-4	-1	0	5	0.4	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**69**	40	25	4	**51**	37	12	3	**-18**	-3	-13	-1	18	2.4	Pass	Pass
Greenhill Overbridge	Kill West	**238**	200	7	31	**223**	194	4	24	**-15**	-6	-3	-7	15	1.0	Pass	Pass
Greenhill Overbridge	Palmerstown	**45**	40	0	5	**47**	44	0	3	**2**	4	0	-2	-2	0.2	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**76**	39	27	9	**65**	36	18	10	**-11**	-3	-9	1	11	1.3	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**33**	29	0	4	**38**	32	0	6	**5**	3	0	2	-5	0.8	Pass	Pass
N7 off-slip WB	Kill West	**42**	35	0	7	**41**	33	0	8	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**140**	117	3	20	**142**	118	2	21	**2**	1	-1	1	-2	0.1	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**1**	1	0	0	**-1**	0	0	-1	1	0.8	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**5**	3	0	2	**-1**	0	0	-1	1	0.5	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**4**	2	0	2	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**96**	64	21	10	**83**	58	14	11	**-13**	-6	-7	1	13	1.3	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**89**	78	0	11	**82**	72	0	9	**-7**	-6	0	-2	7	0.7	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**133**	114	7	12	**120**	105	4	11	**-13**	-9	-3	-1	13	1.2	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**145**	109	25	11	**139**	110	17	13	**-6**	1	-8	2	6	0.5	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**309**	281	2	26	**313**	286	3	25	**4**	5	1	-1	-4	0.2	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**39**	31	2	6	**37**	32	1	5	**-2**	1	-1	-1	2	0.4	Pass	Pass
N7 Access Road	N7 Access Road	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**341**	302	22	17	**347**	327	10	10	**6**	25	-12	-7	-6	0.3	Pass	Pass
N7 Access Road	Greenhill Overbridge	**215**	164	25	25	**198**	169	13	16	**-17**	5	-12	-9	17	1.2	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**110**	81	21	8	**116**	62	31	23	**6**	-19	10	15	-6	0.6	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**1**	1	0	0	**-1**	-1	0	0	1	0.8	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**504**	443	23	37	**528**	477	23	28	**24**	34	0	-9	-24	1.1	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**428**	397	3	28	**463**	431	3	28	**35**	34	0	0	-35	1.6	Pass	Pass
Church Avenue East	Church Avenue West	**63**	55	0	8	**66**	44	0	23	**3**	-11	0	15	-3	0.4	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**463**	431	3	28	**448**	417	3	28	**-15**	-14	0	0	15	0.7	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	11	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**44**	44	0	0	**46**	46	0	0	**2**	2	0	0	-2	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**11**	11	0	0	**8**	8	0	0	**-3**	-3	0	0	3	1.0	Pass	Pass
Church Avenue East	Church Avenue west	**63**	55	0	8	**67**	44	0	23	**4**	-11	0	15	-4	0.5	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**36**	15	21	0	**40**	10	31	0	**4**	-5	10	0	-4	0.6	Pass	Pass
Church Avenue East	Church Avenue west	**74**	66	0	8	**75**	52	0	23	**1**	-14	0	15	-1	0.1	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**481**	449	3	28	**492**	460	3	28	**11**	11	0	0	-11	0.5	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**39**	18	21	0	**38**	18	20	0	**-1**	0	-1	0	1	0.2	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**108**	60	25	22	**117**	62	31	23	**9**	2	6	1	-9	0.9	Pass	Pass
Church Avenue East	Garden Centre	**103**	103	0	0	**106**	106	0	0	**3**	3	0	0	-3	0.3	Pass	Pass
Church Avenue west	Church Avenue East	**504**	443	23	37	**527**	476	23	28	**23**	33	0	-9	-23	1.0	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**25**	25	0	0	**23**	23	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**63**	55	0	8	**66**	44	0	23	**3**	-11	0	15	-3	0.4	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**428**	397	3	28	**464**	432	3	28	**36**	35	0	0	-36	1.7	Pass	Pass
Church Avenue West	School	**197**	197	0	0	**213**	213	0	0	**16**	16	0	0	-16	1.1	Pass	Pass
School	Church Avenue West	**124**	124	0	0	**128**	128	0	0	**4**	4	0	0	-4	0.3	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

RS 2018 PM Peak

Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1926**	1676	61	190	**1925**	1665	60	200	**-1**	-11	-1	10	1	0.0	Pass	Pass
R407 North	Church Avenue East	**101**	94	0	7	**105**	99	0	5	**4**	5	0	-2	-4	0.4	Pass	Pass
R407 South	R407 North	**2479**	2202	84	193	**2469**	2175	89	205	**-10**	-27	5	12	10	0.2	Pass	Pass
R407 South	Church Avenue East	**28**	28	0	0	**27**	27	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**127**	111	0	16	**126**	108	0	18	**-1**	-3	0	2	1	0.1	Pass	Pass
Church Avenue East	R407 North	**20**	18	0	2	**22**	19	0	2	**2**	1	0	0	-2	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**147**	129	0	18	**145**	124	0	21	**-2**	-5	0	3	2	0.2	Pass	Pass
Church Avenue East	Church Avenue South	**359**	329	1	28	**353**	315	4	33	**-6**	-14	3	5	6	0.3	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**4**	4	0	0	**2**	2	0	0	-2	1.1	Pass	Pass
Church Avenue North	Church Avenue East	**26**	25	0	1	**28**	26	0	2	**2**	1	0	1	-2	0.3	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**118**	111	0	7	**121**	116	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**124**	116	0	8	**112**	105	0	7	**-12**	-11	0	-1	12	1.1	Pass	Pass
Church Avenue East	R407 North	**273**	242	1	29	**251**	220	4	27	**-22**	-22	3	-2	22	1.3	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	4	0	2	**-1**	-1	0	0	1	0.4	Pass	Pass
R407 North	R407 South	**2038**	1781	61	197	**2078**	1798	60	219	**40**	17	-1	22	-40	0.9	Pass	Pass
R407 South	Church Avenue East	**29**	29	0	0	**25**	25	0	0	**-4**	-4	0	0	4	0.8	Pass	Pass
R407 South	R407 North	**2228**	1970	85	174	**2246**	1983	85	178	**18**	13	0	4	-18	0.4	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**206**	188	3	15	**206**	187	4	15	**0**	-1	1	0	0	0.0	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**4**	4	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Palmerstown	Kill West	**275**	245	8	21	**278**	249	7	21	**3**	4	-1	0	-3	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**236**	214	1	21	**227**	206	1	20	**-9**	-8	0	-1	9	0.6	Pass	Pass
Kill West	N7 on-slip WB	**105**	90	4	11	**110**	93	4	13	**5**	3	0	2	-5	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**424**	377	13	34	**435**	389	13	34	**11**	12	0	0	-11	0.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**101**	74	23	4	**86**	73	10	3	**-15**	-1	-13	-1	15	1.5	Pass	Pass
Greenhill Overbridge	Kill West	**279**	253	3	23	**266**	244	2	20	**-13**	-9	-1	-3	13	0.8	Pass	Pass
Greenhill Overbridge	Palmerstown	**98**	95	0	3	**98**	97	0	2	**0**	2	0	-1	0	0.0	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**257**	201	22	34	**252**	204	15	33	**-5**	3	-7	-1	5	0.3	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**234**	202	2	30	**236**	203	2	31	**2**	1	0	1	-2	0.1	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**28**	22	0	6	**2**	1	0	1	-2	0.3	Pass	Pass
N7 off-slip WB	Palmerstown	**542**	505	3	34	**529**	495	3	31	**-13**	-10	0	-3	13	0.6	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**7**	7	0	0	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**11**	9	0	2	**0**	1	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**45**	43	1	2	**1**	2	0	0	-1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**109**	84	22	3	**99**	82	15	3	**-10**	-2	-7	0	10	1.0	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**65**	59	2	4	**58**	54	1	3	**-7**	-5	-1	-1	7	0.8	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**178**	157	3	18	**161**	143	1	18	**-17**	-14	-2	0	17	1.3	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	3	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**482**	405	25	52	**467**	400	16	51	**-15**	-5	-9	-1	15	0.7	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**213**	194	2	17	**209**	190	2	17	**-4**	-4	0	0	4	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**8**	7	1	0	**-2**	-1	0	-1	2	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**2**	2	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
N7 Access Road	N7 on-slip EB	**88**	61	21	5	**66**	55	9	2	**-22**	-6	-12	-3	22	2.5	Pass	Pass
N7 Access Road	Greenhill Overbridge	**255**	223	21	11	**245**	230	11	5	**-10**	7	-10	-6	10	0.7	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**511**	439	24	47	**518**	433	30	54	**7**	-6	6	7	-7	0.3	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**5**	0	5	0	**5**	0	5	0	-5	3.2	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**3**	3	0	0	**2**	2	0	0	-2	1.4	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**202**	172	21	9	**204**	177	19	8	**2**	5	-2	-1	-2	0.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**134**	126	0	8	**138**	131	0	8	**4**	5	0	0	-4	0.3	Pass	Pass
Church Avenue East	Church Avenue West	**464**	413	3	47	**458**	399	4	54	**-6**	-14	1	7	6	0.3	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**152**	143	0	8	**128**	120	0	8	**-24**	-23	0	0	24	2.0	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**29**	29	0	0	**2**	2	0	0	-2	0.3	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**6**	6	0	0	**-2**	-2	0	0	2	0.8	Pass	Pass
Church Avenue East	Church Avenue west	**464**	413	3	47	**460**	402	4	54	**-4**	-11	1	7	4	0.2	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**39**	18	21	0	**48**	18	30	0	**9**	0	9	0	-9	1.3	Pass	Pass
Church Avenue East	Church Avenue west	**472**	421	3	47	**472**	414	4	54	**0**	-7	1	7	0	0.0	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**181**	173	0	8	**155**	147	0	8	**-26**	-26	0	0	26	2.0	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**50**	29	21	0	**50**	30	20	0	**0**	1	-1	0	0	0.0	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**513**	431	26	56	**518**	434	30	54	**5**	3	4	-2	-5	0.2	Pass	Pass
Church Avenue East	Garden Centre	**55**	55	0	0	**53**	53	0	0	**-2**	-2	0	0	2	0.2	Pass	Pass
Church Avenue west	Church Avenue East	**203**	173	21	9	**207**	180	19	8	**4**	7	-2	-1	-4	0.3	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**110**	110	0	0	**109**	109	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**464**	413	3	47	**457**	398	4	54	**-7**	-15	1	7	7	0.3	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**139**	131	0	8	**5**	5	0	0	-5	0.4	Pass	Pass
Church Avenue West	School	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**41**	41	0	0	**1**	1	0	0	-1	0.1	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

RS_SENS 2018 AM Peak

Location		Do Minimum 2018				2018 Remediation SENS				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2064**	1779	113	172	**2061**	1768	109	183	**-3**	-11	-4	11	3	0.1	Pass	Pass
R407 North	Church Avenue East	**400**	383	2	15	**407**	394	1	11	**7**	11	-1	-4	-7	0.3	Pass	Pass
R407 South	R407 North	**1687**	1375	112	200	**1720**	1403	108	210	**33**	28	-4	10	-33	0.8	Pass	Pass
R407 South	Church Avenue East	**94**	89	0	5	**96**	91	0	5	**2**	2	0	0	-2	0.2	Pass	Pass
Church Avenue East	R407 South	**45**	44	0	1	**49**	49	0	1	**4**	5	0	0	-4	0.5	Pass	Pass
Church Avenue East	R407 North	**8**	8	0	0	**8**	8	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**44**	44	0	0	**48**	48	0	0	**4**	4	0	0	-4	0.5	Pass	Pass
Church Avenue East	Church Avenue South	**140**	133	2	5	**158**	135	0	23	**18**	2	-2	18	-18	1.4	Pass	Pass
Church Avenue North	Church Avenue West	**8**	7	0	1	**10**	9	0	1	**2**	2	0	0	-2	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**161**	149	1	10	**193**	178	2	13	**32**	29	1	3	-32	2.4	Pass	Pass
Church Avenue West	Church Avenue South	**27**	26	0	1	**27**	26	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**465**	444	2	18	**485**	468	2	15	**20**	24	0	-3	-20	0.9	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**83**	80	1	2	**87**	80	0	7	**4**	0	-1	5	-4	0.5	Pass	Pass
Church Avenue East	R407 North	**91**	84	1	6	**99**	82	0	16	**8**	-2	-1	10	-8	0.8	Pass	Pass
R407 North	Church Avenue East	**14**	13	0	1	**17**	15	0	2	**3**	2	0	1	-3	0.7	Pass	Pass
R407 North	R407 South	**2101**	1814	113	174	**2131**	1834	112	185	**30**	20	-1	11	-30	0.7	Pass	Pass
R407 South	Church Avenue East	**188**	174	1	13	**186**	172	2	12	**-2**	-2	1	-1	2	0.1	Pass	Pass
R407 South	R407 North	**1698**	1396	108	194	**1718**	1411	108	199	**20**	15	0	5	-20	0.5	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**324**	302	1	21	**327**	306	1	20	**3**	4	0	-1	-3	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**377**	341	14	21	**379**	345	13	21	**2**	4	-1	0	-2	0.1	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**94**	82	1	11	**97**	84	1	12	**3**	2	0	1	-3	0.3	Pass	Pass
Kill West	N7 on-slip WB	**206**	190	1	15	**214**	198	1	15	**8**	8	0	0	-8	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**169**	146	13	9	**164**	142	12	9	**-5**	-4	-1	0	5	0.4	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**147**	68	75	4	**100**	64	33	3	**-47**	-4	-42	-1	47	4.2	Pass	Pass
Greenhill Overbridge	Kill West	**238**	200	7	31	**215**	186	4	24	**-23**	-14	-3	-7	23	1.6	Pass	Pass
Greenhill Overbridge	Palmerstown	**45**	40	0	5	**42**	39	0	3	**-3**	-1	0	-2	3	0.5	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**153**	67	77	9	**118**	64	44	10	**-35**	-3	-33	1	35	3.0	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**33**	29	0	4	**35**	29	0	6	**2**	0	0	2	-2	0.3	Pass	Pass
N7 off-slip WB	Kill West	**42**	35	0	7	**41**	33	0	8	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**140**	117	3	20	**142**	119	2	21	**2**	2	-1	1	-2	0.1	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**1**	1	0	0	**-1**	0	0	-1	1	0.8	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**5**	3	0	2	**-1**	0	0	-1	1	0.5	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**4**	2	0	2	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**173**	92	71	10	**133**	85	37	11	**-40**	-7	-34	1	40	3.2	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**89**	78	0	11	**81**	71	0	9	**-8**	-7	0	-2	8	0.9	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**133**	114	7	12	**117**	103	3	11	**-16**	-11	-4	-1	16	1.5	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**223**	137	75	11	**192**	136	43	13	**-31**	-1	-32	2	31	2.1	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**309**	281	2	26	**314**	288	2	25	**5**	7	0	-1	-5	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**39**	31	2	6	**36**	30	1	5	**-3**	-1	-1	-1	3	0.6	Pass	Pass
N7 Access Road	N7 Access Road	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**418**	330	72	17	**380**	337	34	10	**-38**	7	-38	-7	38	1.9	Pass	Pass
N7 Access Road	Greenhill Overbridge	**292**	192	75	25	**237**	186	35	16	**-55**	-6	-40	-9	55	3.4	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**187**	109	71	8	**205**	102	80	23	**18**	-7	9	15	-18	1.3	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**2**	2	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**581**	471	73	37	**602**	505	69	28	**21**	34	-4	-9	-21	0.9	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**428**	397	3	28	**463**	431	3	28	**35**	34	0	0	-35	1.6	Pass	Pass
Church Avenue East	Church Avenue West	**63**	55	0	8	**77**	54	0	23	**14**	-1	0	15	-14	1.7	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**463**	431	3	28	**448**	417	3	28	**-15**	-14	0	0	15	0.7	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	11	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**44**	44	0	0	**46**	46	0	0	**2**	2	0	0	-2	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**11**	11	0	0	**9**	9	0	0	**-2**	-2	0	0	2	0.7	Pass	Pass
Church Avenue East	Church Avenue west	**63**	55	0	8	**77**	54	0	23	**14**	-1	0	15	-14	1.7	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**113**	43	71	0	**118**	38	80	0	**5**	-5	9	0	-5	0.4	Pass	Pass
Church Avenue East	Church Avenue west	**74**	66	0	8	**87**	64	0	23	**13**	-2	0	15	-13	1.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**509**	477	3	28	**492**	460	3	28	**-17**	-17	0	0	17	0.7	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**116**	46	71	0	**111**	46	65	0	**-5**	0	-6	0	5	0.5	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**185**	88	75	22	**207**	103	80	23	**22**	15	5	1	-22	1.6	Pass	Pass
Church Avenue East	Garden Centre	**103**	103	0	0	**118**	118	0	0	**15**	15	0	0	-15	1.4	Pass	Pass
Church Avenue west	Church Avenue East	**581**	471	73	37	**601**	504	69	28	**20**	33	-4	-9	-20	0.8	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**25**	25	0	0	**23**	23	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**63**	55	0	8	**77**	54	0	23	**14**	-1	0	15	-14	1.7	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**428**	397	3	28	**464**	432	3	28	**36**	35	0	0	-36	1.7	Pass	Pass
Church Avenue West	School	**197**	197	0	0	**213**	213	0	0	**16**	16	0	0	-16	1.1	Pass	Pass
School	Church Avenue West	**124**	124	0	0	**128**	128	0	0	**4**	4	0	0	-4	0.3	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		Observed				Model				Difference				Difference			
From	To	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Difference	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1926**	1676	61	190	**1925**	1666	59	200	**-1**	-10	-2	10	1	0.0	Pass	Pass
R407 North	Church Avenue East	**101**	94	0	7	**104**	99	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
R407 South	R407 North	**2479**	2202	84	193	**2477**	2184	88	205	**-2**	-18	4	12	2	0.0	Pass	Pass
R407 South	Church Avenue East	**28**	28	0	0	**27**	27	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**127**	111	0	16	**131**	113	0	18	**4**	2	0	2	-4	0.3	Pass	Pass
Church Avenue East	R407 North	**20**	18	0	2	**22**	20	0	2	**2**	2	0	0	-2	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**147**	129	0	18	**150**	130	0	21	**3**	1	0	3	-3	0.2	Pass	Pass
Church Avenue East	Church Avenue South	**359**	329	1	28	**366**	330	3	33	**7**	1	2	5	-7	0.4	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**4**	4	0	0	**2**	2	0	0	-2	1.1	Pass	Pass
Church Avenue North	Church Avenue East	**26**	25	0	1	**28**	26	0	2	**2**	1	0	1	-2	0.3	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**118**	111	0	7	**121**	116	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**124**	116	0	8	**116**	110	0	7	**-8**	-6	0	-1	8	0.8	Pass	Pass
Church Avenue East	R407 North	**273**	242	1	29	**260**	230	3	27	**-13**	-12	2	-2	13	0.8	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	4	0	2	**-1**	-1	0	0	1	0.4	Pass	Pass
R407 North	R407 South	**2038**	1781	61	197	**2083**	1804	60	219	**45**	23	-1	22	-45	1.0	Pass	Pass
R407 South	Church Avenue East	**29**	29	0	0	**25**	25	0	0	**-4**	-4	0	0	4	0.8	Pass	Pass
R407 South	R407 North	**2228**	1970	85	174	**2246**	1983	85	178	**18**	13	0	4	-18	0.4	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**206**	188	3	15	**206**	187	4	15	**0**	-1	1	0	0	0.0	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**4**	4	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Palmerstown	Kill West	**275**	245	8	21	**278**	250	7	21	**3**	5	-1	0	-3	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**236**	214	1	21	**227**	206	1	20	**-9**	-8	0	-1	9	0.6	Pass	Pass
Kill West	N7 on-slip WB	**105**	90	4	11	**110**	93	4	13	**5**	3	0	2	-5	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**424**	377	13	34	**435**	389	13	34	**11**	12	0	0	-11	0.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**178**	101	73	4	**134**	98	33	3	**-44**	-3	-40	-1	44	3.5	Pass	Pass
Greenhill Overbridge	Kill West	**279**	253	3	23	**259**	237	2	20	**-20**	-16	-1	-3	20	1.2	Pass	Pass
Greenhill Overbridge	Palmerstown	**98**	95	0	3	**93**	91	0	2	**-5**	-4	0	-1	5	0.5	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**335**	229	72	34	**307**	233	41	33	**-28**	4	-31	-1	28	1.5	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**234**	202	2	30	**234**	202	1	31	**0**	0	-1	1	0	0.0	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**25**	20	0	6	**-1**	-1	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**542**	505	3	34	**531**	498	2	31	**-11**	-7	-1	-3	11	0.5	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**7**	7	0	0	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**11**	9	0	2	**0**	1	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**45**	43	1	2	**1**	2	0	0	-1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**186**	112	72	3	**148**	107	38	3	**-38**	-5	-34	0	38	3.0	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**65**	59	2	4	**57**	52	1	3	**-8**	-7	-1	-1	8	1.0	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**178**	157	3	18	**168**	149	1	18	**-10**	-8	-2	0	10	0.7	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	3	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**559**	433	75	52	**522**	428	42	51	**-37**	-5	-33	-1	37	1.6	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**213**	194	2	17	**210**	191	2	17	**-3**	-3	0	0	3	0.2	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**8**	7	1	0	**-2**	-1	0	-1	2	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**1**	1	0	0	**-2**	-1	0	-1	2	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**165**	89	71	5	**111**	77	32	2	**-54**	-12	-39	-3	54	4.6	Pass	Pass
N7 Access Road	Greenhill Overbridge	**333**	251	71	11	**272**	234	33	5	**-61**	-17	-38	-6	61	3.5	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**588**	467	74	47	**615**	482	79	54	**27**	15	5	7	-27	1.1	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**5**	0	5	0	**5**	0	5	0	-5	3.2	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**3**	3	0	0	**2**	2	0	0	-2	1.4	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**279**	199	71	9	**278**	205	65	8	**-1**	6	-6	-1	1	0.1	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**134**	126	0	8	**138**	131	0	8	**4**	5	0	0	-4	0.3	Pass	Pass
Church Avenue East	Church Avenue West	**464**	413	3	47	**475**	418	3	54	**11**	5	0	7	-11	0.5	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**152**	143	0	8	**128**	120	0	8	**-24**	-23	0	0	24	2.0	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**29**	29	0	0	**2**	2	0	0	-2	0.3	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**6**	6	0	0	**-2**	-2	0	0	2	0.8	Pass	Pass
Church Avenue East	Church Avenue west	**464**	413	3	47	**479**	422	3	54	**15**	9	0	7	-15	0.7	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**116**	46	71	0	**128**	47	80	0	**12**	1	9	0	-12	1.0	Pass	Pass
Church Avenue East	Church Avenue west	**472**	421	3	47	**490**	433	3	54	**18**	12	0	7	-18	0.8	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**209**	200	0	8	**155**	148	0	8	**-54**	-52	0	0	54	4.0	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**128**	57	71	0	**123**	58	65	0	**-5**	1	-6	0	5	0.4	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**590**	459	76	56	**616**	483	80	54	**26**	24	4	-2	-26	1.1	Pass	Pass
Church Avenue East	Garden Centre	**55**	55	0	0	**58**	58	0	0	**3**	3	0	0	-3	0.5	Pass	Pass
Church Avenue west	Church Avenue East	**280**	200	71	9	**280**	208	65	8	**0**	8	-6	-1	0	0.0	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**110**	110	0	0	**109**	109	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**464**	413	3	47	**475**	418	3	54	**11**	5	0	7	-11	0.5	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**139**	131	0	8	**5**	5	0	0	-5	0.4	Pass	Pass
Church Avenue West	School	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**41**	41	0	0	**1**	1	0	0	-1	0.1	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2065**	1780	113	172	**2060**	1768	109	183	**-5**	-12	-4	11	5	0.1	Pass	Pass
R407 North	Church Avenue East	**400**	383	2	15	**410**	398	1	11	**10**	15	-1	-4	-10	0.5	Pass	Pass
R407 South	R407 North	**1688**	1375	112	200	**1716**	1398	108	210	**28**	23	-4	10	-28	0.7	Pass	Pass
R407 South	Church Avenue East	**94**	89	0	5	**95**	90	0	5	**1**	1	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 South	**45**	44	0	1	**46**	46	0	1	**1**	2	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 North	**8**	8	0	0	**7**	7	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**44**	44	0	0	**44**	44	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue East	Church Avenue South	**140**	133	2	5	**145**	123	0	23	**5**	-10	-2	18	-5	0.4	Pass	Pass
Church Avenue North	Church Avenue West	**8**	7	0	1	**10**	9	0	1	**2**	2	0	0	-2	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**161**	150	1	10	**193**	178	2	13	**32**	28	1	3	-32	2.4	Pass	Pass
Church Avenue West	Church Avenue South	**27**	26	0	1	**27**	26	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**465**	445	2	18	**485**	468	2	15	**20**	23	0	-3	-20	0.9	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**83**	80	1	2	**81**	74	0	7	**-2**	-6	-1	5	2	0.2	Pass	Pass
Church Avenue East	R407 North	**91**	84	1	6	**93**	76	0	16	**2**	-8	-1	10	-2	0.2	Pass	Pass
R407 North	Church Avenue East	**14**	13	0	1	**17**	15	0	2	**3**	2	0	1	-3	0.7	Pass	Pass
R407 North	R407 South	**2102**	1815	113	174	**2130**	1833	112	185	**28**	18	-1	11	-28	0.6	Pass	Pass
R407 South	Church Avenue East	**188**	174	1	13	**186**	172	2	12	**-2**	-2	1	-1	2	0.1	Pass	Pass
R407 South	R407 North	**1699**	1397	108	194	**1719**	1412	108	199	**20**	15	0	5	-20	0.5	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**324**	302	1	21	**326**	305	1	20	**2**	3	0	-1	-2	0.1	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**377**	342	14	21	**379**	345	13	21	**2**	3	-1	0	-2	0.1	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**94**	82	1	11	**96**	83	1	12	**2**	1	0	1	-2	0.2	Pass	Pass
Kill West	N7 on-slip WB	**206**	190	1	15	**213**	197	1	15	**7**	7	0	0	-7	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**169**	147	13	9	**165**	144	12	9	**-4**	-3	-1	0	4	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**36**	28	4	4	**30**	25	3	3	**-6**	-3	-1	-1	6	1.1	Pass	Pass
Greenhill Overbridge	Kill West	**238**	200	7	31	**231**	200	6	24	**-7**	0	-1	-7	7	0.5	Pass	Pass
Greenhill Overbridge	Palmerstown	**45**	40	0	5	**47**	44	0	3	**2**	4	0	-2	-2	0.2	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**42**	27	6	9	**42**	25	7	10	**0**	-2	1	1	0	0.1	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**33**	29	0	4	**36**	31	0	6	**3**	2	0	2	-3	0.5	Pass	Pass
N7 off-slip WB	Kill West	**42**	35	0	7	**41**	33	0	8	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**140**	117	3	20	**143**	119	3	21	**3**	2	0	1	-3	0.2	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**1**	1	0	0	**-1**	0	0	-1	1	0.8	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**5**	3	0	2	**-1**	0	0	-1	1	0.5	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**4**	2	0	2	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**63**	53	0	10	**59**	48	0	11	**-4**	-5	0	1	4	0.5	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**89**	78	0	11	**82**	73	0	9	**-7**	-5	0	-2	7	0.7	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**133**	114	7	12	**123**	106	6	11	**-10**	-8	-1	-1	10	0.9	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**112**	97	4	11	**116**	99	4	13	**4**	2	0	2	-4	0.4	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**309**	281	2	26	**310**	283	2	25	**1**	2	0	-1	-1	0.0	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**39**	31	2	6	**39**	32	2	5	**0**	1	0	-1	0	0.1	Pass	Pass
N7 Access Road	N7 Access Road	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**308**	290	1	17	**330**	320	1	9	**22**	30	0	-8	-22	1.2	Pass	Pass
N7 Access Road	Greenhill Overbridge	**182**	153	4	25	**181**	162	3	16	**-1**	9	-1	-9	1	0.1	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**77**	69	0	8	**71**	47	0	23	**-6**	-22	0	15	6	0.7	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**6**	2	4	0	**4**	0	4	0	-4	2.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**471**	432	2	37	**497**	466	3	28	**26**	34	1	-9	-26	1.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**424**	393	3	28	**463**	431	3	28	**39**	38	0	0	-39	1.9	Pass	Pass
Church Avenue East	Church Avenue West	**62**	54	0	8	**61**	38	0	23	**-1**	-16	0	15	1	0.1	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**463**	432	3	28	**448**	416	3	28	**-15**	-16	0	0	15	0.7	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	11	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**44**	44	0	0	**46**	46	0	0	**2**	2	0	0	-2	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**11**	11	0	0	**7**	7	0	0	**-4**	-4	0	0	4	1.4	Pass	Pass
Church Avenue East	Church Avenue west	**63**	55	0	8	**62**	39	0	23	**-1**	-16	0	15	1	0.1	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**3**	3	0	0	**1**	1	0	0	**-2**	-2	0	0	2	1.4	Pass	Pass
Church Avenue East	Church Avenue west	**74**	66	0	8	**69**	46	0	23	**-5**	-20	0	15	5	0.6	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**469**	438	3	28	**492**	461	3	28	**23**	23	0	0	-23	1.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**6**	6	0	0	**6**	6	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**75**	49	4	22	**77**	49	4	23	**2**	0	0	1	-2	0.3	Pass	Pass
Church Avenue East	Garden Centre	**103**	103	0	0	**99**	99	0	0	**-4**	-4	0	0	4	0.4	Pass	Pass
Church Avenue west	Church Avenue East	**471**	432	2	37	**496**	465	3	28	**25**	33	1	-9	-25	1.1	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**25**	25	0	0	**23**	23	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**63**	55	0	8	**60**	38	0	23	**-3**	-17	0	15	3	0.3	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**428**	397	3	28	**463**	432	3	28	**35**	35	0	0	-35	1.6	Pass	Pass
Church Avenue West	School	**197**	197	0	0	**213**	213	0	0	**16**	16	0	0	-16	1.1	Pass	Pass
School	Church Avenue West	**124**	124	0	0	**128**	128	0	0	**4**	4	0	0	-4	0.3	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1927**	1677	61	190	**1925**	1666	59	200	**-2**	-11	-2	10	2	0.0	Pass	Pass
R407 North	Church Avenue East	**101**	94	0	7	**104**	99	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
R407 South	R407 North	**2480**	2203	84	193	**2471**	2172	94	205	**-9**	-31	10	12	9	0.2	Pass	Pass
R407 South	Church Avenue East	**28**	28	0	0	**27**	27	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**127**	111	0	16	**123**	105	0	18	**-4**	-6	0	2	4	0.4	Pass	Pass
Church Avenue East	R407 North	**20**	18	0	2	**21**	19	0	2	**1**	1	0	0	-1	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**148**	129	0	18	**141**	120	0	20	**-7**	-9	0	2	7	0.5	Pass	Pass
Church Avenue East	Church Avenue South	**359**	329	1	28	**349**	307	9	33	**-10**	-22	8	5	10	0.5	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**4**	4	0	0	**2**	2	0	0	-2	1.1	Pass	Pass
Church Avenue North	Church Avenue East	**26**	25	0	1	**28**	26	0	2	**2**	1	0	1	-2	0.3	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**118**	111	0	7	**121**	116	0	5	**3**	5	0	-2	-3	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**124**	116	0	8	**109**	102	0	7	**-15**	-14	0	-1	15	1.4	Pass	Pass
Church Avenue East	R407 North	**273**	243	1	29	**251**	216	9	27	**-22**	-27	8	-2	22	1.4	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	4	0	2	**-1**	-1	0	0	1	0.4	Pass	Pass
R407 North	R407 South	**2039**	1782	61	197	**2075**	1796	60	219	**36**	14	-1	22	-36	0.8	Pass	Pass
R407 South	Church Avenue East	**29**	29	0	0	**25**	25	0	0	**-4**	-4	0	0	4	0.8	Pass	Pass
R407 South	R407 North	**2229**	1971	85	174	**2249**	1985	85	179	**20**	14	0	5	-20	0.4	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**206**	188	3	15	**205**	186	4	15	**-1**	-2	1	0	1	0.1	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**4**	4	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Palmerstown	Kill West	**275**	246	8	21	**279**	251	7	21	**4**	5	-1	0	-4	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**236**	214	1	21	**228**	207	1	20	**-8**	-7	0	-1	8	0.6	Pass	Pass
Kill West	N7 on-slip WB	**105**	90	4	11	**110**	93	4	13	**5**	3	0	2	-5	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**424**	377	13	34	**436**	389	13	34	**12**	12	0	0	-12	0.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**68**	62	2	4	**65**	61	1	3	**-3**	-1	-1	-1	3	0.3	Pass	Pass
Greenhill Overbridge	Kill West	**279**	253	3	23	**270**	247	3	20	**-9**	-6	0	-3	9	0.5	Pass	Pass
Greenhill Overbridge	Palmerstown	**98**	95	0	3	**102**	100	0	2	**4**	5	0	-1	-4	0.4	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**224**	189	1	34	**228**	193	2	33	**4**	4	1	-1	-4	0.2	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**234**	202	2	30	**237**	204	2	31	**3**	2	0	1	-3	0.2	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**28**	22	0	6	**2**	1	0	1	-2	0.3	Pass	Pass
N7 off-slip WB	Palmerstown	**543**	505	3	34	**530**	496	3	31	**-13**	-9	0	-3	13	0.5	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**7**	7	0	0	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**11**	9	0	2	**0**	1	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**45**	43	1	2	**1**	2	0	0	-1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**76**	72	1	3	**72**	68	1	3	**-4**	-4	0	0	4	0.4	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**65**	59	2	4	**61**	55	3	3	**-4**	-4	1	-1	4	0.5	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**178**	157	3	18	**163**	141	3	18	**-15**	-16	0	0	15	1.1	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	3	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**449**	393	4	52	**442**	388	3	51	**-7**	-5	-1	-1	7	0.3	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**213**	194	2	17	**210**	191	2	17	**-3**	-3	0	0	3	0.2	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**8**	6	1	0	**-2**	-2	0	-1	2	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**2**	1	0	0	**-1**	-1	0	-1	1	0.7	Pass	Pass
N7 Access Road	N7 on-slip EB	**55**	50	0	5	**50**	47	0	2	**-5**	-3	0	-3	5	0.6	Pass	Pass
N7 Access Road	Greenhill Overbridge	**222**	211	0	11	**230**	225	0	5	**8**	14	0	-6	-8	0.5	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**478**	427	3	47	**467**	409	4	54	**-11**	-18	1	7	11	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**5**	0	5	0	**5**	0	5	0	-5	3.2	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**3**	3	0	0	**2**	2	0	0	-2	1.4	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**169**	160	0	9	**172**	164	0	8	**3**	4	0	-1	-3	0.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**134**	126	0	8	**138**	131	0	8	**4**	5	0	0	-4	0.3	Pass	Pass
Church Avenue East	Church Avenue West	**464**	413	3	47	**453**	390	9	54	**-11**	-23	6	7	11	0.5	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**152**	143	0	8	**128**	120	0	8	**-24**	-23	0	0	24	2.0	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**29**	29	0	0	**2**	2	0	0	-2	0.3	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**6**	6	0	0	**-2**	-2	0	0	2	0.8	Pass	Pass
Church Avenue East	Church Avenue west	**464**	413	3	47	**456**	393	9	54	**-8**	-20	6	7	8	0.4	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**6**	6	0	0	**4**	4	0	0	**-2**	-2	0	0	2	0.9	Pass	Pass
Church Avenue East	Church Avenue west	**472**	421	3	47	**467**	404	9	54	**-5**	-17	6	7	5	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**169**	161	0	8	**155**	147	0	8	**-14**	-14	0	0	14	1.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**17**	17	0	0	**18**	18	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**480**	419	5	56	**468**	410	4	54	**-12**	-9	-1	-2	12	0.6	Pass	Pass
Church Avenue East	Garden Centre	**55**	55	0	0	**51**	51	0	0	**-4**	-4	0	0	4	0.5	Pass	Pass
Church Avenue west	Church Avenue East	**170**	161	0	9	**175**	167	0	8	**5**	6	0	-1	-5	0.4	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**110**	110	0	0	**109**	109	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**464**	413	3	47	**451**	388	9	54	**-13**	-25	6	7	13	0.6	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**139**	131	0	8	**5**	5	0	0	-5	0.4	Pass	Pass
Church Avenue West	School	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**41**	41	0	0	**1**	1	0	0	-1	0.1	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

OS 2022 AM Peak

Location		Observed				Modeled				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2065**	1780	113	172	**2061**	1769	109	183	**-4**	-11	-4	11	4	0.1	Pass	Pass
R407 North	Church Avenue East	**407**	389	2	15	**417**	403	2	11	**10**	14	0	-4	-10	0.5	Pass	Pass
R407 South	R407 North	**1689**	1377	112	200	**1721**	1403	108	210	**32**	26	-4	10	-32	0.8	Pass	Pass
R407 South	Church Avenue East	**95**	90	0	5	**96**	91	0	5	**1**	1	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 South	**47**	46	0	1	**47**	47	0	1	**0**	1	0	0	0	0.1	Pass	Pass
Church Avenue East	R407 North	**8**	8	0	0	**7**	7	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**46**	46	0	0	**45**	45	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Church Avenue East	Church Avenue South	**145**	138	2	5	**151**	129	0	22	**6**	-9	-2	17	-6	0.5	Pass	Pass
Church Avenue North	Church Avenue West	**8**	7	0	1	**10**	9	0	1	**2**	2	0	0	-2	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**163**	152	1	10	**194**	180	2	13	**31**	28	1	3	-31	2.3	Pass	Pass
Church Avenue West	Church Avenue South	**27**	26	0	1	**27**	26	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**473**	453	2	18	**494**	477	2	15	**21**	24	0	-3	-21	1.0	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**85**	82	1	2	**84**	77	0	7	**-1**	-5	-1	5	1	0.1	Pass	Pass
Church Avenue East	R407 North	**93**	86	1	6	**96**	80	0	16	**3**	-6	-1	10	-3	0.3	Pass	Pass
R407 North	Church Avenue East	**14**	13	0	1	**17**	15	0	2	**3**	2	0	1	-3	0.7	Pass	Pass
R407 North	R407 South	**2102**	1815	113	174	**2133**	1835	112	185	**31**	20	-1	11	-31	0.7	Pass	Pass
R407 South	Church Avenue East	**191**	176	1	13	**187**	174	2	12	**-4**	-2	1	-1	4	0.3	Pass	Pass
R407 South	R407 North	**1700**	1398	108	194	**1722**	1415	108	199	**22**	17	0	5	-22	0.5	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**329**	307	1	21	**333**	312	1	20	**4**	5	0	-1	-4	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**377**	342	14	21	**378**	344	13	21	**1**	2	-1	0	-1	0.1	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**95**	83	1	11	**97**	84	1	12	**2**	1	0	1	-2	0.2	Pass	Pass
Kill West	N7 on-slip WB	**206**	190	1	15	**214**	197	1	15	**8**	7	0	0	-8	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**169**	147	13	9	**165**	144	12	9	**-4**	-3	-1	0	4	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**37**	29	4	4	**30**	25	3	3	**-7**	-4	-1	-1	7	1.1	Pass	Pass
Greenhill Overbridge	Kill West	**240**	202	7	31	**229**	198	6	24	**-11**	-4	-1	-7	11	0.7	Pass	Pass
Greenhill Overbridge	Palmerstown	**46**	41	0	5	**48**	45	0	3	**2**	4	0	-2	-2	0.3	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**43**	28	6	9	**42**	25	7	10	**-1**	-3	1	1	1	0.2	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**33**	29	0	4	**36**	31	0	6	**3**	2	0	2	-3	0.5	Pass	Pass
N7 off-slip WB	Kill West	**42**	35	0	7	**41**	33	0	8	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**140**	117	3	20	**143**	119	3	21	**3**	2	0	1	-3	0.2	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**1**	1	0	0	**-1**	0	0	-1	1	0.9	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**5**	3	0	2	**-1**	0	0	-1	1	0.5	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**4**	2	0	2	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**66**	56	0	10	**61**	50	0	11	**-5**	-6	0	1	5	0.7	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**89**	78	0	11	**82**	73	0	9	**-7**	-5	0	-2	7	0.7	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**133**	114	7	12	**123**	105	6	11	**-10**	-9	-1	-1	10	0.9	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**119**	104	4	11	**123**	106	4	13	**4**	2	0	2	-4	0.4	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**309**	281	2	26	**311**	284	2	25	**2**	3	0	-1	-2	0.1	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**39**	31	2	6	**39**	32	2	5	**0**	1	0	-1	0	0.1	Pass	Pass
N7 Access Road	N7 Access Road	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**312**	293	1	17	**327**	316	1	10	**15**	23	0	-7	-15	0.9	Pass	Pass
N7 Access Road	Greenhill Overbridge	**184**	155	4	25	**180**	161	3	16	**-4**	6	-1	-9	4	0.3	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**87**	79	0	8	**81**	58	0	23	**-6**	-21	0	15	6	0.7	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**5**	1	4	0	**3**	-1	4	0	-3	1.6	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**476**	437	2	37	**491**	459	3	28	**15**	22	1	-9	-15	0.7	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**405**	397	0	8	**460**	428	3	28	**55**	31	3	20	-55	2.6	Pass	Pass
Church Avenue East	Church Avenue West	**56**	55	0	1	**68**	46	0	23	**12**	-9	0	22	-12	1.6	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**463**	432	3	28	**447**	416	3	28	**-16**	-16	0	0	16	0.7	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	11	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**44**	44	0	0	**46**	46	0	0	**2**	2	0	0	-2	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**11**	11	0	0	**9**	9	0	0	**-2**	-2	0	0	2	0.7	Pass	Pass
Church Avenue East	Church Avenue west	**63**	55	0	8	**69**	46	0	23	**6**	-9	0	15	-6	0.8	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**14**	14	0	0	**9**	9	0	0	**-5**	-5	0	0	5	1.4	Pass	Pass
Church Avenue East	Church Avenue west	**74**	66	0	8	**72**	49	0	23	**-2**	-17	0	15	2	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**11**	11	0	0	**11**	11	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**469**	438	3	28	**480**	448	3	28	**11**	10	0	0	-11	0.5	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**5**	5	0	0	**6**	6	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Landfill	Church Avenue East	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**85**	59	4	22	**86**	59	4	23	**1**	0	0	1	-1	0.1	Pass	Pass
Church Avenue East	Garden Centre	**103**	103	0	0	**98**	98	0	0	**-5**	-5	0	0	5	0.5	Pass	Pass
Church Avenue west	Church Avenue East	**471**	432	2	37	**490**	459	3	28	**19**	27	1	-9	-19	0.9	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**25**	25	0	0	**23**	23	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**68**	60	0	8	**68**	46	0	23	**0**	-14	0	15	0	0.0	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**428**	397	3	28	**462**	430	3	28	**34**	33	0	0	-34	1.6	Pass	Pass
Church Avenue West	School	**208**	208	0	0	**225**	225	0	0	**17**	17	0	0	-17	1.2	Pass	Pass
School	Church Avenue West	**124**	124	0	0	**128**	128	0	0	**4**	4	0	0	-4	0.3	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

DS 2022 PM Peak

Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1928**	1677	61	190	**1925**	1666	59	201	**-3**	-11	-2	11	3	0.1	Pass	Pass
R407 North	Church Avenue East	**108**	101	0	7	**110**	104	0	5	**2**	3	0	-2	-2	0.2	Pass	Pass
R407 South	R407 North	**2492**	2215	84	193	**2475**	2176	94	205	**-17**	-39	10	12	17	0.3	Pass	Pass
R407 South	Church Avenue East	**30**	30	0	0	**29**	29	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**133**	117	0	16	**126**	108	0	18	**-7**	-9	0	2	7	0.7	Pass	Pass
Church Avenue East	R407 North	**21**	19	0	2	**22**	19	0	2	**1**	0	0	0	-1	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**155**	136	0	18	**145**	125	0	20	**-10**	-11	0	2	10	0.8	Pass	Pass
Church Avenue East	Church Avenue South	**376**	347	1	28	**358**	316	9	33	**-18**	-31	8	5	18	0.9	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**3**	3	0	0	**1**	1	0	0	-1	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**28**	27	0	1	**31**	29	0	2	**3**	2	0	1	-3	0.5	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**13**	13	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Church Avenue West	Church Avenue East	**127**	120	0	7	**130**	124	0	5	**3**	4	0	-2	-3	0.2	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**130**	122	0	8	**112**	106	0	7	**-18**	-16	0	-1	18	1.6	Pass	Pass
Church Avenue East	R407 North	**285**	254	1	29	**257**	221	9	27	**-28**	-33	8	-2	28	1.7	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	4	0	2	**-1**	-1	0	0	1	0.6	Pass	Pass
R407 North	R407 South	**2039**	1782	61	197	**2079**	1800	60	219	**40**	18	-1	22	-40	0.9	Pass	Pass
R407 South	Church Avenue East	**31**	31	0	0	**28**	28	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
R407 South	R407 North	**2231**	1973	85	174	**2249**	1985	85	178	**18**	12	0	4	-18	0.4	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**206**	188	3	15	**205**	186	4	15	**-1**	-2	1	0	1	0.1	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**4**	4	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Palmerstown	Kill West	**275**	246	8	21	**279**	251	7	21	**4**	5	-1	0	-4	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**236**	214	1	21	**228**	207	1	20	**-8**	-7	0	-1	8	0.6	Pass	Pass
Kill West	N7 on-slip WB	**105**	90	4	11	**110**	93	4	13	**5**	3	0	2	-5	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**424**	377	13	34	**436**	389	13	34	**12**	12	0	0	-12	0.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**71**	65	2	4	**68**	64	1	3	**-3**	-1	-1	-1	3	0.3	Pass	Pass
Greenhill Overbridge	Kill West	**291**	265	3	23	**279**	256	3	20	**-12**	-9	0	-3	12	0.7	Pass	Pass
Greenhill Overbridge	Palmerstown	**102**	99	0	3	**105**	103	0	2	**3**	4	0	-1	-3	0.3	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**224**	189	1	34	**228**	194	2	33	**4**	5	1	-1	-4	0.2	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**234**	202	2	30	**237**	204	2	31	**3**	2	0	1	-3	0.2	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**28**	22	0	6	**2**	1	0	1	-2	0.3	Pass	Pass
N7 off-slip WB	Palmerstown	**543**	505	3	34	**530**	496	3	31	**-13**	-9	0	-3	13	0.5	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**7**	7	0	0	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**11**	9	0	2	**0**	1	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**45**	43	1	2	**1**	2	0	0	-1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**76**	72	1	3	**72**	68	1	3	**-4**	-4	0	0	4	0.4	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**65**	59	2	4	**61**	55	3	3	**-4**	-4	1	-1	4	0.5	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**178**	157	3	18	**163**	141	3	18	**-15**	-16	0	0	15	1.1	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	3	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**449**	393	4	52	**442**	388	3	51	**-7**	-5	-1	-1	7	0.3	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**213**	194	2	17	**210**	191	2	17	**-3**	-3	0	0	3	0.2	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**8**	6	1	0	**-2**	-2	0	-1	2	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**2**	2	0	0	**-1**	0	0	-1	1	0.7	Pass	Pass
N7 Access Road	N7 on-slip EB	**59**	54	0	5	**52**	50	0	2	**-7**	-4	0	-3	7	1.0	Pass	Pass
N7 Access Road	Greenhill Overbridge	**242**	231	0	11	**245**	240	0	5	**3**	9	0	-6	-3	0.2	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**478**	427	3	47	**468**	409	4	54	**-10**	-18	1	7	10	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**5**	0	5	0	**5**	0	5	0	-5	3.2	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**3**	3	0	0	**2**	2	0	0	-2	1.4	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**193**	184	0	9	**191**	183	0	8	**-2**	-1	0	-1	2	0.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**134**	126	0	8	**140**	133	0	8	**6**	7	0	0	-6	0.5	Pass	Pass
Church Avenue East	Church Avenue West	**464**	413	3	47	**466**	403	9	54	**2**	-10	6	7	-2	0.1	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**152**	143	0	8	**130**	122	0	8	**-22**	-21	0	0	22	1.8	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**10**	10	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**29**	29	0	0	**2**	2	0	0	-2	0.3	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**6**	6	0	0	**-2**	-2	0	0	2	0.8	Pass	Pass
Church Avenue East	Church Avenue west	**464**	413	3	47	**469**	407	9	54	**5**	-6	6	7	-5	0.2	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**17**	17	0	0	**16**	16	0	0	**-1**	-1	0	0	1	0.3	Pass	Pass
Church Avenue East	Church Avenue west	**472**	421	3	47	**455**	393	9	54	**-17**	-28	6	7	17	0.8	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**11**	11	0	0	**9**	9	0	0	**-2**	-2	0	0	2	0.6	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**169**	161	0	8	**149**	141	0	8	**-20**	-20	0	0	20	1.6	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**24**	24	0	0	**26**	26	0	0	**2**	2	0	0	-2	0.3	Pass	Pass
Landfill	Church Avenue East	**42**	42	0	0	**43**	43	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**480**	419	5	56	**469**	410	4	54	**-11**	-9	-1	-2	11	0.5	Pass	Pass
Church Avenue East	Garden Centre	**55**	55	0	0	**51**	51	0	0	**-4**	-4	0	0	4	0.5	Pass	Pass
Church Avenue west	Church Avenue East	**170**	161	0	9	**193**	186	0	8	**23**	25	0	-1	-23	1.7	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**110**	110	0	0	**109**	109	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**488**	438	3	47	**464**	401	9	54	**-24**	-37	6	7	24	1.1	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**141**	133	0	8	**7**	7	0	0	-7	0.6	Pass	Pass
Church Avenue West	School	**21**	21	0	0	**19**	19	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**41**	41	0	0	**1**	1	0	0	-1	0.1	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

AM Peak

Site/ Junction Name	Link	2027 Do Minimum		2027 Operational Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	10.8	1.2	13.1	1.3	2.3	0.1
	Church Avenue west	7.9	3.3	13.0	3.3	5.1	-0.1
	Landfill	0.0	0.0	2.4	0.8	2.4	0.8
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	3.16	1.08	1.39	0.96	-1.8	-0.1
	Johnstown Garden	0.0	0.0	0.0	0.0	0.0	0.0
	Church Avenue West	13.9	3.8	0.0	3.2	-13.9	-0.5
Site 9 N7 North Roundabout	The Paddocks	5.7	5.4	7.2	5.5	1.5	0.0
	N7 off-slip EB	14.4	5.8	13.7	6.0	-0.7	0.2
	Greenhill Overbridge	4.0	1.4	1.0	1.5	-3.0	0.1
	Church Avenue	19.3	5.7	28.1	5.6	8.7	-0.1
Site 10 N7 South Roundabout	Palmerstown	14.4	2.1	15.3	2.2	0.9	0.0
	Kill West	8.4	1.1	7.9	1.4	-0.5	0.3
	Greenhill Overbridge	12.1	1.8	12.8	1.8	0.7	0.0
	N7 off-slip WB	18.1	3.2	16.2	3.0	-2.0	-0.2
Site 4 Church Ave / Sallins National School	Church Avenue East	0.0	3.0	1.2	3.1	1.2	0.1
	Church Avenue West	0.0	2.0	0.0	2.0	0.0	0.0
	School	24.7	0.7	24.7	0.8	0.0	0.0
Site 1 R407 / Church Ave, Sallins	R407 North	62.0	2.1	37.0	2.0	-24.9	-0.1
	R407 South	60.1	5.8	66.1	6.0	5.9	0.2
	Church Avenue East	14.6	9.6	42.7	15.2	28.1	5.6
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	0.5	0.0	0.5	0.0	0.0
	Church Avenue North	9.8	1.4	13.3	1.7	3.5	0.3
	Church Avenue West	2.5	0.6	14.1	0.8	11.6	0.2
Site 3 R407 / Church Ave (E)	Church Avenue East	38.5	17.1	32.5	18.8	-6.0	1.7
	R407 North	72.6	2.0	69.4	2.0	-3.2	0.0
	R407 South	167.3	10.4	166.9	11.1	-0.4	0.7
Site 5 Church Ave Railway Bridge	Church Avenue East	0.00	1.09	0.00	1.11	0.0	0.0
	Church Avenue West	0.00	1.07	0.00	1.07	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	0.00	2.19	0.00	2.12	0.0	-0.1
	Church Avenue west	6.2	0.9	6.2	0.8	0.0	0.0
	Golf Club	2.6	1.6	1.1	1.6	-1.5	0.0
Garden Centre	Church Avenue East	16.6	1.5	18.6	1.5	2.0	0.0
	Church Avenue west	0.0	2.3	0.0	2.3	0.0	0.0
	Garden Centre	5.1	1.0	6.3	0.9	1.3	-0.1

Site/ Junction Name	Link	2037 Do Minimum		2037 Operational Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	12.15	1.48	11.10	2.03	-1.0	0.6
	Church Avenue west	10.0	3.6	8.3	3.6	-1.7	0.1
	Landfill	0.0	0.0	5.0	0.9	5.0	0.9
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	8.47	1.47	4.28	1.00	-4.2	-0.5
	Johnstown Garden	0.0	0.0	0.0	0.0	0.0	0.0
	Church Avenue West	19.3	4.4	4.7	3.6	-14.7	-0.7
Site 9 N7 North Roundabout	The Paddocks	6.8	5.0	3.3	5.0	-3.5	-0.1
	N7 off-slip EB	17.5	6.3	20.2	6.3	2.7	0.0
	Greenhill Overbridge	1.3	1.5	0.9	1.5	-0.4	0.0
	Church Avenue	28.1	6.3	22.2	7.6	-5.9	1.3
Site 10 N7 South Roundabout	Palmerstown	17.6	4.1	18.1	2.2	0.6	-1.9
	Kill West	9.6	1.3	10.4	1.2	0.8	0.0
	Greenhill Overbridge	20.3	2.0	11.9	1.9	-8.4	-0.1
	N7 off-slip WB	17.1	2.7	16.3	2.7	-0.8	0.0
Site 4 Church Ave / Sallins National School	Church Avenue East	0.0	3.7	0.0	3.4	0.0	-0.3
	Church Avenue West	6.5	2.1	5.2	2.1	-1.3	0.0
	School	24.7	1.0	24.7	0.9	0.0	-0.1
Site 1 R407 / Church Ave, Sallins	R407 North	67.8	2.4	78.0	2.4	10.2	0.0
	R407 South	64.5	7.1	67.8	7.0	3.3	-0.1
	Church Avenue East	13.1	16.2	9.5	18.2	-3.6	2.0
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	0.6	0.0	0.5	0.0	-0.1
	Church Avenue North	8.2	1.6	11.6	1.5	3.4	0.0
	Church Avenue West	5.0	0.6	3.8	0.6	-1.3	0.0
Site 3 R407 / Church Ave (E)	Church Avenue East	56.1	26.0	52.2	25.0	-3.9	-0.9
	R407 North	74.4	1.9	71.8	1.9	-2.6	0.0
	R407 South	195.0	13.8	194.6	12.9	-0.4	-0.9
Site 5 Church Ave Railway Bridge	Church Avenue East	0.00	1.84	0.00	1.39	0.0	-0.4
	Church Avenue West	0.00	1.17	0.00	1.20	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	0.0	2.3	0.0	2.4	0.0	0.1
	Church Avenue west	5.7	0.8	5.2	0.9	-0.5	0.2
	Golf Club	0.0	2.0	0.0	1.5	0.0	-0.5
Garden Centre	Church Avenue East	11.2	1.8	14.8	1.6	3.5	-0.2
	Church Avenue west	0.0	2.4	0.0	2.5	0.0	0.0
	Garden Centre	6.4	1.3	4.0	0.9	-2.5	-0.4

PM Peak

Site/ Junction Name	Link	2027 Do Minimum		2027 Operational Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	15.9	4.2	17.2	4.4	1.3	0.2
	Church Avenue west	9.1	1.8	13.9	1.7	4.8	0.0
	Landfill	2.3	0.5	1.3	0.4	-1.0	-0.1
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	9.06	3.91	8.24	6.34	-0.8	2.4
	Johnstown Garden	7.5	1.4	0.0	0.6	-7.5	-0.8
	Church Avenue West	0.0	1.4	3.3	1.3	3.3	-0.1
Site 9 N7 North Roundabout	The Paddocks	6.7	3.8	6.5	4.0	-0.2	0.2
	N7 off-slip EB	23.3	6.3	21.7	6.1	-1.6	-0.2
	Greenhill Overbridge	7.7	1.1	6.2	1.0	-1.5	-0.1
	Church Avenue	9.7	2.6	12.3	3.2	2.7	0.7
Site 10 N7 South Roundabout	Palmerstown	18.6	3.0	20.7	2.9	2.1	-0.1
	Kill West	23.9	2.8	30.8	2.9	6.9	0.1
	Greenhill Overbridge	10.6	1.7	9.0	1.8	-1.6	0.1
	N7 off-slip WB	42.3	4.7	35.8	4.5	-6.5	-0.1
Site 4 Church Ave / Sallins National School	Church Avenue East	10.2	6.9	7.7	7.0	-2.4	0.1
	Church Avenue West	2.2	1.5	3.5	2.0	1.3	0.4
	School	24.4	1.6	24.5	1.9	0.0	0.3
Site 1 R407 / Church Ave, Sallins	R407 North	23.4	1.7	23.2	1.7	-0.2	0.0
	R407 South	30.4	2.7	43.0	2.9	12.6	0.1
	Church Avenue East	31.6	15.9	32.0	14.4	0.4	-1.5
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	0.0	1.4	0.0	1.5	0.0	0.0
	Church Avenue North	4.6	1.0	5.2	1.3	0.6	0.2
	Church Avenue West	4.9	1.2	4.0	0.9	-0.9	-0.3
Site 3 R407 / Church Ave (E)	Church Avenue East	89.4	38.6	97.2	38.8	7.8	0.2
	R407 North	69.5	1.9	69.0	2.1	-0.5	0.1
	R407 South	144.1	6.8	139.6	6.9	-4.5	0.1
Site 5 Church Ave Railway Bridge	Church Avenue East	0.00	5.16	0.00	5.19	0.0	0.0
	Church Avenue West	0.00	0.51	0.00	0.53	0.0	0.0
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	0.00	1.05	0.00	1.05	0.0	0.0
	Church Avenue west	1.2	0.5	0.0	0.4	-1.2	-0.1
	Golf Club	0.0	6.8	2.8	6.9	2.8	0.1
Garden Centre	Church Avenue East	4.0	3.7	8.0	3.6	4.0	0.0
	Church Avenue west	0.0	1.3	0.0	1.2	0.0	-0.1
	Garden Centre	4.9	0.5	6.1	0.6	1.2	0.1

Site/ Junction Name	Link	2037 Do Minimum		2037 Operational Scenario		Difference	
		Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)	Queue Length (m)	Delay (s)
Site 7 Kerdiffstown Road / Landfill Site	Church Avenue East	17.38	4.33	20.63	4.66	3.3	0.3
	Church Avenue west	11.5	1.8	18.1	2.0	6.6	0.2
	Landfill	0.0	0.3	5.0	0.5	5.0	0.2
Site 8 N7 Access Road / Johnstown Garden Centre	Church Avenue East	14.79	9.42	7.82	4.16	-7.0	-5.3
	Johnstown Garden	6.1	1.2	4.9	1.8	-1.2	0.6
	Church Avenue West	2.3	1.4	2.3	1.5	0.0	0.0
Site 9 N7 North Roundabout	The Paddocks	8.9	4.4	6.8	4.1	-2.1	-0.3
	N7 off-slip EB	24.2	6.9	22.5	6.7	-1.7	-0.2
	Greenhill Overbridge	2.8	1.2	9.2	1.1	6.4	0.0
	Church Avenue	17.0	3.2	11.3	6.1	-5.7	2.9
Site 10 N7 South Roundabout	Palmerstown	19.7	3.0	27.9	3.2	8.1	0.2
	Kill West	32.2	3.4	29.7	3.3	-2.5	-0.1
	Greenhill Overbridge	9.4	1.9	10.8	1.9	1.4	0.0
	N7 off-slip WB	54.7	5.3	44.0	4.9	-10.7	-0.3
Site 4 Church Ave / Sallins National School	Church Avenue East	8.9	7.4	8.4	7.3	-0.5	-0.1
	Church Avenue West	0.0	1.1	4.3	3.1	4.3	2.0
	School	24.7	2.7	24.7	2.7	0.0	0.0
Site 1 R407 / Church Ave, Sallins	R407 North	58.9	2.1	45.0	2.0	-13.9	-0.1
	R407 South	58.4	5.5	64.7	3.7	6.3	-1.8
	Church Avenue East	42.2	20.5	37.9	25.3	-4.3	4.8
Site 2 Church Ave (W) / Church Ave (S), Sallins	Church Avenue East	31.8	3.0	20.3	1.9	-11.4	-1.0
	Church Avenue North	6.3	1.3	6.5	1.4	0.2	0.1
	Church Avenue West	9.5	1.2	6.2	1.5	-3.4	0.3
Site 3 R407 / Church Ave (E)	Church Avenue East	121.3	68.8	125.0	64.3	3.6	-4.4
	R407 North	72.1	2.0	70.2	1.9	-1.9	0.0
	R407 South	171.0	7.6	159.7	8.0	-11.3	0.5
Site 5 Church Ave Railway Bridge	Church Avenue East	0.00	5.42	0.00	5.51	0.0	0.1
	Church Avenue West	0.00	0.49	0.00	0.56	0.0	0.1
Site 6 Kerdiffstown Road / Naas Golf Club	Church Avenue East	0.00	1.09	0.00	1.20	0.0	0.1
	Church Avenue west	2.4	0.5	1.3	0.5	-1.1	0.0
	Golf Club	6.5	6.9	1.2	7.2	-5.3	0.2
Garden Centre	Church Avenue East	3.8	3.5	3.6	3.8	-0.2	0.3
	Church Avenue west	0.0	1.3	0.0	1.3	0.0	0.0
	Garden Centre	5.1	0.5	6.4	0.6	1.3	0.0

DM 2027 AM Peak

Location		Observed				Modeled				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2305**	1987	126	192	**2116**	1825	114	177	**-189**	-162	-12	-15	189	4.0	Fail	Pass
R407 North	Church Avenue East	**425**	407	2	16	**422**	408	2	11	**-3**	1	0	-5	3	0.2	Pass	Pass
R407 South	R407 North	**1905**	1552	127	226	**1775**	1453	107	215	**-130**	-99	-20	-11	130	3.0	Fail	Pass
R407 South	Church Avenue East	**99**	94	0	5	**97**	93	0	5	**-2**	-1	0	0	2	0.2	Pass	Pass
Church Avenue East	R407 South	**48**	47	0	1	**46**	46	0	1	**-2**	-1	0	0	2	0.3	Pass	Pass
Church Avenue East	R407 North	**9**	9	0	0	**7**	7	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**47**	47	0	0	**44**	44	0	0	**-3**	-3	0	0	3	0.4	Pass	Pass
Church Avenue East	Church Avenue South	**150**	143	2	5	**145**	122	0	23	**-5**	-21	-2	18	5	0.4	Pass	Pass
Church Avenue North	Church Avenue West	**9**	7	0	1	**10**	9	0	1	**1**	2	0	0	-1	0.5	Pass	Pass
Church Avenue North	Church Avenue East	**171**	159	1	11	**200**	185	2	13	**29**	26	1	2	-29	2.2	Pass	Pass
Church Avenue West	Church Avenue South	**29**	28	0	1	**29**	27	0	1	**0**	-1	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**495**	473	2	19	**500**	482	2	15	**5**	9	0	-4	-5	0.2	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**88**	85	1	2	**82**	74	0	8	**-6**	-11	-1	6	6	0.7	Pass	Pass
Church Avenue East	R407 North	**97**	89	1	6	**92**	75	0	16	**-5**	-14	-1	10	5	0.5	Pass	Pass
R407 North	Church Avenue East	**15**	14	0	1	**17**	15	0	2	**2**	1	0	1	-2	0.5	Pass	Pass
R407 North	R407 South	**2349**	2029	127	194	**2183**	1889	116	179	**-166**	-140	-11	-15	166	3.5	Fail	Pass
R407 South	Church Avenue East	**199**	184	1	14	**193**	179	2	12	**-6**	-5	1	-2	6	0.5	Pass	Pass
R407 South	R407 North	**1912**	1572	122	218	**1782**	1471	107	203	**-130**	-101	-15	-15	130	3.0	Fail	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**343**	320	1	22	**337**	315	2	21	**-6**	-5	1	-1	6	0.3	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Palmerstown	Kill West	**413**	374	15	23	**390**	356	13	21	**-23**	-18	-2	-2	23	1.1	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**100**	87	1	12	**98**	86	0	11	**-2**	-1	-1	-1	2	0.2	Pass	Pass
Kill West	N7 on-slip WB	**219**	201	1	16	**218**	202	1	14	**-1**	1	0	-2	1	0.0	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**192**	167	15	10	**171**	149	14	9	**-21**	-18	-1	-1	21	1.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**43**	33	5	5	**32**	26	3	3	**-11**	-7	-2	-2	11	1.7	Pass	Pass
Greenhill Overbridge	Kill West	**259**	217	8	34	**239**	207	7	25	**-20**	-10	-1	-9	20	1.3	Pass	Pass
Greenhill Overbridge	Palmerstown	**48**	43	0	5	**48**	45	0	3	**0**	2	0	-2	0	0.0	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**52**	34	7	11	**43**	27	6	10	**-9**	-7	-1	-1	9	1.3	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**35**	31	0	4	**37**	33	0	4	**2**	2	0	0	-2	0.3	Pass	Pass
N7 off-slip WB	Kill West	**45**	37	0	7	**41**	35	0	6	**-4**	-2	0	-1	4	0.6	Pass	Pass
N7 off-slip WB	Palmerstown	**151**	126	3	22	**146**	123	3	20	**-5**	-3	0	-2	5	0.4	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**2**	1	0	1	**0**	0	0	0	0	0.1	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**6**	3	0	3	**0**	0	0	0	0	0.2	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**5**	2	0	2	**1**	0	0	0	-1	0.3	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**66**	55	0	11	**61**	50	0	11	**-5**	-5	0	0	5	0.6	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**94**	82	0	12	**86**	76	0	10	**-8**	-6	0	-2	8	0.8	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**148**	127	8	13	**131**	111	7	12	**-17**	-16	-1	-1	17	1.5	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**124**	107	4	12	**118**	102	4	13	**-6**	-5	0	1	6	0.5	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**328**	298	2	28	**320**	293	2	25	**-8**	-5	0	-3	8	0.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**44**	35	2	7	**40**	33	2	4	**-4**	-2	0	-3	4	0.6	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 Access Road	N7 on-slip EB	**327**	308	1	18	**335**	325	1	10	**8**	17	0	-8	-8	0.4	Pass	Pass
N7 Access Road	Greenhill Overbridge	**196**	165	4	27	**183**	164	3	16	**-13**	-1	-1	-11	13	1.0	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**81**	72	0	9	**73**	49	0	24	**-8**	-23	0	15	8	0.9	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**5**	1	4	0	**3**	-1	4	0	-3	1.5	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**500**	458	2	40	**504**	472	4	27	**4**	14	2	-13	-4	0.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**432**	424	0	9	**477**	444	4	28	**45**	20	4	19	-45	2.1	Pass	Pass
Church Avenue East	Church Avenue West	**59**	58	0	1	**63**	40	0	23	**4**	-18	0	22	-4	0.6	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**447**	416	3	27	**460**	428	4	28	**13**	12	1	1	-13	0.6	Pass	Pass
Church Avenue west	Golf Club	**11**	11	0	0	**12**	12	0	0	**1**	1	0	0	-1	0.4	Pass	Pass
Golf Club	Church Avenue East	**47**	47	0	0	**48**	48	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**12**	12	0	0	**7**	7	0	0	**-5**	-5	0	0	5	1.5	Pass	Pass
Church Avenue East	Church Avenue west	**66**	58	0	9	**64**	40	0	24	**-2**	-18	0	15	2	0.3	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**3**	3	0	0	**1**	1	0	0	**-2**	-2	0	0	2	1.5	Pass	Pass
Church Avenue East	Church Avenue west	**78**	69	0	9	**72**	48	0	24	**-6**	-21	0	15	6	0.7	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**494**	461	3	30	**505**	474	4	28	**11**	13	1	-2	-11	0.5	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**6**	6	0	0	**0**	0	0	0	**-6**	-6	0	0	6	3.6	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**83**	54	4	25	**79**	51	4	24	**-4**	-3	0	-1	4	0.5	Pass	Pass
Church Avenue East	Garden Centre	**109**	109	0	0	**102**	102	0	0	**-7**	-7	0	0	7	0.7	Pass	Pass
Church Avenue west	Church Avenue East	**500**	458	2	40	**503**	472	4	27	**3**	14	2	-13	-3	0.1	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**27**	27	0	0	**24**	24	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**66**	58	0	9	**63**	40	0	23	**-3**	-18	0	14	3	0.4	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**457**	424	3	30	**479**	446	4	28	**22**	22	1	-2	-22	1.0	Pass	Pass
Church Avenue West	School	**208**	208	0	0	**221**	221	0	0	**13**	13	0	0	-13	0.9	Pass	Pass
School	Church Avenue West	**131**	131	0	0	**127**	127	0	0	**-4**	-4	0	0	4	0.4	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

DM 2027 PM Peak

Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1928**	1677	61	190	**1974**	1721	59	194	**46**	44	-2	4	-46	1.1	Pass	Pass
R407 North	Church Avenue East	**108**	101	0	7	**107**	102	0	5	**-1**	1	0	-2	1	0.1	Pass	Pass
R407 South	R407 North	**2492**	2215	84	193	**2561**	2264	92	204	**69**	49	8	11	-69	1.4	Pass	Pass
R407 South	Church Avenue East	**30**	30	0	0	**29**	29	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**133**	117	0	16	**128**	108	0	19	**-5**	-9	0	3	5	0.5	Pass	Pass
Church Avenue East	R407 North	**21**	19	0	2	**21**	19	0	2	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**155**	136	0	18	**145**	124	0	21	**-10**	-12	0	3	10	0.8	Pass	Pass
Church Avenue East	Church Avenue South	**376**	347	1	28	**359**	318	7	34	**-17**	-29	6	6	17	0.9	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**3**	3	0	0	**1**	1	0	0	-1	0.6	Pass	Pass
Church Avenue North	Church Avenue East	**28**	27	0	1	**30**	28	0	2	**2**	1	0	1	-2	0.3	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**14**	14	0	0	**2**	2	0	0	-2	0.5	Pass	Pass
Church Avenue West	Church Avenue East	**127**	120	0	7	**124**	119	0	5	**-3**	-1	0	-2	3	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**130**	122	0	8	**113**	106	0	7	**-17**	-16	0	-1	17	1.5	Pass	Pass
Church Avenue East	R407 North	**285**	254	1	29	**255**	222	7	26	**-30**	-32	6	-3	30	1.8	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	4	0	2	**-1**	-1	0	0	1	0.6	Pass	Pass
R407 North	R407 South	**2039**	1782	61	197	**2135**	1861	60	214	**96**	79	-1	17	-96	2.1	Pass	Pass
R407 South	Church Avenue East	**31**	31	0	0	**28**	28	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
R407 South	R407 North	**2231**	1973	85	174	**2335**	2072	85	178	**104**	99	0	4	-104	2.2	Fail	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**206**	188	3	15	**212**	193	3	16	**6**	5	0	1	-6	0.4	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**5**	5	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**275**	246	8	21	**286**	258	8	20	**11**	12	0	-1	-11	0.7	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**236**	214	1	21	**235**	215	0	20	**-1**	1	-1	-1	1	0.1	Pass	Pass
Kill West	N7 on-slip WB	**105**	90	4	11	**112**	96	3	13	**7**	6	-1	2	-7	0.7	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**424**	377	13	34	**449**	402	14	32	**25**	25	1	-2	-25	1.2	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**71**	65	2	4	**64**	60	1	3	**-7**	-5	-1	-1	7	0.8	Pass	Pass
Greenhill Overbridge	Kill West	**291**	265	3	23	**271**	247	3	21	**-20**	-18	0	-2	20	1.2	Pass	Pass
Greenhill Overbridge	Palmerstown	**102**	99	0	3	**102**	100	0	2	**0**	1	0	-1	0	0.0	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**224**	189	1	34	**241**	206	1	34	**17**	17	0	0	-17	1.1	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**234**	202	2	30	**249**	215	2	33	**15**	13	0	3	-15	0.9	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**29**	24	0	6	**3**	3	0	1	-3	0.5	Pass	Pass
N7 off-slip WB	Palmerstown	**543**	505	3	34	**562**	527	3	32	**19**	22	0	-2	-19	0.8	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**6**	6	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**12**	9	0	3	**1**	1	0	0	-1	0.3	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**44**	41	1	2	**0**	0	0	0	0	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**76**	72	1	3	**77**	73	1	3	**1**	1	0	0	-1	0.1	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**65**	59	2	4	**64**	58	2	4	**-1**	-1	0	0	1	0.1	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**178**	157	3	18	**171**	150	3	19	**-7**	-7	0	1	7	0.5	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	3	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**449**	393	4	52	**461**	407	2	52	**12**	14	-2	0	-12	0.6	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**213**	194	2	17	**218**	198	2	18	**5**	4	0	1	-5	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**9**	7	1	0	**-1**	-1	0	-1	1	0.4	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**1**	1	0	0	**-2**	-1	0	-1	2	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**59**	54	0	5	**48**	46	0	2	**-11**	-8	0	-3	11	1.6	Pass	Pass
N7 Access Road	Greenhill Overbridge	**242**	231	0	11	**223**	218	0	5	**-19**	-13	0	-6	19	1.2	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**478**	427	3	47	**488**	430	3	55	**10**	3	0	8	-10	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**4**	0	4	0	**4**	0	4	0	-4	2.8	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**2**	2	0	0	**1**	1	0	0	-1	0.8	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**193**	184	0	9	**164**	157	0	7	**-29**	-27	0	-2	29	2.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**464**	413	3	47	**142**	135	0	7	**-322**	-278	-3	-40	322	18.5	Fail	Fail
Church Avenue East	Church Avenue West	**134**	126	0	8	**467**	405	7	54	**333**	279	7	46	-333	19.2	Fail	Fail
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**152**	143	0	8	**130**	122	0	7	**-22**	-21	0	-1	22	1.8	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	11	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**24**	24	0	0	**-3**	-3	0	0	3	0.6	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**7**	7	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue East	Church Avenue west	**464**	413	3	47	**472**	410	7	54	**8**	-3	4	7	-8	0.4	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**17**	17	0	0	**4**	4	0	0	**-13**	-13	0	0	13	4.0	Pass	Pass
Church Avenue East	Church Avenue west	**472**	421	3	47	**485**	423	7	55	**13**	2	4	8	-13	0.6	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**11**	11	0	0	**0**	0	0	0	**-11**	-11	0	0	11	4.7	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**169**	161	0	8	**153**	146	0	7	**-16**	-15	0	-1	16	1.2	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**24**	24	0	0	**0**	0	0	0	**-24**	-24	0	0	24	7.0	Pass	Fail
Landfill	Church Avenue East	**42**	42	0	0	**12**	12	0	0	**-30**	-30	0	0	30	5.7	Pass	Fail
Garden Centre																	
Church Avenue East	Church Avenue west	**480**	419	5	56	**489**	431	3	55	**9**	12	-2	-1	-9	0.4	Pass	Pass
Church Avenue East	Garden Centre	**55**	55	0	0	**54**	54	0	0	**-1**	-1	0	0	1	0.1	Pass	Pass
Church Avenue west	Church Avenue East	**170**	161	0	9	**166**	159	0	7	**-4**	-2	0	-2	4	0.3	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**110**	110	0	0	**108**	108	0	0	**-2**	-2	0	0	2	0.2	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**488**	438	3	47	**466**	405	7	54	**-22**	-33	4	7	22	1.0	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**143**	136	0	7	**9**	10	0	-1	-9	0.7	Pass	Pass
Church Avenue West	School	**21**	21	0	0	**11**	11	0	0	**-10**	-10	0	0	10	2.5	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**38**	38	0	0	**-2**	-2	0	0	2	0.4	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

OS 2027 AM Peak

Location		Observed				Modeled				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2305**	1987	126	192	**1999**	1823	0	176	**-306**	-164	-126	-16	306	6.6	Fail	Fail
R407 North	Church Avenue East	**432**	414	2	16	**541**	415	115	11	**109**	1	113	-5	-109	5.0	Fail	Pass
R407 South	R407 North	**1907**	1555	127	226	**1669**	1454	0	215	**-238**	-101	-127	-11	238	5.6	Fail	Fail
R407 South	Church Avenue East	**101**	95	0	5	**112**	94	13	5	**11**	-1	13	0	-11	1.1	Pass	Pass
Church Avenue East	R407 South	**49**	48	0	1	**47**	46	0	1	**-2**	-2	0	0	2	0.3	Pass	Pass
Church Avenue East	R407 North	**9**	9	0	0	**102**	7	96	0	**93**	-2	96	0	-93	12.5	Pass	Fail
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**48**	48	0	0	**44**	44	0	0	**-4**	-4	0	0	4	0.6	Pass	Pass
Church Avenue East	Church Avenue South	**154**	147	2	5	**149**	125	0	24	**-5**	-22	-2	19	5	0.4	Pass	Pass
Church Avenue North	Church Avenue West	**9**	7	0	1	**105**	9	96	1	**96**	2	96	0	-96	12.8	Pass	Fail
Church Avenue North	Church Avenue East	**173**	161	1	11	**201**	188	0	13	**28**	27	-1	2	-28	2.0	Pass	Pass
Church Avenue West	Church Avenue South	**29**	28	0	1	**159**	27	131	1	**130**	-1	131	0	-130	13.4	Fail	Fail
Church Avenue West	Church Avenue East	**503**	481	2	19	**505**	490	0	15	**2**	9	-2	-4	-2	0.1	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**90**	87	1	2	**83**	75	0	8	**-7**	-12	-1	6	7	0.8	Pass	Pass
Church Avenue East	R407 North	**99**	92	1	6	**93**	77	0	17	**-6**	-15	-1	11	6	0.6	Pass	Pass
R407 North	Church Avenue East	**15**	14	0	1	**17**	15	0	2	**2**	1	0	1	-2	0.5	Pass	Pass
R407 North	R407 South	**2349**	2029	127	194	**2066**	1888	0	179	**-283**	-141	-127	-15	283	6.0	Fail	Fail
R407 South	Church Avenue East	**202**	187	1	14	**289**	181	96	12	**87**	-6	95	-2	-87	5.6	Pass	Fail
R407 South	R407 North	**1914**	1574	122	218	**1689**	1472	13	203	**-225**	-102	-109	-15	225	5.3	Fail	Fail
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**348**	324	1	22	**355**	319	15	21	**7**	-5	14	-1	-7	0.4	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Palmerstown	Kill West	**413**	374	15	23	**376**	355	0	21	**-37**	-19	-15	-2	37	1.8	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**102**	89	1	12	**99**	87	0	11	**-3**	-2	-1	-1	3	0.3	Pass	Pass
Kill West	N7 on-slip WB	**219**	201	1	16	**217**	202	1	14	**-2**	1	0	-2	2	0.1	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**13**	0	13	0	**13**	0	13	0	-13	5.1	Pass	Fail
Kill West	Palmerstown	**192**	167	15	10	**159**	149	1	9	**-33**	-18	-14	-1	33	2.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**43**	33	5	5	**35**	27	6	3	**-8**	-6	1	-2	8	1.3	Pass	Pass
Greenhill Overbridge	Kill West	**261**	219	8	34	**235**	210	0	25	**-26**	-9	-8	-9	26	1.6	Pass	Pass
Greenhill Overbridge	Palmerstown	**48**	43	0	5	**53**	46	4	3	**5**	3	4	-2	-5	0.7	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**53**	34	7	11	**37**	27	0	10	**-16**	-7	-7	-1	16	2.4	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**35**	31	0	4	**37**	33	0	4	**2**	2	0	0	-2	0.3	Pass	Pass
N7 off-slip WB	Kill West	**45**	37	0	7	**40**	34	0	6	**-5**	-3	0	-1	5	0.7	Pass	Pass
N7 off-slip WB	Palmerstown	**151**	126	3	22	**143**	123	0	20	**-8**	-3	-3	-2	8	0.7	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**2**	1	0	1	**0**	0	0	0	0	0.2	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**6**	3	0	3	**0**	0	0	0	0	0.2	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**5**	2	0	2	**1**	0	0	0	-1	0.3	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**70**	59	0	11	**65**	54	0	11	**-5**	-5	0	0	5	0.6	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**94**	82	0	12	**87**	77	0	10	**-7**	-5	0	-2	7	0.7	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**148**	127	8	13	**123**	111	0	12	**-25**	-16	-8	-1	25	2.2	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	4	0	0	**-1**	0	0	-1	1	0.6	Pass	Pass
Greenhill Overbridge	N7 Access Road	**131**	114	4	12	**122**	109	0	13	**-9**	-5	-4	1	9	0.8	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**328**	298	2	28	**318**	293	0	25	**-10**	-5	-2	-3	10	0.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**10**	0	10	0	**10**	0	10	0	-10	4.5	Pass	Pass
Greenhill Overbridge	The Paddocks	**44**	35	2	7	**42**	33	5	4	**-2**	-2	3	-3	2	0.3	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 Access Road	N7 on-slip EB	**331**	311	1	18	**345**	336	0	10	**14**	25	-1	-8	-14	0.8	Pass	Pass
N7 Access Road	Greenhill Overbridge	**198**	167	4	27	**185**	169	0	16	**-13**	2	-4	-11	13	1.0	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	2	0	1	**0**	0	0	0	0	0.1	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**92**	83	0	9	**83**	59	0	24	**-9**	-24	0	15	9	0.9	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**1**	1	0	0	**-1**	-1	0	0	1	0.9	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**505**	464	2	40	**513**	486	0	27	**8**	22	-2	-13	-8	0.3	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**443**	435	0	9	**484**	455	0	28	**41**	20	0	19	-41	1.9	Pass	Pass
Church Avenue East	Church Avenue West	**59**	58	0	1	**66**	42	0	24	**7**	-16	0	23	-7	0.9	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**457**	427	3	27	**468**	440	0	28	**11**	13	-3	1	-11	0.5	Pass	Pass
Church Avenue west	Golf Club	**11**	11	0	0	**12**	12	0	0	**1**	1	0	0	-1	0.4	Pass	Pass
Golf Club	Church Avenue East	**47**	47	0	0	**48**	48	0	0	**1**	1	0	0	-1	0.2	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**12**	12	0	0	**8**	8	0	0	**-4**	-4	0	0	4	1.2	Pass	Pass
Church Avenue East	Church Avenue west	**66**	58	0	9	**66**	43	0	24	**0**	-15	0	15	0	0.0	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**14**	14	0	0	**8**	8	0	0	**-6**	-6	0	0	6	1.8	Pass	Pass
Church Avenue East	Church Avenue west	**78**	69	0	9	**74**	50	0	24	**-4**	-19	0	15	4	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**11**	11	0	0	**10**	10	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**504**	471	3	30	**503**	476	0	28	**-1**	5	-3	-2	1	0.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**94**	65	4	25	**84**	60	0	24	**-10**	-5	-4	-1	10	1.0	Pass	Pass
Church Avenue East	Garden Centre	**109**	109	0	0	**103**	103	0	0	**-6**	-6	0	0	6	0.6	Pass	Pass
Church Avenue west	Church Avenue East	**505**	464	2	40	**513**	485	0	27	**8**	21	-2	-13	-8	0.3	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**27**	27	0	0	**24**	24	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**72**	63	0	9	**66**	42	0	24	**-6**	-21	0	15	6	0.7	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**468**	435	3	30	**485**	457	0	28	**17**	22	-3	-2	-17	0.8	Pass	Pass
Church Avenue West	School	**208**	208	0	0	**219**	219	0	0	**11**	11	0	0	-11	0.8	Pass	Pass
School	Church Avenue West	**131**	131	0	0	**127**	127	0	0	**-4**	-4	0	0	4	0.4	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

DS 2027 PM Peak

Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2105**	1831	66	207	**1973**	1719	59	195	**-132**	-112	-7	-12	132	2.9	Fail	Pass
R407 North	Church Avenue East	**114**	106	0	8	**115**	110	0	5	**1**	4	0	-3	-1	0.1	Pass	Pass
R407 South	R407 North	**2726**	2422	92	212	**2552**	2256	92	204	**-174**	-166	0	-8	174	3.4	Fail	Pass
R407 South	Church Avenue East	**32**	32	0	0	**30**	30	0	0	**-2**	-2	0	0	2	0.3	Pass	Pass
Church Avenue East	R407 South	**140**	123	0	18	**124**	105	0	19	**-16**	-18	0	1	16	1.4	Pass	Pass
Church Avenue East	R407 North	**22**	20	0	2	**20**	19	0	2	**-2**	-1	0	0	2	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**163**	143	0	20	**141**	120	0	21	**-22**	-23	0	1	22	1.8	Pass	Pass
Church Avenue East	Church Avenue South	**399**	366	1	31	**347**	306	7	34	**-52**	-60	6	3	52	2.7	Pass	Pass
Church Avenue North	Church Avenue West	**3**	3	0	0	**3**	3	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue North	Church Avenue East	**30**	29	0	1	**34**	32	0	2	**4**	3	0	1	-4	0.8	Pass	Pass
Church Avenue West	Church Avenue South	**14**	14	0	0	**13**	13	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue West	Church Avenue East	**134**	126	0	8	**134**	129	0	5	**0**	3	0	-3	0	0.0	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**139**	130	0	9	**109**	102	0	7	**-30**	-28	0	-2	30	2.7	Pass	Pass
Church Avenue East	R407 North	**302**	268	1	32	**248**	214	7	26	**-54**	-54	6	-6	54	3.2	Pass	Pass
R407 North	Church Avenue East	**8**	6	0	2	**7**	5	0	2	**-1**	-1	0	0	1	0.3	Pass	Pass
R407 North	R407 South	**2224**	1943	66	215	**2130**	1856	60	214	**-94**	-87	-6	-1	94	2.0	Pass	Pass
R407 South	Church Avenue East	**33**	33	0	0	**30**	30	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
R407 South	R407 North	**2452**	2167	93	191	**2336**	2074	85	178	**-116**	-93	-8	-13	116	2.4	Fail	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**221**	201	3	16	**212**	193	3	16	**-9**	-8	0	0	9	0.6	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**5**	5	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Palmerstown	Kill West	**298**	267	9	23	**285**	258	8	20	**-13**	-9	-1	-3	13	0.8	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**251**	227	1	22	**235**	215	0	20	**-16**	-12	-1	-2	16	1.0	Pass	Pass
Kill West	N7 on-slip WB	**116**	99	4	12	**112**	96	3	13	**-4**	-3	-1	1	4	0.4	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**463**	411	14	37	**449**	402	14	32	**-14**	-9	0	-5	14	0.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**78**	71	2	5	**68**	64	1	3	**-10**	-7	-1	-2	10	1.1	Pass	Pass
Greenhill Overbridge	Kill West	**310**	280	3	26	**280**	256	3	21	**-30**	-24	0	-5	30	1.7	Pass	Pass
Greenhill Overbridge	Palmerstown	**108**	104	0	3	**105**	103	0	2	**-3**	-1	0	-1	3	0.3	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**240**	202	1	37	**241**	206	1	34	**1**	4	0	-3	-1	0.1	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**249**	215	2	32	**249**	215	2	33	**0**	0	0	1	0	0.0	Pass	Pass
N7 off-slip WB	Kill West	**28**	22	0	5	**29**	24	0	6	**1**	2	0	1	-1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**576**	536	3	36	**562**	527	3	32	**-14**	-9	0	-4	14	0.6	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**6**	6	0	0	**-1**	-1	0	0	1	0.6	Pass	Pass
The Paddocks	N7 on-slip EB	**12**	9	0	3	**12**	9	0	3	**0**	0	0	0	0	0.1	Pass	Pass
The Paddocks	Greenhill Overbridge	**49**	46	1	2	**44**	41	1	2	**-5**	-5	0	0	5	0.7	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**81**	77	1	3	**73**	70	1	3	**-8**	-7	0	0	8	0.9	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**70**	64	2	4	**61**	55	2	4	**-9**	-9	0	0	9	1.2	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**191**	168	3	20	**163**	141	3	19	**-28**	-27	0	-1	28	2.1	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**3**	3	0	0	**-2**	-1	0	-1	2	1.1	Pass	Pass
Greenhill Overbridge	N7 Access Road	**480**	420	4	55	**461**	407	2	52	**-19**	-13	-2	-3	19	0.9	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**227**	207	2	18	**218**	198	2	18	**-9**	-9	0	0	9	0.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**12**	9	1	1	**9**	7	1	0	**-3**	-2	0	-1	3	0.8	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**1**	1	0	0	**1**	1	0	0	-1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**64**	58	0	6	**51**	49	0	2	**-13**	-9	0	-4	13	1.7	Pass	Pass
N7 Access Road	Greenhill Overbridge	**254**	241	0	13	**247**	241	0	5	**-7**	0	0	-8	7	0.4	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**478**	428	3	48	**485**	427	3	55	**7**	-1	0	7	-7	0.3	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**0**	0	0	0	**1**	1	0	0	**1**	1	0	0	-1	1.4	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**4**	0	4	0	**4**	0	4	0	-4	2.8	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**2**	2	0	0	**1**	1	0	0	-1	0.8	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**202**	192	0	11	**192**	185	0	7	**-10**	-7	0	-4	10	0.7	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**153**	144	0	9	**155**	148	0	7	**2**	4	0	-2	-2	0.2	Pass	Pass
Church Avenue East	Church Avenue West	**495**	441	3	51	**451**	389	7	54	**-44**	-52	4	3	44	2.0	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**142**	135	0	8	**143**	136	0	7	**1**	1	0	-1	-1	0.1	Pass	Pass
Church Avenue west	Golf Club	**11**	11	0	0	**11**	11	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Golf Club	Church Avenue East	**29**	29	0	0	**24**	24	0	0	**-5**	-5	0	0	5	0.9	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**9**	9	0	0	**7**	7	0	0	**-2**	-2	0	0	2	0.5	Pass	Pass
Church Avenue East	Church Avenue west	**495**	441	3	51	**457**	395	7	54	**-38**	-46	4	3	38	1.7	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**17**	17	0	0	**16**	16	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue East	Church Avenue west	**503**	449	3	51	**470**	408	7	55	**-33**	-41	4	4	33	1.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**9**	9	0	0	**9**	9	0	0	-9	4.2	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**171**	163	0	8	**156**	149	0	7	**-15**	-14	0	-1	15	1.2	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**24**	24	0	0	**36**	36	0	0	**12**	12	0	0	-12	2.1	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**511**	446	5	59	**486**	428	3	55	**-25**	-18	-2	-4	25	1.1	Pass	Pass
Church Avenue East	Garden Centre	**58**	58	0	0	**54**	54	0	0	**-4**	-4	0	0	4	0.5	Pass	Pass
Church Avenue west	Church Avenue East	**202**	192	0	11	**194**	187	0	7	**-8**	-5	0	-4	8	0.6	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**116**	116	0	0	**108**	108	0	0	**-8**	-8	0	0	8	0.8	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**519**	463	3	53	**450**	389	7	54	**-69**	-74	4	1	69	3.1	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**153**	144	0	9	**157**	150	0	7	**4**	6	0	-2	-4	0.3	Pass	Pass
Church Avenue West	School	**11**	11	0	0	**11**	11	0	0	**0**	0	0	0	0	0.1	Pass	Pass
School	Church Avenue West	**43**	43	0	0	**38**	38	0	0	**-5**	-5	0	0	5	0.7	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

DM 2037 AM Peak

Location		Observed				Modeled				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2566**	2212	141	214	**2350**	2025	126	199	**-216**	-187	-15	-15	216	4.4	Fail	Pass
R407 North	Church Avenue East	**474**	453	2	18	**466**	452	2	12	**-8**	-1	0	-6	8	0.4	Pass	Pass
R407 South	R407 North	**2121**	1729	141	251	**1979**	1620	121	237	**-142**	-109	-20	-14	142	3.1	Fail	Pass
R407 South	Church Avenue East	**110**	104	0	6	**109**	104	0	5	**-1**	0	0	-1	1	0.1	Pass	Pass
Church Avenue East	R407 South	**53**	52	0	1	**50**	49	0	1	**-3**	-3	0	0	3	0.5	Pass	Pass
Church Avenue East	R407 North	**9**	9	0	0	**8**	8	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**52**	52	0	0	**48**	48	0	0	**-4**	-4	0	0	4	0.6	Pass	Pass
Church Avenue East	Church Avenue South	**167**	159	2	6	**163**	138	0	24	**-4**	-21	-2	18	4	0.3	Pass	Pass
Church Avenue North	Church Avenue West	**9**	8	0	1	**10**	10	0	1	**1**	2	0	0	-1	0.2	Pass	Pass
Church Avenue North	Church Avenue East	**190**	177	1	12	**218**	203	2	14	**28**	26	1	2	-28	2.0	Pass	Pass
Church Avenue West	Church Avenue South	**32**	31	0	1	**32**	30	0	1	**0**	-1	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**551**	527	2	22	**553**	534	2	17	**2**	7	0	-5	-2	0.1	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**99**	95	1	2	**88**	81	0	6	**-11**	-14	-1	4	11	1.1	Pass	Pass
Church Avenue East	R407 North	**108**	100	1	7	**104**	85	0	19	**-4**	-15	-1	12	4	0.4	Pass	Pass
R407 North	Church Avenue East	**17**	15	0	1	**18**	16	0	2	**1**	1	0	1	-1	0.3	Pass	Pass
R407 North	R407 South	**2616**	2259	141	216	**2435**	2104	130	201	**-181**	-155	-11	-15	181	3.6	Fail	Pass
R407 South	Church Avenue East	**222**	205	1	16	**211**	197	2	13	**-11**	-8	1	-3	11	0.7	Pass	Pass
R407 South	R407 North	**2129**	1751	136	243	**1985**	1639	121	224	**-144**	-112	-15	-19	144	3.2	Fail	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**382**	356	1	25	**378**	355	1	22	**-4**	-1	0	-3	4	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.5	Pass	Pass
Palmerstown	Kill West	**459**	416	17	26	**429**	392	14	22	**-30**	-24	-3	-4	30	1.4	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**112**	97	1	13	**107**	95	0	12	**-5**	-2	-1	-1	5	0.4	Pass	Pass
Kill West	N7 on-slip WB	**243**	224	1	18	**241**	224	1	16	**-2**	0	0	-2	2	0.2	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**214**	186	17	12	**190**	166	15	9	**-24**	-20	-2	-3	24	1.7	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**47**	37	5	5	**35**	29	3	3	**-12**	-8	-2	-2	12	1.9	Pass	Pass
Greenhill Overbridge	Kill West	**288**	242	9	38	**260**	226	7	27	**-28**	-16	-2	-11	28	1.7	Pass	Pass
Greenhill Overbridge	Palmerstown	**53**	47	0	6	**53**	50	0	3	**0**	3	0	-3	0	0.1	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**58**	37	8	12	**47**	30	6	10	**-11**	-7	-2	-2	11	1.5	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**39**	34	0	5	**42**	36	0	6	**3**	2	0	1	-3	0.4	Pass	Pass
N7 off-slip WB	Kill West	**50**	42	0	8	**47**	40	0	7	**-3**	-2	0	-1	3	0.4	Pass	Pass
N7 off-slip WB	Palmerstown	**169**	141	4	24	**165**	140	3	22	**-4**	-1	-1	-2	4	0.3	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**2**	1	0	1	**0**	0	0	0	0	0.3	Pass	Pass
The Paddocks	N7 on-slip EB	**7**	4	0	4	**7**	4	0	3	**0**	0	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**5**	2	0	2	**3**	1	0	2	**-2**	-1	0	0	2	0.9	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**74**	62	0	12	**70**	59	0	11	**-4**	-3	0	-1	4	0.4	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**104**	91	0	13	**95**	84	0	11	**-9**	-7	0	-2	9	0.9	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**165**	141	9	15	**142**	122	7	13	**-23**	-19	-2	-2	23	1.9	Pass	Pass
N7 off-slip EB	The Paddocks	**6**	5	0	1	**4**	4	0	0	**-2**	-1	0	-1	2	0.9	Pass	Pass
Greenhill Overbridge	N7 Access Road	**138**	119	5	14	**131**	114	4	13	**-7**	-5	-1	-1	7	0.6	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**366**	332	2	31	**357**	330	2	26	**-9**	-2	0	-5	9	0.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**49**	39	2	7	**44**	37	2	5	**-5**	-2	0	-2	5	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 Access Road	N7 on-slip EB	**364**	343	1	20	**371**	359	0	11	**7**	16	-1	-9	-7	0.3	Pass	Pass
N7 Access Road	Greenhill Overbridge	**218**	183	5	30	**202**	181	4	17	**-16**	-2	-1	-13	16	1.1	Pass	Pass
N7 Access Road	The Paddocks	**4**	2	0	1	**3**	2	0	2	**-1**	0	0	1	1	0.3	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**90**	81	0	9	**81**	55	0	25	**-9**	-26	0	16	9	1.0	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**4**	1	4	0	**2**	-1	4	0	-2	0.9	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**557**	510	2	44	**558**	523	4	30	**1**	13	2	-14	-1	0.1	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**472**	472	0	0	**527**	493	4	30	**55**	21	4	30	-55	2.5	Pass	Pass
Church Avenue East	Church Avenue West	**65**	64	0	1	**70**	45	0	25	**5**	-19	0	24	-5	0.6	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**497**	464	3	30	**512**	478	4	30	**15**	14	1	0	-15	0.7	Pass	Pass
Church Avenue west	Golf Club	**12**	12	0	0	**13**	13	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**52**	52	0	0	**48**	48	0	0	**-4**	-4	0	0	4	0.6	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**13**	13	0	0	**9**	9	0	0	**-4**	-4	0	0	4	1.2	Pass	Pass
Church Avenue East	Church Avenue west	**74**	64	0	9	**70**	45	0	25	**-4**	-19	0	16	4	0.4	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**4**	4	0	0	**2**	2	0	0	**-2**	-2	0	0	2	0.9	Pass	Pass
Church Avenue East	Church Avenue west	**87**	77	0	9	**79**	53	0	25	**-8**	-24	0	16	8	0.8	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**550**	513	4	33	**558**	524	4	30	**8**	11	0	-3	-8	0.4	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**7**	7	0	0	**0**	0	0	0	**-7**	-7	0	0	7	3.8	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**93**	60	5	28	**85**	56	4	25	**-8**	-4	-1	-3	8	0.8	Pass	Pass
Church Avenue East	Garden Centre	**121**	121	0	0	**117**	117	0	0	**-4**	-4	0	0	4	0.4	Pass	Pass
Church Avenue west	Church Avenue East	**557**	510	2	44	**557**	523	4	30	**0**	13	2	-14	0	0.0	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**30**	30	0	0	**24**	24	0	0	**-6**	-6	0	0	6	1.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**74**	64	0	9	**69**	44	0	24	**-5**	-20	0	15	5	0.5	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**509**	472	4	34	**529**	495	4	30	**20**	23	0	-4	-20	0.9	Pass	Pass
Church Avenue West	School	**231**	231	0	0	**241**	241	0	0	**10**	10	0	0	-10	0.6	Pass	Pass
School	Church Avenue West	**146**	146	0	0	**142**	142	0	0	**-4**	-4	0	0	4	0.3	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2343**	2038	74	231	**2250**	1948	69	233	**-93**	-90	-5	2	93	1.9	Pass	Pass
R407 North	Church Avenue East	**119**	110	0	8	**121**	115	0	6	**2**	5	0	-2	-2	0.2	Pass	Pass
R407 South	R407 North	**3022**	2685	102	235	**2892**	2547	109	236	**-130**	-138	7	1	130	2.4	Fail	Pass
R407 South	Church Avenue East	**33**	33	0	0	**32**	32	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	R407 South	**150**	131	0	19	**147**	125	0	22	**-3**	-6	0	3	3	0.2	Pass	Pass
Church Avenue East	R407 North	**24**	21	0	2	**23**	21	0	2	**-1**	0	0	0	1	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**173**	152	0	21	**167**	144	0	24	**-6**	-8	0	3	6	0.5	Pass	Pass
Church Avenue East	Church Avenue South	**425**	390	1	34	**414**	365	11	38	**-11**	-25	10	4	11	0.5	Pass	Pass
Church Avenue North	Church Avenue West	**4**	4	0	0	**3**	3	0	0	**-1**	-1	0	0	1	0.3	Pass	Pass
Church Avenue North	Church Avenue East	**31**	30	0	1	**35**	32	0	3	**4**	2	0	2	-4	0.7	Pass	Pass
Church Avenue West	Church Avenue South	**15**	15	0	0	**14**	14	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue West	Church Avenue East	**139**	131	0	8	**143**	137	0	6	**4**	6	0	-2	-4	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**148**	139	0	10	**131**	123	0	8	**-17**	-16	0	-2	17	1.5	Pass	Pass
Church Avenue East	R407 North	**323**	287	1	35	**297**	256	11	31	**-26**	-31	10	-4	26	1.5	Pass	Pass
R407 North	Church Avenue East	**8**	6	0	2	**7**	4	0	3	**-1**	-2	0	1	1	0.5	Pass	Pass
R407 North	R407 South	**2476**	2163	74	239	**2437**	2111	70	256	**-39**	-52	-4	17	39	0.8	Pass	Pass
R407 South	Church Avenue East	**34**	34	0	0	**31**	31	0	0	**-3**	-3	0	0	3	0.6	Pass	Pass
R407 South	R407 North	**2728**	2411	104	213	**2628**	2324	98	206	**-100**	-87	-6	-7	100	1.9	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**246**	224	4	18	**246**	224	5	17	**0**	0	1	-1	0	0.0	Pass	Pass
Palmerstown	N7 on-slip WB	**6**	6	0	0	**5**	5	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Palmerstown	Kill West	**332**	297	10	26	**326**	293	8	24	**-6**	-4	-2	-2	6	0.4	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**279**	253	1	25	**271**	246	0	25	**-8**	-7	-1	0	8	0.5	Pass	Pass
Kill West	N7 on-slip WB	**129**	111	5	14	**126**	108	4	14	**-3**	-3	-1	0	3	0.3	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**515**	458	16	42	**508**	454	15	39	**-7**	-4	-1	-3	7	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**83**	76	2	5	**76**	72	2	3	**-7**	-4	0	-2	7	0.8	Pass	Pass
Greenhill Overbridge	Kill West	**331**	300	4	28	**322**	296	4	22	**-9**	-4	0	-6	9	0.5	Pass	Pass
Greenhill Overbridge	Palmerstown	**115**	112	0	4	**120**	117	0	2	**5**	5	0	-2	-5	0.4	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**267**	225	1	41	**266**	225	1	39	**-1**	0	0	-2	1	0.1	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**278**	239	2	36	**273**	234	2	37	**-5**	-5	0	1	5	0.3	Pass	Pass
N7 off-slip WB	Kill West	**31**	25	0	6	**32**	26	0	6	**1**	1	0	0	-1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**641**	597	4	41	**614**	573	4	37	**-27**	-24	0	-4	27	1.1	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**8**	8	0	0	**8**	8	0	0	**0**	0	0	0	0	0.1	Pass	Pass
The Paddocks	N7 on-slip EB	**13**	9	0	4	**15**	12	0	3	**2**	3	0	-1	-2	0.5	Pass	Pass
The Paddocks	Greenhill Overbridge	**55**	51	1	2	**54**	51	1	2	**-1**	0	0	0	1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**90**	85	1	4	**87**	82	2	4	**-3**	-3	1	0	3	0.3	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**78**	71	2	5	**71**	64	2	4	**-7**	-7	0	-1	7	0.8	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**212**	187	4	22	**197**	171	5	21	**-15**	-16	1	-1	15	1.1	Pass	Pass
N7 off-slip EB	The Paddocks	**6**	4	0	1	**3**	3	0	0	**-3**	-1	0	-1	3	1.4	Pass	Pass
Greenhill Overbridge	N7 Access Road	**534**	468	5	61	**526**	463	4	60	**-8**	-5	-1	-1	8	0.4	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**253**	230	2	20	**246**	223	2	20	**-7**	-7	0	0	7	0.4	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**13**	10	1	1	**10**	9	1	1	**-3**	-1	0	0	3	0.9	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**1**	1	0	0	**1**	1	0	0	-1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**65**	59	0	6	**60**	57	0	3	**-5**	-2	0	-3	5	0.7	Pass	Pass
N7 Access Road	Greenhill Overbridge	**261**	248	0	13	**268**	262	0	5	**7**	14	0	-8	-7	0.4	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.2	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**479**	428	3	48	**554**	485	5	64	**75**	57	2	16	-75	3.3	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**6**	0	6	0	**6**	0	6	0	-6	3.5	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**4**	4	0	0	**3**	3	0	0	-3	1.7	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**198**	188	0	11	**206**	197	0	9	**8**	9	0	-2	-8	0.5	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**158**	148	0	9	**165**	157	0	9	**7**	9	0	0	-7	0.6	Pass	Pass
Church Avenue East	Church Avenue West	**551**	491	4	56	**536**	463	11	63	**-15**	-28	7	7	15	0.6	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**146**	138	0	8	**152**	143	0	9	**6**	5	0	1	-6	0.5	Pass	Pass
Church Avenue west	Golf Club	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**32**	32	0	0	**35**	35	0	0	**3**	3	0	0	-3	0.5	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**9**	9	0	0	**6**	6	0	0	**-3**	-3	0	0	3	1.3	Pass	Pass
Church Avenue East	Church Avenue west	**551**	491	4	56	**542**	468	11	64	**-9**	-23	7	8	9	0.4	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**7**	7	0	0	**5**	5	0	0	**-2**	-2	0	0	2	0.9	Pass	Pass
Church Avenue East	Church Avenue west	**560**	500	4	56	**554**	479	11	64	**-6**	-21	7	8	6	0.3	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**178**	170	0	9	**186**	178	0	9	**8**	8	0	0	-8	0.6	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**0**	0	0	0	**20**	20	0	0	**20**	20	0	0	-20	6.3	Pass	Fail
Garden Centre																	
Church Avenue East	Church Avenue west	**569**	497	6	66	**555**	486	5	64	**-14**	-11	-1	-2	14	0.6	Pass	Pass
Church Avenue East	Garden Centre	**64**	64	0	0	**62**	62	0	0	**-2**	-2	0	0	2	0.3	Pass	Pass
Church Avenue west	Church Avenue East	**198**	188	0	11	**209**	201	0	9	**11**	13	0	-2	-11	0.8	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**129**	129	0	0	**123**	123	0	0	**-6**	-6	0	0	6	0.6	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**551**	491	4	56	**533**	460	11	62	**-18**	-31	7	6	18	0.8	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**158**	148	0	9	**166**	157	0	9	**8**	9	0	0	-8	0.6	Pass	Pass
Church Avenue West	School	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**47**	47	0	0	**49**	49	0	0	**2**	2	0	0	-2	0.2	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

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Location		Observed				Modeled				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2566**	2212	141	214	**2352**	2028	126	199	**-214**	-184	-15	-15	214	4.3	Fail	Pass
R407 North	Church Avenue East	**480**	460	2	18	**474**	460	2	12	**-6**	0	0	-6	6	0.3	Pass	Pass
R407 South	R407 North	**2123**	1731	141	251	**1979**	1620	121	238	**-144**	-111	-20	-13	144	3.2	Fail	Pass
R407 South	Church Avenue East	**112**	106	0	6	**111**	106	0	5	**-1**	0	0	-1	1	0.1	Pass	Pass
Church Avenue East	R407 South	**55**	53	0	1	**50**	50	0	1	**-5**	-3	0	0	5	0.6	Pass	Pass
Church Avenue East	R407 North	**10**	10	0	0	**8**	8	0	0	**-2**	-2	0	0	2	0.6	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**54**	54	0	0	**49**	49	0	0	**-5**	-5	0	0	5	0.6	Pass	Pass
Church Avenue East	Church Avenue South	**172**	163	2	6	**165**	141	0	24	**-7**	-22	-2	18	7	0.5	Pass	Pass
Church Avenue North	Church Avenue West	**9**	8	0	1	**10**	9	0	1	**1**	1	0	0	-1	0.2	Pass	Pass
Church Avenue North	Church Avenue East	**193**	180	1	12	**222**	207	2	14	**29**	27	1	2	-29	2.0	Pass	Pass
Church Avenue West	Church Avenue South	**32**	31	0	1	**31**	30	0	1	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue West	Church Avenue East	**559**	535	2	22	**562**	543	2	17	**3**	8	0	-5	-3	0.1	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**101**	97	1	2	**88**	82	0	6	**-13**	-15	-1	4	13	1.3	Pass	Pass
Church Avenue East	R407 North	**110**	102	1	7	**107**	87	0	19	**-3**	-15	-1	12	3	0.3	Pass	Pass
R407 North	Church Avenue East	**17**	16	0	1	**19**	18	0	2	**2**	2	0	1	-2	0.5	Pass	Pass
R407 North	R407 South	**2616**	2259	141	216	**2435**	2104	130	201	**-181**	-155	-11	-15	181	3.6	Fail	Pass
R407 South	Church Avenue East	**225**	208	1	16	**214**	199	2	13	**-11**	-9	1	-3	11	0.7	Pass	Pass
R407 South	R407 North	**2131**	1752	136	243	**1985**	1639	121	224	**-146**	-113	-15	-19	146	3.2	Fail	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**387**	361	1	25	**383**	360	1	22	**-4**	-1	0	-3	4	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**0**	0	0	0	**-1**	-1	0	0	1	1.5	Pass	Pass
Palmerstown	Kill West	**459**	416	17	26	**429**	392	14	22	**-30**	-24	-3	-4	30	1.4	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**113**	99	1	13	**109**	96	0	12	**-4**	-3	-1	-1	4	0.4	Pass	Pass
Kill West	N7 on-slip WB	**243**	224	1	18	**241**	224	1	16	**-2**	0	0	-2	2	0.2	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**214**	186	17	12	**190**	166	15	9	**-24**	-20	-2	-3	24	1.7	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**48**	37	5	5	**36**	30	3	3	**-12**	-7	-2	-2	12	1.8	Pass	Pass
Greenhill Overbridge	Kill West	**290**	244	9	38	**264**	229	7	27	**-26**	-15	-2	-11	26	1.6	Pass	Pass
Greenhill Overbridge	Palmerstown	**54**	48	0	6	**54**	51	0	3	**0**	3	0	-3	0	0.0	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**59**	38	8	12	**47**	31	6	10	**-12**	-7	-2	-2	12	1.6	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**39**	34	0	5	**42**	36	0	6	**3**	2	0	1	-3	0.4	Pass	Pass
N7 off-slip WB	Kill West	**50**	42	0	8	**48**	40	0	7	**-2**	-2	0	-1	2	0.3	Pass	Pass
N7 off-slip WB	Palmerstown	**169**	141	4	24	**164**	139	3	22	**-5**	-2	-1	-2	5	0.4	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**2**	1	0	1	**0**	0	0	0	0	0.3	Pass	Pass
The Paddocks	N7 on-slip EB	**7**	4	0	4	**7**	4	0	3	**0**	0	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**5**	2	0	2	**3**	1	0	2	**-2**	-1	0	0	2	0.9	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**77**	65	0	12	**72**	60	0	11	**-5**	-5	0	-1	5	0.6	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**104**	91	0	13	**95**	84	0	11	**-9**	-7	0	-2	9	0.9	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**165**	141	9	15	**144**	124	7	13	**-21**	-17	-2	-2	21	1.7	Pass	Pass
N7 off-slip EB	The Paddocks	**6**	5	0	1	**4**	4	0	0	**-2**	-1	0	-1	2	0.9	Pass	Pass
Greenhill Overbridge	N7 Access Road	**145**	126	5	14	**139**	121	4	13	**-6**	-5	-1	-1	6	0.5	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**366**	332	2	31	**357**	330	2	26	**-9**	-2	0	-5	9	0.5	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**49**	39	2	7	**44**	37	2	5	**-5**	-2	0	-2	5	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 Access Road	N7 on-slip EB	**368**	346	1	20	**378**	367	0	11	**10**	21	-1	-9	-10	0.5	Pass	Pass
N7 Access Road	Greenhill Overbridge	**220**	185	5	30	**206**	185	4	17	**-14**	0	-1	-13	14	1.0	Pass	Pass
N7 Access Road	The Paddocks	**4**	2	0	1	**3**	2	0	2	**-1**	0	0	1	1	0.3	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**101**	91	0	9	**92**	66	0	25	**-9**	-25	0	16	9	0.9	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**4**	1	4	0	**2**	-1	4	0	-2	0.9	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**562**	516	2	44	**568**	534	4	30	**6**	18	2	-14	-6	0.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**492**	483	0	9	**539**	504	4	30	**47**	21	4	21	-47	2.1	Pass	Pass
Church Avenue East	Church Avenue West	**65**	64	0	1	**73**	48	0	25	**8**	-16	0	24	-8	0.9	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**508**	474	3	30	**523**	489	4	30	**15**	15	1	0	-15	0.7	Pass	Pass
Church Avenue west	Golf Club	**12**	12	0	0	**13**	13	0	0	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue East	**52**	52	0	0	**48**	48	0	0	**-4**	-4	0	0	4	0.6	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**13**	13	0	0	**9**	9	0	0	**-4**	-4	0	0	4	1.2	Pass	Pass
Church Avenue East	Church Avenue west	**74**	64	0	9	**74**	49	0	25	**0**	-15	0	16	0	0.0	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**14**	14	0	0	**8**	8	0	0	**-6**	-6	0	0	6	1.9	Pass	Pass
Church Avenue East	Church Avenue west	**87**	77	0	9	**83**	58	0	25	**-4**	-19	0	16	4	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**11**	11	0	0	**12**	12	0	0	**1**	1	0	0	-1	0.4	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**560**	524	4	33	**557**	523	4	30	**-3**	-1	0	-3	3	0.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**13**	13	0	0	**12**	12	0	0	**-1**	-1	0	0	1	0.2	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**103**	71	5	28	**96**	67	4	25	**-7**	-4	-1	-3	7	0.7	Pass	Pass
Church Avenue East	Garden Centre	**121**	121	0	0	**115**	115	0	0	**-6**	-6	0	0	6	0.6	Pass	Pass
Church Avenue west	Church Avenue East	**562**	516	2	44	**567**	533	4	30	**5**	17	2	-14	-5	0.2	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**30**	30	0	0	**24**	24	0	0	**-6**	-6	0	0	6	1.1	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**79**	70	0	9	**73**	48	0	24	**-6**	-22	0	15	6	0.7	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**520**	483	4	34	**540**	506	4	30	**20**	23	0	-4	-20	0.9	Pass	Pass
Church Avenue West	School	**231**	231	0	0	**243**	243	0	0	**12**	12	0	0	-12	0.7	Pass	Pass
School	Church Avenue West	**146**	146	0	0	**141**	141	0	0	**-5**	-5	0	0	5	0.4	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

DS 2037 PM Peak

Location		Observed				Model				Difference				Difference			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2344**	2039	74	231	**2197**	1915	65	216	**-147**	-124	-9	-15	147	3.1	Fail	Pass
R407 North	Church Avenue East	**126**	117	0	9	**127**	121	0	6	**1**	4	0	-3	-1	0.1	Pass	Pass
R407 South	R407 North	**3034**	2695	103	236	**2844**	2514	102	228	**-190**	-181	-1	-8	190	3.5	Fail	Pass
R407 South	Church Avenue East	**35**	35	0	0	**33**	33	0	0	**-2**	-2	0	0	2	0.4	Pass	Pass
Church Avenue East	R407 South	**156**	136	0	20	**140**	120	0	21	**-16**	-16	0	1	16	1.3	Pass	Pass
Church Avenue East	R407 North	**25**	22	0	2	**22**	21	0	1	**-3**	-1	0	-1	3	0.6	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**180**	158	0	22	**160**	138	0	22	**-20**	-20	0	0	20	1.6	Pass	Pass
Church Avenue East	Church Avenue South	**442**	406	1	35	**391**	346	8	37	**-51**	-60	7	2	51	2.5	Pass	Pass
Church Avenue North	Church Avenue West	**4**	4	0	0	**3**	3	0	0	**-1**	-1	0	0	1	0.3	Pass	Pass
Church Avenue North	Church Avenue East	**33**	32	0	1	**37**	35	0	3	**4**	3	0	2	-4	0.7	Pass	Pass
Church Avenue West	Church Avenue South	**15**	15	0	0	**15**	15	0	0	**0**	0	0	0	0	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**148**	139	0	9	**147**	142	0	6	**-1**	3	0	-3	1	0.1	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**154**	144	0	10	**122**	115	0	7	**-32**	-29	0	-3	32	2.7	Pass	Pass
Church Avenue East	R407 North	**335**	298	1	36	**279**	242	8	29	**-56**	-56	7	-7	56	3.2	Pass	Pass
R407 North	Church Avenue East	**9**	6	0	2	**7**	4	0	3	**-2**	-2	0	1	2	0.6	Pass	Pass
R407 North	R407 South	**2476**	2163	74	239	**2376**	2071	66	239	**-100**	-92	-8	0	100	2.0	Fail	Pass
R407 South	Church Avenue East	**36**	36	0	0	**33**	33	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
R407 South	R407 North	**2730**	2413	104	213	**2601**	2308	94	199	**-129**	-105	-10	-14	129	2.5	Fail	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**246**	224	4	18	**236**	216	4	16	**-10**	-8	0	-2	10	0.6	Pass	Pass
Palmerstown	N7 on-slip WB	**6**	6	0	0	**5**	5	0	0	**-1**	-1	0	0	1	0.4	Pass	Pass
Palmerstown	Kill West	**332**	297	10	26	**316**	286	8	23	**-16**	-11	-2	-3	16	0.9	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**279**	253	1	25	**263**	239	0	23	**-16**	-14	-1	-2	16	1.0	Pass	Pass
Kill West	N7 on-slip WB	**129**	111	5	14	**123**	106	4	14	**-6**	-5	-1	0	6	0.6	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**515**	458	16	42	**499**	448	14	38	**-16**	-10	-2	-4	16	0.7	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**86**	78	3	5	**75**	71	1	3	**-11**	-7	-2	-2	11	1.2	Pass	Pass
Greenhill Overbridge	Kill West	**343**	311	4	29	**315**	291	3	21	**-28**	-20	-1	-8	28	1.6	Pass	Pass
Greenhill Overbridge	Palmerstown	**119**	116	0	4	**118**	116	0	2	**-1**	0	0	-2	1	0.1	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**267**	225	1	41	**263**	226	1	35	**-4**	1	0	-6	4	0.3	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**278**	239	2	36	**269**	235	1	33	**-9**	-4	-1	-3	9	0.5	Pass	Pass
N7 off-slip WB	Kill West	**31**	25	0	6	**32**	26	0	6	**1**	1	0	0	-1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**641**	597	4	41	**614**	576	3	34	**-27**	-21	-1	-7	27	1.1	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**8**	8	0	0	**7**	7	0	0	**-1**	-1	0	0	1	0.5	Pass	Pass
The Paddocks	N7 on-slip EB	**13**	9	0	4	**13**	10	0	4	**0**	1	0	0	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**55**	51	1	2	**49**	46	1	1	**-6**	-5	0	-1	6	0.8	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**90**	85	1	4	**86**	82	1	4	**-4**	-3	0	0	4	0.4	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**78**	71	2	5	**69**	64	2	4	**-9**	-7	0	-1	9	1.1	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**212**	187	4	22	**195**	171	4	20	**-17**	-16	0	-2	17	1.2	Pass	Pass
N7 off-slip EB	The Paddocks	**6**	4	0	1	**4**	3	0	0	**-2**	-1	0	-1	2	0.9	Pass	Pass
Greenhill Overbridge	N7 Access Road	**534**	468	5	61	**513**	454	3	56	**-21**	-14	-2	-5	21	0.9	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**253**	230	2	20	**239**	219	2	18	**-14**	-11	0	-2	14	0.9	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**13**	10	1	1	**9**	8	1	1	**-4**	-2	0	0	4	1.2	Pass	Pass
N7 Access Road	N7 Access Road	**0**	0	0	0	**1**	1	0	0	**1**	1	0	0	-1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**70**	64	0	6	**60**	57	0	3	**-10**	-7	0	-3	10	1.3	Pass	Pass
N7 Access Road	Greenhill Overbridge	**281**	267	0	14	**267**	262	0	5	**-14**	-5	0	-9	14	0.8	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	1	0	0	**0**	0	0	0	0	0.3	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**0**	0	0	0	**543**	480	4	60	**543**	480	4	60	-543	33.0	Fail	Fail
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**4**	0	4	0	**4**	0	4	0	-4	2.8	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**2**	2	0	0	**1**	1	0	0	-1	0.6	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**223**	211	0	12	**210**	202	0	8	**-13**	-9	0	-4	13	0.9	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue West	Church Avenue East	**0**	0	0	0	**172**	164	0	8	**172**	164	0	8	-172	18.5	Fail	Fail
Church Avenue East	Church Avenue West	**0**	0	0	0	**509**	443	8	59	**509**	443	8	59	-509	31.9	Fail	Fail
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue west	Church Avenue East	**157**	149	0	8	**161**	153	0	8	**4**	4	0	0	-4	0.3	Pass	Pass
Church Avenue west	Golf Club	**12**	12	0	0	**11**	11	0	0	**-1**	-1	0	0	1	0.3	Pass	Pass
Golf Club	Church Avenue East	**32**	32	0	0	**24**	24	0	0	**-8**	-8	0	0	8	1.5	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Golf Club	**9**	9	0	0	**6**	6	0	0	**-3**	-3	0	0	3	1.3	Pass	Pass
Church Avenue East	Church Avenue west	**551**	491	4	56	**514**	447	8	59	**-37**	-44	4	3	37	1.6	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Landfill	**18**	18	0	0	**17**	17	0	0	**-1**	-1	0	0	1	0.3	Pass	Pass
Church Avenue East	Church Avenue west	**560**	500	4	56	**528**	461	8	59	**-32**	-39	4	3	32	1.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**9**	9	0	0	**9**	9	0	0	-9	4.2	Pass	Pass
Church Avenue west	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue west	Church Avenue East	**189**	180	0	9	**174**	167	0	8	**-15**	-13	0	-1	15	1.1	Pass	Pass
Landfill	Landfill	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**24**	24	0	0	**36**	36	0	0	**12**	12	0	0	-12	2.1	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**569**	497	6	66	**544**	480	4	60	**-25**	-17	-2	-6	25	1.0	Pass	Pass
Church Avenue East	Garden Centre	**64**	64	0	0	**61**	61	0	0	**-3**	-3	0	0	3	0.4	Pass	Pass
Church Avenue west	Church Avenue East	**223**	211	0	12	**212**	204	0	8	**-11**	-7	0	-4	11	0.7	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**129**	129	0	0	**120**	120	0	0	**-9**	-9	0	0	9	0.8	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**575**	513	4	59	**507**	441	8	59	**-68**	-72	4	0	68	2.9	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**169**	159	0	10	**172**	164	0	8	**3**	5	0	-2	-3	0.2	Pass	Pass
Church Avenue West	School	**12**	12	0	0	**12**	12	0	0	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**47**	47	0	0	**44**	44	0	0	**-3**	-3	0	0	3	0.5	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	0	0	0	**0**	0	0	0	0	0.0	Pass	Pass

Location		Observed				Model				Difference				Difference (%)			
From	To	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Total	Cars	HGV	LGV	Difference	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**2043**	1761	112	170	**2038**	**1748**	**109**	**182**	**-5**	-13	-3	12	5	0.1	Pass	Pass
R407 North	Church Avenue East	**396**	379	2	15	**404**	**391**	**2**	**11**	**8**	12	0	-4	-8	0.4	Pass	Pass
R407 South	R407 North	**1670**	1361	111	198	**1701**	**1384**	**110**	**207**	**31**	23	-1	9	-31	0.8	Pass	Pass
R407 South	Church Avenue East	**93**	88	0	5	**93**	**89**	**0**	**5**	**0**	1	0	0	0	0.0	Pass	Pass
Church Avenue East	R407 South	**45**	44	0	1	**46**	**45**	**0**	**1**	**1**	1	0	0	-1	0.1	Pass	Pass
Church Avenue East	R407 North	**8**	8	0	0	**7**	**7**	**0**	**0**	**-1**	-1	0	0	1	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**44**	44	0	0	**43**	**43**	**0**	**0**	**-1**	-1	0	0	1	0.2	Pass	Pass
Church Avenue East	Church Avenue South	**139**	132	2	5	**147**	**120**	**4**	**23**	**8**	-12	2	18	-8	0.7	Pass	Pass
Church Avenue North	Church Avenue West	**8**	7	0	1	**10**	**9**	**0**	**1**	**2**	2	0	0	-2	0.7	Pass	Pass
Church Avenue North	Church Avenue East	**159**	148	1	10	**191**	**177**	**2**	**13**	**32**	29	1	3	-32	2.4	Pass	Pass
Church Avenue West	Church Avenue South	**27**	26	0	1	**27**	**26**	**0**	**1**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**460**	440	2	18	**479**	**462**	**2**	**15**	**19**	22	0	-3	-19	0.9	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**82**	79	1	2	**81**	**72**	**2**	**7**	**-1**	-7	1	5	1	0.1	Pass	Pass
Church Avenue East	R407 North	**90**	83	1	6	**94**	**75**	**2**	**16**	**4**	-8	1	10	-4	0.4	Pass	Pass
R407 North	Church Avenue East	**14**	13	0	1	**17**	**15**	**0**	**2**	**3**	2	0	1	-3	0.8	Pass	Pass
R407 North	R407 South	**2080**	1796	112	172	**2104**	**1810**	**111**	**183**	**24**	14	-1	11	-24	0.5	Pass	Pass
R407 South	Church Avenue East	**186**	172	1	13	**184**	**171**	**2**	**12**	**-2**	-1	1	-1	2	0.1	Pass	Pass
R407 South	R407 North	**1681**	1382	107	192	**1701**	**1397**	**108**	**196**	**20**	15	1	4	-20	0.5	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**321**	299	1	21	**325**	**303**	**1**	**20**	**4**	4	0	-1	-4	0.2	Pass	Pass
Palmerstown	N7 on-slip WB	**1**	1	0	0	**1**	**1**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Palmerstown	Kill West	**373**	338	14	21	**376**	**343**	**13**	**21**	**3**	5	-1	0	-3	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**93**	81	1	11	**95**	**83**	**1**	**12**	**2**	2	0	1	-2	0.2	Pass	Pass
Kill West	N7 on-slip WB	**204**	188	1	15	**211**	**195**	**1**	**15**	**7**	7	0	0	-7	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**167**	145	13	9	**163**	**141**	**12**	**9**	**-4**	-4	-1	0	4	0.3	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**36**	28	4	4	**31**	**25**	**3**	**3**	**-5**	-3	-1	-1	5	0.9	Pass	Pass
Greenhill Overbridge	Kill West	**236**	198	7	31	**228**	**197**	**6**	**24**	**-8**	-1	-1	-7	8	0.5	Pass	Pass
Greenhill Overbridge	Palmerstown	**45**	40	0	5	**47**	**44**	**0**	**3**	**2**	4	0	-2	-2	0.3	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**42**	27	6	9	**42**	**25**	**7**	**10**	**0**	-2	1	1	0	0.0	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**33**	29	0	4	**36**	**31**	**0**	**6**	**3**	2	0	2	-3	0.5	Pass	Pass
N7 off-slip WB	Kill West	**42**	35	0	7	**41**	**33**	**0**	**8**	**-1**	-2	0	1	1	0.2	Pass	Pass
N7 off-slip WB	Palmerstown	**139**	116	3	20	**142**	**118**	**3**	**21**	**3**	2	0	1	-3	0.3	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**2**	1	0	1	**1**	**1**	**0**	**0**	**-1**	0	0	-1	1	0.8	Pass	Pass
The Paddocks	N7 on-slip EB	**6**	3	0	3	**5**	**3**	**0**	**2**	**-1**	0	0	-1	1	0.4	Pass	Pass
The Paddocks	Greenhill Overbridge	**4**	2	0	2	**4**	**2**	**0**	**2**	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**62**	52	0	10	**58**	**47**	**0**	**11**	**-4**	-5	0	1	4	0.5	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**88**	77	0	11	**81**	**71**	**0**	**9**	**-7**	-6	0	-2	7	0.8	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**132**	113	7	12	**122**	**105**	**6**	**11**	**-10**	-8	-1	-1	10	0.9	Pass	Pass
N7 off-slip EB	The Paddocks	**5**	4	0	1	**4**	**4**	**0**	**0**	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**111**	96	4	11	**116**	**99**	**4**	**13**	**5**	3	0	2	-5	0.5	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**306**	278	2	26	**307**	**280**	**2**	**25**	**1**	2	0	-1	-1	0.1	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**39**	31	2	6	**39**	**32**	**2**	**5**	**0**	1	0	-1	0	0.0	Pass	Pass
N7 Access Road	N7 Access Road	**1**	1	0	0	**0**	**0**	**0**	**0**	**-1**	-1	0	0	1	1.4	Pass	Pass
N7 Access Road	N7 on-slip EB	**305**	287	1	17	**327**	**317**	**1**	**10**	**22**	30	0	-7	-22	1.2	Pass	Pass
N7 Access Road	Greenhill Overbridge	**180**	151	4	25	**179**	**160**	**3**	**16**	**-1**	9	-1	-9	1	0.1	Pass	Pass
N7 Access Road	The Paddocks	**3**	2	0	1	**3**	**2**	**0**	**1**	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**76**	68	0	8	**73**	**46**	**4**	**23**	**-3**	-22	4	15	3	0.3	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**2**	2	0	0	**2**	**2**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**466**	427	2	37	**492**	**461**	**3**	**27**	**26**	34	1	-10	-26	1.2	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue East	Church Avenue West	**62**	54	0	8	**63**	**36**	**4**	**23**	**1**	-18	4	15	-1	0.1	Pass	Pass
Church Avenue West	Church Avenue East	**424**	393	3	28	**457**	**426**	**3**	**28**	**33**	33	0	0	-33	1.6	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue East	Church Avenue west	**62**	54	0	8	**63**	**37**	**4**	**23**	**1**	-17	4	15	-1	0.1	Pass	Pass
Church Avenue East	Golf Club	**11**	11	0	0	**7**	**7**	**0**	**0**	**-4**	-4	0	0	4	1.3	Pass	Pass
Church Avenue west	Church Avenue East	**458**	427	3	28	**444**	**413**	**3**	**28**	**-14**	-14	0	0	14	0.7	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**11**	**11**	**0**	**0**	**1**	1	0	0	-1	0.3	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**44**	44	0	0	**46**	**46**	**0**	**0**	**2**	2	0	0	-2	0.3	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Church Avenue west	**73**	65	0	8	**72**	**44**	**4**	**23**	**-1**	-21	4	15	1	0.1	Pass	Pass
Church Avenue East	Landfill	**3**	3	0	0	**1**	**1**	**0**	**0**	**-2**	-2	0	0	2	1.4	Pass	Pass
Church Avenue west	Church Avenue East	**464**	433	3	28	**487**	**456**	**3**	**27**	**23**	23	0	-1	-23	1.1	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**6**	6	0	0	**6**	**6**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**74**	48	4	22	**75**	**48**	**4**	**23**	**1**	0	0	1	-1	0.1	Pass	Pass
Church Avenue East	Garden Centre	**102**	102	0	0	**99**	**99**	**0**	**0**	**-3**	-3	0	0	3	0.3	Pass	Pass
Church Avenue west	Church Avenue East	**466**	427	2	37	**489**	**459**	**3**	**27**	**23**	32	1	-10	-23	1.1	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**25**	25	0	0	**23**	**23**	**0**	**0**	**-2**	-2	0	0	2	0.4	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**62**	54	0	8	**62**	**35**	**4**	**23**	**0**	-19	4	15	0	0.0	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**424**	393	3	28	**459**	**427**	**3**	**28**	**35**	34	0	0	-35	1.7	Pass	Pass
Church Avenue West	School	**195**	195	0	0	**211**	**211**	**0**	**0**	**16**	16	0	0	-16	1.1	Pass	Pass
School	Church Avenue West	**123**	123	0	0	**127**	**127**	**0**	**0**	**4**	4	0	0	-4	0.4	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass

Base Model 2017 PM Peak

Location		Observed				Model				Difference				Difference (%)			
From	To	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Total**	Cars	HGV	LGV	**Difference**	GEH	Flow	GEH
Site 1 R407 / Church Ave, Sallins																	
R407 North	R407 South	**1907**	1659	60	188	**1906**	**1649**	**59**	**198**	**-1**	-10	-1	10	1	0.0	Pass	Pass
R407 North	Church Avenue East	**100**	93	0	7	**104**	**99**	**0**	**5**	**4**	6	0	-2	-4	0.4	Pass	Pass
R407 South	R407 North	**2454**	2180	83	191	**2442**	**2145**	**93**	**203**	**-12**	-35	10	12	12	0.2	Pass	Pass
R407 South	Church Avenue East	**28**	28	0	0	**28**	**28**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	R407 South	**126**	110	0	16	**122**	**104**	**0**	**18**	**-4**	-6	0	2	4	0.4	Pass	Pass
Church Avenue East	R407 North	**20**	18	0	2	**21**	**19**	**0**	**2**	**1**	1	0	0	-1	0.2	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Site 2 Church Ave (W) / Church Ave (S), Sallins																	
Church Avenue East	Church Avenue West	**146**	128	0	18	**139**	**119**	**0**	**20**	**-7**	-9	0	2	7	0.6	Pass	Pass
Church Avenue East	Church Avenue South	**355**	326	1	28	**348**	**306**	**9**	**33**	**-7**	-20	8	5	7	0.4	Pass	Pass
Church Avenue North	Church Avenue West	**2**	2	0	0	**4**	**4**	**0**	**0**	**2**	2	0	0	-2	1.2	Pass	Pass
Church Avenue North	Church Avenue East	**26**	25	0	1	**29**	**26**	**0**	**2**	**3**	1	0	1	-3	0.6	Pass	Pass
Church Avenue West	Church Avenue South	**12**	12	0	0	**12**	**12**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**117**	110	0	7	**120**	**115**	**0**	**5**	**3**	5	0	-2	-3	0.3	Pass	Pass
Site 3 R407 / Church Ave (E)																	
Church Avenue East	R407 South	**123**	115	0	8	**109**	**102**	**0**	**7**	**-14**	-13	0	-1	14	1.3	Pass	Pass
Church Avenue East	R407 North	**270**	240	1	29	**250**	**215**	**9**	**27**	**-20**	-25	8	-2	20	1.2	Pass	Pass
R407 North	Church Avenue East	**7**	5	0	2	**6**	**4**	**0**	**2**	**-1**	-1	0	0	1	0.4	Pass	Pass
R407 North	R407 South	**2018**	1763	60	195	**2055**	**1779**	**60**	**216**	**37**	16	0	21	-37	0.8	Pass	Pass
R407 South	Church Avenue East	**29**	29	0	0	**26**	**26**	**0**	**0**	**-3**	-3	0	0	3	0.6	Pass	Pass
R407 South	R407 North	**2206**	1950	84	172	**2221**	**1959**	**85**	**177**	**15**	9	1	5	-15	0.3	Pass	Pass
Site 10 N7 South Roundabout																	
Palmerstown	Greenhill Overbridge	**204**	186	3	15	**203**	**185**	**4**	**15**	**-1**	-1	1	0	1	0.1	Pass	Pass
Palmerstown	N7 on-slip WB	**5**	5	0	0	**4**	**4**	**0**	**0**	**-1**	-1	0	0	1	0.5	Pass	Pass
Palmerstown	Kill West	**272**	243	8	21	**276**	**248**	**7**	**21**	**4**	5	-1	0	-4	0.2	Pass	Pass
Palmerstown	Palmerstown	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Greenhill Overbridge	**234**	212	1	21	**226**	**205**	**1**	**20**	**-8**	-7	0	-1	8	0.5	Pass	Pass
Kill West	N7 on-slip WB	**104**	89	4	11	**109**	**92**	**4**	**13**	**5**	3	0	2	-5	0.5	Pass	Pass
Kill West	Kill West	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Kill West	Palmerstown	**420**	373	13	34	**433**	**386**	**13**	**34**	**13**	13	0	0	-13	0.6	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	N7 on-slip WB	**67**	61	2	4	**64**	**60**	**1**	**3**	**-3**	-1	-1	-1	3	0.4	Pass	Pass
Greenhill Overbridge	Kill West	**276**	250	3	23	**266**	**243**	**3**	**20**	**-10**	-7	0	-3	10	0.6	Pass	Pass
Greenhill Overbridge	Palmerstown	**97**	94	0	3	**101**	**100**	**0**	**2**	**4**	6	0	-1	-4	0.4	Pass	Pass
N7 off-slip WB	Greenhill Overbridge	**222**	187	1	34	**226**	**192**	**2**	**33**	**4**	5	1	-1	-4	0.3	Pass	Pass
N7 off-slip WB	N7 on-slip WB	**232**	200	2	30	**235**	**203**	**2**	**30**	**3**	3	0	0	-3	0.2	Pass	Pass
N7 off-slip WB	Kill West	**26**	21	0	5	**28**	**22**	**0**	**6**	**2**	1	0	1	-2	0.4	Pass	Pass
N7 off-slip WB	Palmerstown	**537**	500	3	34	**525**	**492**	**3**	**30**	**-12**	-8	0	-4	12	0.5	Pass	Pass
Site 9 N7 North Roundabout																	
The Paddocks	N7 Access Road	**7**	7	0	0	**7**	**7**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
The Paddocks	N7 on-slip EB	**11**	8	0	3	**11**	**9**	**0**	**2**	**0**	1	0	-1	0	0.0	Pass	Pass
The Paddocks	Greenhill Overbridge	**44**	41	1	2	**45**	**42**	**1**	**2**	**1**	1	0	0	-1	0.1	Pass	Pass
The Paddocks	The Paddocks	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
N7 off-slip EB	N7 Access Road	**75**	71	1	3	**71**	**67**	**1**	**3**	**-4**	-4	0	0	4	0.5	Pass	Pass
N7 off-slip EB	N7 on-slip EB	**64**	58	2	4	**60**	**54**	**3**	**3**	**-4**	-4	1	-1	4	0.5	Pass	Pass
N7 off-slip EB	Greenhill Overbridge	**176**	155	3	18	**161**	**139**	**3**	**18**	**-15**	-16	0	0	15	1.2	Pass	Pass
N7 off-slip EB	The Paddocks	**4**	3	0	1	**3**	**3**	**0**	**0**	**-1**	0	0	-1	1	0.5	Pass	Pass
Greenhill Overbridge	N7 Access Road	**444**	389	4	51	**439**	**385**	**3**	**51**	**-5**	-4	-1	0	5	0.2	Pass	Pass
Greenhill Overbridge	N7 on-slip EB	**211**	192	2	17	**209**	**189**	**2**	**17**	**-2**	-3	0	0	2	0.1	Pass	Pass
Greenhill Overbridge	Greenhill Overbridge	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Greenhill Overbridge	The Paddocks	**10**	8	1	1	**8**	**7**	**1**	**0**	**-2**	-1	0	-1	2	0.7	Pass	Pass
N7 Access Road	N7 Access Road	**3**	2	0	1	**2**	**1**	**0**	**0**	**-1**	-1	0	-1	1	0.6	Pass	Pass
N7 Access Road	N7 on-slip EB	**54**	49	0	5	**49**	**47**	**0**	**2**	**-5**	-2	0	-3	5	0.7	Pass	Pass
N7 Access Road	Greenhill Overbridge	**220**	209	0	11	**227**	**222**	**0**	**5**	**7**	13	0	-6	-7	0.5	Pass	Pass
N7 Access Road	The Paddocks	**1**	1	0	0	**1**	**1**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Site 8 N7 Access Road / Johnstown Garden Centre																	
Church Avenue East	Church Avenue West	**473**	423	3	47	**465**	**407**	**4**	**54**	**-8**	-16	1	7	8	0.4	Pass	Pass
Church Avenue East	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue East	Johnstown Garden	**1**	1	0	0	**1**	**1**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Johnstown Garden	Church Avenue West	**0**	0	0	0	**5**	**0**	**5**	**0**	**5**	0	5	0	-5	3.2	Pass	Pass
Johnstown Garden	Church Avenue East	**1**	1	0	0	**3**	**3**	**0**	**0**	**2**	2	0	0	-2	1.4	Pass	Pass
Johnstown Garden	Johnstown Garden	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue West	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**167**	158	0	9	**171**	**164**	**0**	**7**	**4**	6	0	-2	-4	0.3	Pass	Pass
Church Avenue West	Johnstown Garden	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Site 5 Church Ave Railway Bridge																	
Church Avenue East	Church Avenue West	**459**	409	3	47	**450**	**387**	**9**	**53**	**-9**	-22	6	6	9	0.4	Pass	Pass
Church Avenue West	Church Avenue East	**133**	125	0	8	**137**	**130**	**0**	**8**	**4**	5	0	0	-4	0.3	Pass	Pass
Site 6 Kerdiffstown Road / Naas Golf Club																	
Church Avenue East	Church Avenue west	**459**	409	3	47	**453**	**390**	**9**	**54**	**-6**	-19	6	7	6	0.3	Pass	Pass
Church Avenue East	Golf Club	**8**	8	0	0	**6**	**6**	**0**	**0**	**-2**	-2	0	0	2	0.8	Pass	Pass
Church Avenue west	Church Avenue East	**150**	142	0	8	**126**	**119**	**0**	**8**	**-24**	-23	0	0	24	2.0	Pass	Pass
Church Avenue west	Golf Club	**10**	10	0	0	**10**	**10**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue west	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Golf Club	Church Avenue East	**27**	27	0	0	**29**	**29**	**0**	**0**	**2**	2	0	0	-2	0.4	Pass	Pass
Site 7 Kerdiffstown Road / Landfill Site																	
Church Avenue East	Church Avenue west	**467**	417	3	47	**464**	**402**	**9**	**54**	**-3**	-15	6	7	3	0.1	Pass	Pass
Church Avenue East	Landfill	**6**	6	0	0	**4**	**4**	**0**	**0**	**-2**	-2	0	0	2	0.9	Pass	Pass
Church Avenue west	Church Avenue East	**167**	159	0	8	**153**	**146**	**0**	**7**	**-14**	-13	0	-1	14	1.1	Pass	Pass
Church Avenue west	Landfill	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue west	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Landfill	Church Avenue East	**17**	17	0	0	**18**	**18**	**0**	**0**	**1**	1	0	0	-1	0.2	Pass	Pass
Garden Centre																	
Church Avenue East	Church Avenue west	**475**	415	5	55	**466**	**409**	**4**	**54**	**-9**	-6	-1	-1	9	0.4	Pass	Pass
Church Avenue East	Garden Centre	**54**	54	0	0	**50**	**50**	**0**	**0**	**-4**	-4	0	0	4	0.6	Pass	Pass
Church Avenue west	Church Avenue East	**168**	159	0	9	**174**	**167**	**0**	**7**	**6**	8	0	-2	-6	0.5	Pass	Pass
Church Avenue west	Garden Centre	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue west	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Garden Centre	Church Avenue East	**109**	109	0	0	**107**	**107**	**0**	**0**	**-2**	-2	0	0	2	0.2	Pass	Pass
Site 4 Church Ave / Sallins National School																	
Church Avenue East	Church Avenue West	**459**	409	3	47	**447**	**385**	**9**	**53**	**-12**	-24	6	6	12	0.6	Pass	Pass
Church Avenue East	School	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
Church Avenue West	Church Avenue East	**133**	125	0	8	**138**	**131**	**0**	**8**	**5**	6	0	0	-5	0.4	Pass	Pass
Church Avenue West	School	**10**	10	0	0	**10**	**10**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass
School	Church Avenue West	**40**	40	0	0	**41**	**41**	**0**	**0**	**1**	1	0	0	-1	0.2	Pass	Pass
School	Church Avenue East	**0**	0	0	0	**0**	**0**	**0**	**0**	**0**	0	0	0	0	0.0	Pass	Pass

Appendix A14.2 TRICS Output Files

Calculation Reference: AUDIT-202601-161121-1103

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 07 - LEISURE
Category : M - COUNTRY PARKS
VEHICLES

Selected regions and areas:

03	SOUTH WEST		
	GS	GLOUCESTERSHIRE	1 days
08	NORTH WEST		
	LC	LANCASHIRE	1 days
12	CONNAUGHT		
	GA	GALWAY	1 days
	RO	ROSCOMMON	1 days
13	MUNSTER		
	LI	LIMERICK	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Filtering Stage 2 selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Site area
Actual Range: 16.00 to 323.00 (units: hect)
Range Selected by User: 15.20 to 560.00 (units: hect)

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/08 to 12/05/12

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Saturday	4 days
Sunday	1 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	5 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Free Standing (PPS6 Out of Town)	5

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Out of Town	5

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Filtering Stage 3 selection:

Use Class:

Not Known	2 days
D2	2 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 1 mile:

1,000 or Less	4 days
1,001 to 5,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,000 or Less	3 days
5,001 to 25,000	1 days
125,001 to 250,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

1.1 to 1.5	4 days
1.6 to 2.0	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	5 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

LIST OF SITES relevant to selection parameters

1	GA-07-M-01	COUNTRY PARK		GALWAY
	GORT NEAR GALWAY Free Standing (PPS6 Out of Town) Out of Town			
	Total Site area:		62.00 hect	
	Survey date: SATURDAY		06/08/11	Survey Type: MANUAL
2	GS-07-M-01	COUNTRY PARK		GLOUCESTERSHIRE
	B4070 NEAR GLOUCESTER Free Standing (PPS6 Out of Town) Out of Town			
	Total Site area:		60.80 hect	
	Survey date: SUNDAY		25/04/10	Survey Type: MANUAL
3	LC-07-M-03	COUNTRY PARK		LANCASHIRE
	SKITHAM LANE PILING PRESTON Free Standing (PPS6 Out of Town) Out of Town			
	Total Site area:		16.00 hect	
	Survey date: SATURDAY		12/05/12	Survey Type: MANUAL
4	LI-07-M-01	FOREST PARK		LIMERICK
	KILCORNAN NEAR LIMERICK Free Standing (PPS6 Out of Town) Out of Town			
	Total Site area:		100.00 hect	
	Survey date: SATURDAY		25/06/11	Survey Type: MANUAL
5	RO-07-M-01	COUNTRY PARK		ROSCOMMON
	BOYLE Free Standing (PPS6 Out of Town) Out of Town			
	Total Site area:		323.00 hect	
	Survey date: SATURDAY		16/07/11	Survey Type: MANUAL

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 07 - LEISURE/M - COUNTRY PARKS
VEHICLES
Calculation factor: 1 hect
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	5	112.36	0.050	5	112.36	0.020	5	112.36	0.070
08:00 - 09:00	5	112.36	0.135	5	112.36	0.057	5	112.36	0.192
09:00 - 10:00	5	112.36	0.171	5	112.36	0.105	5	112.36	0.276
10:00 - 11:00	5	112.36	0.283	5	112.36	0.151	5	112.36	0.434
11:00 - 12:00	5	112.36	0.279	5	112.36	0.265	5	112.36	0.544
12:00 - 13:00	5	112.36	0.310	5	112.36	0.251	5	112.36	0.561
13:00 - 14:00	5	112.36	0.340	5	112.36	0.233	5	112.36	0.573
14:00 - 15:00	5	112.36	0.278	5	112.36	0.237	5	112.36	0.515
15:00 - 16:00	5	112.36	0.249	5	112.36	0.285	5	112.36	0.534
16:00 - 17:00	5	112.36	0.169	5	112.36	0.335	5	112.36	0.504
17:00 - 18:00	5	112.36	0.114	5	112.36	0.322	5	112.36	0.436
18:00 - 19:00	5	112.36	0.085	5	112.36	0.158	5	112.36	0.243
19:00 - 20:00	3	133.67	0.035	3	133.67	0.067	3	133.67	0.102
20:00 - 21:00	1	323.00	0.006	1	323.00	0.037	1	323.00	0.043
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			2.504			2.523			5.027

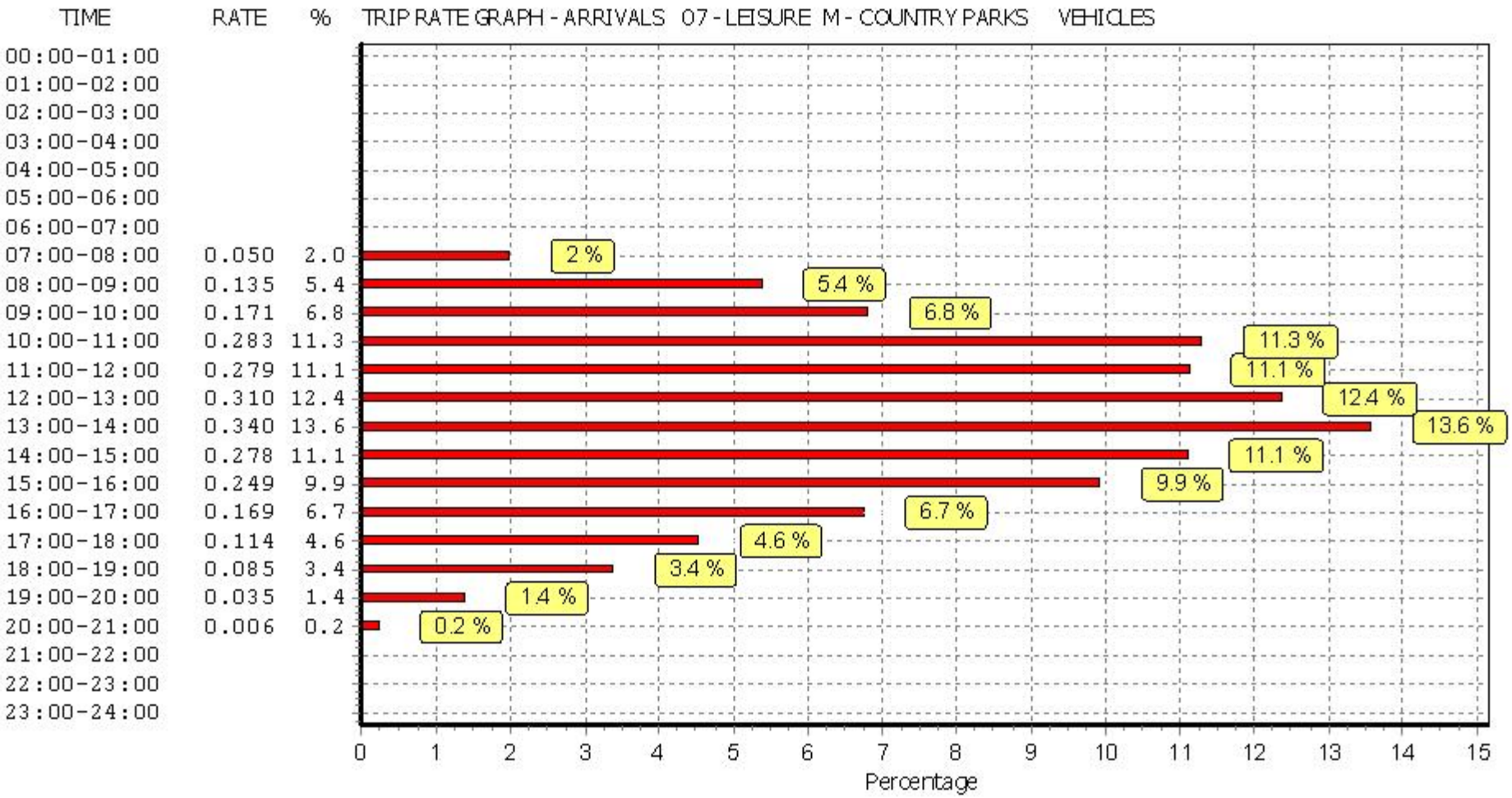
This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

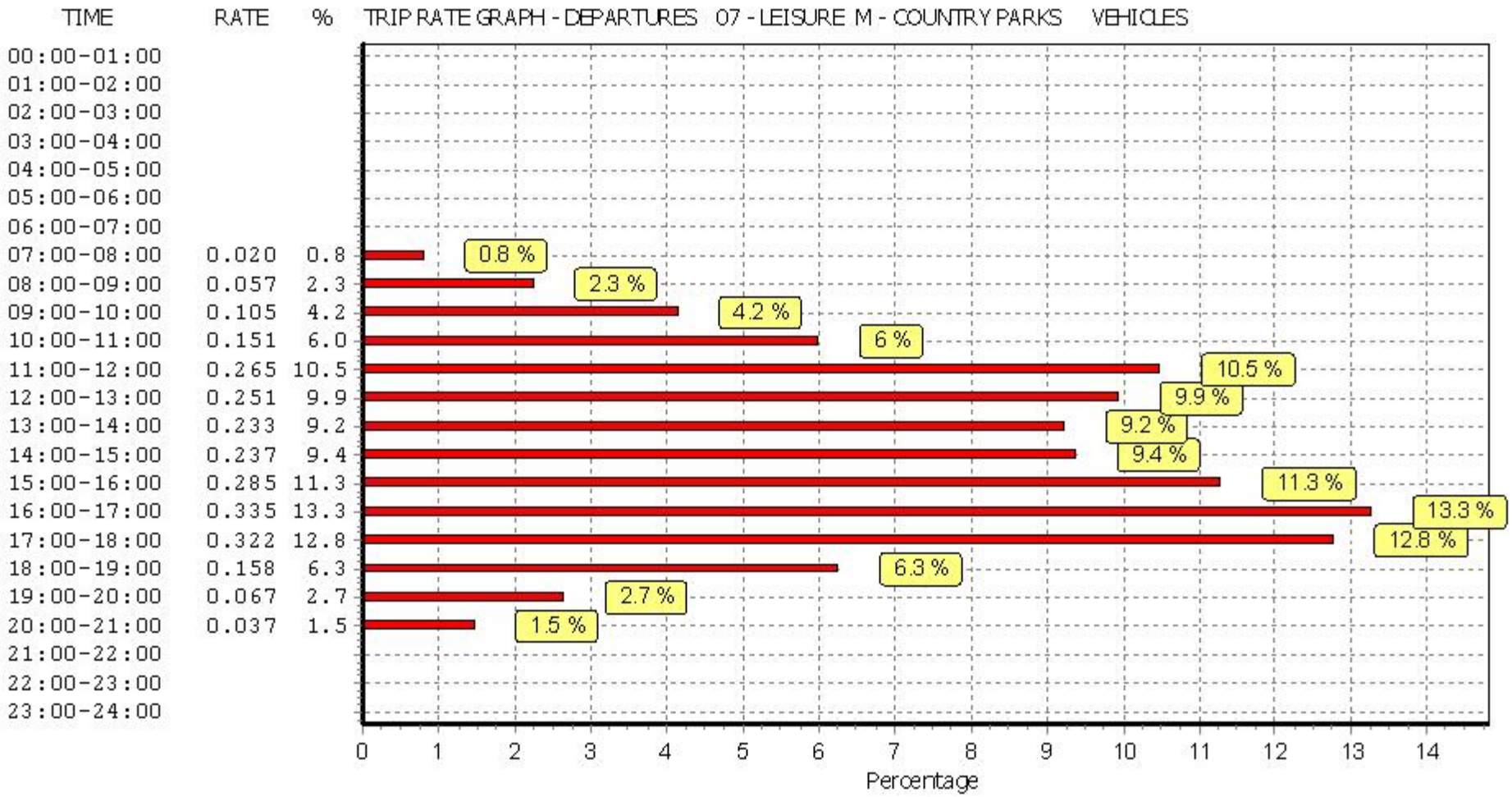
Parameter summary

Trip rate parameter range selected:	16.00 to 323.00 (units: hect)
Survey date date range:	01/01/08 - 12/05/12
Number of weekdays (Monday-Friday):	0
Number of Saturdays:	4
Number of Sundays:	1
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

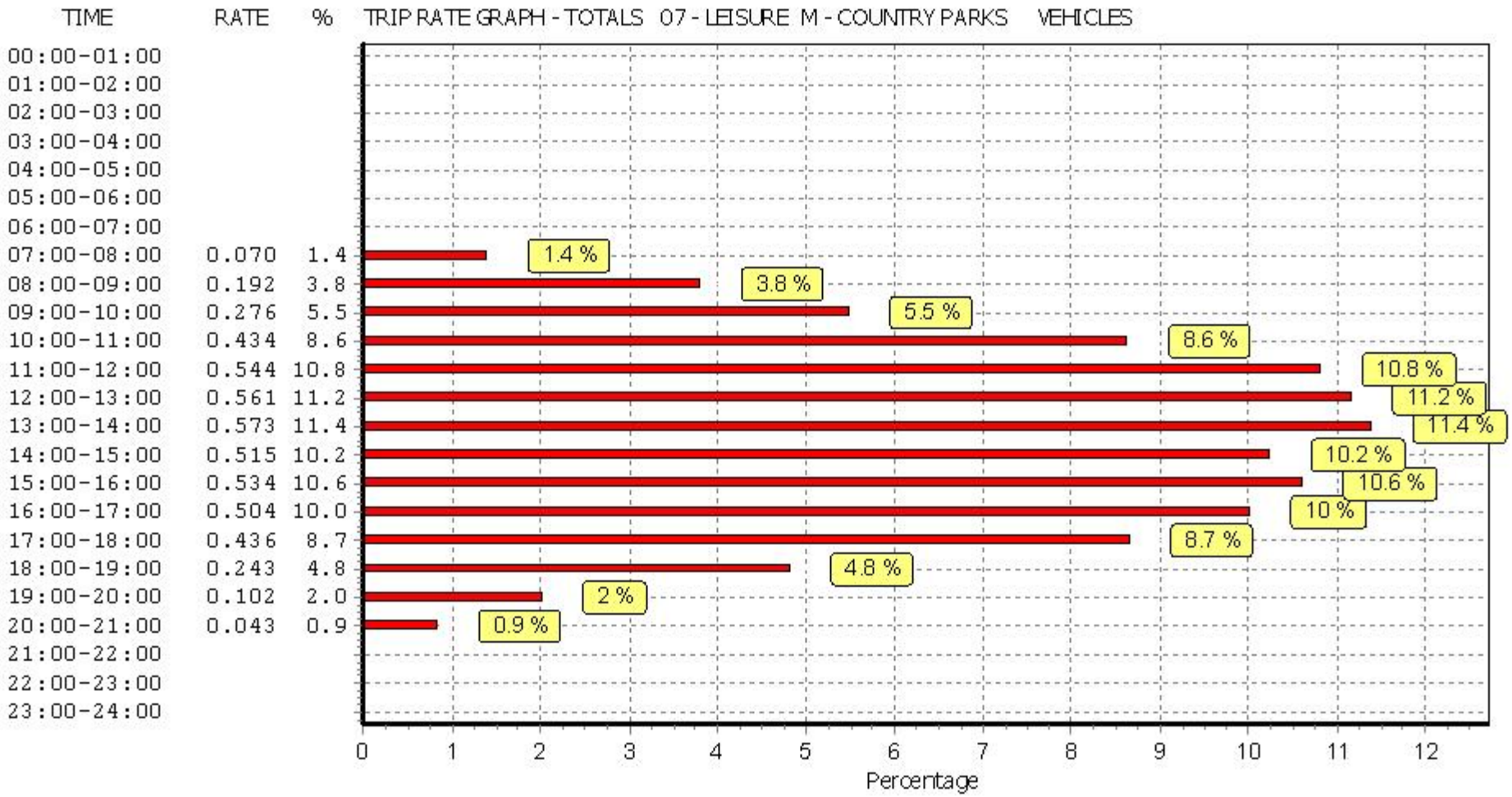


This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

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This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

TRIP RATE for Land Use 07 - LEISURE/M - COUNTRY PARKS
TAXIS
Calculation factor: 1 hect
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
08:00 - 09:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
09:00 - 10:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
10:00 - 11:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
11:00 - 12:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
12:00 - 13:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
13:00 - 14:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
14:00 - 15:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
15:00 - 16:00	5	112.36	0.002	5	112.36	0.000	5	112.36	0.002
16:00 - 17:00	5	112.36	0.000	5	112.36	0.002	5	112.36	0.002
17:00 - 18:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
18:00 - 19:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
19:00 - 20:00	3	133.67	0.000	3	133.67	0.000	3	133.67	0.000
20:00 - 21:00	1	323.00	0.000	1	323.00	0.000	1	323.00	0.000
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.002			0.002			0.004

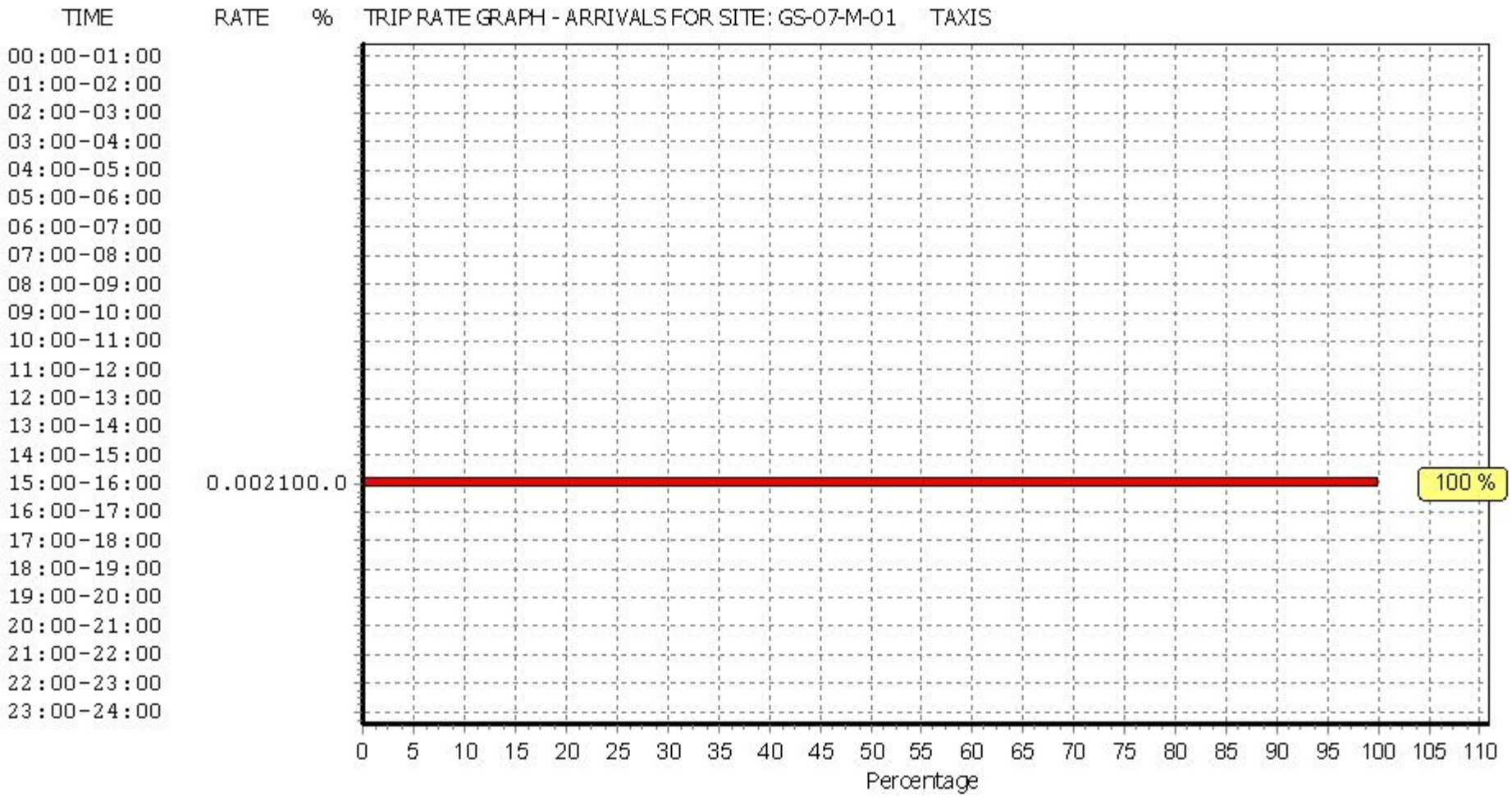
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To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.

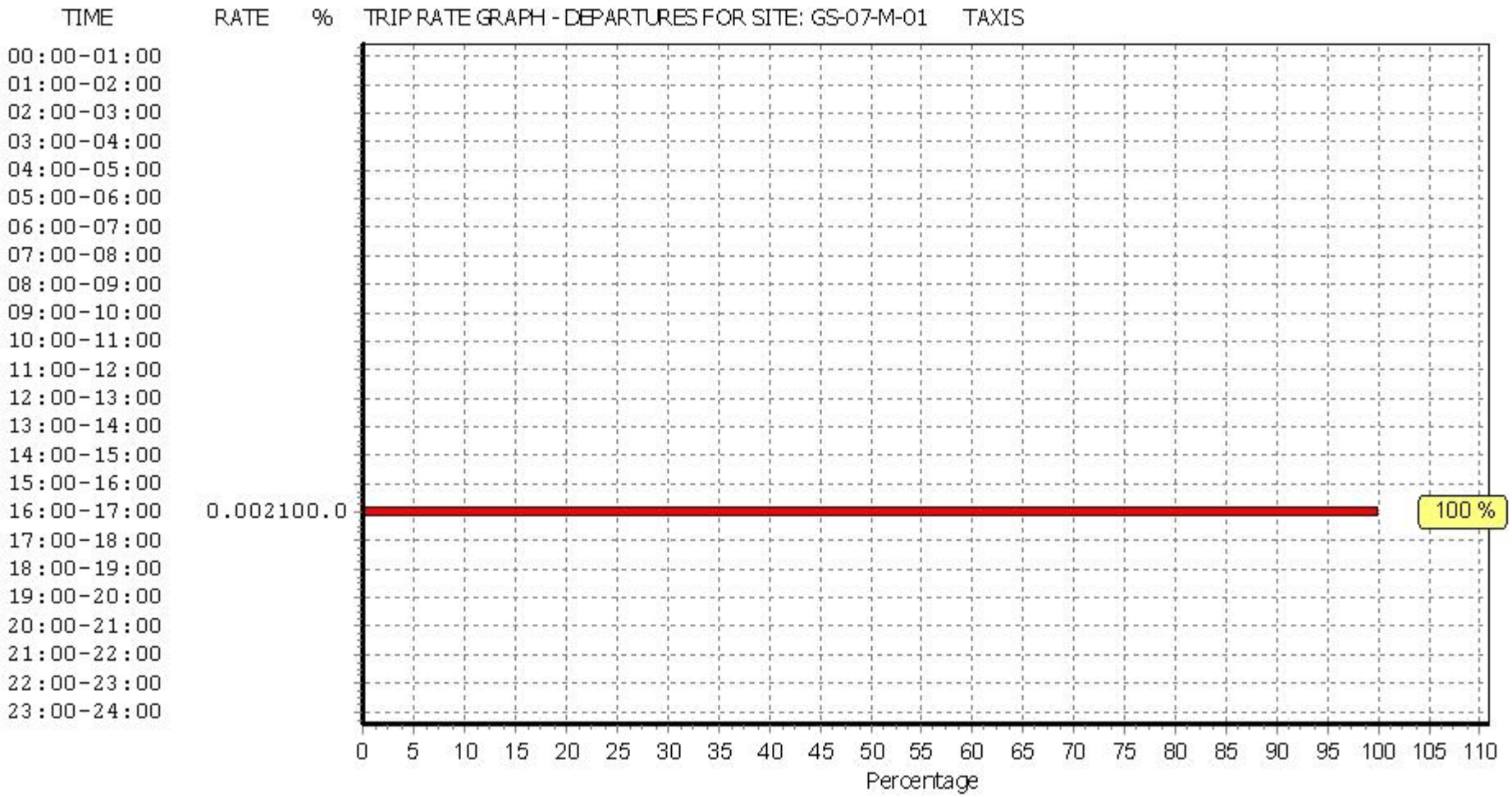
Parameter summary

Trip rate parameter range selected:	16.00 to 323.00 (units: hect)
Survey date date range:	01/01/08 - 12/05/12
Number of weekdays (Monday-Friday):	0
Number of Saturdays:	4
Number of Sundays:	1
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

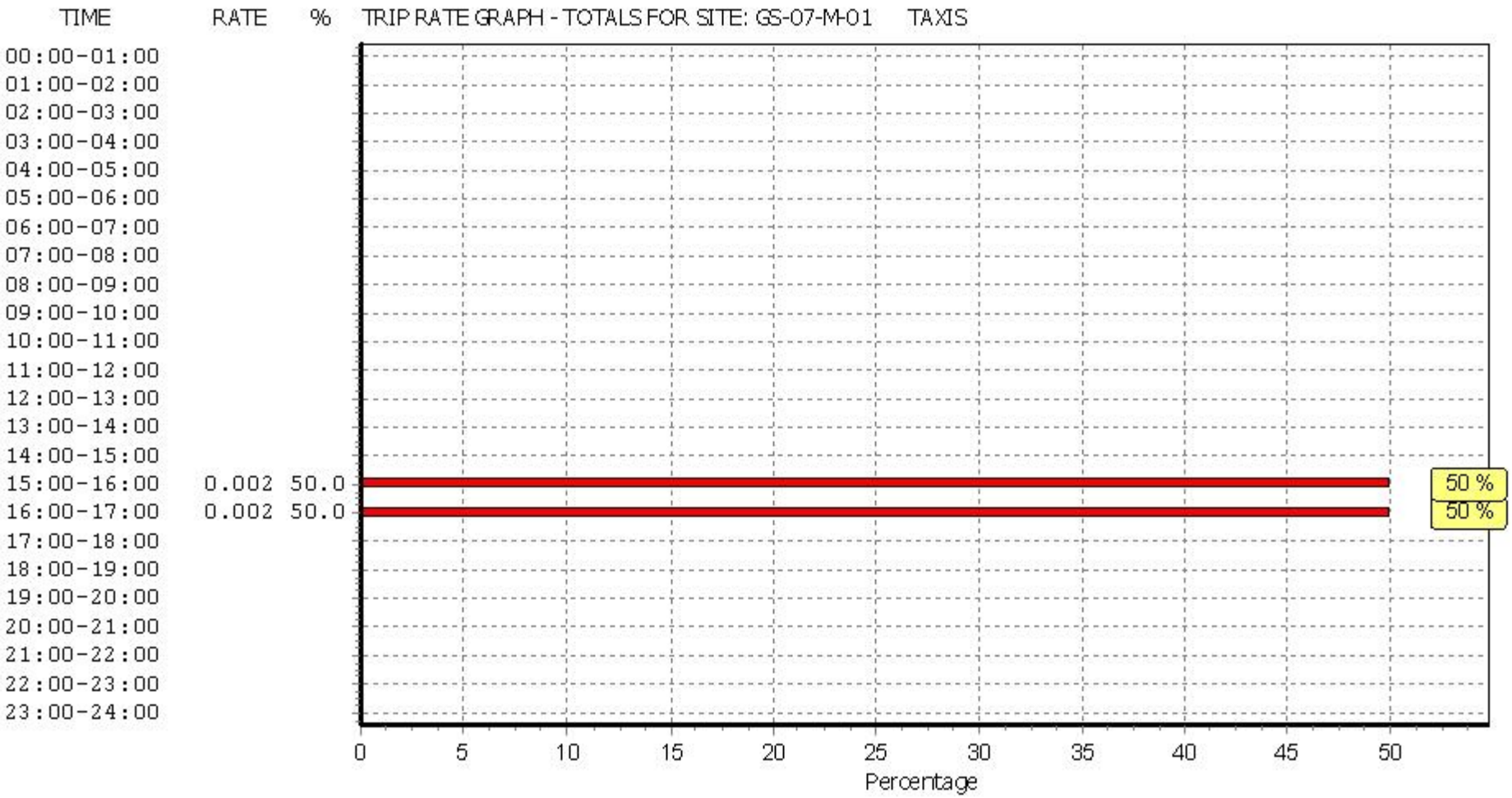
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TRIP RATE for Land Use 07 - LEISURE/M - COUNTRY PARKS
OGVS
Calculation factor: 1 hect
BOLD print indicates peak (busiest) period

Time Range	ARRIVALS			DEPARTURES			TOTALS		
	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
08:00 - 09:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
09:00 - 10:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
10:00 - 11:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
11:00 - 12:00	5	112.36	0.002	5	112.36	0.002	5	112.36	0.004
12:00 - 13:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
13:00 - 14:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
14:00 - 15:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
15:00 - 16:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
16:00 - 17:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
17:00 - 18:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
18:00 - 19:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
19:00 - 20:00	3	133.67	0.000	3	133.67	0.000	3	133.67	0.000
20:00 - 21:00	1	323.00	0.000	1	323.00	0.000	1	323.00	0.000
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.002			0.002			0.004

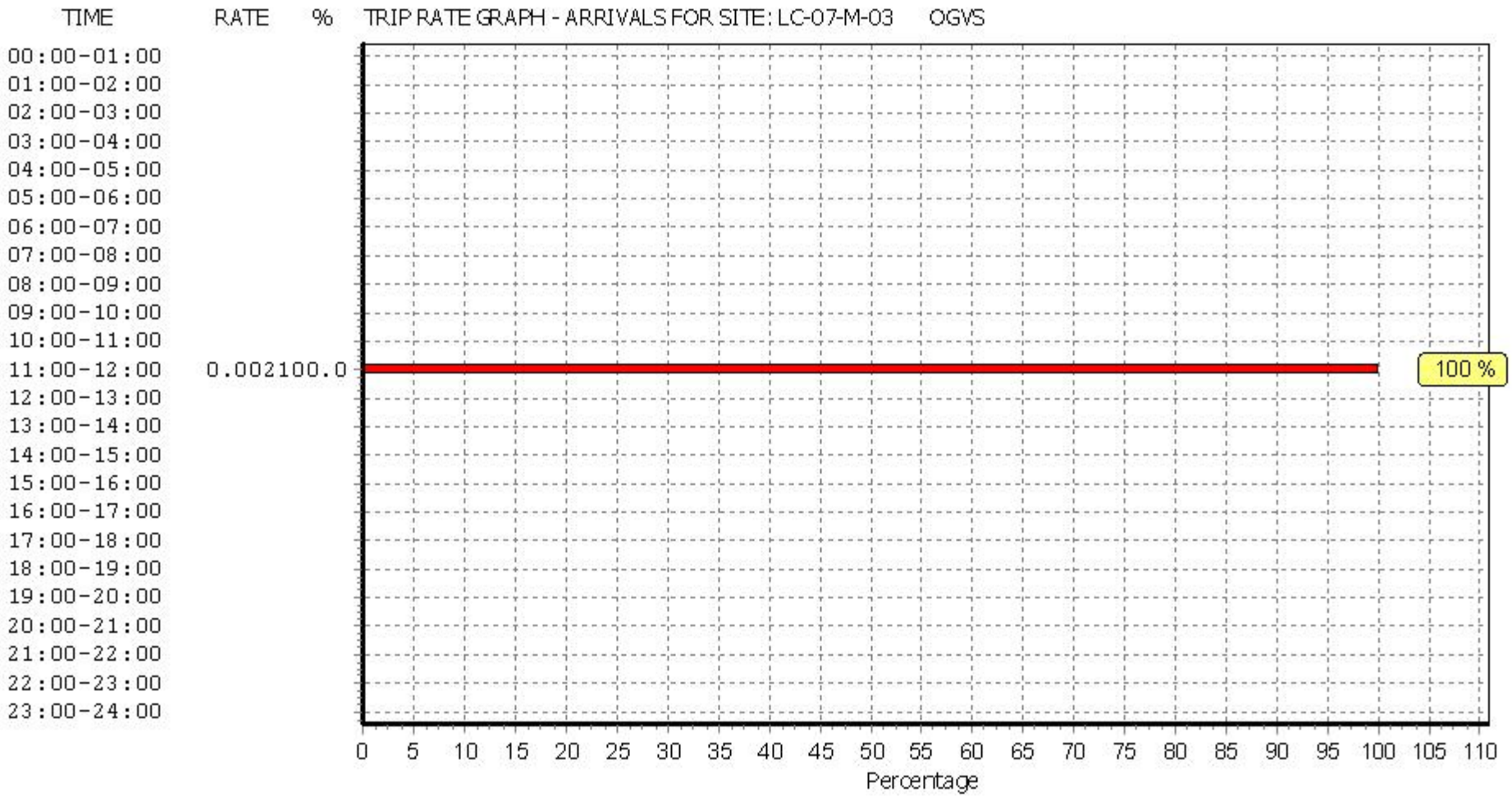
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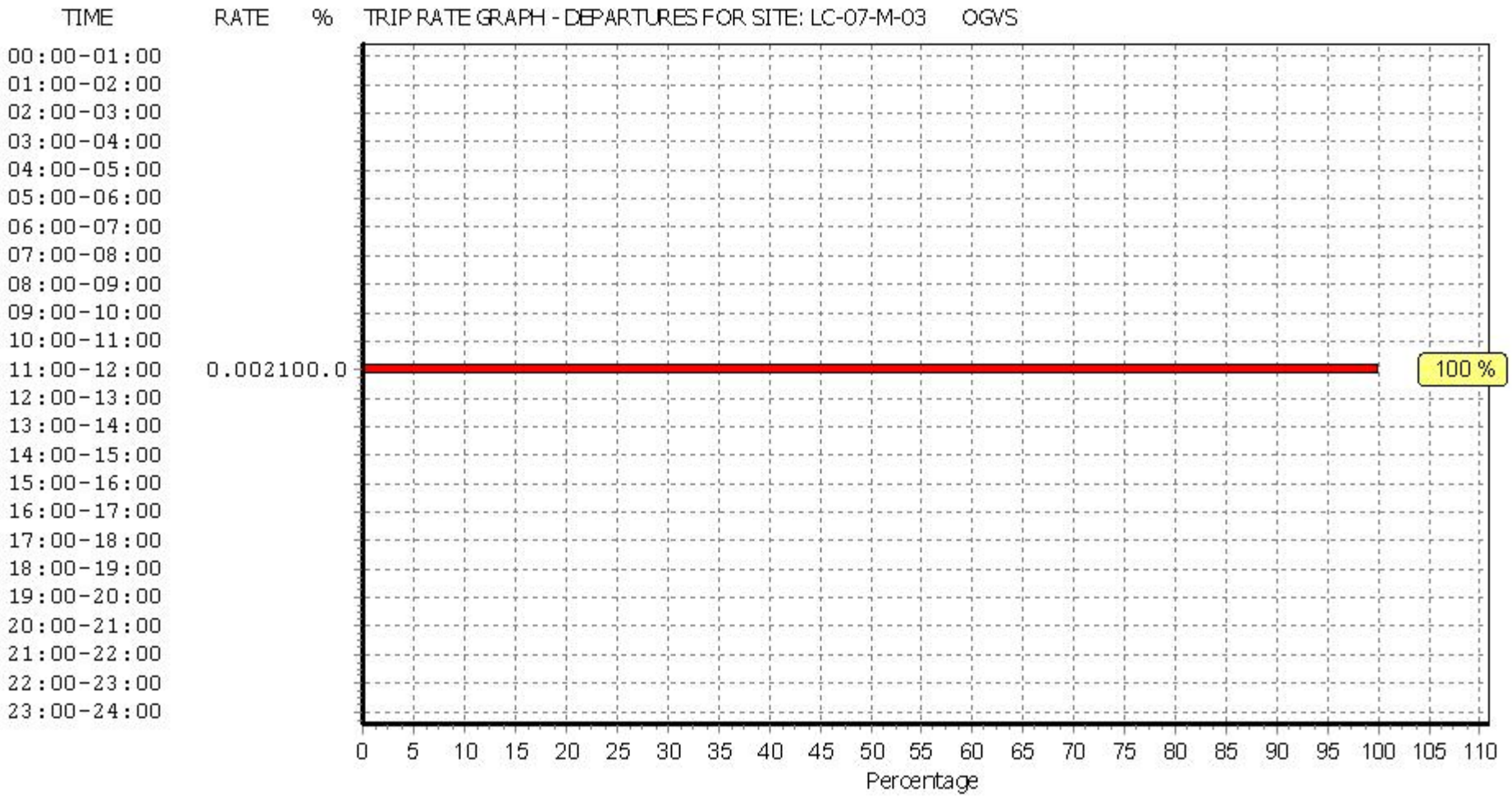
Parameter summary

Trip rate parameter range selected:	16.00 to 323.00 (units: hect)
Survey date date range:	01/01/08 - 12/05/12
Number of weekdays (Monday-Friday):	0
Number of Saturdays:	4
Number of Sundays:	1
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

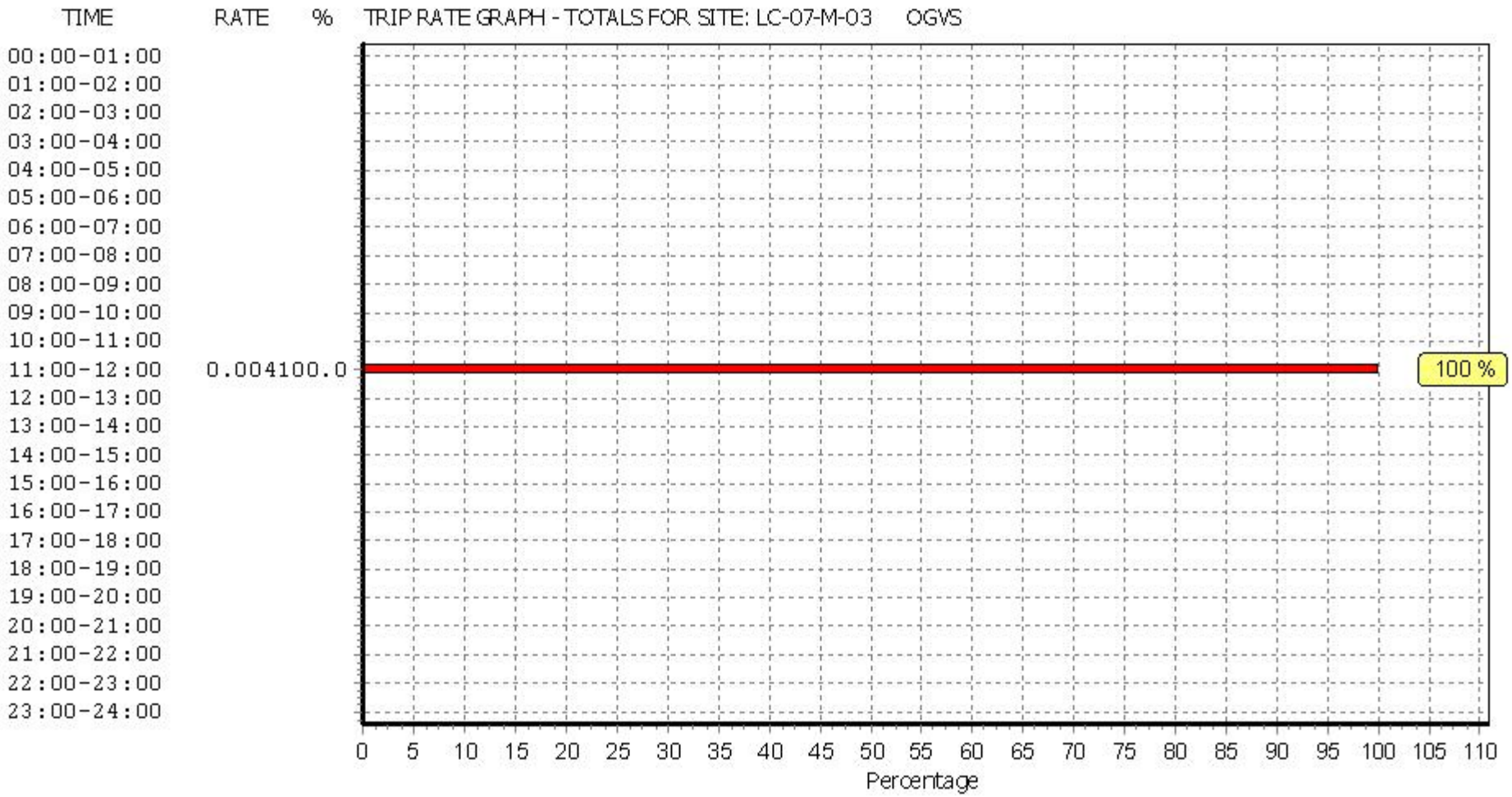
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TRIP RATE for Land Use 07 - LEISURE/M - COUNTRY PARKS
PSVS
Calculation factor: 1 hect
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
08:00 - 09:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
09:00 - 10:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
10:00 - 11:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
11:00 - 12:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
12:00 - 13:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
13:00 - 14:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
14:00 - 15:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
15:00 - 16:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
16:00 - 17:00	5	112.36	0.002	5	112.36	0.000	5	112.36	0.002
17:00 - 18:00	5	112.36	0.000	5	112.36	0.002	5	112.36	0.002
18:00 - 19:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
19:00 - 20:00	3	133.67	0.000	3	133.67	0.000	3	133.67	0.000
20:00 - 21:00	1	323.00	0.000	1	323.00	0.000	1	323.00	0.000
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.002			0.002			0.004

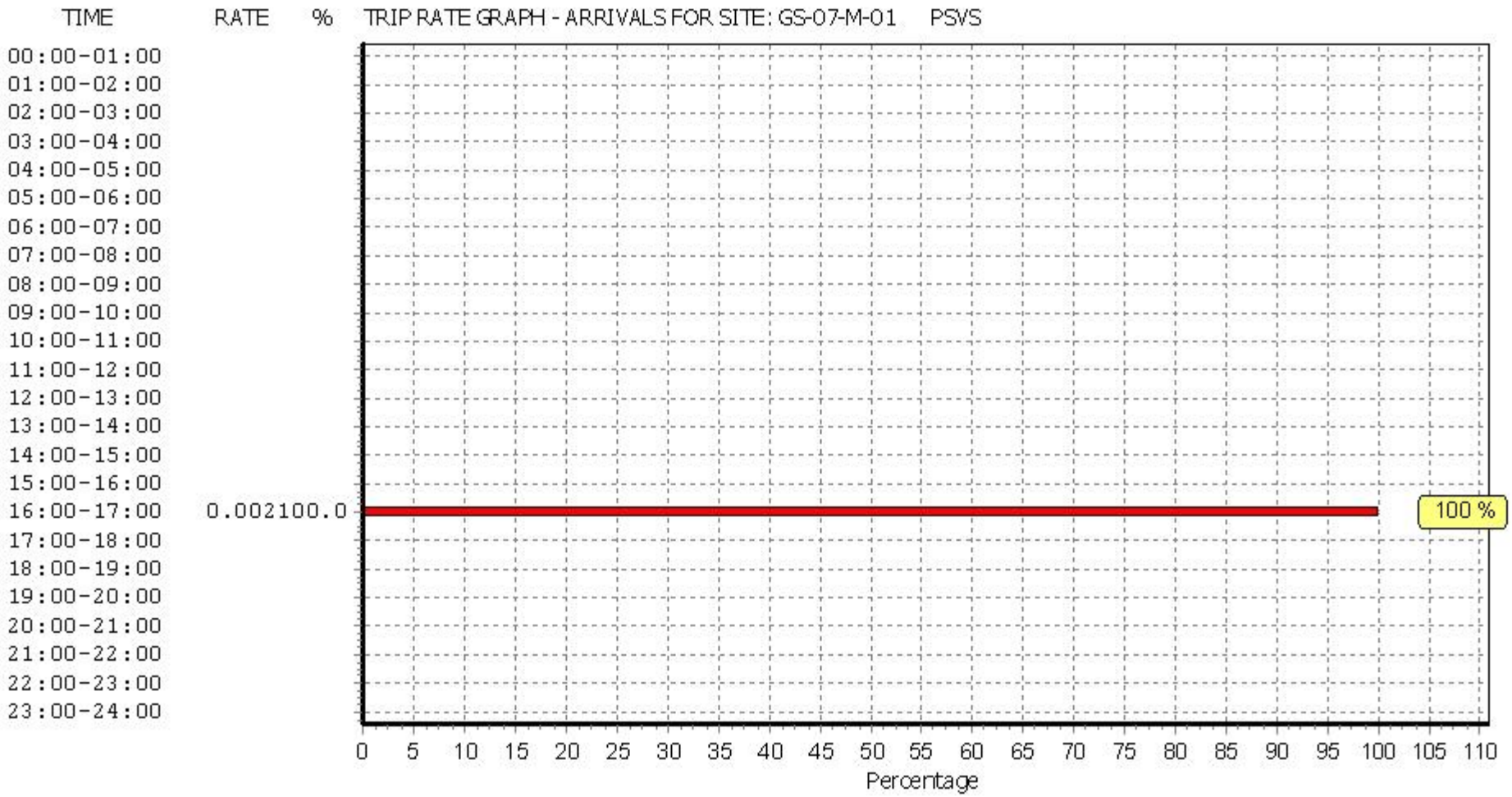
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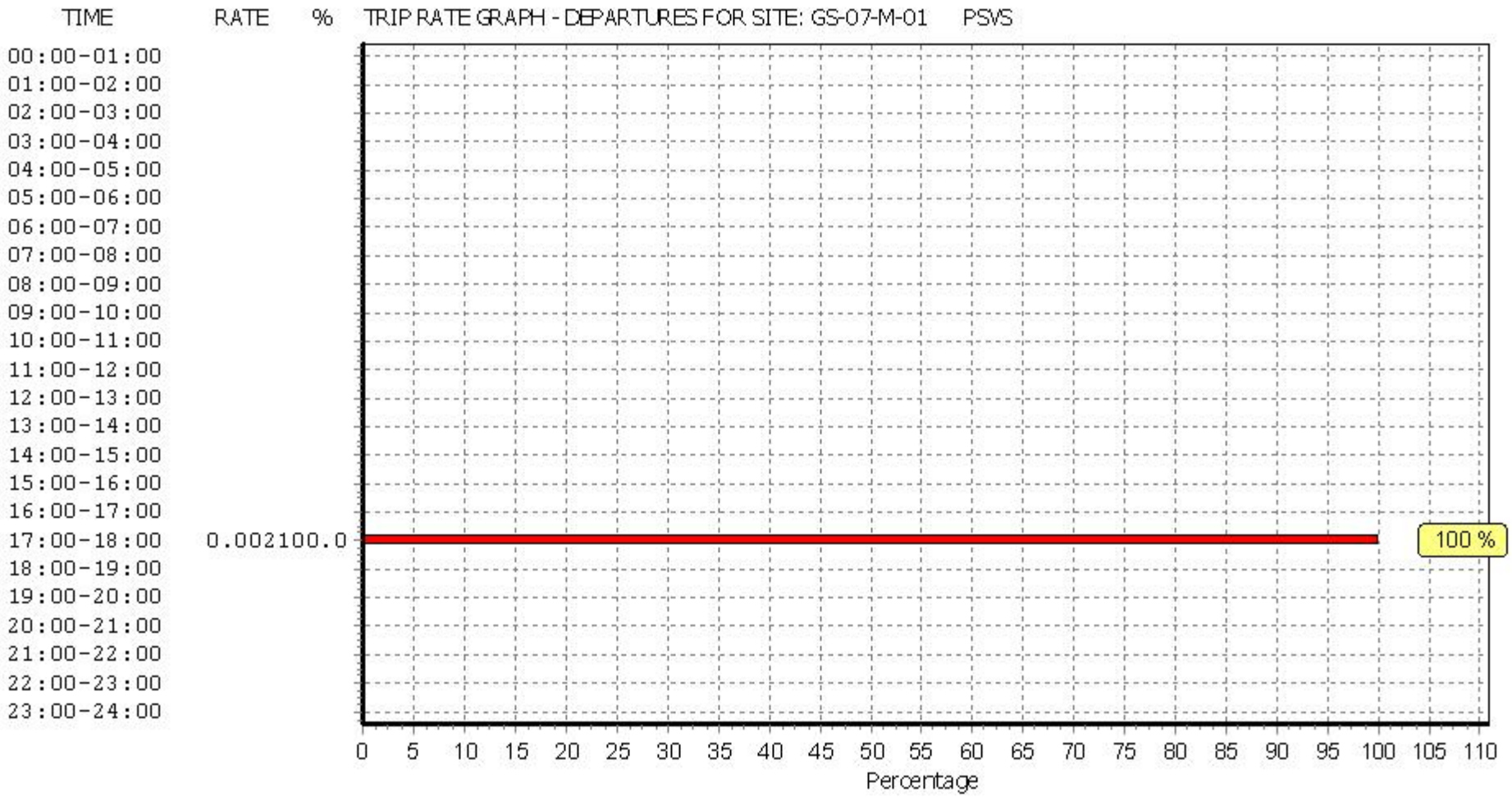
Parameter summary

Trip rate parameter range selected:	16.00 to 323.00 (units: hect)
Survey date date range:	01/01/08 - 12/05/12
Number of weekdays (Monday-Friday):	0
Number of Saturdays:	4
Number of Sundays:	1
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

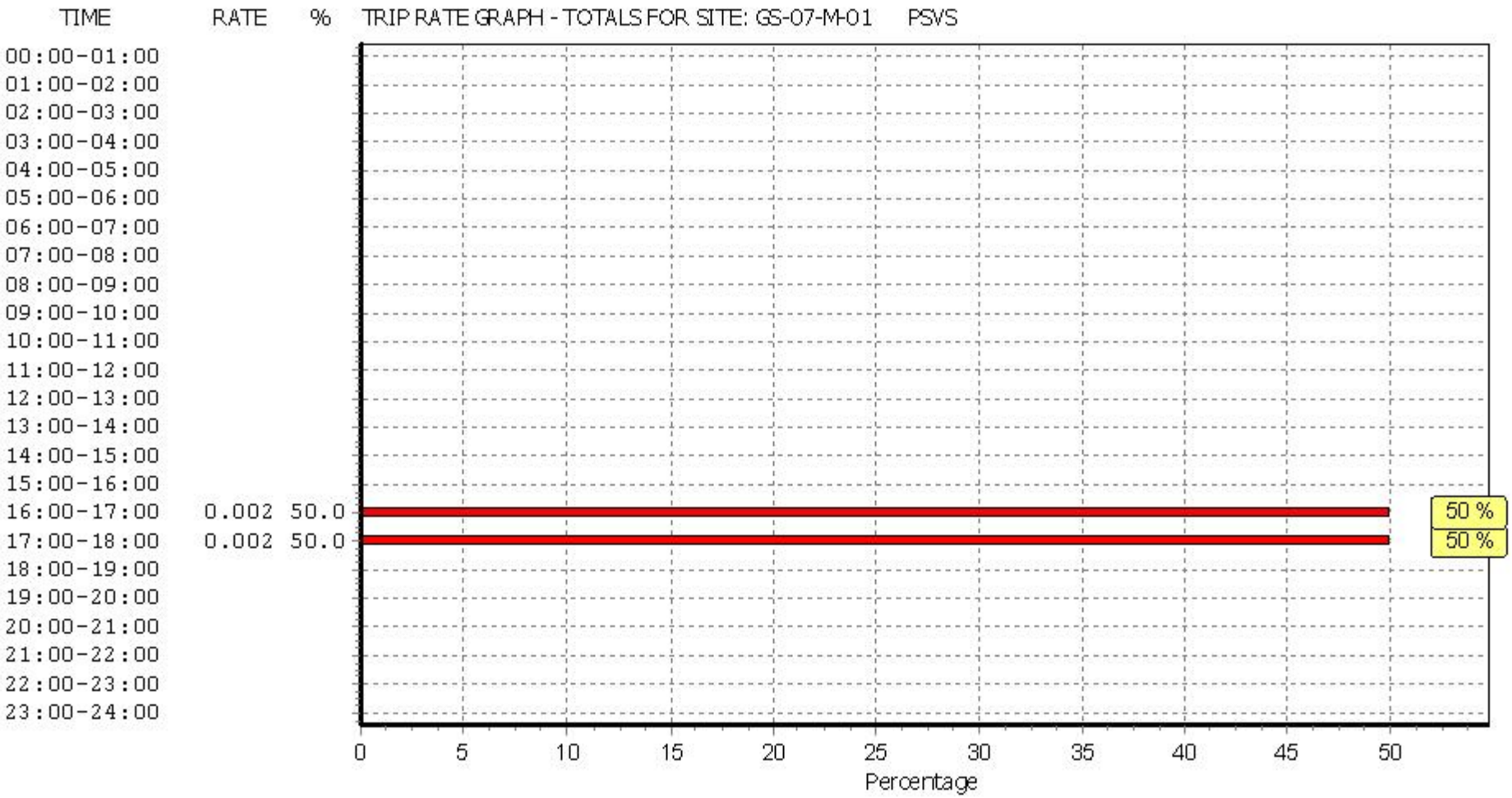
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TRIP RATE for Land Use 07 - LEISURE/M - COUNTRY PARKS
CYCLISTS
Calculation factor: 1 hect
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate	No. Days	Ave. AREA	Trip Rate
00:00 - 01:00									
01:00 - 02:00									
02:00 - 03:00									
03:00 - 04:00									
04:00 - 05:00									
05:00 - 06:00									
06:00 - 07:00									
07:00 - 08:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
08:00 - 09:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
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11:00 - 12:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
12:00 - 13:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
13:00 - 14:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
14:00 - 15:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
15:00 - 16:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
16:00 - 17:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
17:00 - 18:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
18:00 - 19:00	5	112.36	0.000	5	112.36	0.000	5	112.36	0.000
19:00 - 20:00	3	133.67	0.000	3	133.67	0.000	3	133.67	0.000
20:00 - 21:00	1	323.00	0.000	1	323.00	0.000	1	323.00	0.000
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			0.000			0.000			0.000

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

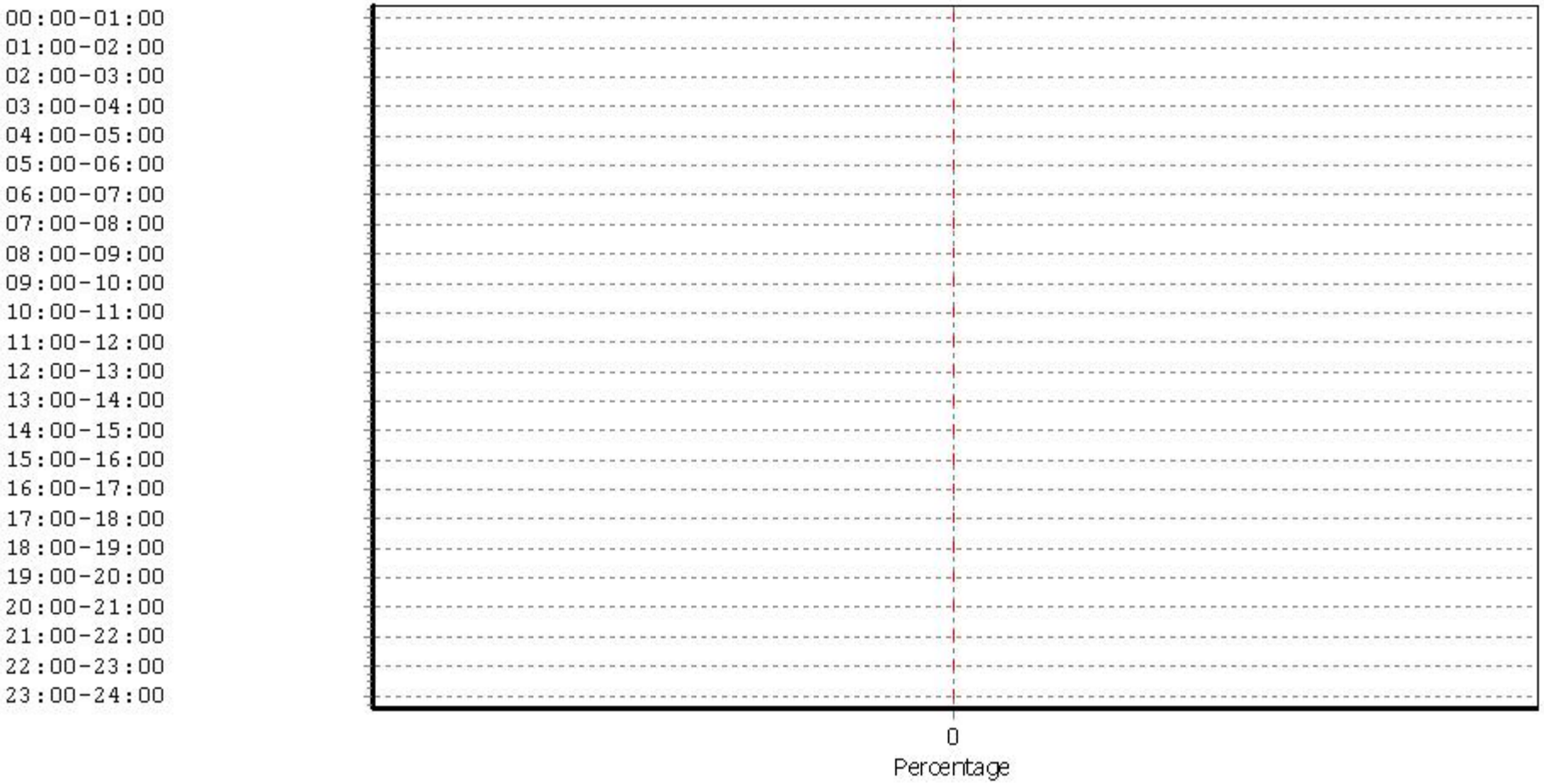
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Parameter summary

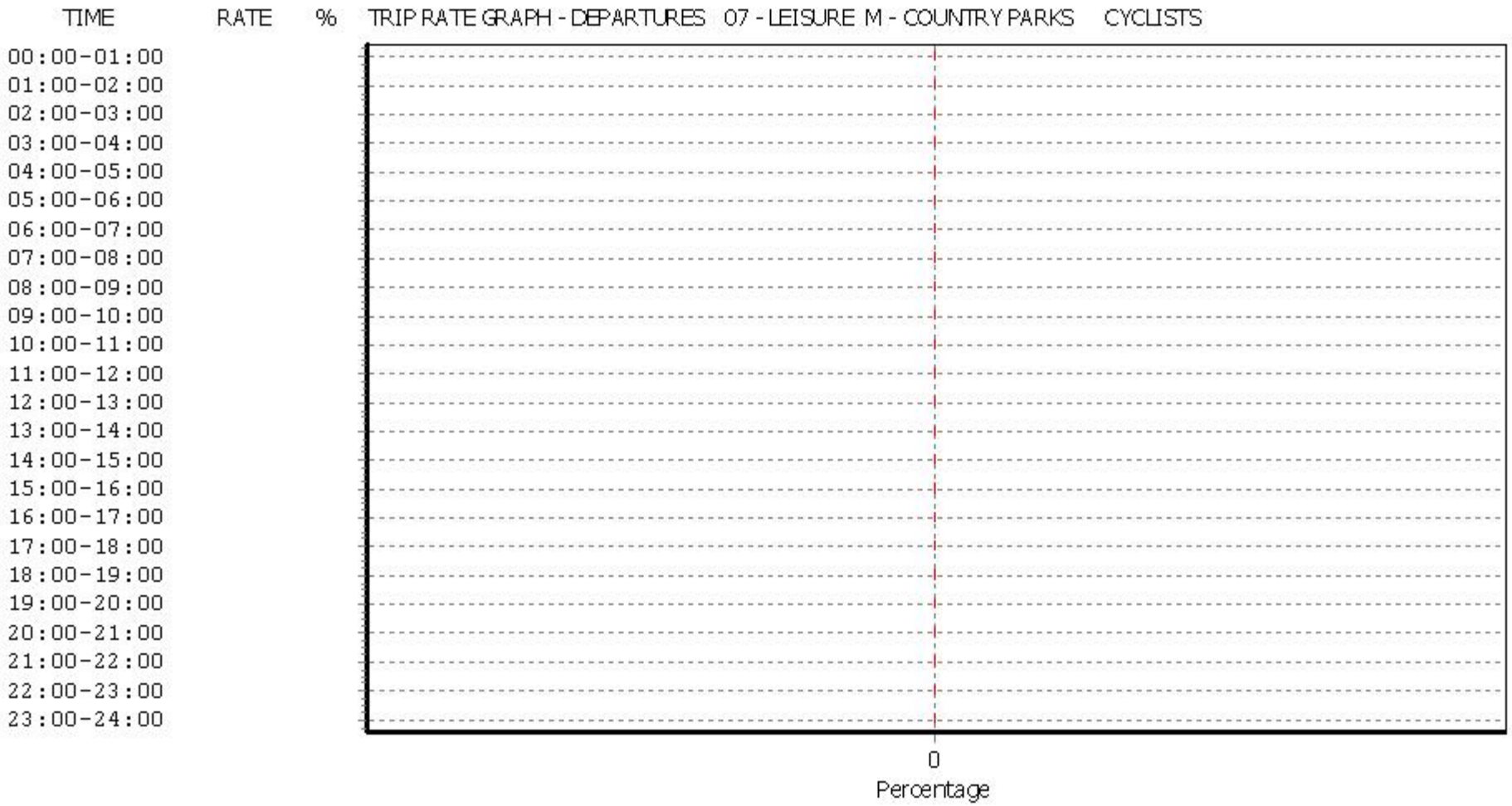
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TIME RATE % TRIP RATE GRAPH - ARRIVALS 07 - LEISURE M - COUNTRY PARKS CYCLISTS

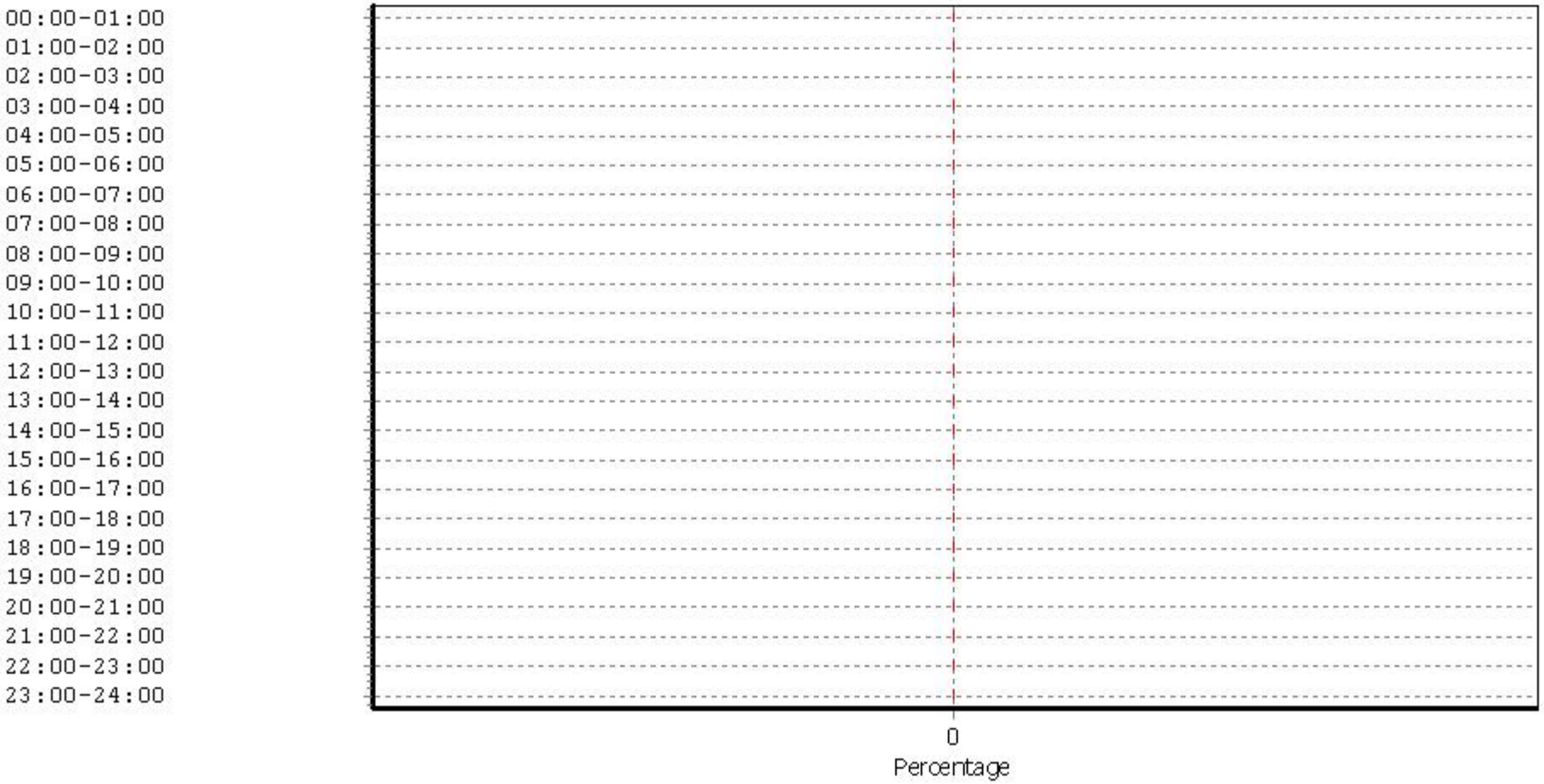


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TIME RATE % TRIP RATE GRAPH - TOTALS 07 - LEISURE M - COUNTRY PARKS CYCLISTS



This graph is a visual representation of the trip rate calculation results screen. The same time periods and trip rates are displayed, but in addition there is an additional column showing the percentage of the total trip rate by individual time period, allowing peak periods to be easily identified through observation. Note that the type of count and the selected direction is shown at the top of the graph.

Appendix A14.3 Road Safety Audit

Title: **STAGE 1 ROAD SAFETY AUDIT**

Kerdiffstown Landfill Remediation Project

Co. Kildare

Client: **Jacobs**

Date: **March 2017**

Report reference: **0308R01**

VERSION: **FINAL**

Prepared By:

Bruton Consulting Engineers Ltd

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Co. Louth.

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Mob: 086 8067075
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W: www.brutonceng.ie

BRUTON CONSULTING ENGINEERS

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1.0 Introduction

This report was prepared in response to a request from Ms. Sharon Sugrue of Jacobs for a Stage 1 Road Safety Audit of the proposed 3 arm roundabout and link roads to the former landfill site at Kerdiffstown, Co. Kildare.

The Road Safety Audit Team comprised of;

Team Leader:	**Norman Bruton**, BE CEng FIEI, Cert Comp RSA, MSoRSA
	TII approval number: NB 168446
Team Member:	**Owen O'Reilly**, B.SC. Eng Dip Struct. Eng NCEA Civil Dip Civil. Eng CEng MIEI
	TII Auditor Approval number: OO1291756

The Road Safety Audit comprised an examination of the information provided and a site visit by the Audit Team, together on the 30th March 2017.

The weather at the time of the site visit was dry and the road surface was wet.

This Stage 1 Road Safety Audit has been carried out generally in accordance with the requirements of TII DMRB HD 19/15 Road Safety Audits. (TII Publication Number GE-STY-01024)

The scheme has been examined and this report compiled in respect of the consideration of those matters that have an adverse effect on road safety. It has not been examined or verified for compliance with any other standards or criteria.

The problems identified in this report are considered to require action in order to improve the safety of the scheme for road users.

If any of the recommendations within this safety audit report are not accepted, a written response is required, stating reasons for non-acceptance. Comments made within the report under the heading of Observation are intended to be for information only. Written responses to Observations are not required.

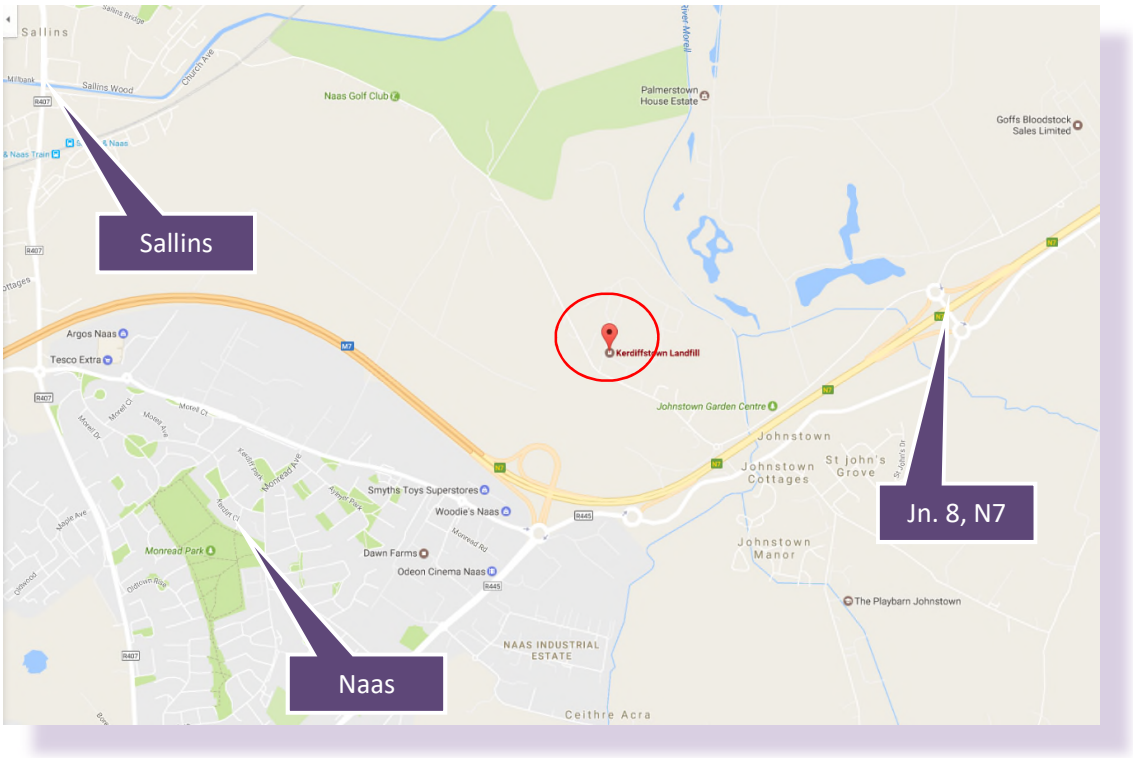
The information supplied is listed in Appendix A.

No previous road safety audits were carried out on this scheme.

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2.0 Background

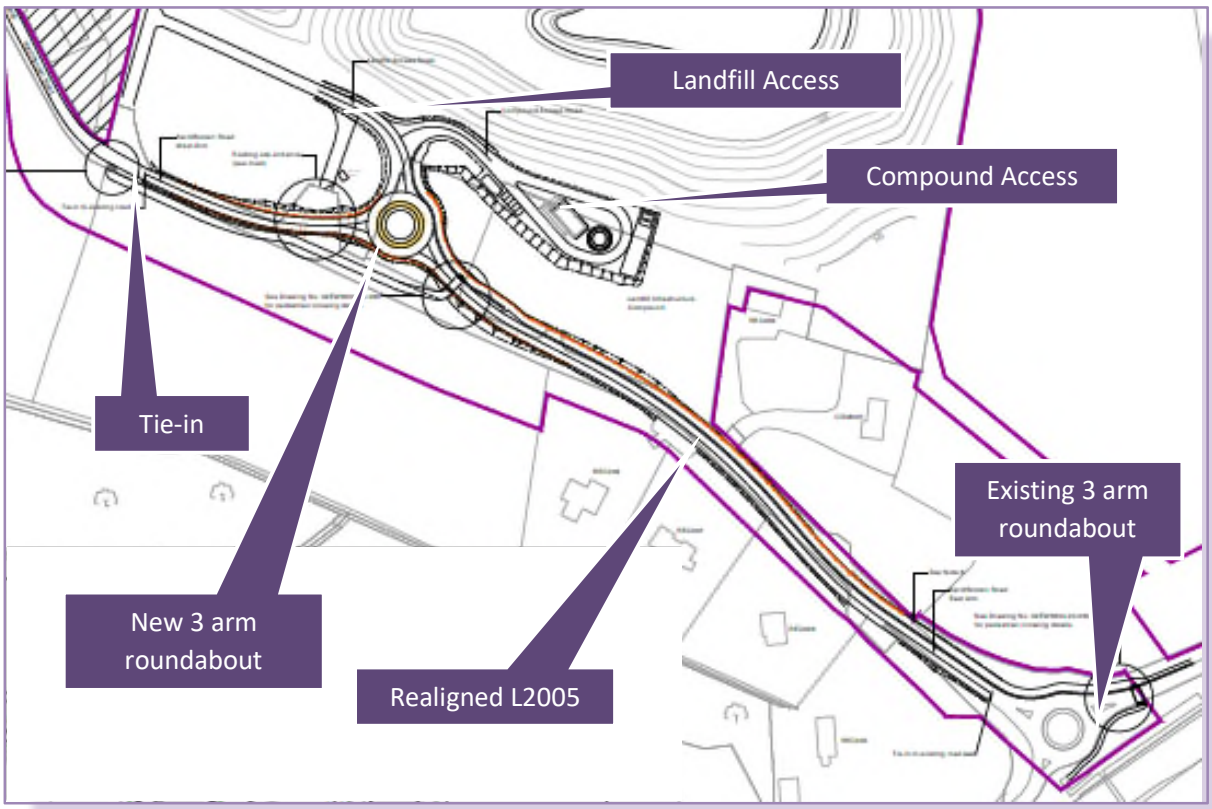
The site of the previous landfill at Kerdiffstown Co. Kildare is proposed to be remediated. It is proposed thereafter to redevelop the site as an amenity area. This Stage 1 Road Safety Audit is required as part of the design process for a new site access. The remediation process will require the importation of a substantial quantity of material using heavy goods vehicles. The site is located off the L2005 Kerdiffstown Road which links Sallins and Johnstown via the grade separated Junction 8 on the N7 National Primary route. The site location is shown below.



Site Location Map – image courtesy of Google

The extents of the site (site for road safety audit purposes) includes a proposed 3 arm roundabout into the site, realignment of the L2005 between the existing 3 arm roundabout south west of Johnstown Garden Centre, realignment of, and tie-in with the existing L2005 to the northwest of the site, the provision of shared use cycle/pedestrian facilities, provision of a new access road to the landfill and the compound and other ancillary works. The site extents for the purposes of the road safety audit are shown below.

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Site Extents Map

The Road Safety Authority's website (http://www.rsa.ie/RSA/Road-Safety/Our-Research/Collision-Statistics/Ireland-Road-Collisions/) indicates that there were no reported collisions along this section of the L2005 between 2005 and 2013.

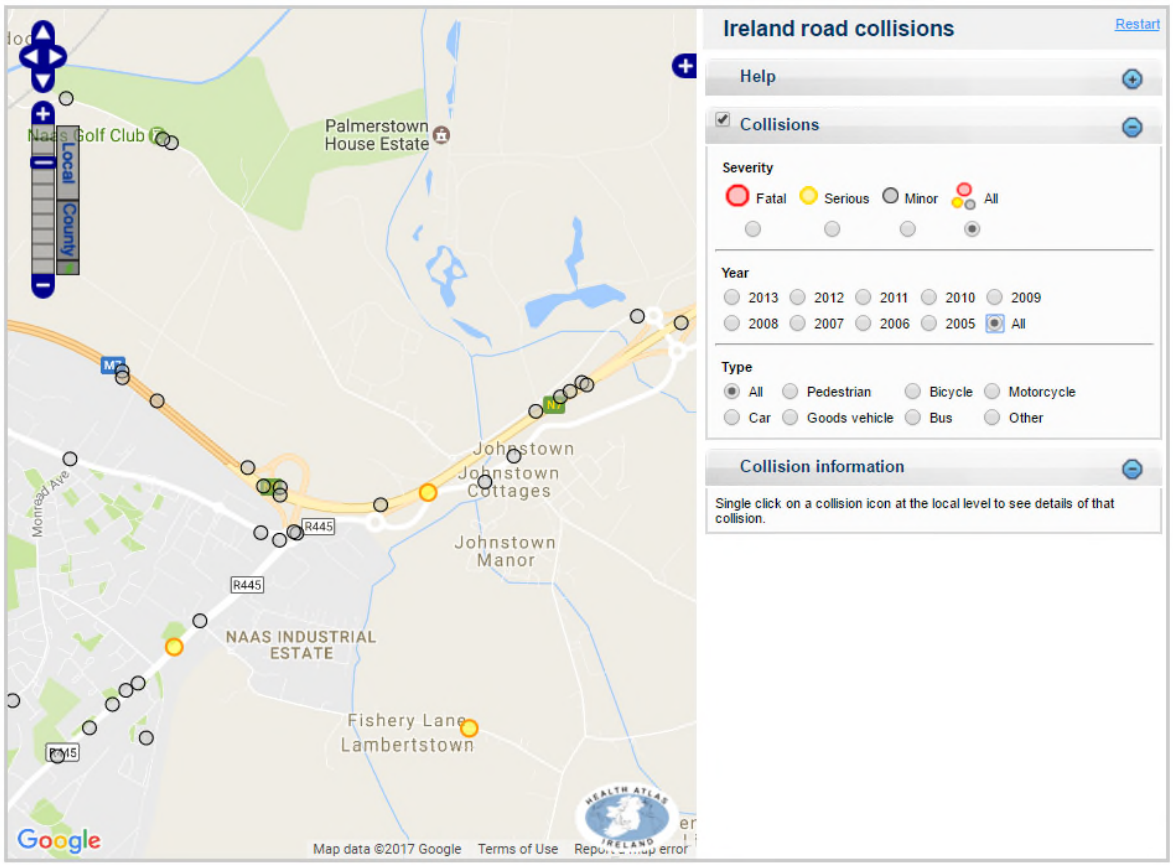
Historic collision data provided by Jacobs was as follows;

'A review of NRA collision statistics was undertaken for the previous five years, on the roads in the immediate vicinity of the proposed Project, which identified the following accidents:

- Minor accident on Kerdiffstown Road, north of proposed site access, in the vicinity of the railway bridge; and
- Minor accident on N7 Eastbound, at Junction 8 off-slip.

Given that only a small number of minor accidents have occurred in the vicinity of the proposed Project, none of which are linked to operations at the site, it is clear that there are no existing accident or safety issues based on these statistics.'

Ireland Road Collisions



Screenshot from RSA Website.

3.0 Main Report

3.1 Problem

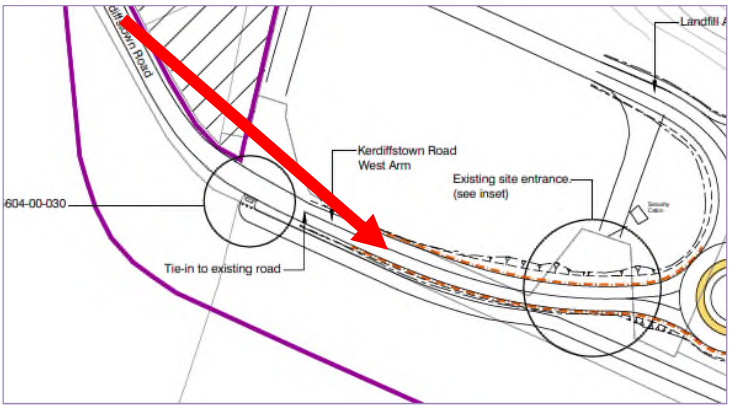
LOCATION

Drawing 32EW5604-00-029 Rev O New Site Access Proposed Road Layout and Site Observation.

PROBLEM

There is a tight horizontal radius bend on the existing L2005 Cardiff's town road to the west of the proposed realignment. There is a risk that drivers approaching from the Sallins direction will not have adequate forward visibility at this bend or to the proposed roundabout and as a result may lose control of their vehicle, collide with stationary traffic or collide with vulnerable road users.

The Audit Team are aware that at 60 km/h speed limit exists on the L2005. During the site visit it was felt that the actual speeds were in excess of the speed limit. The higher the 85th percentile speed on the road the greater the required forward visibility is.



RECOMMENDATION

It is recommended that the actual 85th percentile speed on the L2005 is determined and that re-alignment of the road or verge widening is provided to ensure adequate forward visibility for that speed.

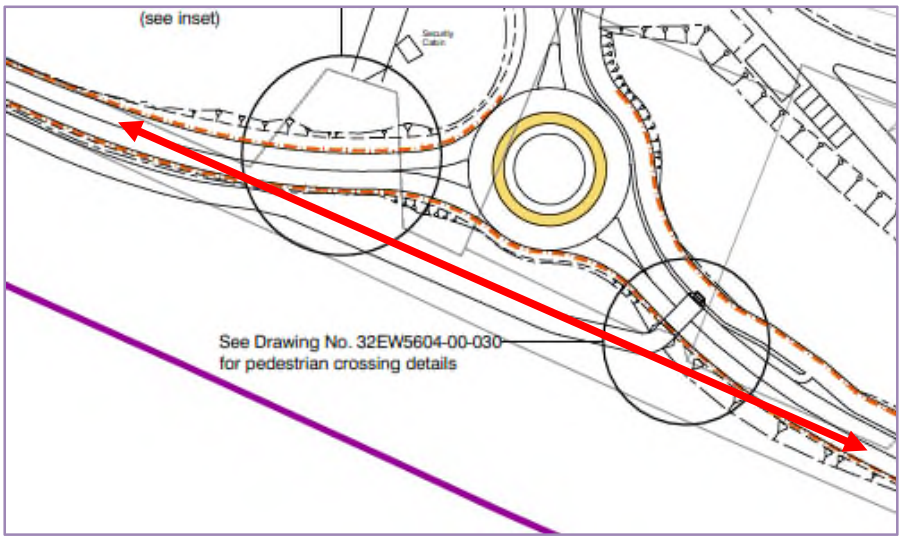
3.2 Problem

LOCATION

Drawing 32EW5604-00-029 Rev O New Site Access Proposed Road Layout

PROBLEM

It is proposed to utilise the old L2005 as a shared use footway/cycleway in the vicinity of the proposed roundabout. There is a risk that drivers approaching from the Sallins direction may sight through onto the old alignment. This may lead to loss of control when they suddenly realise that the new alignment turns to the left.



RECOMMENDATION

It is recommended that suitable screening be provided by the use of earth berms or signage or both suitably positioned so as not to become roadside hazards and to eliminate potential sight-through from both directions.

3.3 Problem

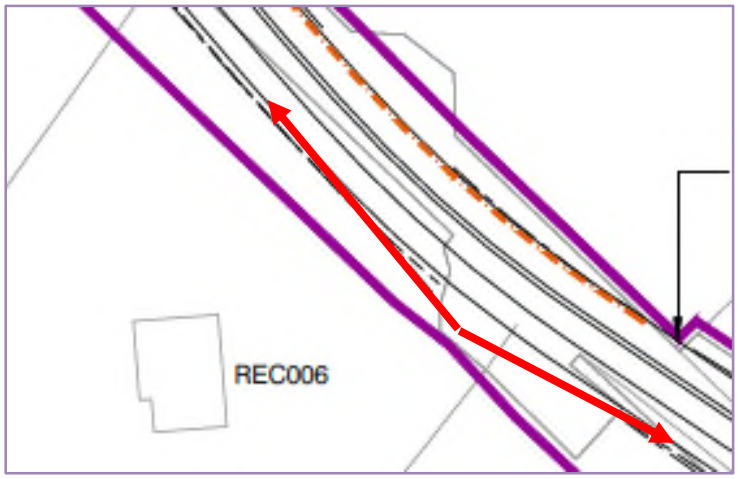
LOCATION

Drawing 32EW5604-00-029 Rev O, New Site Access Proposed Road Layout and Site Observation.

PROBLEM

It is unclear from the drawings provided the proposed accommodation works at each private access along the L2005. It was observed during the site visit that there is limited visibility at a number of the existing accesses. Insufficient visibility could lead to side impact collisions with through traffic on the L2005.

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RECOMMENDATION

It is recommended that visibility splays be provided with suitable X and Y distances for the design speed of the realigned road.

3.4 Problem

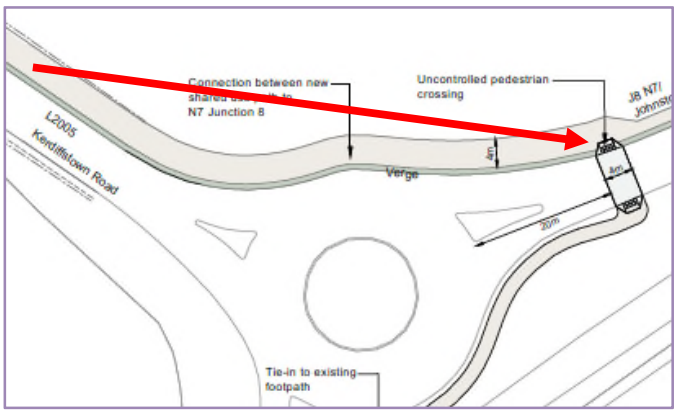
LOCATION

Drawing 32EW5604-00-030 Rev O, New Site Access Proposed Pedestrian Access and Cycleway & Site Observation.

PROBLEM

It is proposed to provide an informal crossing point 20 m north-east of the existing three arm roundabout. It was observed during the site visit that vehicles travelling from the Sallins direction towards Junction 8 on the N7, maintained high speed whilst on the circulating carriageway of this roundabout. This is most likely due to the alignment of the roundabout and the fact that the south-west arm leads only to private property and therefore drivers familiar with the area do not yield as they do not expect to encounter circulating traffic. There is a risk that pedestrians or cyclists crossing at the proposed location may not have adequate inter-visibility with drivers of approaching vehicles. It was also observed on site that roadside furniture and vegetation behind the existing footpath reduced visibility.

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RECOMMENDATION

It is recommended that the uncontrolled pedestrian crossing is relocated closer to the roundabout, similar to the existing situation with a refuge being provided as part of the splitter island. Visibility to the northern side of the crossing point should be provided without been obscured by roadside furniture or landscaping.

3.5 Problem

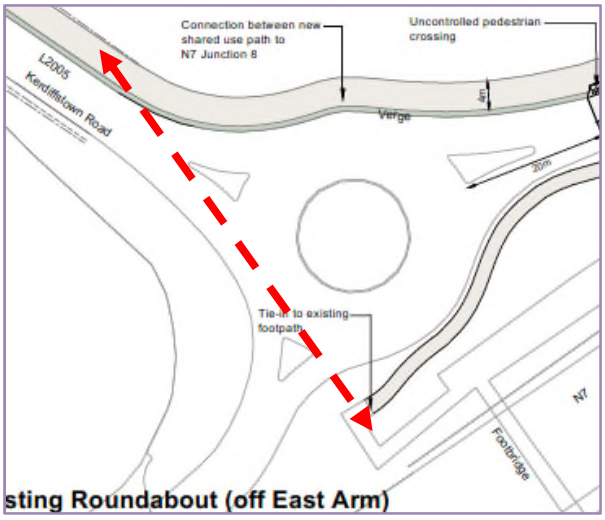
LOCATION

Drawing 32EW5604-00-030 Rev O, New Site Access Proposed Pedestrian Access and Cycleway & Site Observation.

PROBLEM

There is a risk that the proposed informal pedestrian crossing at the existing three arm roundabout will not cater for the desire line of pedestrians travelling from the future amenity area to the overbridge on the N7. During the site visit a pedestrian was observed walking on the south-western side of the circulating carriageway to get to the over bridge. There is a risk that pedestrians will continue to enter the carriageway if the proposed informal crossing point is moved further to the north-east than the existing crossing point. Vulnerable road users that enter the carriageway are at a greater risk of being struck by vehicles.

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RECOMMENDATION

It is recommended that two additional informal crossing points are provided on the two other arms of the roundabout and that a footpath is provided in the south-western verge connecting the crossing points.

3.6 Problem

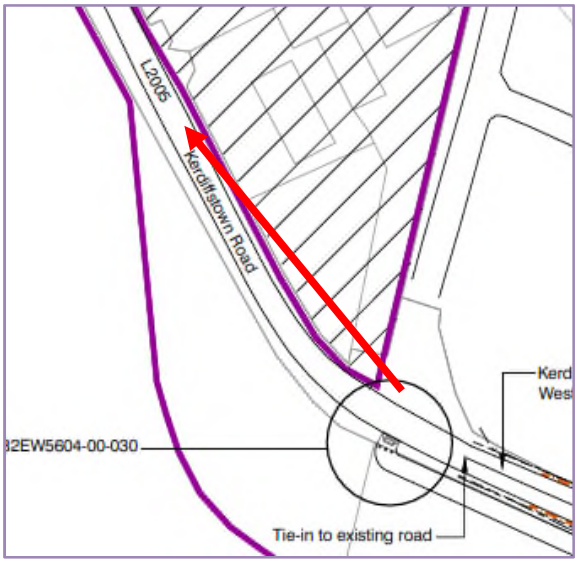
LOCATION

Drawing 32EW5604-00-029 Rev O, New Site Access Proposed Road Layout & Site Observation.

PROBLEM

It is proposed to terminate the shared use footway/cycleway at the tie-in point with the existing L2005 where there is a tight horizontal radius curve. There is a risk that pedestrians or cyclists wishing to cross the L2005 at this location will not have sufficient visibility to the right (towards Salllins) which may lead to collisions with oncoming vehicles.

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RECOMMENDATION

Ensure adequate inter-visibility between drivers and vulnerable road users at this potential crossing point.

3.7 Problem

LOCATION

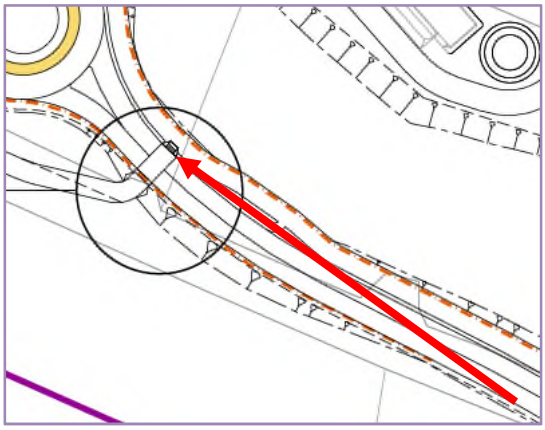
Drawing 32EW5604-00-030 Rev O, New Site Access Proposed Pedestrian Access and Cycleway &

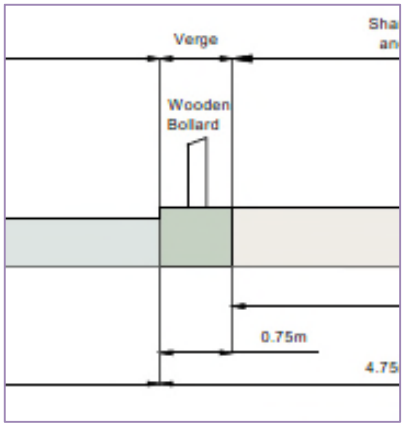
Drawing 32EW5604-00-029 Rev O, New Site Access Proposed Road Layout.

PROBLEM

It is proposed to provide wooden bollards in the verge between the carriageway and the shared use path and cycleway. There is a risk that these bollards may obscure inter-visibility between drivers approaching the proposed roundabout from the south-east and pedestrians or cyclists wishing to cross the L2005 at the informal crossing point on approach to the roundabout due to the relatively steep vertical alignment of the L2005. A lack of inter-visibility could lead to collisions with vulnerable road users.

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RECOMMENDATION

Ensure that adequate inter-visibility is provided without obstruction by the bollards to a low object height of 0.6 m which could represent a child.

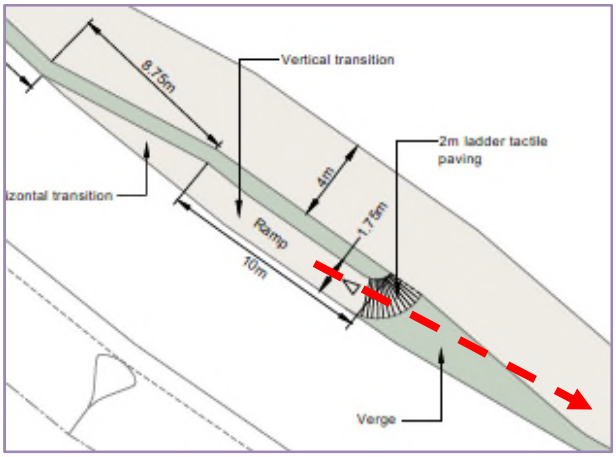
3.8 Problem

LOCATION

Drawing 32EW5604-00-030 Rev O, New Site Access Proposed Pedestrian Access and Cycleway

PROBLEM

It is proposed to provide a transition for cyclists from on-road to off-road to the south-east of the proposed roundabout. There is a risk that cyclists using this facility and wishing to continue their journey towards the existing three-armed roundabout may travel across the grassed verge and lose control of their bicycle leading to injury. In addition, the proposed ladder tactile paving may provide discomfort for cyclists.



RECOMMENDATION

Ensure that the transition caters for the desire line of south-east bound cyclists. It is also recommended that tramline tactile paving be provided for cyclists.

3.9 Problem

LOCATION

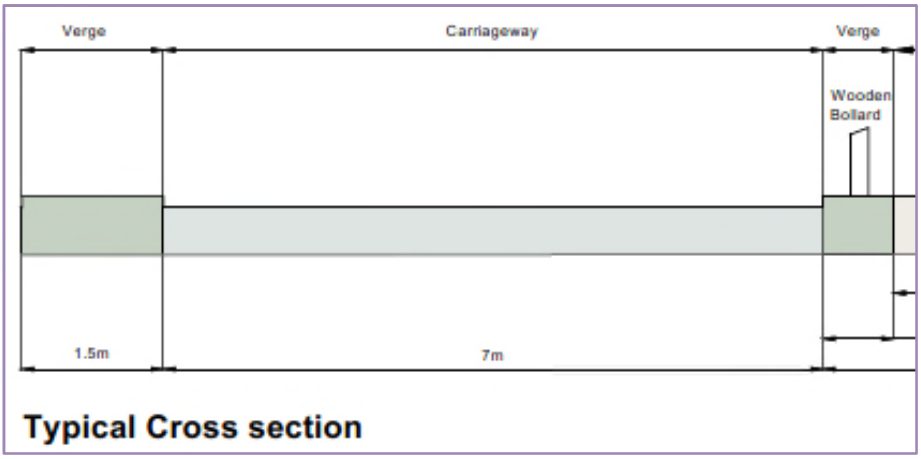
Drawing 32EW5604-00-031 Rev O, Site Access Design Profiles.

PROBLEM

It is unclear at this preliminary design stage what the exact crossfall and drainage details are for the realigned L2005. The proposed long sections for the Kerdiffstown Rd, East Arm shows at SAG in the vertical alignment at approximate chainage 25. This is followed by a relatively long vertical gradient of 0.5%.

There is a risk of surface water ponding on the carriageway surface or, of larger than acceptable water film depths on the surface if inadequate drainage is provided.

The typical cross-section indicates that the verges will be raised relative to the carriageway level. Should this be the intention the risk of surface ponding will be increased. Ponding can lead to loss of traction and loss of control in wet or icy conditions.



RECOMMENDATION

Ensure that all road surfaces are adequately drained.

4.0 Observations

4.1 Observation

It was observed during the site visit that there are a number of telecom and electrical cables crossing the L2005. It is assumed that the clearances to these cables will be checked for the revised vertical alignment.

4.2 Observation

It is assumed that an inappropriately located 'all routes' sign on approach to the existing three arm roundabout will be removed as part of the site clearance.

4.3 Observation

It was observed during the site visit that the ramp on the N7 overbridge had a slippy surface with some surface water ponding on the dwell areas. The Audit Team acknowledge that this is outside the scope of the works, however as the new amenity facility will lead to increased usage of this overbridge this issue should be brought to the attention of the Roads Authority.

4.4 Observation

It is assumed that at the detailed design stage suitable aggregate with suitable PSV will be provided on the north-west approach to the proposed roundabout taking into consideration the actual 85th percentile speed on the L2005.

4.5 Observation

It is assumed that the public lighting columns and the supports for road signs will be placed at the back of the shared use facility such that there will not reduce its effective width.

4.6 Observation

If it is intended to have 4 m wide crossing points then the dropped kerb and tactile paving should be provided over the 4 m with. Transition kerbs should be provided thereafter.

4.7 Observation

It is unclear if the realigned L2005 is to be kerbed throughout. If not it is assumed that kerbing would be provided at the vicinity of the proposed roundabout.

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5.0 Audit Statement

We certify that we have examined the information provided and the site on the 30th March 2017. The examination has been carried out with the sole purpose of identifying any features of the design which could be removed or modified in order to improve the safety of the scheme.

The problems identified have been noted in this report together with associated safety improvement suggestions which we would recommend should be studied for implementation. The audit has been carried out by the persons named below who have not been involved in any design work on this scheme as a member of the Design Team.

Norman Bruton **Signed:** 

(Audit Team Leader) **Dated: 25-4-2017**

Owen O'Reilly **Signed:** 

(Audit Team Member) **Dated: 25-4-2017**

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Appendix A

List of material Supplied for this Stage 1 Road Safety Audit;

- Drawing 32EW5604-00-029 Rev O, New Site Access Proposed Road Layout.
- Drawing 32EW5604-00-030 Rev O, New Site Access Proposed Pedestrian Access and Cycleway
- Drawing 32EW5604-00-031 Rev O, Site Access Design Profiles.

Background material

- Jacobs Technical Note – Road and New Site Access Design, 29th March 2017
- Details of collision history from NRA Data for last 5 years – From Jacobs.
- Proposed traffic volumes during remediation phase – From Jacobs.

Appendix B

Feedback Form

SAFETY AUDIT FORM – FEEDBACK ON AUDIT REPORT

Scheme: Kerdiffstown Landfill Remediation Project
Stage: 1 Road Safety Audit.
Date Audit (Site visit) Completed: 30th March 2017

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
3.1	Yes	No	<u>Area 1 – existing bend</u> The requirement for third party land is likely to be at a disproportionate cost to KCC to effect road realignment, hence alternatives to satisfy the 85th percentile speeds (ave 71kph) are: • Mitigation would be provided using appropriate roundabout warning signs, speed limit signs (along the entire length of the road) and SLOW markings in advance of the bend; • Existing hedgeline vegetation to be trimmed back to property boundary; • The urbanisation of the road (refer to Problem 3.6) also offers improvement and identification of change in road layout. <u>Area 2 – new roundabout</u> The design speed for L2005 Kerdiffstown Road is 60kph, hence the SSD for the new roundabout is sufficient to satisfy the DMURs guidance of min. 65m at this design speed. Assessment of the 85th percentile (ave 71kph) recorded north and south east of the existing junction exceeds the design guidance in DMURs and as such would require TII DMRB guidance to be utilised. The DMRB requires SSD at 120m, or with two steps below, 70m, though use of DMRB guidance would also require more significant horizontal and vertical alignments which are not achievable with the lands available. With mitigation proposed above and in Problem 3.6 with the urbanisation improvements to the road/ pathway/ cycleway DMURs is considered the appropriate standard to follow hence no further actions are proposed.	YES

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
3.2	Yes	Yes	Screening requirements will be addressed during detailed design stage. Appropriate signage would also be erected to warn of new road layout / junction ahead.	
3.3	Yes	Yes	Existing vegetation will be removed as part of the site clearance works to provide requisite visibility splays.	
3.4	Yes	No	The splitter island at the current crossing location is not considered appropriate as a refuge. The proposed crossing location (c.20m from roundabout) provides the requisite forward visibility. This proposed crossing also provides for the desire line of pedestrians and cyclists travelling from the footbridge onwards to the east. For users wishing to travel onwards to Sallins/the park from the footbridge, a new crossing will be provided (see 3.5 below).	YES
3.5	Yes	Yes	A 2.2m pathway will be provided around the south side of the junction to a further crossing point located at the private drive on level grade (the third arm of the roundabout) as recommended. The pathway will extend to a further crossing point over Kerdiffstown Road, north of the existing roundabout, to meet visibility standards. Design drawing to be revised accordingly.	
3.6	Yes	Yes	The trail will be extended to the west, towards the centre of the bend to improve visibility looking north along Kerdiffstown Road, whilst maintaining visibility back towards the new roundabout. Lighting will be provided along the pathway and cycleway improving visibility of this crossing point for road users, and ease of identification in daylight hours.	
3.7	Yes	Yes	Height will not exceed 0.6m. Drawing to be revised accordingly.	

Paragraph No. in Safety Audit Report	Problem accepted (yes/no)	Recommended measure accepted (yes/no)	Alternative measures (describe)	Alternative measures accepted by Auditors (Yes/No)
3.8	Yes	No	During detailed design the most effective tactile paving will be investigated, in order to clearly indicate the transition from carriageway to shared use pathway and effectively communicate this transition to cyclists and pedestrians, whilst posing no danger to either. Additionally, SLOW markings will be provided to the ramp in advance of the yield marking and low plantings (<0.6m height) or other physical barrier will be provided to the top of the ramp to keep cyclists channelized.	YES
3.9	Yes	Yes (see comment)	It is confirmed that the design will mitigate any potential drainage issues. Reference on Drawing Number 32EW5604-00-031 to be changed from Typical Cross Section to 'Indicative Conceptual Section'. This is intended to show widths only. The MX design has incorporated 2.5% adverse camber on horizontal curves over 178m radius and 2.5% superelevation on horizontal curves at 136m radius.	YES

Signed..... **Date** 21/04/2017

Design Team Leader

Signed..... **Date** 25/4/2017

Audit Team Leader

Signed..... **Date** 25/4/17

Employer