WYG Environment

part of the WYG group

West Dorset District Council

2011 Detailed Air Quality Assessment

Bridport and Chideock

June 2011

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1.0 Introduction

West Dorset District Council (WDDC) commissioned WYG Sustainability and Environment to prepare a Detailed Air Quality Assessment as part of the Council's local air quality management duties under the Environment Act 1995 (the Act).

The purpose of the report is to outline the findings of detailed air quality dispersion modelling which has been undertaken to build on air quality monitoring data obtained by the Council during the 2009 calendar year, which represents the most recent year for which complete annual data is available. The monitoring data demonstrates that the annual average mean Air Quality Objective for nitrogen dioxide has been exceeded in 2009 at some monitoring locations within the District. As such the Council are looking to investigate the geographical extent of exceedances of the Objective and to determine likely pollutant concentrations in future years. The report aims to inform decisions regarding the boundaries of the AQMA in Chideock and a potential AQMA in Bridport, and to ascertain source apportionment of emissions for use within action planning in both locations.

Air quality dispersion modelling of predicted nitrogen oxides and respirable particulates from road sources within the study areas has been undertaken. Outputs from the dispersion model have been compared to air quality monitoring results to adjust the model parameters in order to provide the best practicable representation of local emissions sources.

The dispersion model has been used to predict exposure to key air quality pollutants at relevant receptor locations during 2009 within the study areas. The results of these predictions have been compared against the relevant Air Quality Objectives.

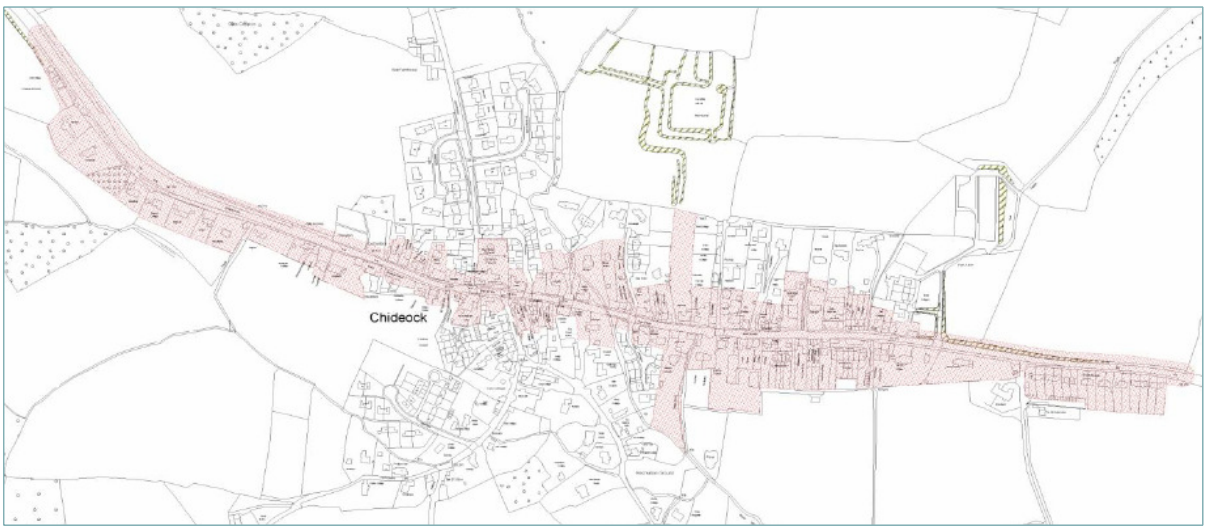
Based on the results of the assessment, recommendations have been made to enable the Council to continue to meet their duties under the Act.

1.1 Study Area Locations and Context

Bridport is a small town located approximately 1km from the coast and 20km west of Dorchester. Annual average NO_2 concentrations adjacent to the A35 (trunk road) along East Road are monitored by WDDC and have been found to exceed the annual objective concentration at one dwelling located very close to the kerbside. The study area in Bridport consists of the A35 along East Road on the eastern side of Bridport.

Chideock is a small village in West Dorset. Dwellings are situated either side of the A35 (trunk road) going through the village with dwellings immediately adjacent to a steep incline leaving the village going west. An air quality management area for NO_2 has been declared along the main road as annual average NO_2 concentrations here exceed the annual objective concentration, as illustrated in Figure 1 below. 2009 monitoring has shown that the objective is only likely to be exceeded along the section of road going uphill to the west of the post office car park.

Figure 1: Chideock AQMA



1.2 Documents Consulted

The following documents were consulted during the undertaking of this assessment:

Legislation and Guidance

- The Air Quality Standards Regulations, 2007;
- The Air Quality Strategy for England, Scotland, Wales and Northern Ireland, 2007;
- The Environment Act, 1995;
- Local Air Quality Management Technical Guidance LAQM.TG(09), DEFRA, 2009;
- Design Manual for Roads and Bridges, Volume 11, Section 3, Part 1, HA 207/07 - Air Quality, Highways Agency, 2007;
- Development Control: Planning for Air Quality, EPUK, (2010 Update);

Websites Consulted

- Google maps (maps.google.co.uk);
- The UK National Air Quality Archive (www.airquality.co.uk);
- Department for Transport Matrix (www.dft.go.uk/matrix); and,

Site Specific Reference Documents

- 2010 Air Quality Progress Report for West Dorset District Council
- 2009 Air Quality Updating and Screening Assessment for West Dorset District Council
- Chideock Air Quality Management Area Further Assessment Report, July 2008

2.0 Air Quality Legislation and Guidance

2.1 European Legislation

European air quality legislation is consolidated under Directive 2008/50/EC, which came into force on 11th June 2008. This Directive consolidates previous legislation which was designed to deal with specific pollutants in a consistent manner and provides new air quality objectives for fine particulates. The consolidated Directives include:

- **Directive 99/30/EC** – the First Air Quality "Daughter" Directive – sets ambient air limit values for nitrogen dioxide and oxides of nitrogen, sulphur dioxide, lead and particulate matter;
- **Directive 2000/69/EC** – the Second Air Quality "Daughter" Directive – sets ambient air limit values for benzene and carbon monoxide; and,
- **Directive 2002/3/EC** – the Third Air Quality "Daughter" Directive – seeks to establish long-term objectives, target values, an alert threshold and an information threshold for concentrations of ozone in ambient air.

The fourth daughter Directive was not included within the consolidation and is described as:

- **Directive 2004/107/EC** – sets health-based limits on polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury, for which there is a requirement to reduce exposure to as low as reasonably achievable.

2.2 UK Legislation

The Air Quality Standards Regulations (2007) seek to simplify air quality regulation and provide a new transposition of the Air Quality Framework Directive, First, Second and Third Daughter Directives and also transpose the Fourth Daughter Directive within the UK. The Air Quality Limit Values are transposed into the updated Regulations as Air Quality Standards, with attainment dates in line with the European Directives. SI 2007 No. 64 Regulation 14 extends powers, under Section 85(5) of the Environment Act (1995), for the Secretary of State to give directions to Local Authorities (LAs) for the implementation of these Directives.

The UK Air Quality Strategy is the method for implementation of the air quality limit values in England, Scotland, Wales and Northern Ireland and provides a framework for improving air quality and protecting human health from the effects of pollution.

For each nominated pollutant, the Air Quality Strategy sets clear, measurable, outdoor air quality standards and target dates by which these must be achieved; the combined standard and target date is referred to as the Air Quality Objective (AQO) for that pollutant. Adopted national standards are based on the recommendations of the Expert Panel on Air Quality Standards (EPAQS) and have been translated into a set of Statutory Objectives within the Air Quality (England) Regulations (2000) SI 928, and subsequent amendments.

The AQOs for respirable particulates within the Air Quality Strategy are presented in Table 1 along with European Commission (EC) Directive Limits and World Health Organisation (WHO) Guidelines.

Table 1: Air Quality Standards, Objectives, Limits and Target Values

<table>
<tr><th>Pollutant</th><th>Applies</th><th>Objective</th><th>Concentration Measured as[10]</th><th>Date to be Achieved by and Maintained thereafter</th><th>European Obligations</th><th>Date to be achieved and maintained thereafter</th><th>New or existing</th></tr>
<tr><td rowspan="3">PM_{10}</td><td>UK</td><td>50µg.m^{-3} not to be exceeded more than 35 times a year</td><td>24 Hour Mean</td><td>31st December 2004</td><td>50µg.m^{-3} not to be exceeded more than 35 times a year</td><td>1 January 2005</td><td rowspan="2">Retain existing</td></tr>
<tr><td>UK</td><td>40µg.m^{-3}</td><td>Annual Mean</td><td>31st December 2004</td><td>40µg.m^{-3}</td><td>1 January 2005</td></tr>
<tr><td colspan="7">Indicative 2010 objectives for PM_{10} (from the 200 strategy and 2003 Addendum) have been replaced by an exposure reduction approach for $PM_{2.5}$ (except in Scotland)</td></tr>
<tr><td rowspan="2">$PM_{2.5}$
Exposure Reduction</td><td>UK (except Scotland)</td><td>25µg.m^{-3}</td><td rowspan="2">Annual Mean</td><td>2020</td><td>Target Value 25µg.m^{-3}</td><td>2010</td><td rowspan="2">New (European obligations still under negotiation)</td></tr>
<tr><td>UK Urban Areas</td><td>Target of 15% reduction in concentrations at urban background</td><td>Between 2010 and 2020</td><td>Target of 20% reduction in concentrations at urban background</td><td>Between 2010 and 2020</td></tr>
<tr><td rowspan="2">Nitrogen Dioxide</td><td>UK</td><td>200µg.m^{-3} not to be exceeded more than 18 times a year</td><td>1 Hour Mean</td><td>31st December 2005</td><td>200µg.m^{-3} not to be exceeded more than 18 times a year</td><td>1st January 2010</td><td rowspan="2">Retain Existing</td></tr>
<tr><td>UK</td><td>40µg.m^{-3}</td><td>Annual Mean</td><td>31st December 2005</td><td>40µg.m^{-3}</td><td>1st January 2010</td></tr>
<tr><td colspan="8">National Air Quality Objectives and European Directive Limit and target values for the protection of vegetation and ecosystems</td></tr>
<tr><td>Nitrogen Oxides</td><td>UK</td><td>30µg.m^{-3}</td><td>Annual Mean</td><td>31st December 2000</td><td>30µg.m^{-3}</td><td>19th July 2001</td><td>Retain existing in accordance with 1st Daughter Directive</td></tr>
</table>

2.3 Local Authority Pollution Control

Local Authorities (LAs), including WDDC, have formal powers to control air quality through a combination of Environmental Permitting, Local Air Quality Management (LAQM) and through use of their wider planning policies.

2.4 Local Air Quality Management

Under Section 82 of the Environment Act (1995) (Part IV) LAs are required to periodically review and assess air quality within their area of jurisdiction under the system of LAQM. This review and assessment of air quality involves assessing present and likely future air quality against the AQOs. If it is predicted that levels at relevant receptor locations where members of the public are regularly present (normally residential properties) are likely to be exceeded, the LA is required to declare an Air Quality Management Area (AQMA). For each AQMA the LA is required to produce an Air Quality Action Plan (AQAP), the objective of which is to reduce pollutant concentrations in pursuit of the AQOs.

The process of reviewing and assessing air quality follows a logical phased sequence so that LAs should only undertake a level of assessment commensurate with the risk of an air quality objective being exceeded. The phased approach is summarised in Table 2.

Table 2: Phased Approach to Review and Assessment

Level of Assessment	Objective	Approach
Updating and Screening	To identify those matters that have changed since the last review and assessment, which might lead to a risk of an air quality being exceeded	Use a checklist to identify significant changes that require further consideration. Where such changes are identified, then apply simple screening tools to decide whether there is sufficient risk of exceedance of an objective to justify a Detailed Assessment
Detailed Assessment	To provide an accurate assessment of the likelihood of an air quality objective being exceeded at locations with relevant exposure. This should be sufficiently detailed to allow the designation or amendment of any necessary AQMAs.	Use quality assured monitoring and validated modelling methods to determine current and future pollutant concentrations in areas where there is a significant risk of exceeding and air quality objective.
Further Assessments (only required following the declaration of an AQMA)	To supplement the information provided in the Detailed assessment. To confirm the exceedance of objectives, define what improvement in air quality and corresponding reduction in emission is required and provide information on source contributions.	Refine knowledge about sources of pollution and if necessary carry out more focused monitoring of the sources of pollution to check the assumptions on which the AQMA has been based

Level of Assessment	Objective	Approach
Progress Reports	To maintain continuity in the LAQM process and fill gaps between the years when assessments are not produced	Uses a basic checklist to summarise monitoring data and significant new development since the previous reports as well as tracking the delivery of Air Quality Action Plans, Local Air Quality Strategies, Planning and Policies and Local Transport Plans and Strategies.

A timescale for the delivery of the LAQM cycle has been set out and is summarised in Table 3.

Table 3: LAQM Cycles

Year	Updating and Screening Assessment	Progress Report	Detailed Assessment and Further Assessments
Round 4 Completion Dates			
2009	30 April 2009	-	Whenever necessary
2010	-	30 April 2010	Whenever necessary
2011	-	30 April 2011	Whenever necessary
Round 5 Completion Dates			
2012	30 April 2012	-	Whenever necessary
2013	-	30 April 2013	Whenever necessary
2014	-	30 April 2014	Whenever necessary
Round 6 Completion Dates			
2015	30 April 2015	-	Whenever necessary
2016	-	30 April 2016	Whenever necessary
2017	-	30 April 2017	Whenever necessary

To assist with the process of air quality assessments DEFRA have issued guidance designed to support local authorities in their duties under the Act.

3.0 Air Quality in Bridport and Chideock

3.1 Summary of Review and Assessment in West Dorset

West Dorset District Council completed its first round of Review and Assessment in 2001. The review of the local air quality concluded that the objectives for all the seven regulatory pollutants were being met and did not require any further assessment.

The second round of Review and Assessment began with an Updating and Screening Assessment (USA) in 2003. The USA, completed in 2004, concluded that a Detailed Assessment (DA) was required for some areas in Chideock, Bridport and Dorchester having the potential to exceed the AQO for NO_2. The Detailed Assessment was completed in 2006. Based on the findings of the DA and comments by DEFRA, it was concluded to declare an AQMA in Chideock and increase monitoring in Bridport and Dorchester to confirm if an AQMA was required in these areas.

In the third round of Review and Assessment the Council submitted a Progress Report in May 2007. Based on new monitoring data for NO_2, the report concluded that a Detailed Assessment was required for NO_2 due to road traffic emissions in Bridport and Dorchester.

The Detailed Assessment was produced in 2008 based on new monitoring data collected during 2007. Based on the findings of the Detailed Assessment and comments by Defra, it was concluded to declare an AQMA in High East Street, Dorchester and undertake modelling and further monitoring of NO_2 in East Street, Bridport.

A Further Assessment was also published in 2008 for Chideock. This concluded that based on future year projections the annual average AQO for NO_2 would be achieved in 2010. However WDDC have produced and implemented an Action Plan. Progress on actions taken is regularly reviewed at stakeholder meetings.

A Further Assessment was published in 2010 for High East Street, Dorchester. WDDC are currently in the process of producing an action plan in pursuit of the annual average AQO for NO_2 here.

3.2 Review of Air Quality Monitoring

3.2.1 Bridport Monitoring Sites

In 2009 WDDC operated 6 diffusion tubes in Bridport. Diffusion tubes were exposed for 4/5 week periods throughout the year at each monitoring site. These tubes were supplied and analysed by Gradko laboratories and distributed and collected by the Council. Diffusion tubes were placed between 1.5m and 2m above ground level and positioned at locations representative of residential receptor façades.

Table 4: Bridport NO_2 Diffusion Tube Locations

Site Type	Site Type	OS Grid Ref		Relevant Exposure (Y/N Distance to Relevant Exposure)	Distance to kerb of nearest road
		Easting	Northing		
East Road 1 (717)	Kerbside	347557	93023	Y (adjacent up hill)	2m
East Road 2 (730)	Kerbside	347612	93050	N	1m
East Road 3 (733)	Kerbside	347635	93060	N	1m
East Road 4 (734)	Kerbside	347489	92989	N	1m
West St (718)	Kerbside	346505	92964	Y (1m)	2m
South St (719)	Kerbside	346570	92899	Y(2m)	2m

The assessment has focused on monitoring locations adjacent to East Road either side of a residential property adjacent to the road as exceedances of the National Air Quality Objectives in Bridport have to date been confined to this location. A spatial representation of the monitoring sites included in the modelling is included in Appendix A, SK01.

3.2.2 Chideock Monitoring Sites

In 2009 WDDC operated 5 diffusion tube monitoring locations within Chideock. Triplicate diffusion tubes were co-located at the automatic monitoring site on the northern boundary of the post office car park. Positioned at the inlet of the continuous monitor, these tubes were intended to allow a suitable bias adjustment factor to be applied to all the diffusion tube monitoring results in accordance with best practice guidance.

Table 5: Chideock NO2 Diffusion Tube Locations

Site Type	Site Type	OS Grid Ref		Relevant Exposure (Y/N Distance to Relevant Exposure)	Distance to kerb of nearest road
		Easting	Northing		
Duck St (724)	Kerbside	342190	92840	Y (1m)	1m
George Pub (725)	Kerbside	342486	92791	Y (1m)	1m
Village Hall (726)	Kerbside	342015	92887	N	1m
Chervil Cottage (715)	Kerbside	342174	92818	Y (2m)	1m
Post Office (735)	Kerbside	342301	92817	N	1m
Post Office (736)	Kerbside	342301	92817	N	1m
Post Office (737)	Kerbside	342301	92817	N	1m

A spatial representation of the Chideock monitoring locations is included in Appendix A, SK04.

3.2.3 Bias Adjustment

An automatic monitoring station was installed in Chideock on 31 March 2009 to measure nitrogen dioxide (NO_2), however communication problems prevented the station becoming operational until November 2009. Therefore only one full months worth of data was collected in 2009 and as such WDDC were unable to conduct a co-location study in order to derive a local bias adjustment factor. Therefore the National Bias Adjustment Factor was used.

The bias adjustment factor was obtained from the on-line spreadsheet based tool at http://www.uwe.ac.uk/aqm/review/diffusiontube131108.xls, which publishes the bias correction factors of numerous surveys from across the UK in order to obtain a national average correction factor for the analysis technique. The bias correction factor used is taken from the published data from 2009 surveys.

3.2.4 PM_{10}

WDDC did not identify any areas within the district where PM_{10} could be a problem during the last Updating and Screening Assessment. This has not changed; therefore the council does not currently undertake any monitoring of this pollutant. However concerns have been raised by residents in Chideock regarding PM_{10} levels due to the unique topography of the area and as such it has been considered throughout the course of this assessment.

3.2.5 Other pollutants monitored

No other pollutants are monitored in West Dorset.

3.3 Monitoring Results

Table 6: Bias Adjusted Nitrogen Dioxide Monitoring Results in Bridport

Site Type	Site Type	Within AQMA	Data Capture for 2009	Bias Adjusted Monitoring Result ($\mu g.m^{-3}$)		
				2007	2008	2009
717	East Road 1	N	95	**51.34**	**55.11**	**57.07**
730	East Road 2	N	95	38.8	**40.02**	**41.03**
733	East Road 3	N	75	-	-	**43.32**
734	East Road 4	N	95	-	-	**51.41**
718	West Street	N	95	33.78	28.57	28.71
719	South Street	N	95	31.07	29.48	30.08

Table 7: Bias Adjusted Nitrogen Dioxide Monitoring Results in Chideock

Site Type	Site Type	Within AQMA	Data Capture for 2009	Bias Adjusted Monitoring Result ($\mu g.m^{-3}$)		
				2007	2008	2009
724	Duck St (Cleal Cottage)	Y	95	**41.65**	**44.34**	**50.9**
725	George Pub	Y	95	32.67	31.5	33.5
726	Village Hall	Y	100	39.25	41.58	**47.48**
715	Chervil Cottage	Y	90	-	-	13.9
735	Post Office	Y	65	-	-	13.6
736	Post Office	Y	65	-	-	14.1
737	Post Office	Y	65	-	-	14.1

Tables 6 and 7 illustrate that in 2009 the annual mean objective for NO_2 was exceeded at 6 monitoring locations along the A35 in Chideock and East Road, Bridport.

All monitoring sites located along East Road, Bridport, showed an exceedance of the objective in 2009 with recorded concentrations ranging from 41.03µg/m^3 to 57.07µg/m^3. This location has previously been identified as exceeding the annual objective and a Detailed Assessment was required from the outcome of the USA 2009.

Results for Chideock in 2009 showed that the NO_2 levels along the A35, at sites 724 (Duck Street) and 726 (Village Hall) were approximately 25% above the national objective, being 50.9$\mu g/m^3$ and 47.48$\mu g/m^3$ respectively. The 2008 Further Assessment predicted, using the LAQM Year Adjustment Calculator, that there would be a general decline in NO_2 levels in Chideock and that the objective would be met by 2009. Monitoring results for the past 3 years have shown an increase in NO_2 levels, contrary to the outcome of the Further Assessment. An Action Plan is in place to try to improve the levels in Chideock.

New monitoring was undertaken at Chervil Cottage, Duck Street (715) in 2009 to assess whether NO_2 levels exceeded the annual objective in Duck Street and not just at the junction of the A35. This location is approximately 10m back from the A35. The 2009 annual mean at this site showed results well within the national objective.

4.0 Methodology

4.1 Scope of Detailed Air Quality Assessment

WYG Sustainability and Environment was commissioned on behalf of WDDC to undertake a detailed assessment of air quality in the study areas identified. Specifically the purpose of this assessment is to:

1. Determine with reasonable certainty whether air quality standards and objectives for nitrogen dioxide and respirable particulates are being achieved in Bridport for the last year in which full monitoring data is available (section 82 (2) of the Environment Act 1995).

2. Determine the source apportionment of NO_X, NO_2, PM_{10} and $PM_{2.5}$ at key receptors within Bridport where the AQOs are not met.

3. Determine the year in which the AQOs will be met within Bridport taking account of predicted changes in traffic growth and predicted changes in emissions based the most recent emissions factors published by DfT.

4. Determine with reasonable certainty whether air quality standards and objectives for nitrogen dioxide and respirable particulates are being achieved in Chideock for the last year in which full monitoring data is available (section 82 (2) of the Environment Act 1995).

5. Determine the source apportionment of NO_X, NO_2, PM_{10} and $PM_{2.5}$ at key receptors within Chideock where the AQOs are not met.

6. Determine the year in which the AQOs will be met within Chideock taking account of predicted changes in traffic growth and predicted changes in emissions based on 2009 emissions factors published by DfT.

7. Predict the changes in exposure to NO_2 and PM_{10} at key receptors in Chideock as a result of the implementation of the following measures:

    a. Introduction of parking restrictions on the A35 going through the village, specifically on the incline west of the car park by the post office.
    b. Prohibiting vehicles over 7.5 tonnes using the A35 through Chideock.
    c. Extension of the 30mph speed restriction through the village further west along the A35 beyond houses adjacent to the steep incline.

d. Installation of a mini-roundabout at the junction of the A35 and Duck Street.

e. Installation of a signalized junction at the junction of the A35 and Duck Street.

f. Removal of vehicles using the A35/Duck Street junction to access the caravan parks at Seatown.

8. Provide modelling evidence to WDDC to aid determination on whether to designate an Air Quality Management Area (AQMA) in Bridport and revoke or amend the existing AQMA in Chideock.

The following assessment stages have been undertaken as part of this assessment:

- Review of available monitoring data;
- Dispersion modelling of nitrogen oxide to develop a verified model based on the available monitoring data;
- Assessment of potential exceedances of the annual mean Air Quality Objectives at appropriate receptor locations;
- Assessment of the geographical extents of and exceedances of the air quality objectives

The results are detailed in the following sections of this report.

4.2 Modelling

The dispersion model used for this assessment was ADMS Roads Extra. The ADMS-Roads pollution model is a comprehensive tool for investigating air pollution problems due to networks of roads. It incorporates the latest understanding of the boundary layer structure, and goes beyond the simplistic Pasquill-Gifford stability categories method with explicit calculation of important parameters. The model uses advanced algorithms for the height-dependence of wind speed, turbulence and stability to produce improved predictions.

The outputs of the model have been used to determine pollutant concentrations at existing monitoring locations and sensitive receptor façades. Additionally contour plots have been produced to illustrate the extents of pollution within the areas of study.

While emissions from road sources are assessed in detail, contributions from other pollutant sources have been considered via the use of background concentrations within the modelling process. These are discussed in detail in Chapter 5, along with other local conditions such as meteorological data, receptor locations and emission sources.

4.3 Model Verification

Model verification involves the comparison of modelled data to monitored data in order to gain the best possible representation of current pollutant concentrations for the assessment years. The verification process is in general accordance with that contained in Annex 3 of the TG (09) guidance note and uses recent monitoring data to best represent this.

4.4 Gradient Considerations

Observed pollutant concentrations within both Chideock and Bridport are likely to be significantly influenced by the surrounding topography. In order to accurately model air quality at these locations it is therefore vital that the model consider the relevant changes in gradient.

In accordance with TG (09) guidance paragraph A2.22, 'hill sections' were introduced into model. Normal Emission Factors for cars and LDVs were applied to these 'hill sections' while taking account of typical reductions in average speed due to gradient. Conversely, there are larger changes in emissions generated by HDVs when travelling up/down gradients necessitating a different approach. Specifically, emission factor gradient equations contained within Technical Guidance LAQM.TG(09) were applied to HDV EFs based on gradient values derived from site observations and OS mapping data. These amended EF values were only applied to sections of road with gradients steeper than 2.5%. Full details of the calculation process are included in Appendix C.

4.5 Traffic Data

Traffic data used within the model was supplied by Dorset County Council and West Dorset District Council, full details of which are included in Appendix B.

The majority of the data was surveyed during 2009, that recorded in other years was scaled to represent 2009 figures using NRTF forecast factors for medium traffic growth. Traffic figures have been broken down into class specific data in order to ensure calculated emission factors are as accurate as possible and allow the completion of a source apportionment study.

For the purposes of the air quality assessment only roads which experience significant flows have been included in the air quality model. Where traffic speeds were not available they have been estimated based on site observations and liaison with Dorset County Council. All of the roads within the Bridport and Chideock dispersion models are illustrated in Appendix A, SK03 and SK06 respectively.

In conjunction with guidance outlined in LAQM.TG(09), road junctions have been modelled with the assumption of a 50m slow-down phase, prior to the junction line. This slow-down phase has been modelled at a speed of $20km.h^{-1}$.

4.6 Source Apportionment

Where exceedances of the National Air Quality Objectives have been observed in the verification year at both existing monitoring locations and sensitive receptors, separate models have been run for each individual vehicle class to determine the source apportionment from each. Specifically this details the contribution of background sources, cars, heavy goods vehicles, buses, motor cycles and other light goods vehicles to total NO_x concentrations. The outputs of the source apportionment study determine the necessary reduction in NO_2 concentrations in order for the AQO to be met.

5.0 Existing Local Conditions

5.1 Receptors

Receptor locations where objectives apply are defined in the AQS as locations outside buildings or other natural or man-made structures above or below ground where members of the public are regularly present and might reasonably be expected to be exposed over the relevant averaging period of the objectives.

More specific guidance on receptors is provided in TG(09) and the 2010 EPUK guidance which provides specific land and property uses which may and may not be relevant for each objective averaging period.

For annual average objectives receptors should be considered where members of the public might be regularly exposed i.e. building facades of residential properties, schools, hospitals, care homes etc. Receptors should not be considered at building facades of offices or other places of work where members of the public do not have regular access, hotels (unless people live there as their permanent residence), gardens of residential properties, kerbside sites (as opposed to locations at the building façade), or any other location where public exposure is expected to be short term.

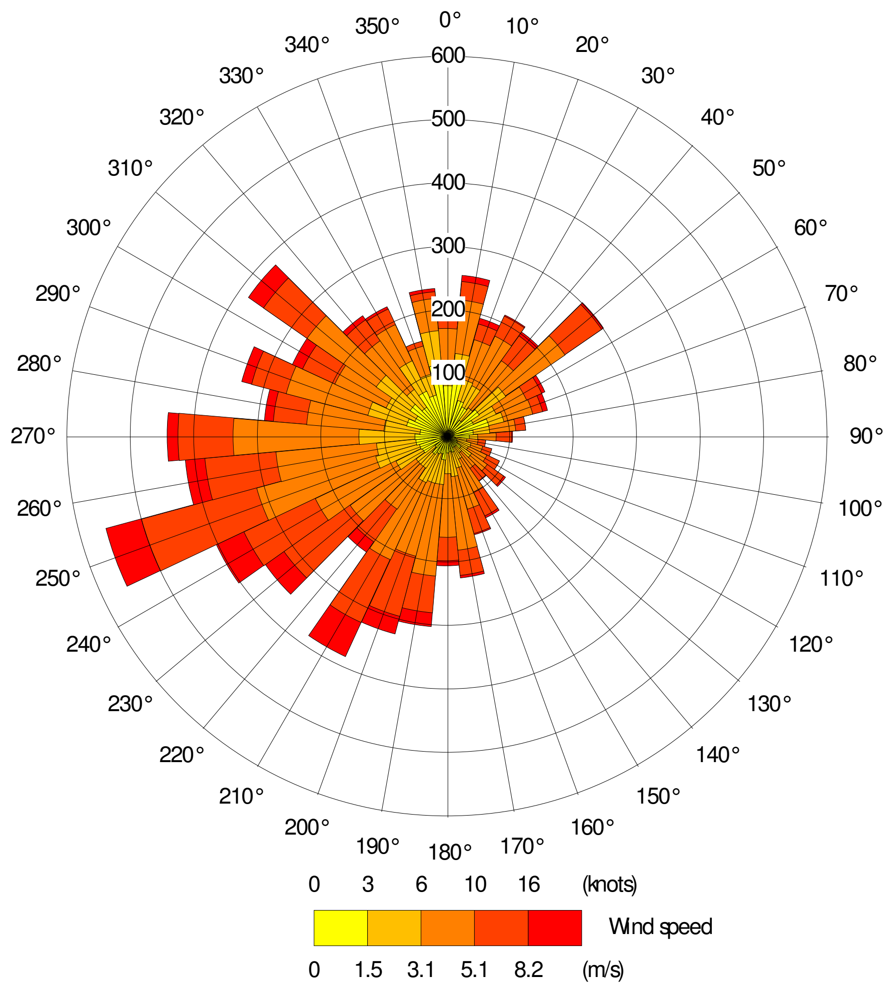
For the 24 hour mean objective for PM_{10}, receptors to be considered should include all of those considered for the annual average objective, but also included should be hotels and gardens of residential properties. For the 1 hour Objective for NO_2, receptors should be considered in busy shopping streets and outdoor locations where the public may be expected to spend one hour or more (e.g. recreational parks, open bus stations).

Receptors are modelled at a height of 1.5m to represent pollutant exposure at ground floor windows/façades. Those receptors considered in the Bridport and Chideock air quality models are detailed in the respective sections of Chapter 6. Additionally a spatial representation of all receptors can be found in Appendix A, SK02 and SK05.

5.2 Meteorological Data

Meteorological conditions have significant influence over air pollutant concentrations and dispersion. Pollutant levels can vary significantly from hour to hour as well as day to day, thus any air quality predictions need to be based on detailed meteorological data. The ADMS model calculates the dispersion of pollutants on an hourly basis using a year of local meteorological data. The meteorological data used in the assessment is derived from Bournemouth Met Station 2009, which is the nearest meteorological station with all the complete parameters necessary for the ADMS model.

Figure 2: Bournemouth Met Station 2009 Wind Rose



5.3 Background Air Quality

Background concentrations as used within the prediction calculations were referenced from the estimated air pollution maps for 2009 published on the DEFRA website. These are derived from ambient NO_x, NO_2,

PM_{10} and $PM_{2.5}$ monitoring locations within the region operated on behalf of DEFRA as part of the as part of the Automatic Urban Network and from local monitoring data obtained by West Dorset District Council.

Annual average pollutant levels were determined directly from the DEFRA background air pollution maps for the relevant 1km square over the study area, as presented in Table 8 and Table 9 below.

Table 8: Bridport Background Air Quality Levels 2009 (µg/m^3)

1km Grid Square		2009			
		NO_2	NO_x	PM_{10}	$PM_{2.5}$
346500	93500	9.68	12.25	13.60	8.68
347500	93500	8.88	11.14	13.37	8.55
346500	92500	9.12	11.46	13.11	8.48
347500	92500	8.05	10.02	12.99	8.35

Table 9: Chideock Background Air Quality Levels 2009 (µg/m^3)

1km Grid Square		2009			
		NO_2	NO_x	PM_{10}	$PM_{2.5}$
341500	93500	6.19	7.58	13.30	8.13
342500	93500	5.49	6.69	13.58	8.07
341500	92500	5.41	6.58	13.63	7.87
342500	92500	6.11	7.47	12.86	8.07

The use of these background concentrations within the modelling process ensures that pollutant sources other than traffic are represented appropriately. These secondary sources of pollutants include industrial, domestic and rail emissions within the vicinity of the study site.

The predicted background concentrations in the Archive decrease year on year based on the predicted progressive positive influence of EU and UK air quality legislation. However, guidance published on the DEFRA online Air Quality Review and Assessment Helpdesk in September 2010 states that "there is little evidence of a consistent downward trend in either NO_X or NO_2 concentrations, that would be suggested by emission inventory estimates."

The assessment has assumed that there will be no improvement in background air quality. As such, 2009 concentrations have been used throughout.

5.4 Topography

Given the nature of the Chideock and Bridport assessment locations, topography was considered likely to have a very significant effect on the dispersion of emissions within the study area. Road gradients have been taken into account using TG(09) best practice guidance as detailed in Chapter 4, section 4.4.

5.5 Local Regulated Emissions Sources

Site observations identified that traffic derived pollutants were likely to be the most significant local source of pollutants affecting the study sites and their surroundings. The principal source of nitrogen dioxide likely to impact local receptors is from the surrounding road traffic network.

Beyond the immediate surroundings for the two study sites, there are no other significant local sources of nitrogen oxides or particulates regulated by the Environment Agency under the Environmental Permitting Regulations (EPR), according to the Agencies online Industrial Emissions Archive.

6.0 Detailed Air Quality Assessment

6.1 Bridport

6.1.1 Model verification

The verification process consists of using the monitoring data and the published background air quality data in the UK National Air Quality Information Archive to calculate the road traffic contribution of nitrogen oxides (NO_x) at the monitoring locations. Outputs from the ADMS Roads model are provided as predicted road traffic contribution NO_x emissions. These are converted into predicted roadside contribution NO_2 exposure at the relevant receptor locations based on the updated approach to deriving NO_2 from NO_x for road traffic sources published in paragraphs 2.22 to 2.27 of Local Air Quality Management TG(09). The calculation was derived using the NO_x to NO_2 worksheet in the online LAQM tools website hosted by DEFRA.

Based on these results an overall adjustment factor is calculated which produces a best fit correlation between the model predictions and monitoring results. This approach ensures that the model provides the best possible representation of local traffic emissions. Figure 3 below indicates the correlation after model adjustments.

A primary model correction of 5.6944 was applied to roadside predicted NO_x concentrations before converting to NO_2. This figure demonstrates that the model was under predicting the road traffic emissions at the monitoring locations, probably due to the effects of congestion, stop-start driving and the effects of increased tailpipe emissions as traffic accelerates while travelling up/down the gradient within the study area. Following this adjustment a secondary model correction of 0.9966 was applied to the final total NO_2 model predictions in order to further improve the correlation between monitored and modelled data. Table 12 below summarises the final model/monitored data correlation following the application of the relevant adjustment factor.

Table 10: Calculation of Monitored Traffic Derived NO_X

Tube location	Monitored Total NO_2 ($\mu g/m^3$)	Background NO_2 ($\mu g/m^3$)	Monitored Traffic Derived NO_2 ($\mu g/m^3$)	Monitored Traffic NO_x ($\mu g/m^3$)
East Road 1 (717)	57.07	8.88	48.19	135.21
East Road 2 (730)	41.03	8.88	32.15	77.95
East Road 3 (733)	43.32	8.88	34.44	85.23
East Road 4 (734)	51.41	8.05	43.36	113.34

Table 11: Calculation of Adjusted Modelled NO_2

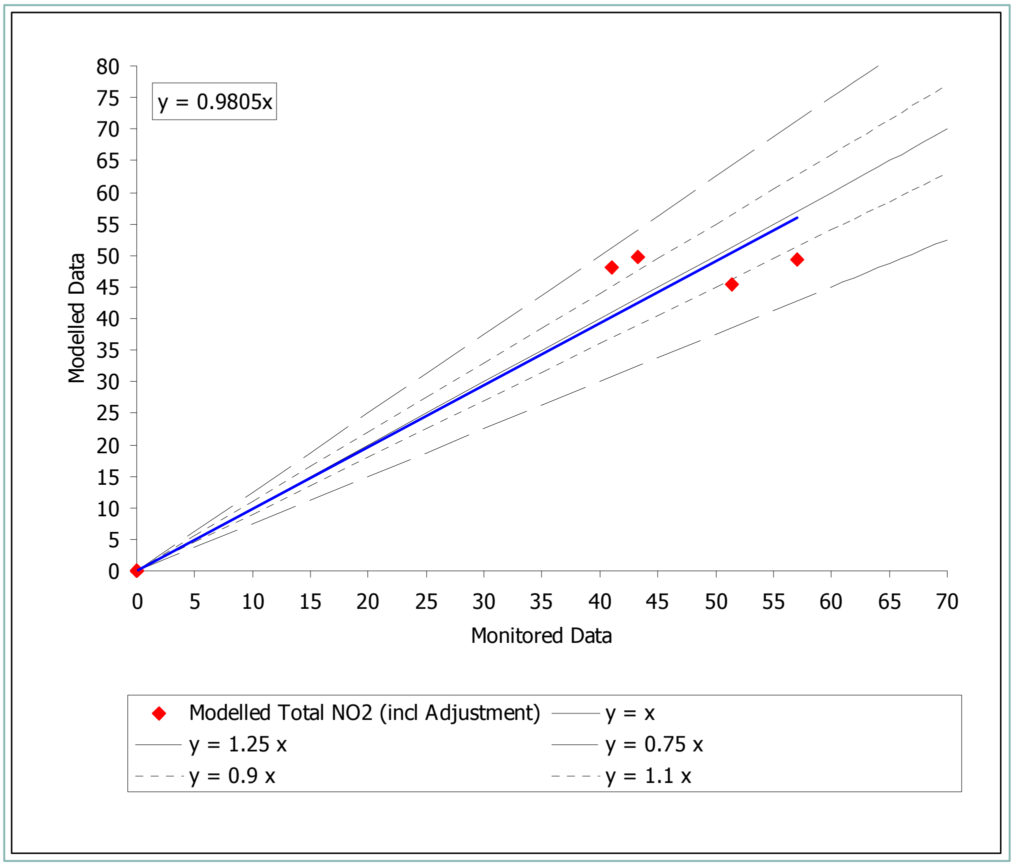
Tube location	Modelled Traffic NO_x ($\mu g/m^3$)	Monitored Traffic NO_x ($\mu g/m^3$)	Adjustment Factor	Primary Adjusted Modelled Traffic NO_x ($\mu g/m^3$)	Modelled Traffic NO_2 ($\mu g/m^3$)	Monitored Traffic NO_2 ($\mu g/m^3$)	Secondary Adjusted Modelled Total NO_2 ($\mu g/m^3$)
East Road 1 (717)	18.65	135.21	5.6944	106.18	40.6	48.19	49.31
East Road 2 (730)	17.89	77.95		101.87	39.4	32.15	48.11
East Road 3 (733)	18.89	85.23		107.58	40.95	34.44	49.69
East Road 4 (734)	16.65	113.34		94.79	37.49	43.36	45.41

Table 12: Comparison of Roadside Modelling & Monitoring Results for NO_2 in Bridport

Tube location	NO_2 $\mu g/m^3$		
	Monitored NO_2	Modelled NO_2	Difference (%)
East Road 1 (717)	57.07	49.31	13.59%
East Road 2 (730)	41.03	48.11	-17.25%
East Road 3 (733)	43.32	49.69	-14.71%
East Road 4 (734)	51.41	45.41	11.67%

The final model produced data at the monitoring locations to within 25% of the monitoring results. The model verification calculations for all of the locations were within the tolerance limits recommended in TG(09). The model is therefore considered to be verified and suitably representative of local emissions and exposures.

Figure 3: Final Verification Correlation for Bridport



6.1.2 Summary of Model Inputs

Table 13: Bridport Model Inputs

Parameter	Description	Input Value
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), nitrogen dioxide (NO_2), Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	Bournemouth 2009, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**0.5m** representing a typical surface roughness for parkland and open suburbia
Latitude	Allows the location of the model area to be set	United Kingdom = **52º**.
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Small Town= **30m.**
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = **0m**.
Road Width	Allows the width of the road link to be specified.	Road width used obtained from OS map data for the specific road link
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	Topographical influences were considered using TG(09) gradient factors (see section 5.4)
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	No time varied emissions used
Road Type	Allows the effect of different types of roads to be assessed.	**Urban Road** settings were used
Road Speeds	Enables individual road speeds to be added for each road link	Derived from Dorset CC traffic data and detailed site observations
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	No canyons were used
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the in-built DMRB database of traffic emission factors.	The **DMRB 2010** dataset was used.
Year	Predicted DMRB emissions rates depend on the year of emission.	**2009** data for the base year model validation. **2010, 2011, 2012, 2013 and 2014** data for future year predictions

6.1.3 ADMS Modelling Results

Table 14: 2009 Modelled Pollutant Concentrations at WDDC Monitoring Locations

Receptor		2009 Annual Average (µg/m³)			
		NO_X	NO_2	PM_{10}	$PM_{2.5}$
717	East Road 1	117.3	**49.3**	20.5	13.5
730	East Road 2	113.0	**48.1**	20.0	13.1
733	East Road 3	118.7	**49.7**	20.3	13.3
734	East Road 4	104.8	**45.4**	19.5	12.8

Table 15: 2009 Modelled Pollutant Concentrations at Sensitive Receptors

Receptor		2009 Annual Average (µg/m³)			
		NO_X	NO_2	PM_{10}	$PM_{2.5}$
REC 1	47 East Road	117.7	**49.4**	20.4	13.4
REC 2	Mill House Flats	117.3	**43.0**	20.5	12.8
REC 3	11 East Road	113.0	**47.4**	20.0	13.5
REC 4	1 Asker Mead	118.7	**50.0**	20.3	14.0
REC 5	6 Toll House Mews	104.8	37.4	19.5	11.8
REC 6	9 Manor Fields	97.1	31.1	19.3	11.0
REC 7	29 Manor Fields	111.9	29.9	20.4	10.8
REC 8	65 East Road	121.6	26.3	21.1	10.3
REC 9	75 East Road	79.5	25.6	18.0	10.3
REC 10	89 East Road	61.8	26.0	16.8	10.3
REC 11	103 East Road	57.8	25.1	16.6	10.2
REC 12	69 Howard Road	48.8	30.2	15.9	10.9
REC 13	12 East Road	47.2	29.0	15.9	11.1
REC 14	3a Longs Lane	48.1	22.7	15.9	10.5
REC 15	5 Longs Lane	46.0	18.9	15.8	9.9

As highlighted in Table 14, the model indicates exceedances of the AQO for NO_2 at all WDDC East Road monitoring sites in 2009, in conjunction with monitoring results.

An additional 15 residential receptor locations off East Road were included in the model in order to derive relevant NO_x, NO_2, PM_{10} and $PM_{2.5}$ exposure at property façades along the full length of the road. A spatial representation of all receptor locations considered within the Bridport model is included within Appendix A, SK02. As illustrated by Table 15 above, exceedances of the AQO for NO_2 were observed at 4 modelled receptor locations.

The maximum modelled annual average exposure to nitrogen dioxide at any residential receptor in 2009 is 50.0µg/m^3 at 1 Asker Mead which constitutes a 25% exceedance of the National Air Quality Objective. Exceedances are also observed at the façade of 47 East Road, Mill House Flats and 11 East Road. There are no exceedances of the AQO for NO_2 at any other receptors included in the model.

Based on model outputs, no existing or potential residential receptor locations exceeded the annual average objective for PM_{10} in 2009.

SK07 in Appendix A provides a contour plot for the dispersion of NO_2 in relation to modelled receptor locations in 2009.

24-hour Mean PM_{10} Concentrations

As identified in TG(09), dispersion models are inherently less accurate at predicting the number of exceedences of the 24-hour mean PM_{10} objective than for the annual mean objective. As such a relationship between the annual mean and the number of 24-hour mean exceedances of PM_{10} has been devised by applying the default 1.3 correction factor to the Tapered Element Oscillating Microbalance (TEOM) analyser data:

$$\text{No. 24-hour mean exceedances} = -18.5 + 0.00145 * \text{annual mean}^3 + (206/\text{annual mean})$$

This formula has been applied to all modelled locations within Bridport, the results of which are summarised in Table 16.

Table 16: Predicted number of PM_{10} 24-hour Mean AQO Exceedances in Bridport

Receptor		2009 Annual Average (µg/m^3)	Number of 24-hour Mean Exceedances
717	East Road 1	20.5	4
730	East Road 2	20.0	3
733	East Road 3	20.3	4
734	East Road 4	19.5	3
REC 1	47 East Road	20.4	4
REC 2	Mill House Flats	20.5	3
REC 3	11 East Road	20.0	4
REC 4	1 Asker Mead	20.3	5
REC 5	6 Toll House Mews	19.5	1
REC 6	9 Manor Fields	19.3	1
REC 7	29 Manor Fields	20.4	1
REC 8	65 East Road	21.1	0
REC 9	75 East Road	18.0	0
REC 10	89 East Road	16.8	0
REC 11	103 East Road	16.6	0
REC 12	69 Howard Road	15.9	1
REC 13	12 East Road	15.9	1
REC 14	3a Longs Lane	15.9	0
REC 15	5 Longs Lane	15.8	0

As Table 16 illustrates, the predicted number of exceedances of the 24-hour AQO for PM_{10} in Bridport at all receptors is well within the maximum permitted figure of 35.

1-Hour Mean Nitrogen Dioxide Concentrations

Exceedances of the 1-hour objective for NO_2 are highly variable from year to year. Additionally, as with PM_{10}, the dispersion model is poorer at predicting short-term peaks than annual mean concentrations. The assessment has therefore followed guidance contained within TG(09), which references studies carried out on behalf of Defra and the Devolved Administrations[1]. Specifically, this research identified a relationship

[1] Laxen D and Marner B (2003). Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites. Available at www.airquality.co.uk/archive/reports/list.php

between the annual mean and the 1-hour mean objective, such that exceedences of the latter were considered unlikely where the annual mean was below 60µg/m^3. Based on this relationship, it is unlikely that exceedances of the 1-hour mean AQO for nitrogen dioxide (see Table 1) will be exceeded at any receptor within Bridport, with the worst effected residential receptor (1 Asker Mead) experiencing an annual average exposure of 50.0µg/m^3.

Source Apportionment

Where exceedances of the National Air Quality Objective for NO_2 have been observed, a source apportionment study has been conducted to provide a breakdown of the contribution of individual vehicle classes to total pollutant concentrations. Specifically, the contribution made by cars, HGVs, motor cycles, buses and other LGVs to the modelled NO_x concentrations in 2009 has been calculated and is presented in Table 17.

Table 17: NO_x Source Apportionment by vehicle class

Receptor	Contribution to Total NO_x											
	Car		HGV		Other LGV		Bus		MC		Background	
	µg/m^3	%	µg/m^3	%	µg/m^3	%	µg/m^3	%	µg/m^3	%	µg/m^3	%
East Road 1 (717)	30.2	25.8	63.4	54.0	6.4	5.4	6.1	5.2	0.1	0.1	11.1	9.5
East Road 2 (730)	26.7	23.6	63.4	56.1	5.6	5.0	6.1	5.4	0.1	0.1	11.1	9.9
East Road 3 (733)	27.9	23.5	67.3	56.7	5.7	4.8	6.5	5.5	0.1	0.1	11.1	9.4
East Road 4 (734)	28.2	26.9	55.3	52.8	5.8	5.6	5.3	5.1	0.1	0.1	10.0	9.6
47 East Road	28.9	24.6	65.3	55.5	6.0	5.1	6.3	5.3	0.2	0.1	11.1	9.4
Mill House Flats	33.5	34.4	40.1	41.2	7.6	7.8	6.1	6.3	0.1	0.1	10.0	10.3
11 East Road	35.2	31.5	53.0	47.4	7.4	6.6	5.9	5.3	0.2	0.2	10.0	9.0
1 Asker Mead	40.5	33.4	55.2	45.5	8.8	7.3	6.6	5.4	0.2	0.2	10.0	8.3

At all of those locations modelled to have experienced NO_2 concentrations in excess of the AQO in 2009, HGVs provide the largest contribution to predicted NO_x levels by a significant margin, this is primarily due to the dramatic effects of gradient on HGV emissions when compared to those of other vehicle classes. Cars account for the second largest proportion of emissions followed by background sources, other LGVs and Buses. The contribution from motor cycles is considered negligible.

At those residential properties within close proximity to the East Road/East Street roundabout, the contribution of HGV is slightly less significant, due to the reduced role of gradient in determining emission rates. At these locations it is likely that modelled exceedances are as a result of reduced speeds up to and away from the roundabout and the influence of meteorological conditions on the dispersion of pollutants.

At the worst effected monitoring location according to the model (East Road 3) a 30.4% reduction in traffic derived NO_x is required in order for total NO_2 levels to be compliant with the AQO of 40 µg/m^3.

At the worst effected residential receptor according to the model (1 Asker Mead) a 31% reduction in traffic derived NO_x is required in order for total NO_2 levels to be compliant with the AQO of 40 µg/m^3.

These figures were derived using the NO_x to NO_2 worksheet in the online LAQM tools website hosted by DEFRA as discussed in section 6.1.1.

Future Year Scenarios

The assessment includes air quality modelling in future years in order to determine when the National Air Quality Objectives are predicted to be met at the worst effected receptors without the need for additional measures to reduce concentrations. The results are illustrated in Table 18 below.

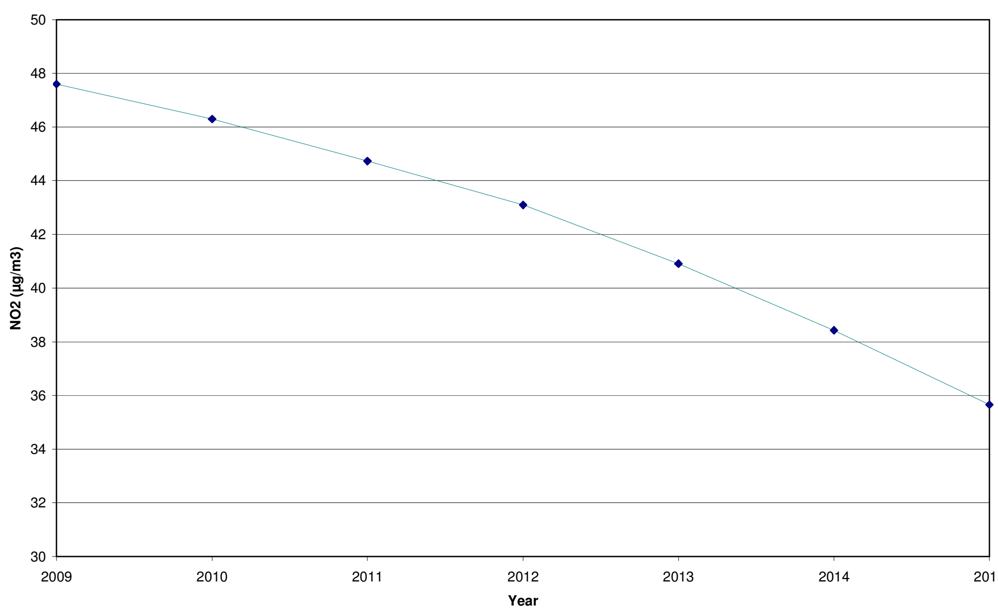
Table 18: Modelled NO2 Concentrations in Future Years

Receptor	NO_2 (µg/m^3)						
	2009	2010	2011	2012	2013	2014	2015
East Road 1 (717)	**49.3**	**48.0**	**46.4**	**44.7**	**42.4**	39.8	36.8
East Road 2 (730)	**48.1**	**46.8**	**45.2**	**43.6**	**41.4**	38.7	35.8
East Road 3 (733)	**49.7**	**48.4**	**46.8**	**45.2**	**42.9**	**40.2**	37.1
East Road 4 (734)	**45.4**	**43.9**	**42.3**	**40.7**	38.5	36.0	33.4
47 East Road	**49.4**	**48.1**	**46.5**	**44.8**	**42.5**	39.9	36.9
Mill House Flats	**43.2**	**42.0**	**40.5**	38.9	37.0	34.9	32.6
11 East Road	**47.4**	**46.1**	**44.5**	**42.9**	**40.7**	38.3	35.5
1 Asker Mead	**50.1**	**48.9**	**47.4**	**45.7**	**43.5**	**41.1**	38.4

As illustrated, it is predicted that NO_2 concentrations at the worst effected receptor will achieve the AQO by 2015 at the earliest. The decreases in pollutant concentration can primarily be attributed to increased vehicle efficiency and greater control of vehicle emissions, the impacts of which outweigh those of predicted increases in traffic flow. As mentioned in section 5.3, it has been assumed that there will be no reduction in background concentrations in accordance with recent guidance and in order to represent worst case scenario. Figure 3 below provides a graphical illustration of the predicted trend in future average NO_2 concentrations with reference to the receptors in Table 18.

It should be noted that predictions of future pollutant concentrations are based on increased traffic flows as derived from NRTF scaling factors, future year emission factors as derived from the Emission Factor Toolkit Version 4.2.2 and assumptions within the NO_x to NO_2 worksheet in the online LAQM tools website. Therefore predictions are subject to the uncertainties within each of the approved air quality tools.

Figure 4: Predicted Decrease in NO_2 concentrations on East Road, Bridport.



6.2 Chideock

6.2.1 Model verification

The methodology for deriving verification factors is described in detail in section 6.1.1 and is identical to that implemented for air quality assessment in Bridport.

A primary model correction of 2.0659 was applied to roadside predicted NO_x concentrations before converting to NO_2. This figure demonstrates that the model was under predicting the road traffic emissions at the monitoring locations, probably due to the effects of congestion, stop-start driving, and the effects of increased tailpipe emissions as traffic accelerates away from junctions and while travelling up/down gradients within the study area. Following this adjustment a secondary model correction of 0.9705 was applied to the final total NO_2 model predictions in order to further improve the correlation between monitored and modelled data. Table 21 below summarises the final model/monitored data correlation following the application of the relevant adjustment factor.

Table 19: Calculation of Monitored Traffic Derived NO_X

Tube location	Monitored Total NO_2 ($\mu g/m^3$)	Background NO_2 ($\mu g/m^3$)	Monitored Traffic NO_2 ($\mu g/m^3$)	Monitored Traffic NO_x ($\mu g/m^3$)
Duck St (724)	**50.9**	6.11	44.79	119.27
George Pub (725)	33.5	6.11	27.39	62.48
Village Hall (726)	**47.5**	6.11	41.37	106.76
Chervil Cottage (715)	13.9	6.11	7.79	15.48
Post Office (735)	13.6	6.11	7.46	14.79
Post Office (736)	14.1	6.11	7.97	15.85
Post Office (737)	14.1	6.11	8.00	15.91

Table 20: Calculation of Adjusted Modelled NO_2

Tube location	Modelled Traffic NO_x ($\mu g/m^3$)	Monitored Traffic NO_x ($\mu g/m^3$)	Adjustment Factor	Primary Adjusted Modelled Traffic NO_x ($\mu g/m^3$)	Modelled Traffic NO_2 ($\mu g/m^3$)	Monitored Traffic NO_2 ($\mu g/m^3$)	Secondary Adjusted Modelled Total NO_2 ($\mu g/m^3$)
Duck St (724)	59.65	119.27	2.0659	123.22	45.84	44.79	50.59
George Pub (725)	31.45	62.48		64.97	28.28	27.39	33.55
Village Hall (726)	38.17	106.76		78.85	32.97	41.37	38.10
Chervil Cottage (715)	17.19	15.48		35.51	16.87	7.79	22.48
Post Office (735)	12.69	14.79		26.21	12.8	7.46	18.53
Post Office (736)	12.69	15.85		26.21	12.8	7.97	18.53
Post Office (737)	12.69	15.91		26.21	12.8	8.00	18.53

Table 21: Comparison of Roadside Modelling & Monitoring Results for NO_2 in Bridport

Tube location	NO_2 µg/m^3		
	Monitored NO_2	Modelled NO_2	Difference (%)
Duck St (724)	**50.9**	50.59	0.60%
George Pub (725)	33.5	33.55	-0.16%
Village Hall (726)	**47.5**	38.10	19.75%
Chervil Cottage (715)	13.9	22.48	-61.72%
Post Office (735)	13.6	18.53	-36.54%
Post Office (736)	14.1	18.53	-31.60%
Post Office (737)	14.1	18.53	-31.32%

As illustrated by Table 21, the model was over-predicting NO_2 at the automatic monitoring station adjacent to the post office car park and at Chervil Cottage off Duck Street. Due to limitations within the model and the dramatic variations in monitored NO_2 between locations of close proximity, verifying to within 25% of monitoring results was not feasible.

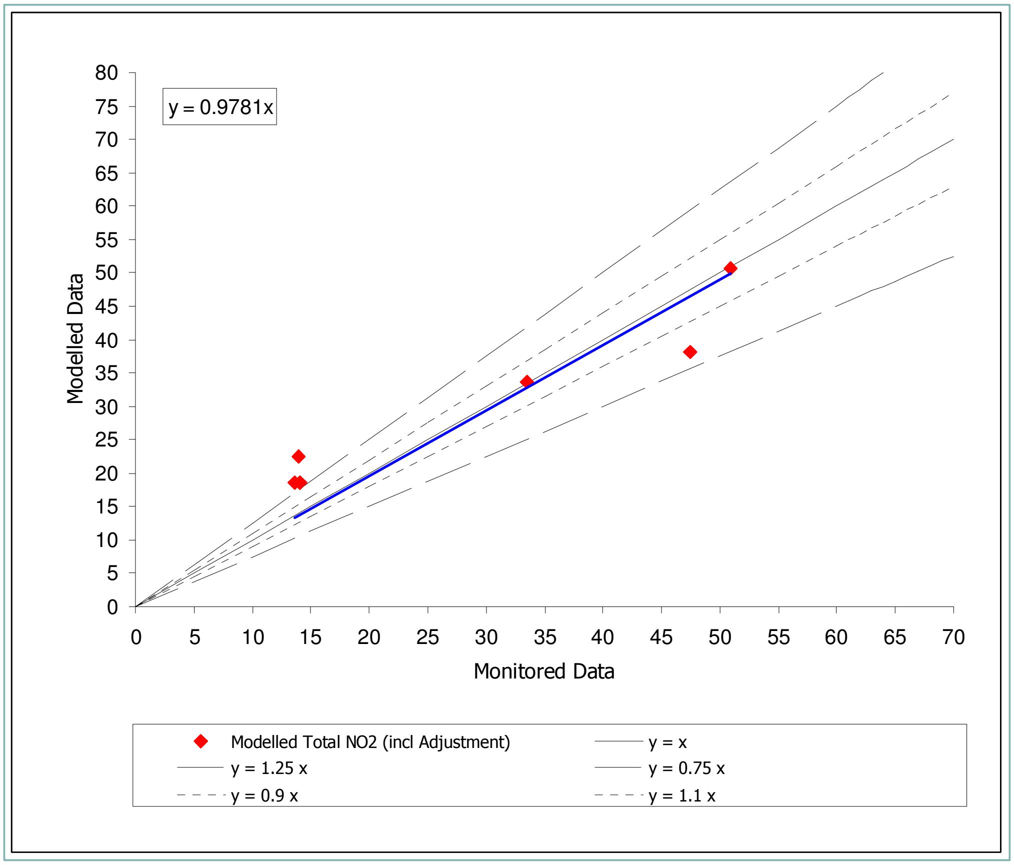
Because of the difficulties in verifying the model at all monitoring locations, emphasis was placed on accurately modelling those locations which have previously been identified as experiencing exceedances of the Air Quality Objectives. The final model produced data at these sites (Duck Street, The George Pub and the Village Hall) to within 25% of the monitoring, within the tolerance limits recommended in TG (09). Locations at which the model was over predicting NO_2 can be considered absolute worst case.

Whilst within TG(09) tolerance limits, a 19.75% under-prediction of NO_2 at the Village Hall monitoring site results in modelled pollutant concentrations within the AQO, in contrast to 2009 monitoring results of 47.5µg/m^3. Therefore, model outputs will represent comparative under-predictions at adjacent properties, namely Humberts and Whitecroft. However, it should be noted that despite this issue, source apportionment at these locations remains relatively accurate.

As such the model is considered to be verified and suitably representative of local emissions and receptor exposures.

At the Village Hall site, a number of variable scenarios based on gradient, speed and canyon height were tested aimed at verifying as accurately as possible. However none of the scenarios tested, other than those which utilised unrepresentative conditions, resulted in modelled NO_2 values within 19.75% of the monitoring results, it is unclear why this should be the case. Following rigorous testing it was concluded that sacrifices should not be made concerning the accuracy of model inputs, despite the fact that modelling results at the Village Hall location were under-predicting NO_2 relative to WDDC monitoring, and therefore not indicating an exceedance of the AQO for NO_2 at this location.

Figure 5: Final Verification Correlation for Chideock



6.2.2 Summary of Model Inputs

Table 22: Chideock Model Inputs

Parameter	Description	Input Value
Chemistry	A facility within ADMS-Roads to calculate the chemical reactions in the atmosphere between Nitric Oxide (NO), nitrogen dioxide (NO_2), Ozone (O_3) and Volatile organic compounds (VOCs).	No atmospheric chemistry parameters included
Meteorology	Representative meteorological data from a local source	Bournemouth 2009, hourly sequential data
Surface Roughness	A setting to define the surface roughness of the model area based upon its location.	**0.5m** representing a typical surface roughness for parkland and open suburbia
Latitude	Allows the location of the model area to be set	United Kingdom = **52º**.
Monin-Obukhov Length	This allows a measure of the stability of the atmosphere within the model area to be specified depending upon its character.	Small Town= **30m.**
Elevation of Road	Allows the height of the road link above ground level to be specified.	All road links were set at ground level = **0m**.
Road Width	Allows the width of the road link to be specified.	Road width used obtained from OS map data for the specific road link
Topography	This enables complex terrain data to be included within the model in order to account for turbulence and plume spread effects of topography	Topographical influences were considered using TG(09) gradient factors (see section 5.4)
Time Varied Emissions	This enables daily, weekly or monthly variations in emissions to be applied to road sources	No time varied emissions used
Road Type	Allows the effect of different types of roads to be assessed.	**Urban Road** settings were used
Road Speeds	Enables individual road speeds to be added for each road link	Derived from Dorset CC traffic data and detailed site observations
Canyon Height	Allows the model to take account turbulent flow patterns occurring inside a street with relatively tall buildings on both sides, known as a "street canyon".	Small sections of canyon were included along appropriate lengths of the A35 (4m – 6m)
Road Source Emissions	Road source emission rates are calculated from traffic flow data using the in-built DMRB database of traffic emission factors.	The **DMRB 2010** dataset was used.
Year	Predicted DMRB emissions rates depend on the year of emission.	**2009** data for the base year model validation. **2010, 2011, 2012, 2013, 2014, 2015 and 2016** data for future year predictions

6.2.3 ADMS Modelling Results

Table 23: 2009 Modelled Pollutant Concentrations in Chideock

Receptor		2009 Annual Average (µg/m^3)			
		NO_X	NO_2	PM_{10}	$PM_{2.5}$
724	Duck St	130.7	**50.6**	18.7	12.9
725	George Pub	72.4	33.6	16.4	10.8
726	Village Hall	86.3	38.1	16.6	11.1
715	Chervil Cottage	43.0	22.5	14.7	9.5
735	Post Office	33.7	18.5	15.0	9.7
736	Post Office	33.7	18.5	15.0	9.7
737	Post Office	33.7	18.5	15.0	9.7
REC 1	Hope Cottage	33.7	18.6	15.0	10.5
REC 2	St Giles Church	65.6	31.2	15.9	10.5
REC 3	Humberts	72.0	33.4	16.1	10.7
REC 4	Whitecroft	71.3	32.9	15.7	10.3
REC 5	Clock Cottages	91.8	39.8	17.0	11.4
REC 6	Warren House	80.5	36.2	16.6	11.1
REC 7	Bridge Cottage	42.3	22.2	15.4	10.0
REC 8	Lilac Cottage	46.3	23.9	15.0	9.8
REC 9	Linnet Cottage	79.2	35.8	16.8	11.2
REC 10	Park Farmhouse	58.4	28.6	15.4	10.1
REC 11	1 Park Farmhouse	70.6	32.9	16.0	10.5
REC 12	Bilberry Close	45.5	23.5	14.9	9.6
REC 13	Rose Cottage	56.1	27.7	16.0	10.8
REC 14	Duckling Cottage	28.6	16.3	14.0	8.9
REC 15	Mill Lane Cottage	22.5	13.4	13.7	8.7

In conjunction with 2009 monitoring results, the model identifies that site 724 Duck Street, at the façade of Cleal Cottage, experiences the highest concentrations of NO_2 at 50.6µg/m^3.

An additional 15 residential receptor locations off the A35 Main Street and Duck Street were included within the model in order to derive relevant NO_x, NO_2, PM_{10} and $PM_{2.5}$ exposure at property façades. A spatial representation of these 15 locations is included within Appendix A, SK05.

The maximum modelled annual average exposure to nitrogen dioxide at any receptor, other than the façade of Cleal Cottage (724), is 39.8µg/m^3 at Clock Cottages. Warren House also experiences NO_2 concentrations within 10% of the AQO and as such both receptors should be considered of high sensitivity to changes in traffic conditions.

Based on model outputs, no existing or potential residential receptor locations exceeded the annual average objective for PM_{10} or in 2009.

Figure 09 in Appendix A provides a contour plot for the dispersion of NO_2 in relation to modelled receptor locations in 2009.

24-hour Mean PM_{10} Concentrations

The methodology used to calculate the number exceedances of the 24-hour mean PM_{10} AQO within Chideock is identical to that described in section 6.1.3, using the relationship below:

$$\text{No. 24-hour mean exceedances} = -18.5 + 0.00145 * \text{annual mean}^3 + (206/\text{annual mean})$$

This formula has been applied to all modelled locations within Chideock, the results of which are summarised in Table 24.

Table 24: Predicted number of PM_{10} 24-hour Mean Exceedances in Chideock

Receptor		2009 Annual Average (µg/m^3)	Number of 24-hour Mean Exceedances
724	Duck St	18.7	2
725	George Pub	16.4	0
726	Village Hall	16.6	1
715	Chervil Cottage	14.7	0
735	Post Office	15.0	0
736	Post Office	15.0	0
737	Post Office	15.0	0
REC 1	Hope Cottage	15.0	0
REC 2	St Giles Church	15.9	0
REC 3	Humberts	16.1	0
REC 4	Whitecroft	15.7	0
REC 5	Clock Cottages	17.0	1
REC 6	Warren House	16.6	1

REC 7	Bridge Cottage	15.4	0
REC 8	Lilac Cottage	15.0	0
REC 9	Linnet Cottage	16.8	1
REC 10	Park Farmhouse	15.4	0
REC 11	1 Park Farmhouse	16.0	0
REC 12	Bilberry Close	14.9	0
REC 13	Rose Cottage	16.0	0
REC 14	Duckling Cottage	14.0	0
REC 15	Mill Lane Cottage	13.7	0

As Table 24 illustrates, the predicted number of exceedances of the 24-hour AQO for PM_{10} in Chideock, at all receptors, is within the maximum permitted figure of 35.

1-Hour Mean Nitrogen Dioxide Concentrations

Exceedances of the 1-hour objective for NO_2 are highly variable from year to year. Additionally, as with PM_{10}, the dispersion model is poorer at predicting short-term peaks than annual mean concentrations. The assessment has therefore followed guidance contained within TG(09), which references studies carried out on behalf of Defra and the Devolved Administrations[2]. Specifically, this research identified a relationship between the annual mean and the 1-hour mean objective, such that exceedences of the latter were considered unlikely where the annual mean was below 60µg/m^3. Based on this relationship, it is unlikely that exceedances of the 1-hour mean AQO for nitrogen dioxide (see Table 1) will be exceeded at any receptor within Chideock, with the worst effected residential receptor (724 Duck St - Cleal Cottage) experiencing an annual average exposure in 2009 of 50.6µg/m^3.

Source Apportionment

A source apportionment study has been conducted to provide a breakdown of the contribution of individual vehicle classes to total pollutant concentrations at those locations displaying the NO_2 exposure in excess of and within 10% of the AQO.

Specifically, the percentage contribution made by cars, HGVs, other LGVs, buses, motor cycles and background to the modelled NO_x concentrations in 2009 has been calculated and is presented in Table 25 below.

[2] Laxen D and Marner B (2003). Analysis of the relationship between 1-hour and annual mean nitrogen dioxide at UK roadside and kerbside monitoring sites. Available at www.airquality.co.uk/archive/reports/list.php

Table 25: NO_x Source Apportionment by vehicle class (%)

Receptor	% Contribution to Total NO_x											
	Car		HGV		Other LGV		Bus		MC		Background	
	µg/m^3	%	µg/m^3	%	µg/m^3	%	µg/m^3	%	µg/m^3	%	µg/m^3	%
Duck St (724)	21.9	16.7	81.4	62.3	8.2	6.3	11.9	9.1	0.1	0.0	7.5	5.7
Village Hall (726)	13.9	16.1	51.6	59.8	5.5	6.4	7.8	9.0	0.0	0.0	7.5	8.7
Clock Cottages	15.9	17.4	53.9	58.7	6.5	7.1	8.0	8.7	0.0	0.0	7.5	8.1
Warren House	14.5	18.0	46.3	57.5	5.7	7.1	6.6	8.2	0.0	0.0	7.5	9.3

At all of those locations modelled to have experienced NO_2 concentrations either in excess or within 10% of the AQO in 2009, HGVs again provide the largest contribution to predicted NO_x levels (≈60%), this is due to the dramatic effects of gradient on HGV emissions when compared to those of other vehicle classes. Cars account for the second largest proportion of emissions followed by background buses, other LGVs, and background sources. The contribution from motor cycles is considered negligible.

At the Duck Street 1 monitoring location (724), a 31.3% reduction in traffic derived NO_x is required in order for total NO_2 levels to be compliant with the AQO of 40µg/m^3, as derived from the NO_x to NO_2 worksheet located at the online LAQM tools website.

In reference to section 6.2.1 paragraph 5, despite modelled under-predictions of NO_2 at the Village Hall site, source apportionment at this location remains relatively accurate and is largely calculated outside the model using emission factors. Based on source apportionment at WDDC 724 (Duck Street), HGV contributions at the Village Hall site may be up to 4% greater, whilst the contribution of background sources to total NO_x at this location would subsequently be around 6%.

Reductions may be achieved by limiting traffic flows are implementing measures designed to aid the flow of traffic. However, as is the case in Bridport, given that the primary cause of exceedances is the variation in gradient there is a limit to the measures which can be taken to reduce traffic derived pollutants. Given that the dominant source of roadside NO_x is again HGVs the same principle applies that a small reduction in these vehicle numbers would result in a disproportionate reduction in emissions. This scenario is explored further in the following sections of the report.

It should be noted that suggested reductions to traffic contribution are subject to uncertainty within the model and potential uncertainty concerning the monitoring results utilised in the verification process.

Future Year Scenarios

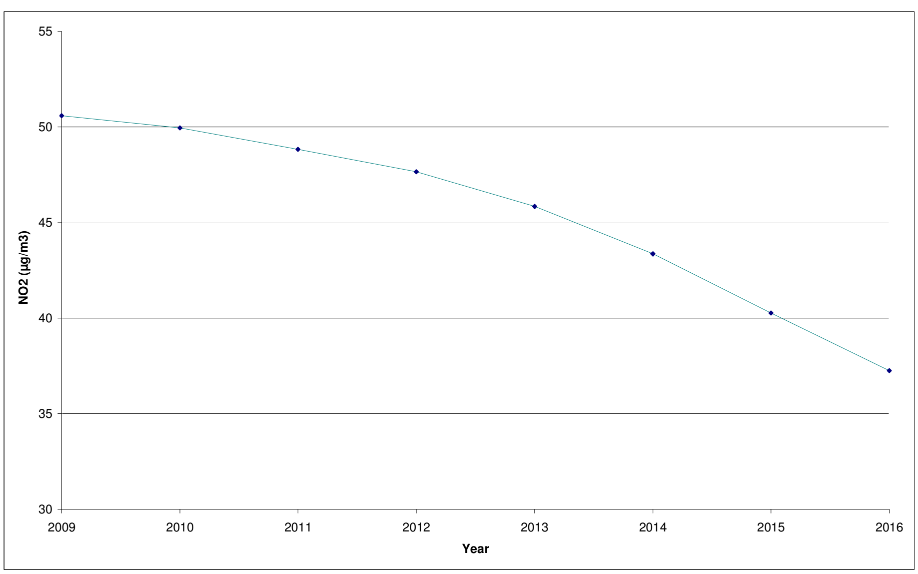
The assessment includes air quality modelling in future years in order to determine when the National Air Quality Objectives are predicted to be met at the worst effected residential receptor without the need for additional measures to reduce concentrations. The results are illustrated in Table 26 below.

Table 26: Modelled NO_2 Concentrations in Future Years

Receptor	% Contribution to Total NO_x							
	2009	2010	2011	2012	2013	2014	2015	2016
WDDC Duck St (724)	**50.59**	**49.96**	**48.83**	**47.66**	**45.84**	**43.36**	**40.26**	37.25

As illustrated it is predicted that NO_2 concentrations will be within the AQO by 2016 at the earliest. The decreases in pollutant concentration can primarily be attributed to increased vehicle efficiency and greater control of vehicle emissions, the impacts of which outweigh those of predicted increases in traffic flow. As mentioned in section 5.3, it has been assumed that there will be no reduction in background concentrations in accordance with recent guidance and in order to represent worst case scenario. Figure 6 below provides a graphical illustration of the predicted trend in future average NO2 concentrations for monitoring site 724.

Figure 6: Predicted decrease in NO_2 concentrations at WDDC 724 (Duck Street)



It should be noted that predictions of future pollutant concentrations are based on increased traffic flows as derived from NRFT scaling factors, future year emission factors as derived from the Emission Factor Toolkit Version 4.2.2 and assumptions within the NO_x to NO_2 worksheet in the online LAQM tools website. Therefore predictions are subject to uncertainties and errors within these utilities.

Scenario Testing

Potential Parking Restrictions on the A35 Main Street

The introduction of car parking restrictions on the A35 on the incline west of the post office has been suggested as a means of aiding traffic flow through Chideock and therefore reducing pollutant exposure at sensitive receptors. In order to predict the impacts of this proposed action the model has been assumed (following consultation with Dorset County Council) that average speeds along the relevant road sections will increase slightly (3kph) as a result of said restrictions, due to improved vehicle flow. 2012 is assumed as the opening operational year and the results of the assessment are presented in Table 27 with reference to modelled 2012 baseline conditions.

Table 27: Modelled Impact of A35 Parking Restrictions in 2012

Receptor		2012 Annual Average (µg/m³)		2012 with scenario (µg/m³)		% Change	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
WDDC 724	Duck St	47.7	17.8	46.3	17.7	-2.9	-0.6
WDDC 725	George Pub	30.8	15.9	30.8	15.9	0.0	0.0
WDDC 726	Village Hall	35.2	16.1	34.5	16	-2.0	-0.6
WDDC 715	Chervil Cottage	20.3	14.4	19.8	14.4	-2.5	0.0
WDDC 735	Post Office	17.0	14.8	16.9	14.8	-0.6	0.0
WDDC 736	Post Office	17.0	14.8	16.9	14.8	-0.6	0.0
WDDC 737	Post Office	17.0	14.8	16.9	14.8	-0.6	0.0
REC 1	Hope Cottage	17.0	14.8	16.9	14.8	-0.6	0.0
REC 2	St Giles Church	28.3	15.4	27.3	15.3	-3.5	-0.6
REC 3	Humberts	30.5	15.6	29.7	15.5	-2.6	-0.6
REC 4	Whitecroft	29.9	15.2	29.8	15.2	-0.3	0.0
REC 5	Clock Cottages	36.9	16.4	35.7	16.3	-3.3	-0.6
REC 6	Warren House	33.3	16.0	32.1	15.9	-3.6	-0.6
REC 7	Bridge Cottage	20.2	15.1	20.0	15.1	-1.0	0.0
REC 8	Lilac Cottage	21.5	14.7	21.5	14.7	0.0	0.0
REC 9	Linnet Cottage	33	16.3	33.0	16.3	0.0	0.0
REC 10	Park Farmhouse	25.8	15.0	25.8	15.0	0.0	0.0
REC 11	1 Park Farmhouse	29.9	15.6	29.9	15.6	0.0	0.0
REC 12	Bilberry Close	21.2	14.6	21.2	14.5	0.0	-0.7
REC 13	Rose Cottage	25.3	15.6	25.2	15.6	-0.4	0.0
REC 15	Duckling Cottage	14.7	13.8	14.5	13.8	-1.4	0.0
REC 16	Mill Lane Cottage	12.3	13.6	12.2	13.6	-0.8	0.0

As illustrated by Table 27, based on the identified assumptions, introducing car parking restrictions along the A35 west of the post office is likely to have a slight positive impact on pollutant concentrations at receptor façades. The maximum predicted decrease in NO_2 is 1.4µg/m^3 at the existing WDDC Duck Street monitoring location.

Potential HGV Restrictions

Currently, there are ongoing discussions between the relevant parties concerning the potential to limit the number of HGVs using the A35 trunk road through Chideock. Specifically it has been suggested that such measures could play a significant role in reducing pollutant exposure in the village. In order to provide evidence of the effect of HGV restrictions and support the conclusions of the source apportionment study, the assessment considers pollutant exposure at residential façades assuming there are no HGV movements through Chideock. The results of the model are again presented with reference to baseline 2012 conditions.

Table 28: Modelled Impact of HGV Restrictions in 2012

Receptor		2012 Annual Average (µg/m³)		2012 with scenario (µg/m³)		% Change	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
WDDC 724	Duck St	47.7	17.8	20.0	16.0	-58.1	-10.1
WDDC 725	George Pub	30.8	15.9	14.9	15.0	-51.6	-5.7
WDDC 726	Village Hall	35.2	16.1	15.3	14.9	-56.5	-7.5
WDDC 715	Chervil Cottage	20.3	14.4	10.9	13.9	-46.3	-3.5
WDDC 735	Post Office	17.0	14.8	12.7	14.5	-25.3	-2.0
WDDC 736	Post Office	17.0	14.8	12.7	14.5	-25.3	-2.0
WDDC 737	Post Office	17.0	14.8	12.7	14.5	-25.3	-2.0
REC 1	Hope Cottage	17.0	14.8	12.8	14.5	-24.7	-2.0
REC 2	St Giles Church	28.3	15.4	13.6	14.5	-51.9	-5.8
REC 3	Humberts	30.5	15.6	14.0	14.6	-54.1	-6.4
REC 4	Whitecroft	29.9	15.2	12.3	14.3	-58.9	-5.9
REC 5	Clock Cottages	36.9	16.4	16.5	15.2	-55.3	-7.3
REC 6	Warren House	33.3	16.0	15.4	14.9	-53.8	-6.9
REC 7	Bridge Cottage	20.2	15.1	13.3	14.7	-34.2	-2.6
REC 8	Lilac Cottage	21.5	14.7	11.3	14.2	-47.4	-3.4
REC 9	Linnet Cottage	33	16.3	16.1	15.3	-51.2	-6.1
REC 10	Park Farmhouse	25.8	15.0	11.9	14.2	-53.9	-5.3
REC 11	1 Park Farmhouse	29.9	15.6	13.2	14.6	-55.9	-6.4
REC 12	Bilberry Close	21.2	14.6	10.8	14.0	-49.1	-4.1
REC 13	Rose Cottage	25.3	15.6	14.7	15.1	-41.9	-3.2
REC 15	Duckling Cottage	14.7	13.8	9.0	13.5	-38.8	-2.2
REC 16	Mill Lane Cottage	12.3	13.6	8.3	13.4	-32.5	-1.5

Based on the conclusions of the source apportionment study, restricting HGV movement through Chideock would reduce NO_2 exposure by around 60%. As illustrated by Table 28, the scenario model supports this prediction. Again the maximum decrease in NO_2 (27.7µg/m^3) is observed at WDDC's Duck Street monitoring site. The model predicts that if HGVs were restricted from using the A35 trunk road through Chideock, there would be no exceedances of the AQO within the village and maximum concentrations of NO_2 would total 20.07µg/m^3.

The modelling has not accounted for air quality impacts associated with the redistribution of HGV movements, at receptors affected by diverted vehicles.

Potential Extension of 30mph Zone to the West of the Village Hall

Based on the relationship between speed, gradient and vehicle class, an extension of the 30mph zone through the village further west along the A35, beyond houses adjacent to the steep incline, is likely to have a limited effect on observed pollutant concentrations. This can be explained by the opposing effects of such an action on the emission factors of LGVs and HGVs. Specifically, while a decrease in speeds along this section of road would increase the rate of emissions from cars and other LGVs, it is likely to decrease the rate of emissions from HGVs based on the gradient calculations detailed in section 5.4 and Appendix C. Given the balance between the greater number of LDVs and greater scale of emission factors for HDVs when compared to LDVs, this results in the opposing effects essentially cancelling each other out, minimising the impact of such an approach, as supported by Table 29. Despite this an extension to the 30mph zone is likely to have a net negative impact.

Table 29: Modelled Impact of 30mph zone extensions in 2012

Receptor		2012 Annual Average (µg/m^3)		2012 with scenario (µg/m^3)		% Change	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
WDDC 724	Duck St	47.7	17.8	47.7	17.9	0.0	0.6
WDDC 725	George Pub	30.8	15.9	30.8	15.9	0.0	0.0
WDDC 726	Village Hall	35.2	16.1	35.9	16.2	2.0	0.6
WDDC 715	Chervil Cottage	20.3	14.4	20.4	14.4	0.5	0.0
WDDC 735	Post Office	17.0	14.8	17.0	14.8	0.0	0.0
WDDC 736	Post Office	17.0	14.8	17.0	14.8	0.0	0.0
WDDC 737	Post Office	17.0	14.8	17.0	14.8	0.0	0.0
REC 1	Hope Cottage	17.0	14.8	17.0	14.8	0.0	0.0
REC 2	St Giles Church	28.3	15.4	28.4	15.4	0.4	0.0

REC 3	Humberts	30.5	15.6	31.0	15.7	1.6	0.6
REC 4	Whitecroft	29.9	15.2	32.4	15.5	8.4	2.0
REC 5	Clock Cottages	36.9	16.4	37.0	16.4	0.3	0.0
REC 6	Warren House	33.3	16.0	33.5	16	0.6	0.0
REC 7	Bridge Cottage	20.2	15.1	20.2	15.1	0.0	0.0
REC 8	Lilac Cottage	21.5	14.7	21.5	14.7	0.0	0.0
REC 9	Linnet Cottage	33.0	16.3	33.1	16.3	0.3	0.0
REC 10	Park Farmhouse	25.8	15.0	25.8	15.0	0.0	0.0
REC 11	1 Park Farmhouse	29.9	15.6	30.0	15.6	0.3	0.0
REC 12	Bilberry Close	21.2	14.6	21.2	14.6	0.0	0.0
REC 13	Rose Cottage	25.3	15.6	25.3	15.6	0.0	0.0
REC 15	Duckling Cottage	14.7	13.8	14.8	13.8	0.7	0.0
REC 16	Mill Lane Cottage	12.3	13.6	12.4	13.6	0.8	0.0

Properties predicted to be most significantly effected by an extension to the 30mph zone are obviously those adjacent to the section of road which would experience a reduction in average speeds. Whitecroft and Humberts are the closest modelled residential receptors and both are predicted to be subject to an increase in NO_2 exposure of 2.57µg/m^3 and 0.57µg/m^3 respectively. Increases in PM_{10} exposure as a result of this scenario are considered negligible.

Potential Installation of Mini-roundabout/Signalised Junction at A35/Duck Street Junction

In order to fully explore the range of scenarios put forward as a means of reducing pollutant concentrations in Chideock, the detailed assessment has considered the installation of both a mini-roundabout and a signalised junction at the A35/Duck Street junction. Following discussion with both Dorset County Council and WYG Transport Planning consultants, it was concluded that both measures would result in a reduction in average speeds along the sections of road either side of the junction. This can be explained by typical reductions in flow due to increased stop start driving behaviour. As such the model has assumed that each scenario would result in a similar reduction in average speed of 5kph. The impacts of such a reduction on pollutant exposure are illustrated below in Table 30.

Table 30: Modelled Impact of mini-roundabout/signalised Junction in 2012

Receptor		2012 Annual Average ($\mu g/m^3$)		2012 with scenario ($\mu g/m^3$)		% Change	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
WDDC 724	Duck St	47.7	17.8	50.6	18.2	6.1	2.2
WDDC 725	George Pub	30.8	15.9	30.8	15.9	0.0	0.0
WDDC 726	Village Hall	35.2	16.1	35.2	16.1	0.0	0.0
WDDC 715	Chervil Cottage	20.3	14.4	21.0	14.5	3.4	0.7
WDDC 735	Post Office	17.0	14.8	17.1	14.8	0.6	0.0
WDDC 736	Post Office	17.0	14.8	17.1	14.8	0.6	0.0
WDDC 737	Post Office	17.0	14.8	17.1	14.8	0.6	0.0
REC 1	Hope Cottage	17.0	14.8	17.0	14.8	0.0	0.0
REC 2	St Giles Church	28.3	15.4	30.2	15.6	6.7	1.3
REC 3	Humberts	30.5	15.6	30.5	15.6	0.0	0.0
REC 4	Whitecroft	29.9	15.2	29.9	15.4	0.0	1.3
REC 5	Clock Cottages	36.9	16.4	37.1	16.2	0.5	-1.2
REC 6	Warren House	33.3	16.0	33.3	16.0	0.0	0.0
REC 7	Bridge Cottage	20.2	15.1	20.4	15.1	1.0	0.0
REC 8	Lilac Cottage	21.5	14.7	21.5	14.7	0.0	0.0
REC 9	Linnet Cottage	33	16.3	33	16.3	0.0	0.0
REC 10	Park Farmhouse	25.8	15.0	25.8	15.0	0.0	0.0
REC 11	1 Park Farmhouse	29.9	15.6	29.9	15.6	0.0	0.0
REC 12	Bilberry Close	21.2	14.6	21.2	14.6	0.0	0.0
REC 13	Rose Cottage	25.3	15.6	25.3	15.6	0.0	0.0
REC 15	Duckling Cottage	14.7	13.8	15	13.9	2.0	0.7
REC 16	Mill Lane Cottage	12.3	13.6	12.5	13.6	1.6	0.0

Pollutant concentrations are unlikely to change significantly at those receptors which are not within the vicinity of the Duck Steet/A35 junction. However at those receptors located within close proximity to the links approaching the junction, that is Clock Cottages, St Giles Church and WDDC monitoring location 724 (Duck Street), the likely reduction in average speed results in an increase in NO_2 and PM_{10} levels at receptor façade. At the Council's Duck Street monitoring location, which experiences the highest pollutant exposure throughout the village, NO_2 is predicted to increase by 1.9µg/m^3 to 50.6µg/m^3, whereas PM_{10} exposure increase by 0.4µg/m^3 to 18.2µg/m^3.

Removal of Vehicles using A35/Duck Street to access Seatown Caravan Park

Given that that the most significant exceedance of the AQO is observed at the façades of those properties located off the Main Street at the A35/Duck Street junction, redistributing the traffic using said junction to access Seatown Caravan Park may result in a reduction of pollutant exposure. In order to quantify the effects of this scenario, model inputs have assumed a 33.3% reduction in annual average traffic flows along Duck Street. These flows have been redistributed onto the existing Doghouse Farm access road simply to represent an alternative access route. Flows on the A35 have not been altered as a result of the scenario based on the assumption that traffic using the Duck Street junction is split evenly between the A35 east bound and A35 west bound. Therefore A35 flows would only alter should an alternative access route be utilised which does not form a junction with the A35.

Table 31: Modelled Impact of redistribution of Seatown Caravan Park Traffic

Receptor		2012 Annual Average (μg/m^3)		2012 with scenario (μg/m^3)		% Change	
		NO_2	PM_{10}	NO_2	PM_{10}	NO_2	PM_{10}
WDDC 724	Duck St	47.7	17.8	47.4	17.8	-0.6	-0.1
WDDC 725	George Pub	30.8	15.9	30.8	15.9	-0.1	-0.2
WDDC 726	Village Hall	35.2	16.1	35.2	16.1	-0.1	0.0
WDDC 715	Chervil Cottage	20.3	14.4	19.7	14.3	-3.1	-0.5
WDDC 735	Post Office	17.0	14.8	17.0	14.8	0.0	0.0
WDDC 736	Post Office	17.0	14.8	17.0	14.8	0.0	0.0
WDDC 737	Post Office	17.0	14.8	17.0	14.8	0.0	0.0
REC 1	Hope Cottage	17.0	14.8	17.0	14.8	-0.2	0.1
REC 2	St Giles Church	28.3	15.4	28.2	15.4	-0.4	-0.2
REC 3	Humberts	30.5	15.6	30.5	15.6	-0.1	0.0
REC 4	Whitecroft	29.9	15.2	29.9	15.2	-0.1	0.0
REC 5	Clock Cottages	36.9	16.4	36.9	16.2	0.0	-1.4
REC 6	Warren House	33.3	16.0	33.3	16.0	-0.1	0.1
REC 7	Bridge Cottage	20.2	15.1	20.1	15.1	-0.3	-0.2
REC 8	Lilac Cottage	21.5	14.7	21.5	14.7	-0.1	0.2
REC 9	Linnet Cottage	33.0	16.3	33.0	16.3	0.1	-0.2
REC 10	Park Farmhouse	25.8	15.0	25.8	15.0	0.0	0.3
REC 11	1 Park Farmhouse	29.9	15.6	29.9	15.6	0.1	-0.3
REC 12	Bilberry Close	21.2	14.6	21.2	14.6	-0.1	-0.3
REC 13	Rose Cottage	25.3	15.6	25.3	15.6	-0.1	0.1

REC 15	Duckling Cottage	14.7	13.8	14.3	13.8	-2.9	-0.3
REC 16	Mill Lane Cottage	12.3	13.6	12.1	13.6	-1.4	-0.3

Table 31 reiterates the influence of A35 traffic flows and the effect of gradient on pollutant exposure at the façades on the southern boundary of the A35 trunk road. In relative terms, traffic using Duck Street to access Seatown Caravan Park has little influence on these pollutant concentrations, which is proven by the minor impact of a 1/3 reduction in traffic using this link. Of greater importance is that traffic using the A35 trunk road which as previously mentioned is unlikely to change, due to the lack alternative access roads which would not require a junction with the A35.

7.0 Conclusions

WYG undertook a Detailed Air Quality Assessment of NO_x, NO_2, PM_{10} and $PM_{2.5}$ Bridport and Chideock, West Dorset where previous exceedances of the National Air Quality Objective for NO_2 had been observed. Atmospheric dispersion modelling of traffic sources within the study area was undertaken and the dispersion model was verified using ambient NO_2 monitoring data provided by West Dorset District Council.

Within Chideock, various traffic scenarios were modelled based on best estimate assumptions derived following consultation between WYG Sustainability and Environment, Dorset County Council and WYG Transport Planning.

The assessment concludes that in 2009 the annual average objective for NO_2 was exceeded at all WDDC monitoring locations on East Road, Bridport. Additionally the model identified exceedances of the AQO for NO_2 at 4 residential receptors to the east of the East Road/East Street Roundabout.

Where exceedances of the annual average objective for NO_2 were modelled, a source apportionment study concluded that HGV emissions account for the greatest proportion of pollutant concentrations. At existing WDDC monitoring locations on East Road this contribution is around 60% due to the significant gradient of the section of road adjacent to these monitoring sites. At residential receptors to the west of WDDC's monitoring sites, the contribution of HGV emissions to total pollutant concentrations is slightly less significant. Here it is concluded that gradient plays a less influential role in causing exceedances and instead, slowing traffic and meteorological conditions are accountable.

It was concluded that the National Air Quality Objective for NO_2 is predicted to be met in Bridport, at the worst effected receptor, without the need for additional measures to reduce concentrations, in 2015.

The AQO for PM_{10} was not exceeded at any locations within the Bridport study area in 2009 or years thereafter.

The assessment concludes that within Chideock, in 2009 the annual average objective for NO_2 was exceeded at WDDC monitoring site 724, Duck Street. The model did not identify any other exceedances of the AQO for NO_2 at any other locations within Chideock, although it was shown to be underestimating pollutant exposure at WDDC 726 by around 20%, within TG(09) criteria.

It was concluded that the National Air Quality Objective for NO_2 is predicted to be met in Chideock, at the worst effected receptor, without the need for additional measures to reduce concentrations, in 2016.

The annual average AQO for PM_{10} was not exceeded at any locations within the Chideock study area in 2009 or years thereafter.

The assessment concludes that in 2009 the 1-hour average objective for NO_2 was not likely to have been exceeded at any locations within either Bridport or Chideock, based on guidance contained within TG(09). Additionally, based on calculations contained within this document, in 2009 the 24-hour AQO for PM_{10} was not exceeded at any receptor locations within Bridport or Chideock.

Based on detailed scenario testing:

At modelled receptor locations, introducing car parking restrictions on the A35 west of the post office car park, is predicted to result in a change in NO_2 pollutant exposure of between -3.6% and 0%. PM_{10} concentrations at receptor locations are predicted to change by -0.7% to 0% as a result of said scenario.

At modelled receptor locations, a 100% reduction in HGV movements on the A35 through Chideock is predicted to result in a decrease in NO_2 pollutant exposure of between -58.9% and -24.7%. PM_{10} concentrations at receptor locations are predicted to reduce by -10.1% to -1.5% as a result of said scenario.

At modelled receptor locations, an extension of the 30mph zone on the A35 to the west of the village is predicted to result in a change in NO_2 pollutant exposure of between 0% and +8.4%. PM_{10} concentrations at receptor locations are predicted to change by 0% to +2% as a result of said scenario.

At modelled receptor locations, the introduction of either a signalised junction or a mini-roundabout at the A35/Duck Street junction is predicted to result in a change in NO_2 pollutant exposure of between 0% and +6.7%. PM_{10} concentrations at receptor locations are predicted to change by -1.2% to +2.2% as a result of said scenario.

At modelled receptor locations, redistributing traffic using the A35/Duck Street junction to access the Seatown Caravan Park, is predicted to result in a change in NO_2 pollutant exposure of between -3.1% and 0%. PM_{10} concentrations at receptor locations are predicted to change by -1.4% – +0.1% as a result of said scenario.

8.0 Recommendations

Given the results of the assessment WYG would make the following recommendations:

- That West Dorset District Council submits this report to DEFRA as part of the discharge of their duties under the Environment Act;
- It is recommended that the Council continue to monitor NO_2 at existing locations off East Road, Bridport in order to monitor whether predicted downward trends in pollutant exposure continue. Additionally, the Council should monitor at residential façades to the west of existing sites at 1 Asker Mead and 11 East Road to further investigate modelled exceedances of the AQO at these locations.
- Given the number and scale of exceedances along East Road, Bridport and the uncertainty in future downward trends of pollutant exposure, it is recommended that West Dorset District Council consider the designation of an AQMA along the section of the A35 East Road, west of the East Road/East Street Roundabout.
- An Air Quality Action Plan should be produced outlining cost effective measures and actions to reduce NO_2 exposure on East Road.
- The Council should continue monitoring at existing sites in Chideock, again in order to confirm whether the predicted downward trend in pollutant exposure is realistic. Whilst no other suitable options could be found when the automatic monitoring station was commissioned it is recommended that it be relocated if possible to a site experiencing higher exposure to pollutants than the current location on the northern boundary of the Post Office car park. Ideally the new site should be at the A35/Duck Street junction or site 726 at the Village Hall.
- Given the likelihood of AQO exceedances in future years up to 2016, it is recommended that the AQMA in Chideock be retained.
- Based on the conclusions of the scenario testing it is not recommended that any of the proposed measures be put in place prior to full cost/benefit review. Not considering this assessment, purely from an air quality perspective, only potential restrictions to HGV movements along the A35 trunk road running through Chideock are likely to have a significant beneficial impact, the feasibility of which is questionable.

- Given the dramatic variations and particularly localised exceedances of the AQO in Chideock, additional monitoring is recommended to provide a better understanding of spatial variations in pollutant exposure. Specifically it is suggested that diffusion tubes be located adjacent to the A35/Duck Street junction, and along the A35 west of the Village Hall and Whitecroft, within close proximity and on both northern and southern sides of the road. In fact this suggestion has already been addressed. When the Council reviewed monitoring locations at the end of 2009 additional tubes were located along the A35 on the northern and southern sides of the road from January 2010.

Units and Abbreviations Used

AADT	Annual Average Daily Traffic
AQAP	Air Quality Action Plan
AQO	Air Quality Objective
AQS	Air Quality Standards
AQMA	Air Quality Management Area
AURN	Automatic Urban and Rural Network
DEFRA	Department for Environment, Food and Rural Affairs
WDDC	West Dorset District Council
DMRB	Design Manual for Roads and Bridges
EC	European Commission
EPAQS	Expert Panel on Air Quality Standards
LA	Local Authority
LAQM	Local Air Quality Management
LDF	Local Development Framework
HDV	Heavy Duty Vehicle
LDV	Light Duty Vehicle
$\mu g.m^{-3}$	Concentration (in micrograms per cubic metre)
m	Metre
µm	Micrometre
NGR	National Grid Reference
NO_2	Nitrogen dioxide
NO_X	Total oxides of nitrogen
PM_{10}	Particulate matter with mean hydraulic diameter of less than 10 micrometres
$PM_{2.5}$	Particulate matter with mean hydraulic diameter of less than 2.5 micrometres
PPS	Planning Policy Statement
PPG	Planning Policy Guidance
UDP	Unitary Development Plan
WHO	World Health Organisation
WYG	WYG Sustainability and Environment

APPENDICES

Appendix A: Sketches

Appendix B: Traffic Data

Appendix C: Gradient Calculations

Appendix D: Report Conditions

APPENDIX A: SKETCHES

SK01: WDDC Monitoring Locations in Bridport

SK02: Modelled Residential Receptors in Bridport

SK03: Modelled Roads in Bridport

SK04: WDDC Monitoring Locations in Chideock

SK05: Modelled Residential Receptors in Chideock

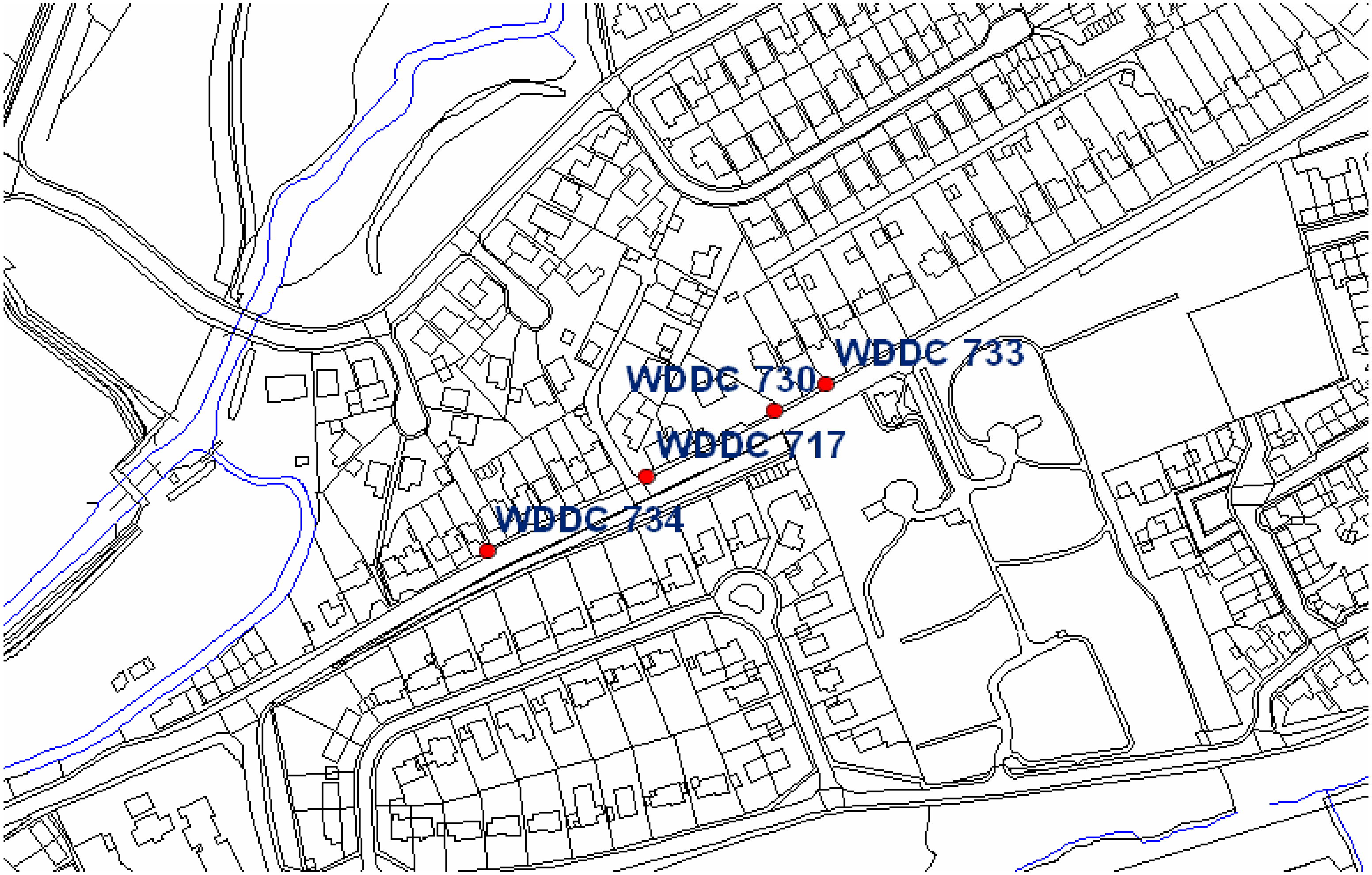
SK06: Modelled Roads in Chideock

SK07: 2009 NO_2 Contour Plot of Bridport

SK08: 2015 NO_2 Contour Plot of Bridport

SK09: 2009 NO_2 Contour Plot of Chideock

SK10: 2016 NO_2 Contour Plot of Chideock



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Project:
Bridport and Chideock Detailed Air Quality Assessment

Client:
West Dorset District Council

Drawing Title:
SK01: WDDC Monitoring Locations in Bridport

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK01	1

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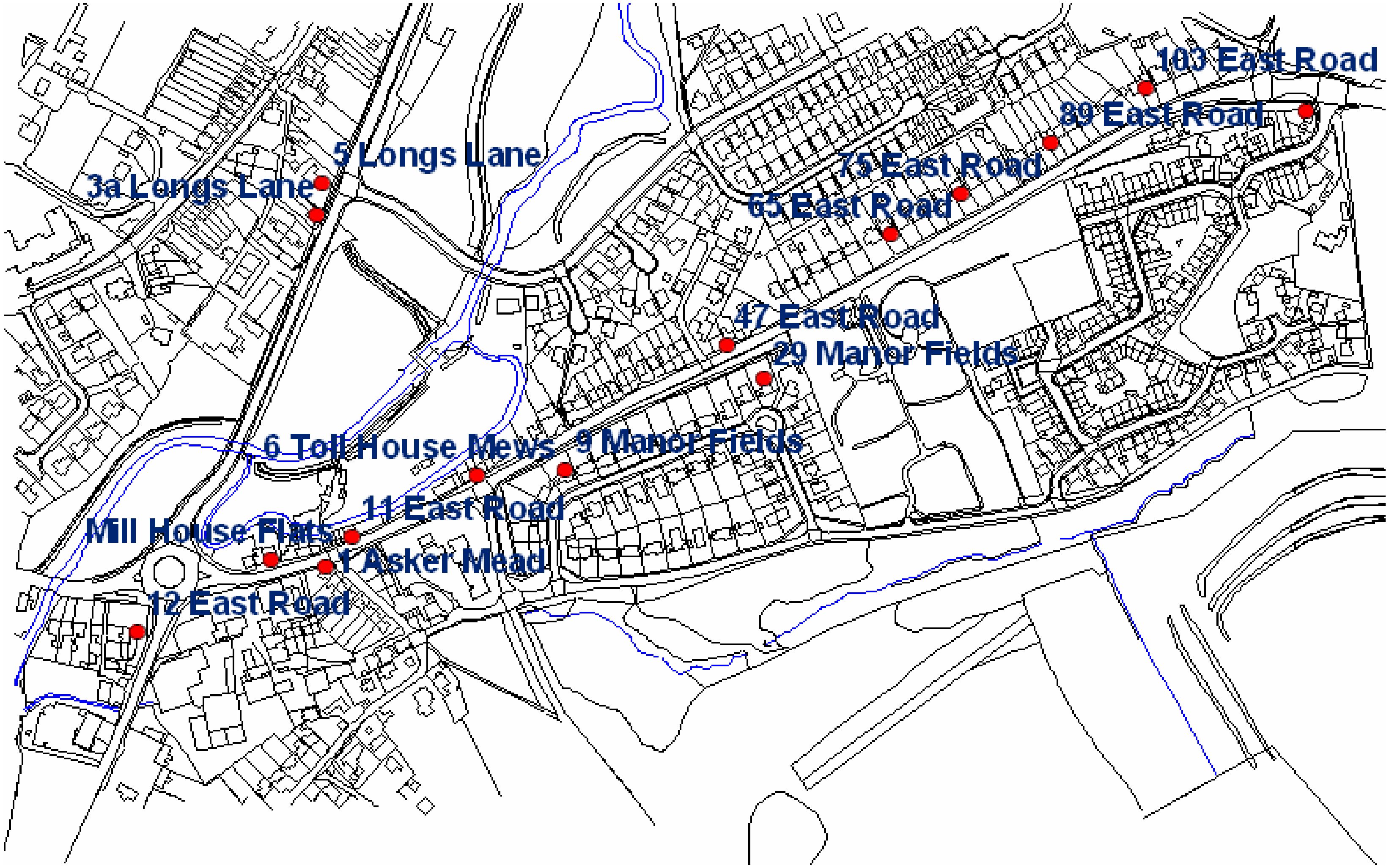

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Project:
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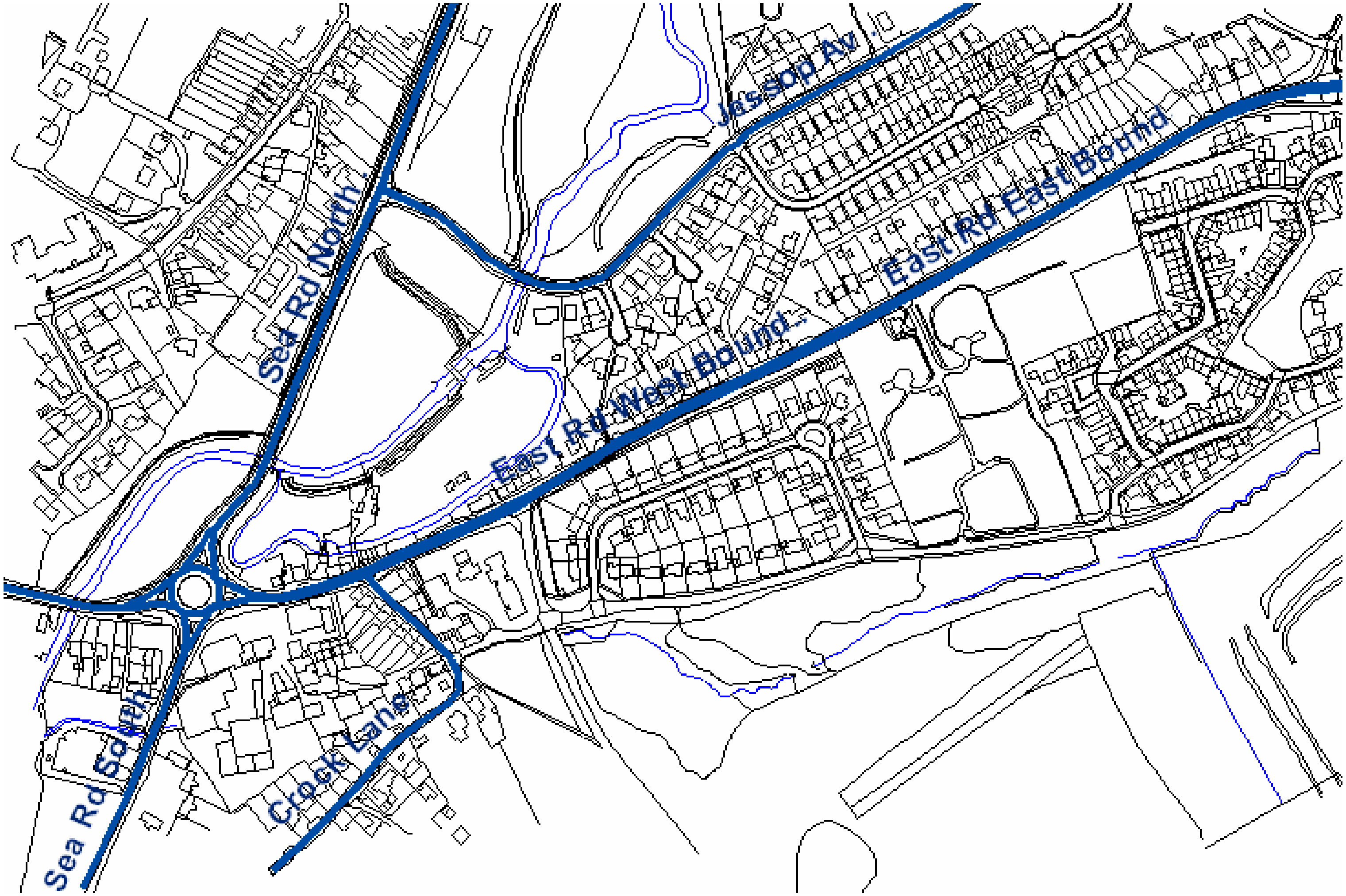
Client:
West Dorset District Council

Drawing Title:
SK02: Modelled Residential Receptors in Bridport

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK02	1

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



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Project:
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Client:
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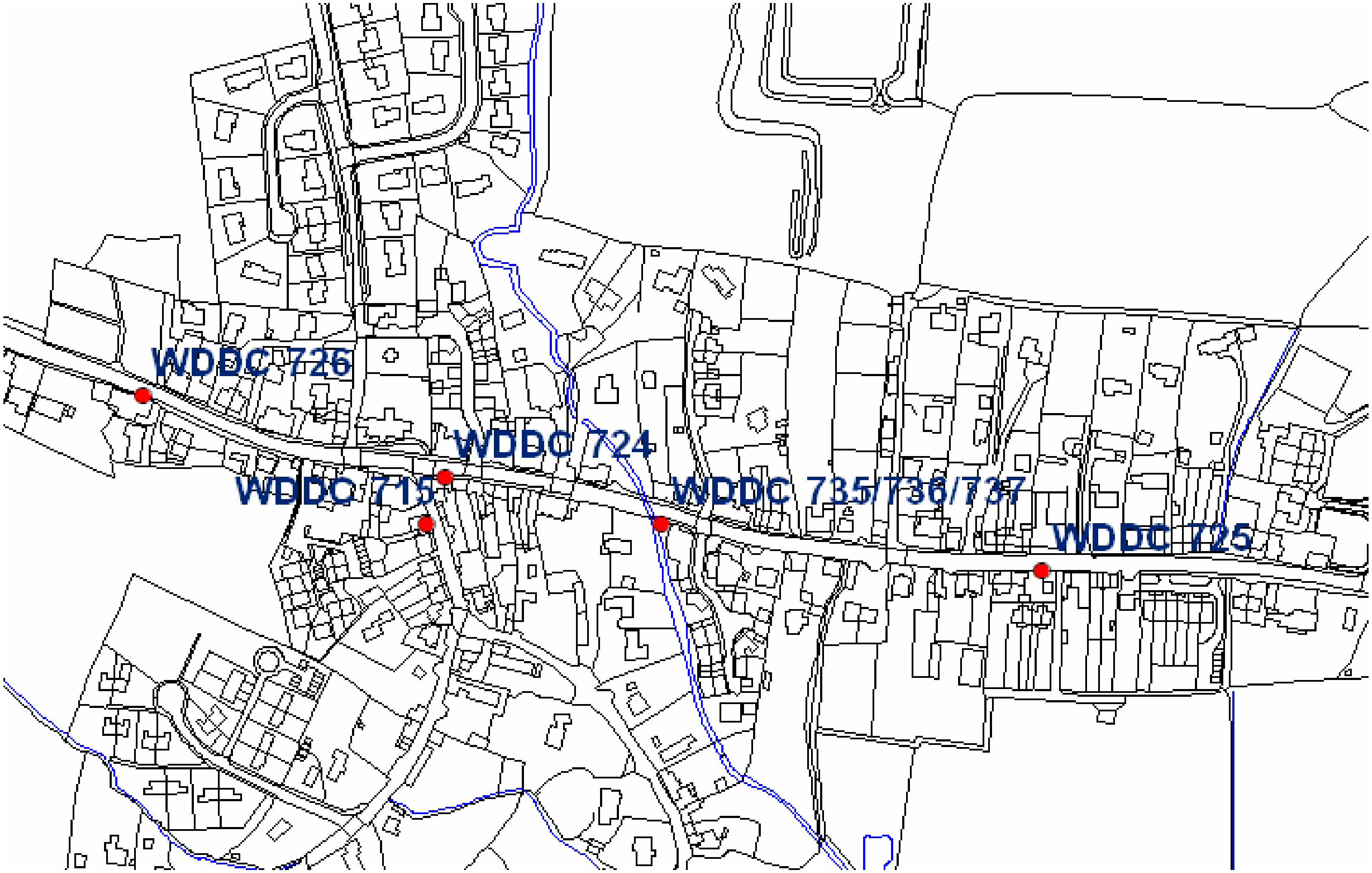
Drawing Title:
SK03: Modelled Roads in Bridport

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK03	1

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



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Project:
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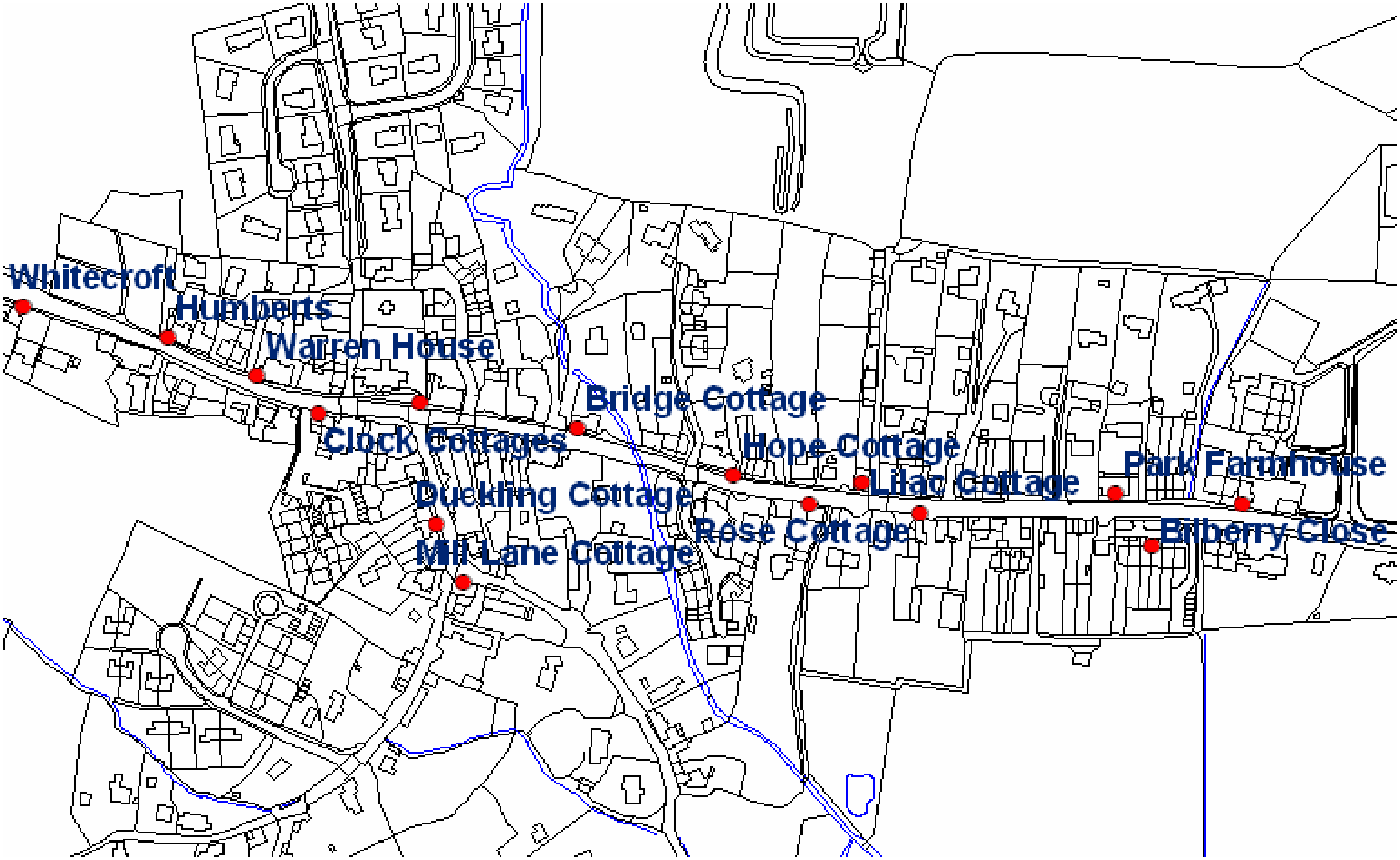
Client:
West Dorset District Council

Drawing Title:
SK04: WDDC Monitoring Locations in Chideock

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK04	1

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



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Project:
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Client:
West Dorset District Council

Drawing Title:
SK05: Modelled Residential Receptors in Chideock

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK05	1

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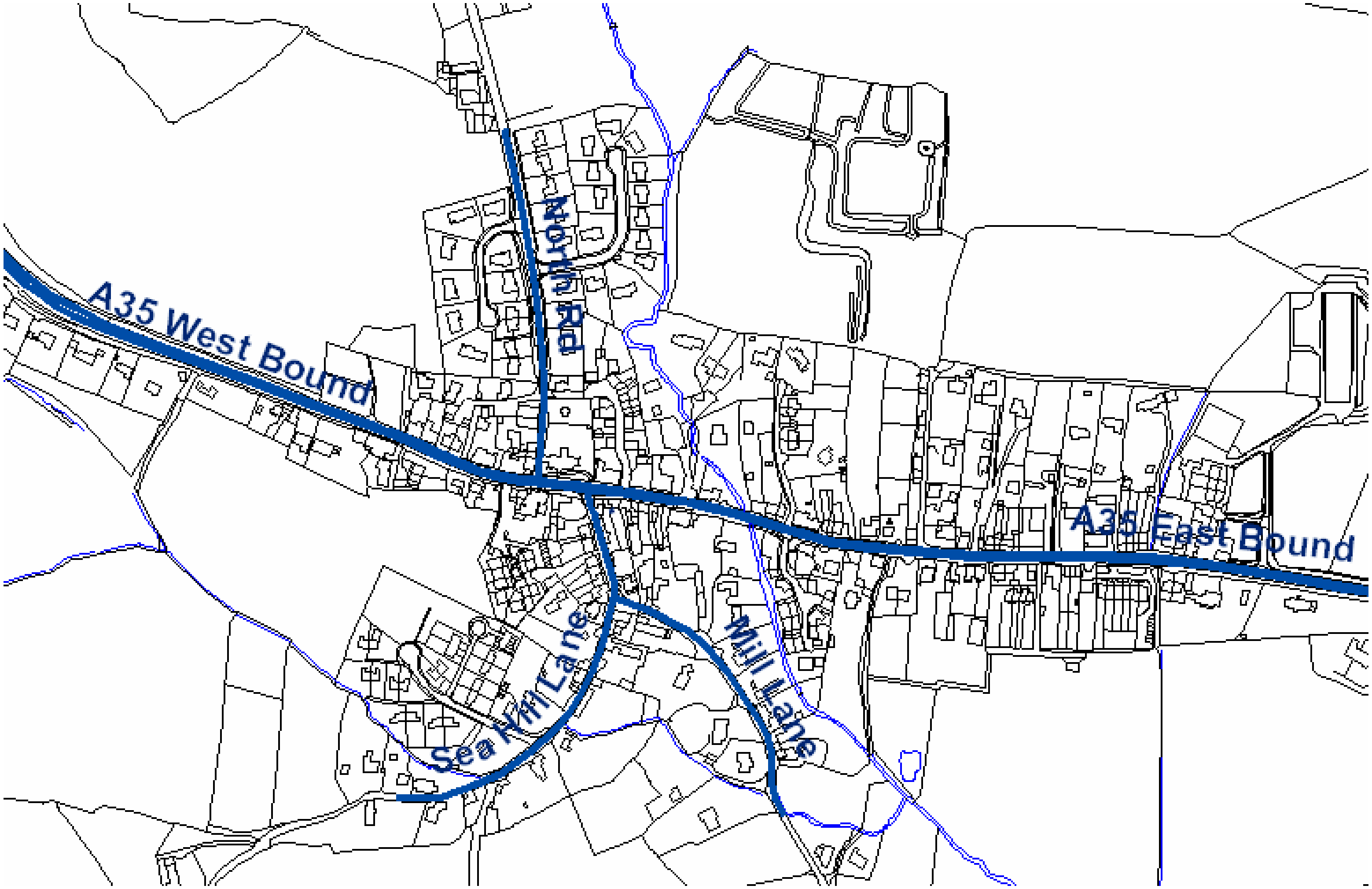

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Project:

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Client:

West Dorset District Council

Drawing Title:

SK06: Modelled Roads in Chideock

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK06	1

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Project:
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Client:
West Dorset District Council

Drawing Title:
SK07: 2009 NO_2 Exposure in Bridport ($\mu g/m^3$)

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK07	1

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Project: Bridport and Chideock Detailed Air Quality Assessment

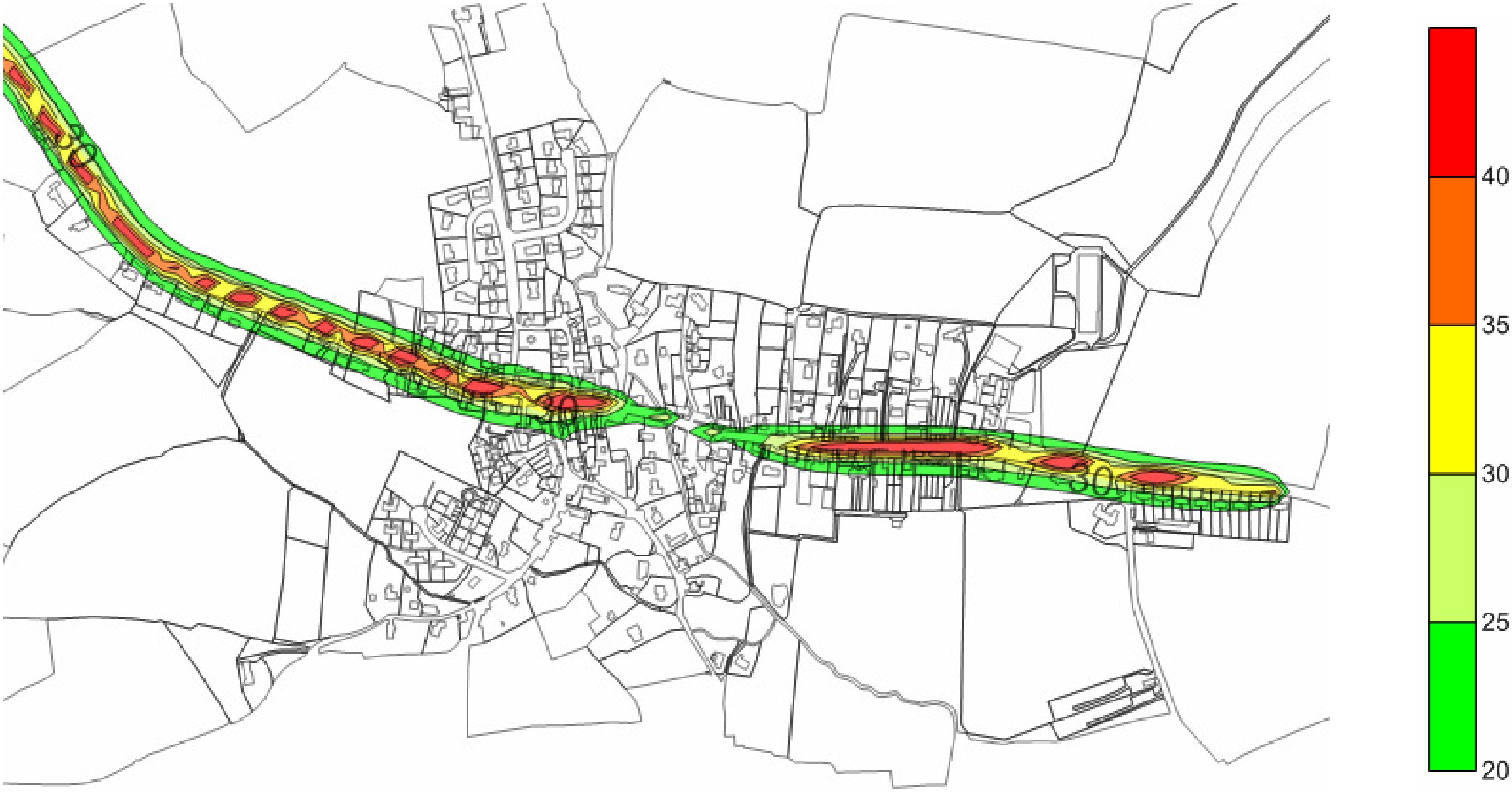
Client: West Dorset District Council

Drawing Title: SK08: 2015 NO_2 Exposure in Bridport ($\mu g/m^3$)

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK08	1

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



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Project:
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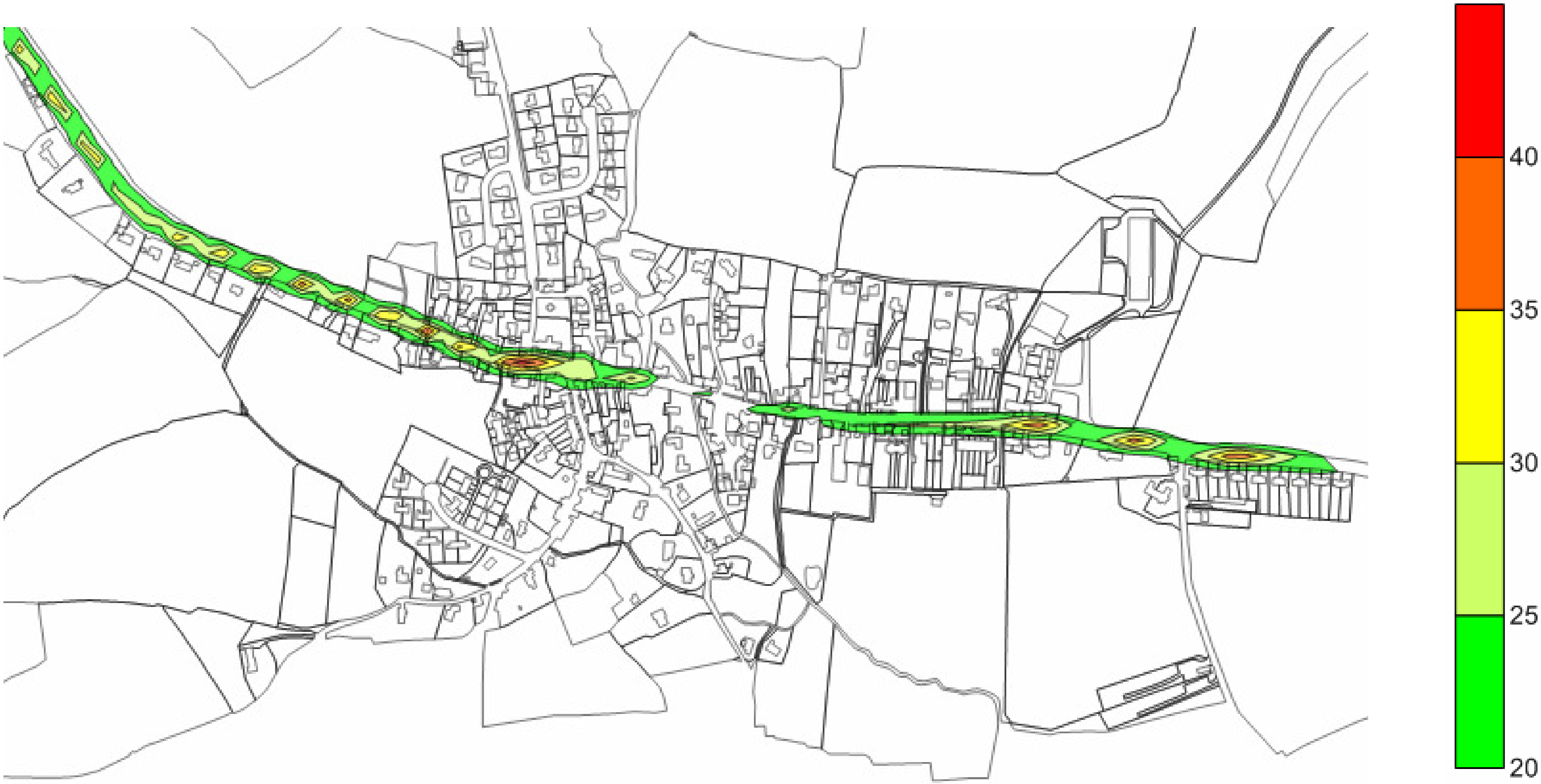
Client:
West Dorset District Council

Drawing Title:
SK09: 2009 NO_2 Exposure in Chideock ($\mu g/m^3$)

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	24.02.2011	MH	24.02.2011	MH	24.02.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK09	1

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐



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Project:
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Client:
West Dorset District Council

Drawing Title:
SK10: 2016 NO_2 Exposure in Chideock ($\mu g/m^3$)

Scale at A3	Drawn By	Date	Checked By	Date	Approved By	Date
	JC	15.03.2011	MH	15.03.2011	MH	15.03.2011

Project No.	Office	Type	Drawing No.	Revision
A069692	35	04	SK10	1

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

APPENDIX B: TRAFFIC DATA

Table 32: 2009 Chideock Traffic Data

Modelled Road Source	2009 AADT	Speed	Breakdown of Vehicle Classes (%)				
			Car	HGV	Bus	MC	Other LDV
Duck Lane	1605	25	94.87	3.80	0.00	1.34	-
Duck Lane sdl	1605	20	94.87	3.80	0.00	1.34	-
Main Street eb 1	6642	50	79.22	6.24	0.68	0.27	13.59
Main Street eb 2	6642	50	79.22	6.24	0.68	0.27	13.59
Main Street eb 3	6642	40	79.22	6.24	0.68	0.27	13.59
Main Street eb 3i	6642	30	79.22	6.24	0.68	0.27	13.59
Main Street eb 4	6642	30	79.22	6.24	0.68	0.27	13.59
Main Street eb 5	6802	30	79.46	6.05	0.64	0.28	13.57
Main Street eb 6	6802	30	79.46	6.05	0.64	0.28	13.57
Main Street eb 7	6962	40	79.34	6.15	0.66	0.28	13.58
Main Street eb 8	6962	45	79.34	6.15	0.66	0.28	13.58
Main Street eb 9	6962	45	79.46	6.05	0.64	0.28	13.57
Main Street eb 10	6962	40	79.46	6.05	0.64	0.28	13.57
Main Street eb 11	6962	30	79.46	6.05	0.64	0.28	13.57
Main Street eb 12	6962	30	79.46	6.05	0.64	0.28	13.57
Main Street eb 13	6962	30	79.46	6.05	0.64	0.28	13.57
Main Street wb 1	6642	50	79.22	6.24	0.68	0.27	13.59
Main Street wb 2	6642	50	79.22	6.24	0.68	0.27	13.59
Main Street wb 3	6642	40	79.22	6.24	0.68	0.27	13.59
Main Street wb 3i	6642	30	79.22	6.24	0.68	0.27	13.59
Main Street wb 4	6642	30	79.22	6.24	0.68	0.27	13.59
Main Street wb 5	6802	30	79.46	6.05	0.64	0.28	13.57
Main Street wb 6	6802	30	79.46	6.05	0.64	0.28	13.57
Main Street wb 7	6962	40	79.34	6.15	0.66	0.28	13.58
Main Street wb 8	6962	45	79.34	6.15	0.66	0.28	13.58
Main Street wb 9	6962	45	79.46	6.05	0.64	0.28	13.57
Main Street wb 10	6962	40	79.46	6.05	0.64	0.28	13.57
Main Street wb 11	6962	30	79.46	6.05	0.64	0.28	13.57
Main Street wb 12	6962	30	79.46	6.05	0.64	0.28	13.57
Main Street wb 13	6962	30	79.46	6.05	0.64	0.28	13.57
Mill Lane	340	26	96.89	2.24	0.00	0.87	-
Mill Lane sdl	340	20	96.89	2.24	0.00	0.87	-
North Rd	501	28	78.95	2.87	0.00	0.00	18.18
North Rd sdl	501	20	78.95	2.87	0.00	0.00	18.18
Sea Hill Lane	940	34	94.87	4.06	0.00	1.08	-

Table 33: 2009 Bridport Traffic Data

Modelled Road Source	2009 AADT	Speed	Breakdown of Vehicle Classes (%)				
			Car	HGV	Bus	MC	Other LDV
A35 Roundabout	14496	20	90.16	1.29	0.59	0.72	7.24
Crock Lane 1	490	30	93.49	6.28	0.03	0.20	0.00
Crock Lane 2	490	30	93.49	6.28	0.03	0.20	0.00
Crock Lane 3	490	30	93.49	6.28	0.03	0.20	0.00
Crock Lane sdl	490	20	93.49	6.28	0.03	0.20	0.00
East Rd eb 1	8568	20	86.35	5.60	0.40	0.79	6.86
East Rd eb 10	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 11	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 2	8568	20	86.35	5.60	0.40	0.79	6.86
East Rd eb 3	8568	30	86.35	5.60	0.40	0.79	6.86
East Rd eb 4	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 5	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 5i	8568	41	86.35	5.60	0.40	0.79	6.86
East Rd eb 6	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 7	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 8	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd eb 9	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 1	8568	20	86.35	5.60	0.40	0.79	6.86
East Rd wb 10	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 11	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 2	8568	20	86.35	5.60	0.40	0.79	6.86
East Rd wb 3	8568	30	86.35	5.60	0.40	0.79	6.86
East Rd wb 4	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 5	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 5i	8568	41	86.35	5.60	0.40	0.79	6.86
East Rd wb 6	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 7	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 8	8568	40	86.35	5.60	0.40	0.79	6.86
East Rd wb 9	8568	40	86.35	5.60	0.40	0.79	6.86
East Street 1	9670	40	87.01	1.06	1.08	0.58	10.27
East Street 2	9670	40	87.01	1.06	1.08	0.58	10.27
East Street 3	9670	30	87.01	1.06	1.08	0.58	10.27
East Street sdl 1	4835	20	87.01	1.06	1.08	0.58	10.27
East Street sdl 2	4835	20	87.01	1.06	1.08	0.58	10.27
Jessop Av 1	598	30	92.94	6.03	0.00	1.03	0.00
Jessop Av 2	598	40	92.94	6.03	0.00	1.03	0.00
Jessop Av 3	598	40	92.94	6.03	0.00	1.03	0.00
Jessop Av 4	598	40	92.94	6.03	0.00	1.03	0.00

Jessop Av 5	598	40	92.94	6.03	0.00	1.03	0.00
Jessop Av 6	458	40	93.89	6.11	0.00	0.00	0.00
Jessop Av sdl 1	598	20	92.94	6.03	0.00	1.03	0.00
Sea Rd North 1	14454	50	86.81	1.24	0.66	0.59	10.70
Sea Rd North 2	14454	50	86.81	1.24	0.66	0.59	10.70
Sea Rd North 3	14454	40	86.81	1.24	0.66	0.59	10.70
Sea Rd North 4	14454	30	86.81	1.24	0.66	0.59	10.70
Sea Rd North sdl 1	7227	20	86.81	1.24	0.66	0.59	10.70
Sea Rd North sdl 2	7227	20	86.81	1.24	0.66	0.59	10.70
Sea Rd South 1	14496	40	90.16	1.29	0.59	0.72	7.24
Sea Rd South 2	14496	30	90.16	1.29	0.59	0.72	7.24
Sea Rd South sdl 1	7248	20	90.16	1.29	0.59	0.72	7.24
Sea Rd South sdl 2	7248	20	90.16	1.29	0.59	0.72	7.24

APPENDIX C: GRADIENT CALCULATIONS

For HGVs the general equation for the emended speed related EF for vehicles going up a hill, as taken from Local Air Quality Management: Technical Guidance LAQM.TG(09), is:

$EF_2 = EF_1 (1+G*[C_1*V+C_2])$

Where:

EF_1 = emission factor for vehicles travelling at speed V on a level road (grams per vehicle km)
EF_2 = emission factor for vehicles travelling at the speed V on a level road (grams per vehicle km)
V = vehicle speed
G = the gradient of the hill, expressed as a decimal fraction (for example, a 6% gradient should be expressed as 0.06
C_1 and C_2 are constants, which differ according to the HDV type, emission standard and the pollutant. These are given in Table 28.

For vehicles going down a hill the amended EF is:

$EF_2 = EF_1 (1-G*[C_1*V+C_2])$ for gradients <= 2.5%

$EF_2 = EF_1 (1-0.025*[C_1*V+C_2])$ for gradients >2.5%

Table 34: Gradient Coefficients

	New vehicles (post 2001)				Old vehicles (2001 and earlier)			
	NO_x	NO_x	PM	PM	NO_x	NO_x	PM	PM
Vehicle weight category	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
Small rigid HGV	0.29	10.74	0.12	-2.29	0.32	12.47	0.35	-1.35
Medium rigid HGV	0.48	10.81	0.36	-2.27	0.60	12.15	0.54	-3.25
Articulated trucks	0.62	12.44	0.46	-0.80	0.54	18.90	0.76	-2.86
Urban buses and coaches	0.48	7.41	0.17	5.01	0.53	10.20	0.46	1.14

APPENDIX D: REPORT CONDITIONS

REPORT CONDITIONS
AIR QUALITY ASSESSMENT
Bridport and Chideock, West Dorset

This report is produced solely for the benefit of West Dorset District Council and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYG Sustainability and Environment. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYG Environmental Planning Transport Ltd using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYG Environmental Planning Transport Ltd by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYG Environmental Planning Transport Ltd accepts no liability for issues with performance arising from such factors.

February 2008