PORTSMOUTH LOCAL AIR QUALITY PLAN ANALYTICAL ASSURANCE STATEMENT

Local authorities covered	Portsmouth City Council
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1. Introduction

1.1. Purpose of document

The purpose of this document is to outline the main limitations, risks, uncertainties, and suitability for use of the evidence for the transport and air quality baseline modelling.

This document is being submitted as part of the Initial Evidence Submission, and an updated version will be resubmitted at the Outline Business Case and Full Business Case milestones covering all aspects of evidence (including economic evidence and scenario modelling), for review by the Independent Review Panel.

2. Limitations of the analysis

2.1. Has the analysis been constrained by time or cost, meaning further proportionate analysis has not been undertaken?

Transport modelling

An existing Transport Model has been adapted and utilised as part of the study. The forecast years for this model are 2019 and 2026 (plus 2031 and 2036) and the decision to interpolate outputs to the AQ Forecast year of 2022 instead of developing a new 2022 forecast year in the model was taken based on time constraints.

The benefits of the interpolation approach have been borne out by the change in AQ forecast year from 2021 to 2022 during the study timeframe.

Air quality modelling

The air quality modelling that has been completed has used the best and most up-to-date available data and tools, including the latest emissions information from JAQU within EFT v.9.1.b released in September 2019. This tool which contains the latest information on current and project vehicle fleets and emissions for different road types in urban/rural areas.

A number of model re-runs have been made as part of the development of the baseline, primarily a change in the future base year from 2021 to 2022 to allow sufficient time for a benchmark CAZ to be implemented. Additional amendments include modification of receptor placements, updates to emissions based on improved fleet information, updates to the EFT spreadsheet and refinements on consideration of compliant and non-compliant vehicles. A number of sensitivity tests have been conducted during the study.

Interim years between the modelled base year and projected year of compliance have been interpolated rather than explicitly modelled. This is principally due to the time and budgetary constraints.

Sensitivity test at Church Street

For this specific location, a comparison between the outputs of the strategic transport model was made with observed flow and speed data, it was concluded that the model outputs were over-estimating flows on Church Street thus resulting in an over-prediction of NO_2 concentrations compared to measured values at the Council's monitoring sites. A sensitivity test was conducted using observed traffic flows which resulted in a reduction in modelled concentrations, closer to the monitoring value. Based on concentrations at receptor 526, this road link would no long exceed the EU Limit Value in the Projected Base year of 2022.

2.2. Could this further analysis lead to a substantive change in the conclusions?

Transport baseline modelling

At this stage of the study we do not believe that further analysis would lead to a substantive change in conclusions.

Air quality baseline modelling

Based on the Church Street sensitivity tests it has been agreed with JAQU that this site should be treated as a near exceedance during the option development process and additional traffic data will be collected to provide further evidence of the local situation. Further model sensitivity tests as well as comparisons between observed data will be considered. It is expected that these tests may have led to marginally different results but any variations may be within the uncertainty of the model.

It is possible that by modelling the interim years, differing concentrations would have been reported, though this was not feasible within the time and budgetary constraints.

2.3. Does the analysis rely on appropriate sources of evidence?

Transport modelling

Traffic flows have been extracted from the existing Sub-Regional Transport Model (SRTM) that covers the areas of Southampton, Portsmouth and South Hampshire which has been validated to 2015.

The data used to build, calibrate and validate the SRTM includes roadside interview surveys (RSIs), screenline, manual classified and automatic traffic counts, automatic number plate recognition (ANPR) and TrafficMaster data for journey times. More detailed information is included in document T2.

Local fleet composition data was derived from an analysis of a comprehensive automatic number plate recognition (ANPR) camera survey covering 86 sites across the city over the period of 18th to 25th March 2019. This has been used to provide both compliant/non-compliant split in the traffic model.

Air quality baseline modelling

The air quality modelling relies on modelled traffic data from the Sub-Regional Transport Model (SRTM), described above. The model has been factored up from a 2015 baseline to the air quality model years of 2018 and 2021 based on a linear extrapolation, conducted by the Systra transport team.

The vehicle fleet in Portsmouth has been obtained from the ANPR survey, which registered more than 8 million vehicle movements. This was used to provide a breakdown of vehicle type and disaggregation by Euro emission standard by matching to the DVLA database. Although this was only conducted for one neutral week of the year, this data is considered to be more reliable than using national fleet assumptions for Portsmouth. Further analysis of the ANPR data has also been conducted to gain more detailed information on specific vehicle types, for example:

- Additional information from JAQU allowed the licensed taxis within Portsmouth (including hackney carriages) to be matched against observed vehicles based on their registration plate and emissions for these vehicles have been modelled independently to private cars. Taxis licensed out of Portsmouth have been treated as private cars in the modelling;

- Public buses were identified in the ANPR database based on their make and model as these were provided by the two main bus operators in Portsmouth (Stagecoach and First). The Euro emission standard of the bus fleet was further refined based on known information from the operators.
- Assumptions on the Euro emission standards of private coaches (e.g. National Express, who operate 117 Euro 6 coaches around Gunwharf Quays/the Hard Interchange) were incorporated into the future baseline.

The process of air quality modelling uses the latest available tools and follows the guidance given by JAQU. For example, the most recent model runs were updated using the latest emissions factor toolkit (v9.1.b) and the associated background maps and tools were used for the baseline modelling. The updated tools were released midway through the modelling study, so a significant amount of time and effort was required in order to incorporate these updates. In addition, the latest EFT v9.1.b including an update to the petrol/diesel split was released after submission of the TD1 spreadsheet. These emissions have been incorporated into the modelling and therefore the latest data incorporates the latest available information and evidence on future vehicle fleets and background concentrations, so it was considered essential to utilise them. This also will help to ensure consistency with other 3rd wave JAQU studies.

EFT v9.1.b enables the user to define the proportion of each vehicle type that is registered as a specific Euro emission standard within the fleet, which, whilst based on the ANPR data, is for the purposes of the modelling regressed or progressed to be representative of the relevant year from the 2019-representative data that was captured within the ANPR. The spreadsheet also includes a petrol/diesel tool for use in future projections which has been used in the updated baseline model runs in this study. This spreadsheet tool has been provided at the request of JAQU and is therefore considered a robust methodology.

<u>Options modelling</u>

To model the CAZ and shortlisted options, every effort has been made to obtain likely local impacts to make assumptions on model inputs (for example impacts on traffic flows or vehicle fleet composition) and data from a local focus group have been compared with regional or national datasets.

2.4. How reliable are the underpinning assumptions?

<u>Transport baseline modelling</u>

The SRTM has been used to determine the traffic impacts within the area of interest. The SRTM is a multi-modal model developed in accordance with WebTAG guidelines. The model incorporates a Saturn Highway model, a Cube Voyager Public Transport model and a Demand model to account for demand responses. The model also utilises a DELTA land use model. Values of Time and Fuel costs are consistent with WebTAG Databook March 2017. We believe this provides a reliable basis from which to proceed.

<u>Air quality baseline modelling</u>

The methodology follows a prescribed process as set out in JAQU's guidance documents. The assumptions made as part of this process are considered to be the best available at the time and are therefore considered to be appropriate and reliable for this study.

<u>Options modelling</u>

National information from JAQU has been used to model compliance with the CAZ options, as these figures were considered more robust than the outputs from the stated preference survey. In summary, CAZ B and C options have been represented in the modelling using the following assumptions:

- Fleet will continue to turnover, leading to some natural upgrade from non-compliant to compliant vehicles between the current year and 2022;
- 90% of buses and coaches and mini buses will be compliant after upgrades in response to the CAZ (as the majority will already be compliant due to the ongoing programme of retrofits);
- 90% of taxi trips in Portsmouth will all be undertaken by compliant Euro 6 vehicles (with the remaining 10% paying the charge). For run 2, 100% taxis are assumed to be compliant;
- LGV and HGV drivers respond to the CAZ in line with the JAQU national average response rates as set out in Table 1;
- The charge is applied to all trips on Portsea Island, and at this stage no account is taken of any exemptions;
- Daily charges are converted into charges per trip on the basis of the estimated number of trips made per vehicle within the day. This leads to an average charge of £6.67 for LGVs and £10.42 for HGVs. However, as there is no scope for mode or destination shift within the model, this value only influences the routing for the small subset of trips that have a choice of passing through the CAZ zone or taking another route to their destination (primarily the International Port which can be accessed via the M275 without routing through the CAZ area).

- Consideration is being made to refine vehicle fleet breakdown between compliant and non-compliant vehicles.

Table 1: Assumed responses of LGVs and HGVs to a CAZ (based on JAQU data)

Response	LGV trips	LGV vehicles	HGV trips	HGV vehicles
Replace/upgrade vehicle	64%	25%	83%	44%
Cancel trip	6%	12%	4%	13%
Change mode	2%	4%	0%	0%
Avoid zone	8%	17%	4%	13%
Pay charge	20%	42%	9%	29%

A number of sensitivity tests were undertaken to assess the robustness of the alternative package. This included changes the following changes to the air quality assumptions with the ADMS-Roads model;

- Metrological assumptions - ADMS-Roads run with 2017 and 2016 meteorological year from Thorney Island (to compare against 2018 data used from the same sites for core tests).
- Surface roughness assumption - ADMS-Roads run with a modified surface roughness to represent the more built up conditions in the city centre

The results of these sensitivity tests are provided in the AQ3 report but they showed the core tests conducted in this study represent a pessimistic or worst case picture in terms of the assumed meteorological conditions and surface roughness conditions. It is concluded that the results present therefore provide confidence that the EU limit will be achieved on both exceedance links, and that concentrations will remain below the EU limit at all ‘near exceedance’ sites.

3. Risk of error / Robustness of the analysis

3.1. Has there been sufficient time and space for proportionate levels of quality assurance to be undertaken?

Transport modelling

Yes, proportionate levels of QA have been undertaken on the transport modelling. Quality management for all Systra's projects (and all deliverables produced) is delivered in accordance to the requirements of the International Standard ISO 9001:2015. Systra's appointed Project Director oversees the review and sign-off of all deliverables. Principles of quality assurance (QA) are integrated in all our activities and at all levels through established and implemented procedures according to the international standard. The formally appointed Project Manager and Project Director lead in ensuring the project is undertaken in accordance with the current Systra Quality Assurance processes and that the system is effective.

Air quality modelling

AECOM approaches quality management in alignment with the BS EN ISO 9001:2008 International Standard. The company is fully committed to the management principles underlying the ISO 9001:2008 standard and to AECOM's quality systems.

One of the key quality aspects of our approach to quality assurance and control (QA/QC) is the technical review process which ensures that deliverables are scientifically robust, meet the client's requirements, and are suitable for the intended audience. The data inputs, calculations and outputs in this study have been reviewed by qualified technical staff and deliverables approved by AECOM's project approvers. Time for this approval process has been incorporated into the overall programme. This robust checking process has at times led to slight delays in submission of data or revisions in outputs, but this is considered worthwhile to allow a thorough QA/QC to be conducted. In addition, further checks by the wider team in Atkins have also been conducted on the data inputs, methodology and outputs.

3.2. Have sufficient checks been made on the analysis to ensure absence of errors in calculations?

Transport modelling

Checks on modelling work are carried out as part of our quality assurance process. With complex models across several thousand road-links there is a large amount of data and calculations to check. With this amount of data it is not possible to check everything. Our approach has been as follows:

- Review and check all methods being used in the model set up and calculations;
- Review model input data for consistency, this has focused on samples of data and key locations;
- Check calculations in all spreadsheets, again using a sampling approach to check calculation steps;
- Sense check results using the experience of the project director and wider team to ensure that they seem reasonable.

Air quality modelling

The air quality model domain is large and contains over 800 road links and the data inputs and spreadsheets used to feed into this network are sizeable – for example the ANPR database with 8 million vehicle captures is too large to open within Excel and needed to be broken down within a statistical analysis programme, ‘R1’. Therefore during the process of data analysis, model setup and processing, it is possible that that there are a number of steps which may introduce errors into the process, though these errors are minimised as far as possible using the quality assurance principles described above.

The data templates provided by JAQU have been used as required, though as these differ to the standard processing sheets set up by AECOM, these required further checks.

AECOM technical reviewers have undertaken checking during each stage of the data processing and modelling as part of the QA/QC process and the baseline modelling has been re-run a number of times before the final version in order to account for improvements and updates to input information as and when it was received.

3.3. Have sufficiently skilled staff been responsible for producing the analysis?

Transport modelling

The transport modelling team at SYSTRA has significant experience in the modelling of transport networks in general and specifically providing outputs that feed into Air Quality models for other consultants. Systra’s project team draws on individuals who have been involved with the SRTM since its development in 2009/10 and the team has an excellent understanding of the model and the Portsmouth transport networks. The Systra Project Director has 20 years’ experience in highway scheme design and transport modelling.

SYSTRA has also been able to draw on support and share best practices from other project teams that have been working on CAZ projects elsewhere in the country, such as Southampton, Fareham, Nottingham and Derby.

Air quality modelling

The air quality modelling is led by experienced air quality specialists who have worked on large scale assessments for many years. The project is managed by Anna Savage, an Associate Director with 18 years’ experience in air quality management, and supported by Alistair Thorpe and Max Nancarrow, who are senior members of staff within the team. These staff members have previous experience working for Portsmouth in conducting their Local Air Quality Management duties for the last few years, and have also been involved in JAQU studies with authorities in earlier waves and the current 3rd wave (Leicester and Liverpool). These experienced staff members supervise junior staff to do the day-day data inputs and process.

AECOM has a large air quality team with almost 40 members of staff and can draw upon additional resources with specific expertise if necessary. All staff within the team are members of the Institute of Air Quality Management (IAQM)

4. Uncertainty

4.1. What is the level of residual uncertainty (the level of uncertainty remaining at the end of the analysis)?

Transport modelling

[1] Copyright (C) 2015 The R Foundation for Statistical Computing

The level of uncertainty included within the transport modelling is identified in the base year model, as part of the validation process comparing the modelled and observed data (model validation is covered in detail in document T2 as part of this study).

The validation for Cordon and Screenline totals meets WebTAG requirements and confirms a high degree of certainty in base year trip demand.

The base year link flow validation for vehicle totals in the local area do not meet WebTAG requirements, and while the vast majority of locations pass the % requirements there are a number that fail to be within a GEH of 5 of the observed flow. However, these overall criteria mask a reasonable performance which is close to meeting the acceptability guidelines with the majority of link flows being within a GEH of 10 of observed values.

The SRTM scenarios representing forecast year conditions include both new transport infrastructure schemes and land-use development assumptions to represent expected changes in conditions compared to the Base year.

For proposed Transport infrastructure not related to this AQ study, only those schemes that have received the necessary planning approvals and are fully funded are included. This provides a high degree of certainty that the schemes will be constructed.

Forecast year land-use inputs (sqm floorspace) are consistent with PCC's ongoing update to the development Local Plan and are considered the best representation of currently anticipated growth in the area of interest.

Air quality modelling

Through a process of model verification, the model NO_x outputs are compared with measured concentrations at fixed points. These process was used to provide a single adjustment factor which was applied to all model outputs across the study area. Following model verification, the level of residual uncertainty as measured by the RMSE (root mean squared error) value for modelled NO_2 concentration was 3.4 µg/m^3 which is are less than 10% of the EU Limit Value. This is therefore considered to be acceptable for this purpose according to the methodology specified in LAQM.TG(16), which provides the technical specifications for local authority air quality modelling within the UK.

The use of a single verification factor across the large study area was requested by JAQU and PCC as it was considered there were not sufficient differences in the traffic network to warrant zoning of the model and the use of multiple adjustment factors. Although the model performs well across the study area, there are some monitoring locations where the outputs under or over-predicts road NO_x concentrations to a greater extent than others. For example, the model over-predicts at Church Street monitoring sites (DT32a, 32b and DT34) by 30-40%, but under-predicts on London Road (e.g. by more than 40% at monitoring site DT26 and C2). It is important to be mindful of this when considering the results.

5. Use of analysis

5.1. Does the evidence provided support the business case?

Transport modelling

The transport modelling outputs (Flows and Speed by vehicle type and compliance) feed into the Air Quality models that determine AQ exceedance sites. The results of the AQ modelling and link to the business case are identified below.

Air quality modelling

The outputs from the air quality modelling directly feed into the business case as they provide the predicted NO_2 concentrations for the future baseline target year of 2022 and for the shortlisted package of options. The provides the evidence required to determine what road links are likely to experience an exceedance of the EU Limit Value and what level of reduction is likely to be required to achieve the EU Limit Value in this year.

The results from the options modelling will demonstrate whether each one or combination of measures are able to result in sufficient emissions reductions to reduce NO_2 concentrations to below the EU Limit Value in the shortest possible time – i.e. to meeting the primary objective of the study.

5.2. Is there evidence the agreed target will be achieved?

Transport baseline modelling

The transport modelling outputs (Flows and Speed by vehicle type and compliance) feed into the Air Quality models that determine AQ exceedance sites. The results of the AQ modelling in terms of exceedance issues are identified below.

Air quality baseline modelling

The outputs from the future baseline in 2022 using EFT v9.1b within exceedance and near exceedance locations are given in Table 2.

Table 2 Future Baseline outputs and required NO_x reductions to meet EU Limit Value, 2022

Receptor ID	Unique Link ID (Census ID if applicable)	Road Name	Modelled NO_2 (µg/m^3) – 2022 baseline	Modelled Road-NOx (µg/m^3) – 2022 baseline	% Road NOx reduction to meet EU limit	Year compliance would be achieved, assuming no intervention
Road sections on the local network modelled as exceeding the EU limit (40 µg/m^3) in 2022						
573	51842 (18114)	**A3 Alfred Road (Unicorn Rd to Queen St, s/b)**	**41.7**	47.3	-6.7%	**2023**
546	51448 (80848)	**A3 Commercial Road (south of Church St Rbt, s/b)**	**41.1**	39.6	-3.8%	**2023**
Road sections on the local network not exceeding the EU limit, but still above 37 µg/m^3 in 2022						
526	51411	Church Street (east of Church St Rbt, n/b)	40.4	37.6	(+0.6%)	-
526	51411	Church Street (sensitivity test) – described below	38.7	33.4	(+1.0%)	-
536	51546 (74735)	A3 Hope Street (south of Church St R'bout, s/b)	38.9	34.9	(+11.0%)	-
824	51828 (8250)	A2030 Eastern Road Water Bridge (s/b)	38.8	43.9	(+9.5%)	-
648	51601 (38333)	A2047 London Road (Stubbington Ave to Kingston Crescent, s/b)	38.5	33.1	(+14.3%)	-
520	51399 (48196)	Mile End Road (north of Church St R'bout, s/b)	37.6	30.9	(+22.2%)	-
557	51461 (18114)	A3 Marketway (Hope St Rbt to Unicorn Rd)	37.4	38.5	(+19.8%)	

Receptor ID	Unique Link ID (Census ID if applicable)	Road Name	Modelled NO_2 ($\mu g/m^3$) – 2022 baseline	Modelled Road-NOx ($\mu g/m^3$) – 2022 baseline	% Road NOx reduction to meet EU limit	Year compliance would be achieved, assuming no intervention
Road sections on the Strategic Road Network exceeding the EU limit (40 $\mu g/m^3$) in 2022						
986	52157	A27 (north of Portsea Island, w/b)	**48.5**	68.6	-29.5%	2026
1089	52408	A27 (east of Portsea Island, w/b)	**46.1**	65.3	-21.3%	2025
11	51817	M27 (west of Portsea Island, w/b)	**45.3**	68.0	-17.9%	2025
968	53122	A27 (north of Portsea Island, e/b)	**43.7**	59.9	-14.7%	2024
834	51837	A27 (east of Portsea Island, w/b)	**41.1**	49.0	-3.0%	2023

Benchmark modelling

On the basis of the modelling results, implementing a CAZ C to target HGVs, LGVs, buses and taxis across the entire Portsea Island is forecast to deliver compliance in the shortest possible time, on all Portsmouth controlled roads. Exceedances remain on the strategic road network, which is controlled by Highways England (see Table 3)[2].

Table 3: Modelled NO_2 concentrations with the Benchmark option, 2022

Receptor ID	Road Name	NO_2 concentrations with Portsea Island CAZ-C ($\mu g/m^3$)
573	**A3 Alfred Road (Unicorn Rd to Queen St, s/b)**	39.7
546	**A3 Commercial Road (south of Church St Rbt, s/b)**	39.2
526	Church Street (east of Church St Rbt, n/b) (revised assessment)	<38.7[a]
536	A3 Hope Street (south of Church St R'bout, s/b)	37.5
824	A2030 Eastern Road Water Bridge (s/b)	36.3
648	A2047 London Road (Stubbington Ave to Kingston Crescent, s/b)	37.3
520	Mile End Road (north of Church St R'bout, s/b)	36.3
557	A3 Marketway (Hope St Rbt to Unicorn Rd)	35.7

Strategic Road Network

a. The concentration at Church Rd has not been modelled directly, but the above options reduce traffic levels and improve average fleet emissions compared with the baseline. It therefore follows that the concentration will be lower than the baseline concentration.

986	A27 (north of Portsea Island, w/b)	**45.4**
1089	A27 (east of Portsea Island, w/b)	**43.8**
11	M27 (west of Portsea Island, w/b)	**42.6**
968	A27 (north of Portsea Island, e/b)	**40.7**
834	A27 (east of Portsea Island, w/b)	38.8

<u>Packages modelling</u>

There are a number of shortlisted options which were modelled to determine whether these would deliver the improvements as for the benchmark in 2022. Results from the model runs with EFT v9.1b are provided below in Table 4.

The results show that a CAZ-B for the Portsea Island or small area around the city centre would achieve compliance on A3 Alfred Road in 2022, but concentrations are close to the EU Limit.

Table 4: Modelled NO_2 concentrations with packages, 2022

Receptor ID	Road Name	Annual Mean NO_2 concentrations (μg/m^3)		
		CAZ-B Portsea Island	CAZ-B External trips only	CAZ-B Small Area
573	**A3 Alfred Road (Unicorn Rd to Queen St, s/b)**	40.4	**41.1**	40.3
546	**A3 Commercial Road (south of Church St Rbt, s/b)**	40.0	**40.6**	39.9
526	Church Street (east of Church St Rbt, n/b) (revised assessment)	<38.7	-	<38.7a
536	A3 Hope Street (south of Church St R'bout, s/b)	37.9	38.4	37.8
824	A2030 Eastern Road Water Bridge (s/b)	36.8	37.0	38.4
648	A2047 London Road (Stubbington Ave to Kingston Crescent, s/b)	38.1	38.5	37.7
520	Mile End Road (north of Church St R'bout, s/b)	37.0	37.5	36.9
557	A3 Marketway (Hope St Rbt to Unicorn Rd)	36.3	37.1	36.3
Strategic Road Network				
986	A27 (north of Portsea Island, w/b)	**46.7**	**46.9**	**48.2**
1089	A27 (east of Portsea Island, w/b)	**45.1**	**45.2**	**46.0**
11	M27 (west of Portsea Island, w/b)	**44.0**	**44.0**	**45.3**
968	A27 (north of Portsea Island, e/b)	**41.7**	**42.0**	**43.1**
834	A27 (east of Portsea Island, w/b)	39.7	39.9	**40.9**

<u>Alternative Package modelling</u>

In recognition of the potential impacts on individuals and businesses, an alternative package based on a CAZ B plus non-charging measures was also developed to put forward against the benchmark. This includes changes to parking charges, cycle lanes and signalisation improvements on A3 Alfred Road. The results of this package are provided in Table 5. Concentrations within the city centre are improved with this alternative package compared to a CAZ-B on its own and comply with the EU Limit Value in 2022, i.e. within the shortest possible time.

Table 5: Modelled NO2 concentrations with alternative package, 2022

Receptor ID	Road Name	Annual Mean NO_2 concentrations (μg/m^3) CAZ-B Small Area +Non charging measures
573	**A3 Alfred Road (Unicorn Rd to Queen St, s/b)**	40.1
546	**A3 Commercial Road (south of Church St Rbt, s/b)**	39.5
526	Church Street (east of Church St Rbt, n/b) (revised assessment)	<38.7
536	A3 Hope Street (south of Church St R'bout, s/b)	37.8
824	A2030 Eastern Road Water Bridge (s/b)	38.3
648	A2047 London Road (Stubbington Ave to Kingston Crescent, s/b)	37.6
520	Mile End Road (north of Church St R'bout, s/b)	36.9
557	A3 Marketway (Hope St Rbt to Unicorn Rd)	36.2
Strategic Road Network		
986	A27 (north of Portsea Island, w/b)	**48.2**
1089	A27 (east of Portsea Island, w/b)	**46.0**
11	M27 (west of Portsea Island, w/b)	**45.3**
968	A27 (north of Portsea Island, e/b)	**43.1**
834	A27 (east of Portsea Island, w/b)	**40.8**