Modelling of Ringsend Discharge

Effluent Concentration $10,000 cfu/100ml$

Aodh Dowley and Zeinab Bedri
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April 30, 2007

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1. $100,000 cfu/100ml$
2. $20,000 cfu/100ml$
3. $10,000 cfu/100ml$
4. $5,000 cfu/100ml$

The values of the variables common to all four cases are as follows:

- Low river flow in the Liffey estuary $4.0 m^3/s$
- Ringsend effluent flow $500,000 m^3/day$, or $5.79 m^3/s$
- ESB warm cooling water dilution flow $4.5 m^3/s$
- Hydrodynamics corresponding to Mean Spring Tide for all 4 cases
- Calm weather, i.e. no wind
- Isotropic diffusion coefficient $20 m^2/s$
- T_{90} ecoli of $30 hrs$

1.1 EColi Distributions/Effluent Conc. 10,000cfu/100ml

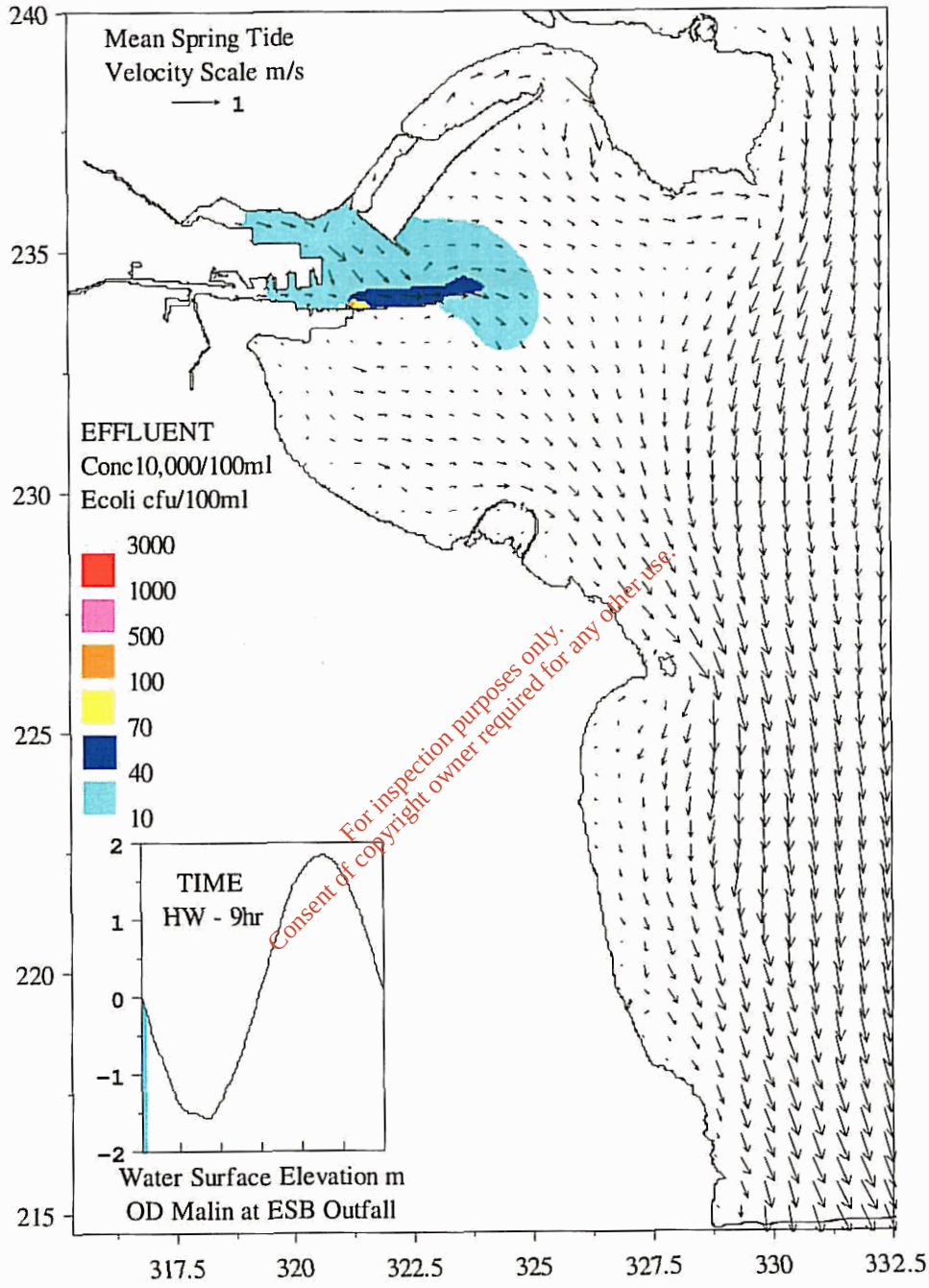


Figure 1: 9 Hours before High Water of Mean Spring Tide

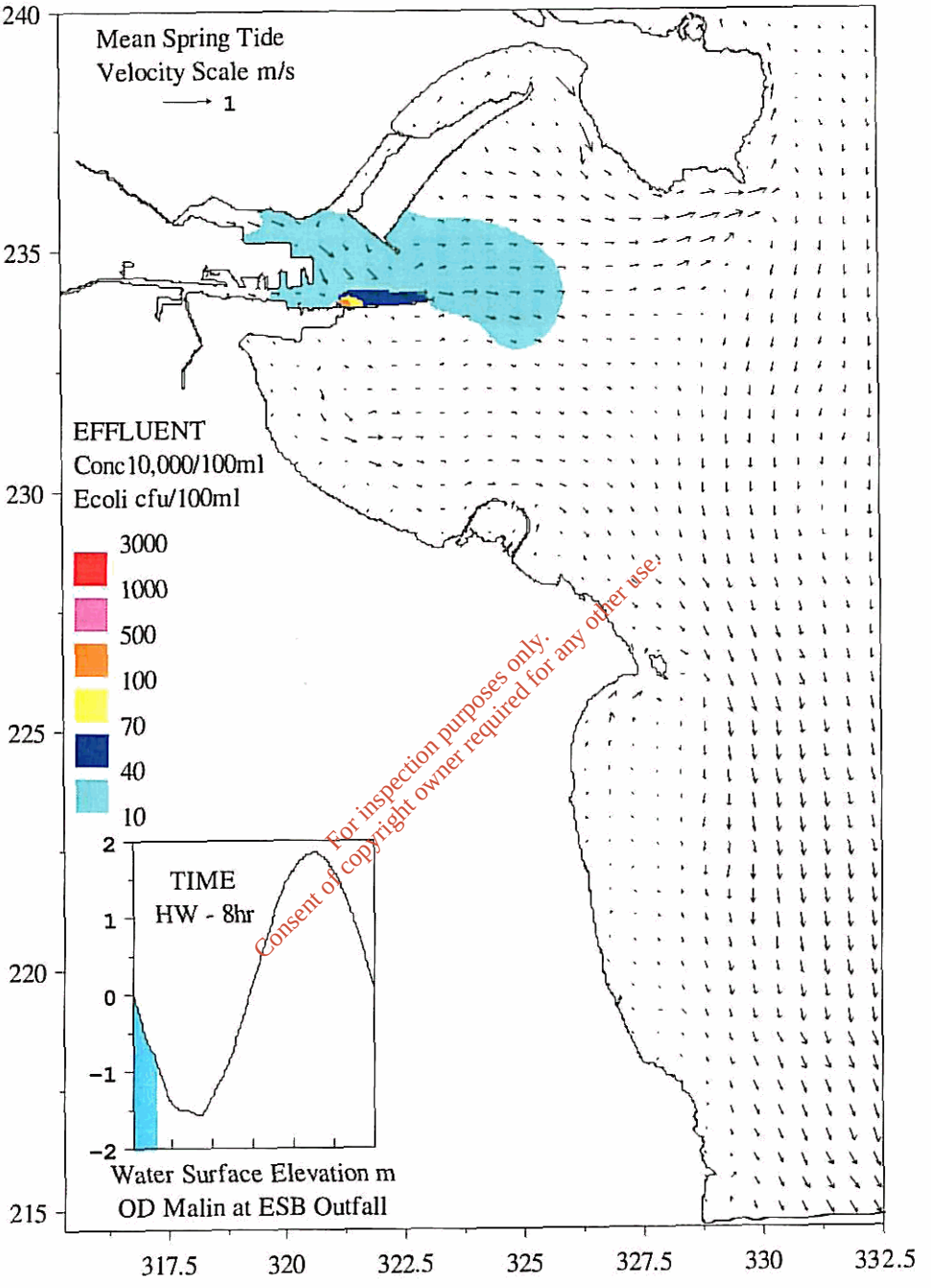
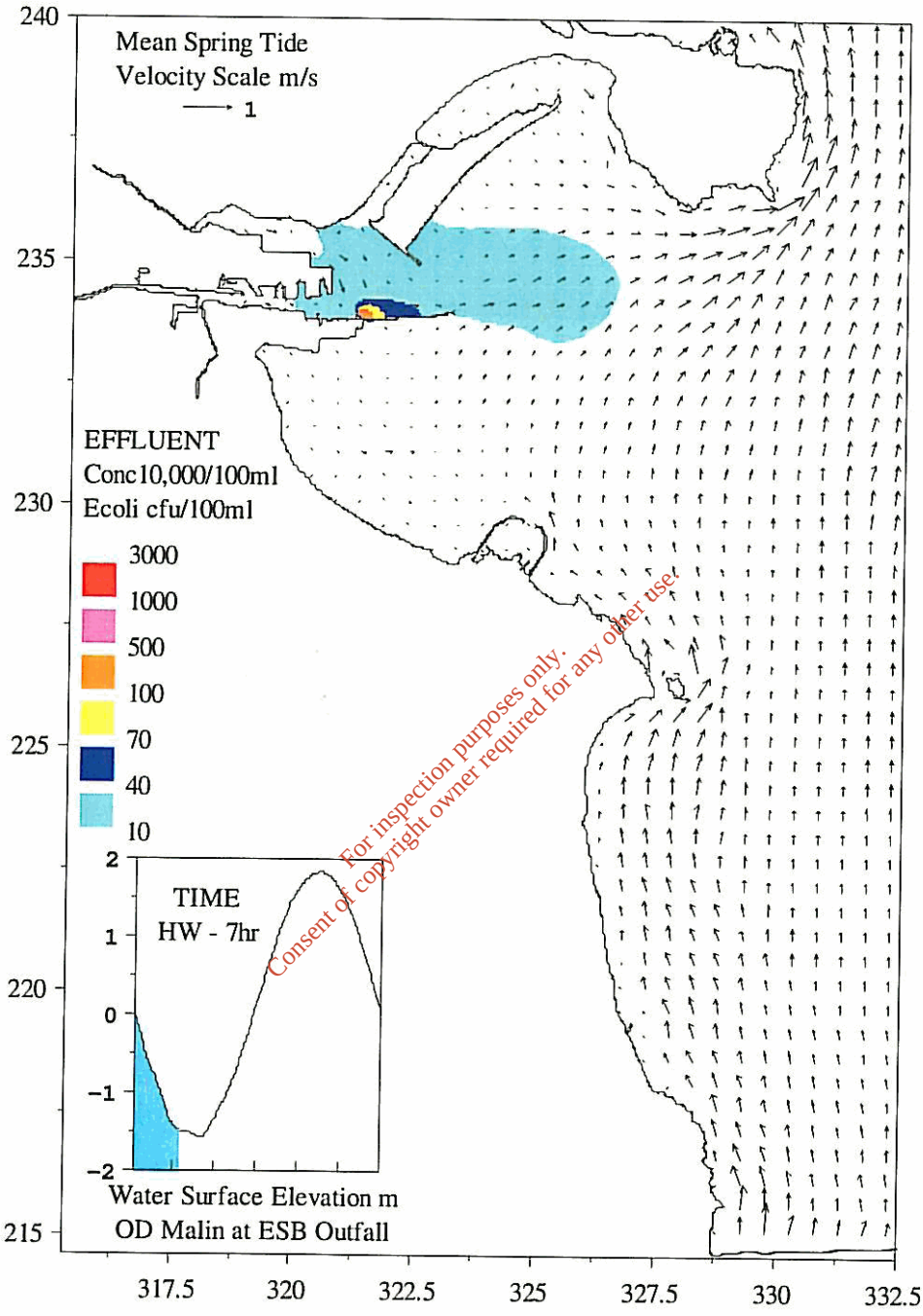


Figure 2: 8 Hours before High Water of Mean Spring Tide



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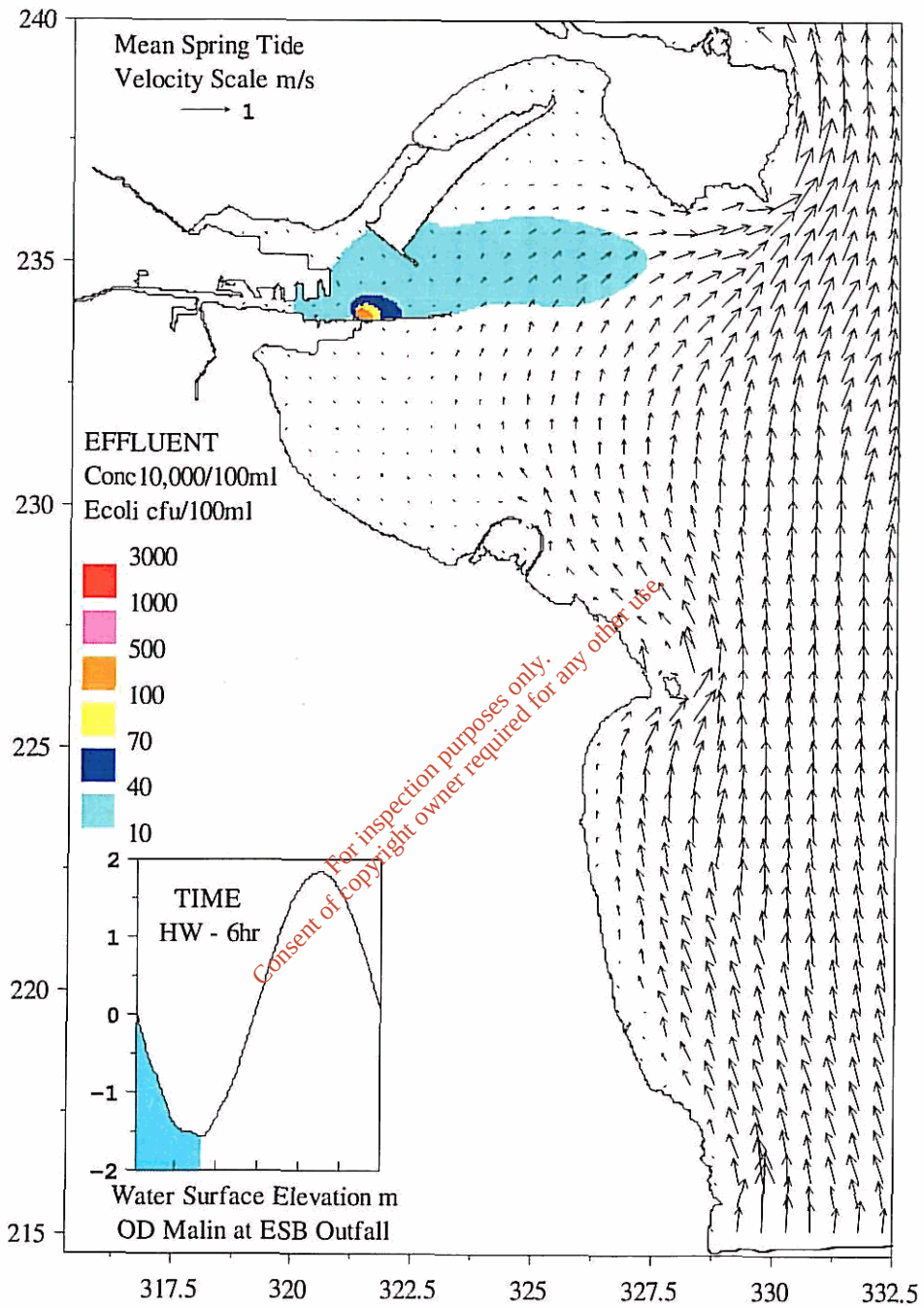


Figure 4: 6 Hours before High Water of Mean Spring Tide

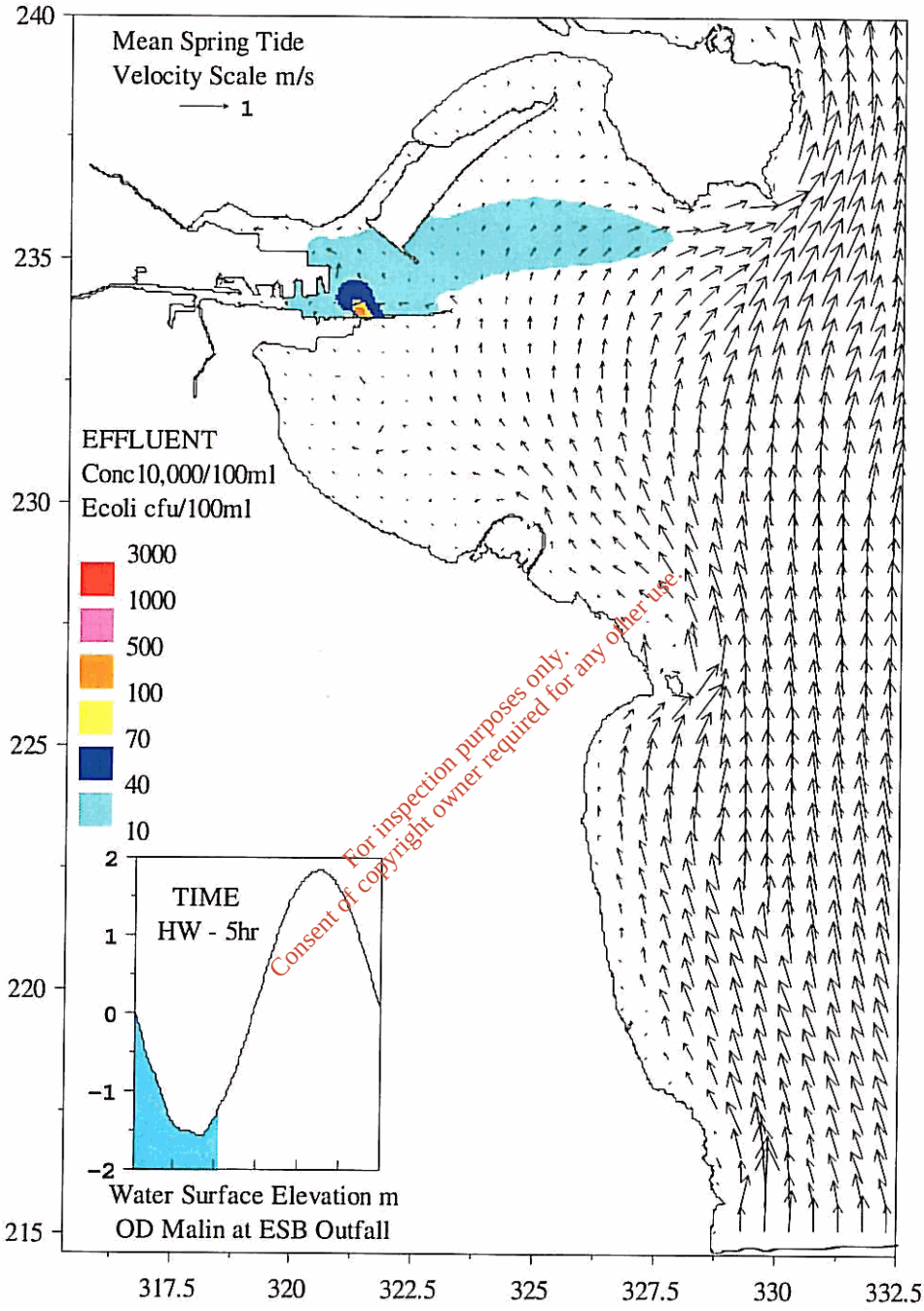


Figure 5: 5 Hours before High Water of Mean Spring Tide

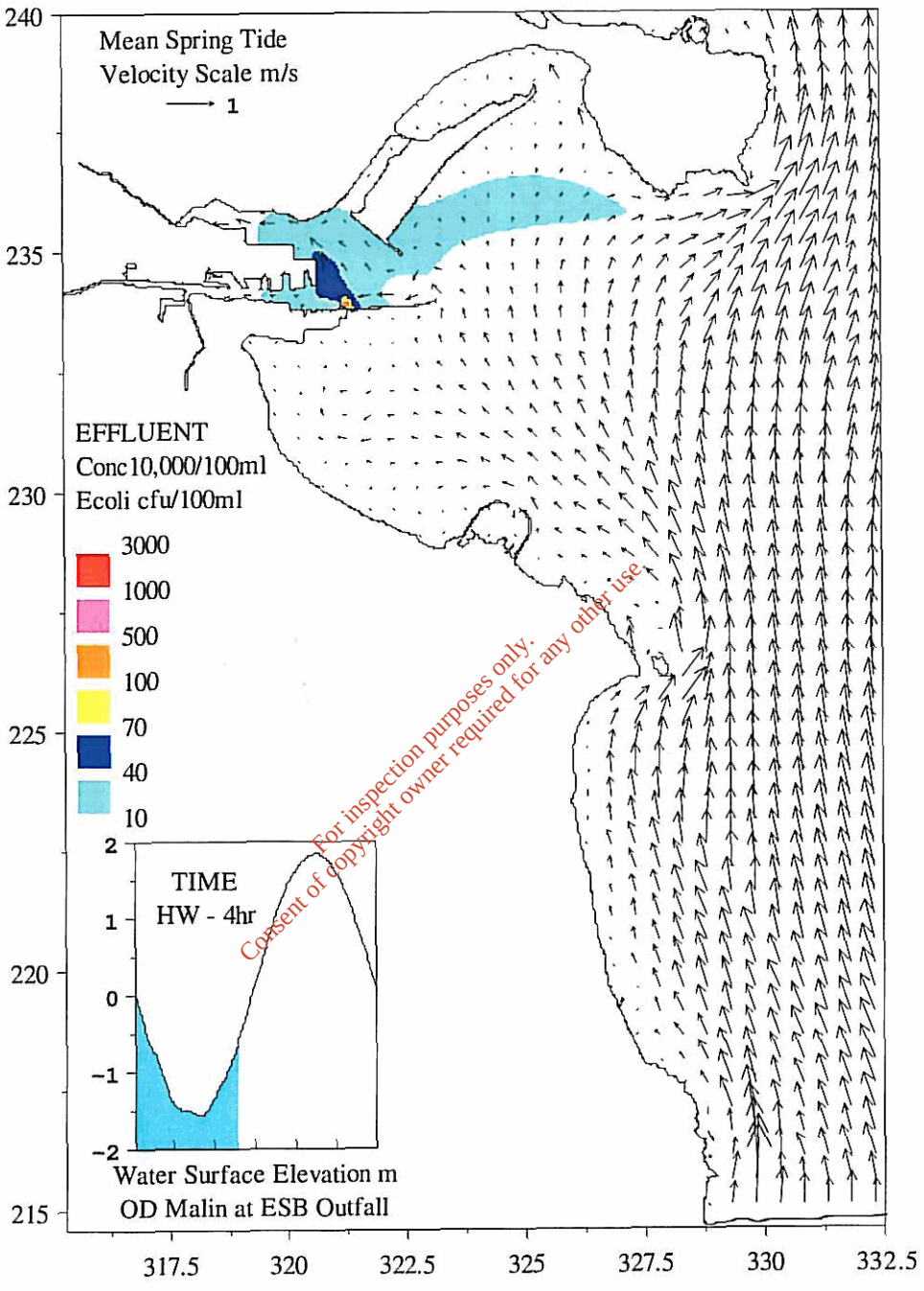


Figure 6: 4 Hours before High Water of Mean Spring Tide

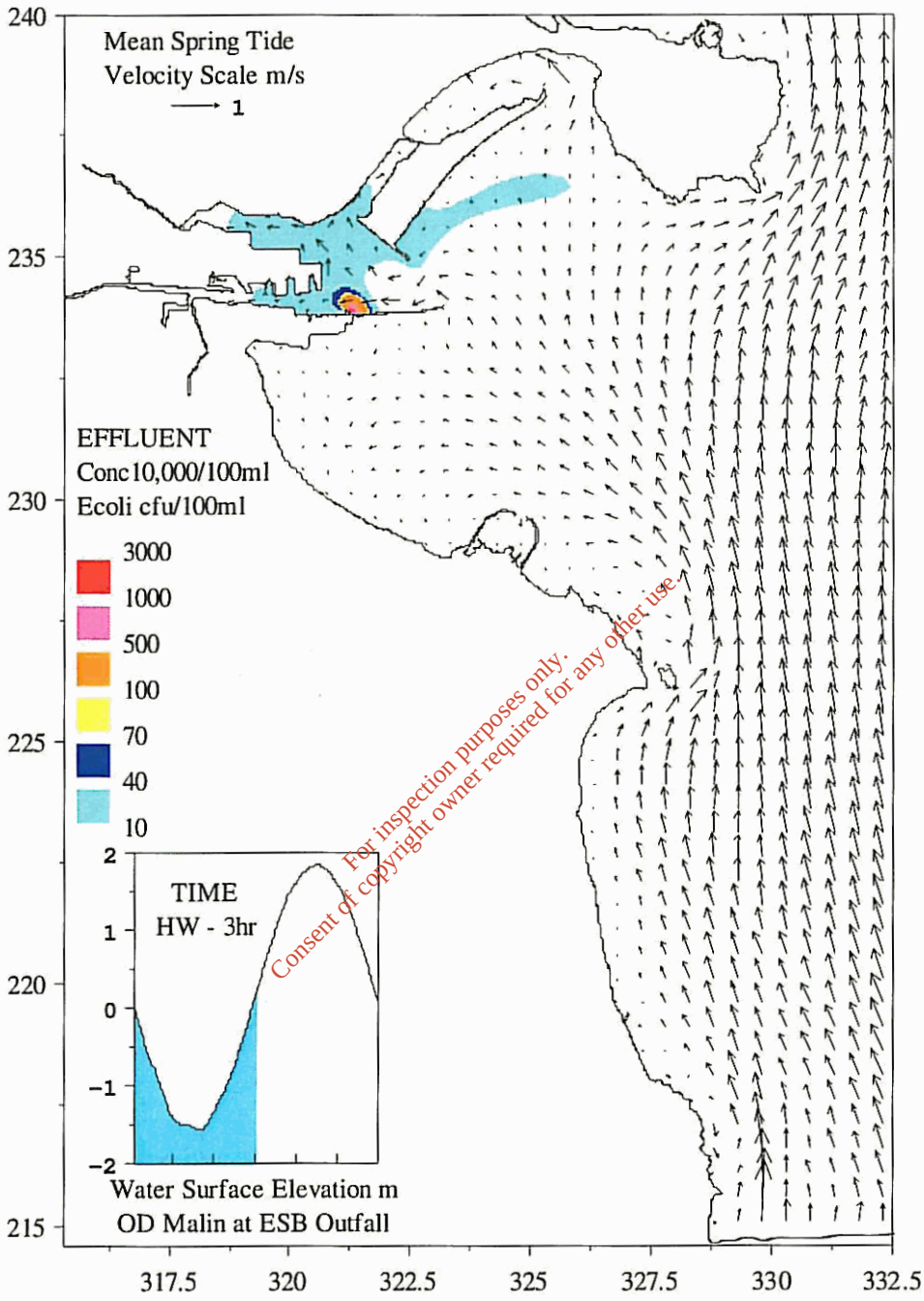
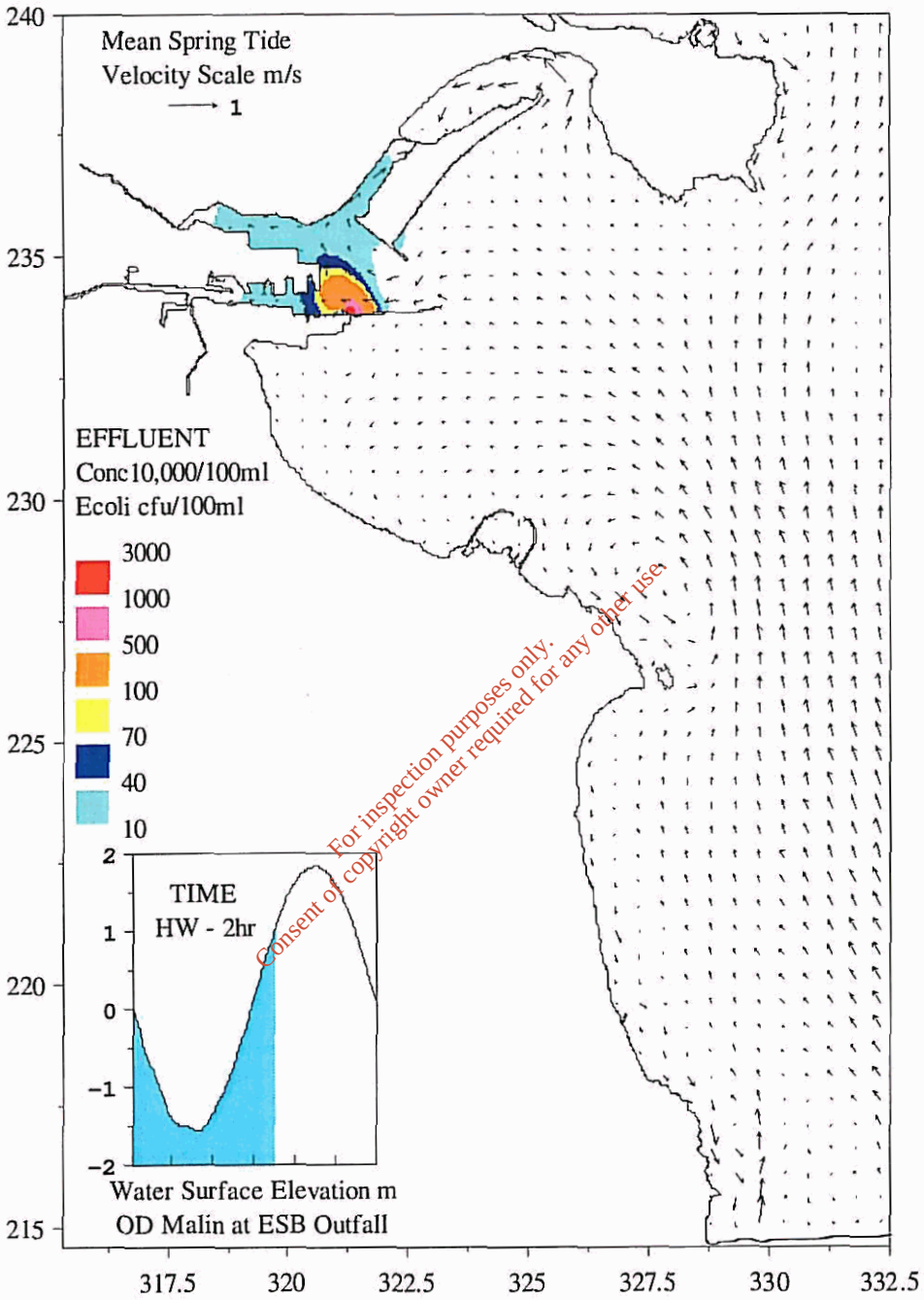


Figure 7: 3 Hours before High Water of Mean Spring Tide



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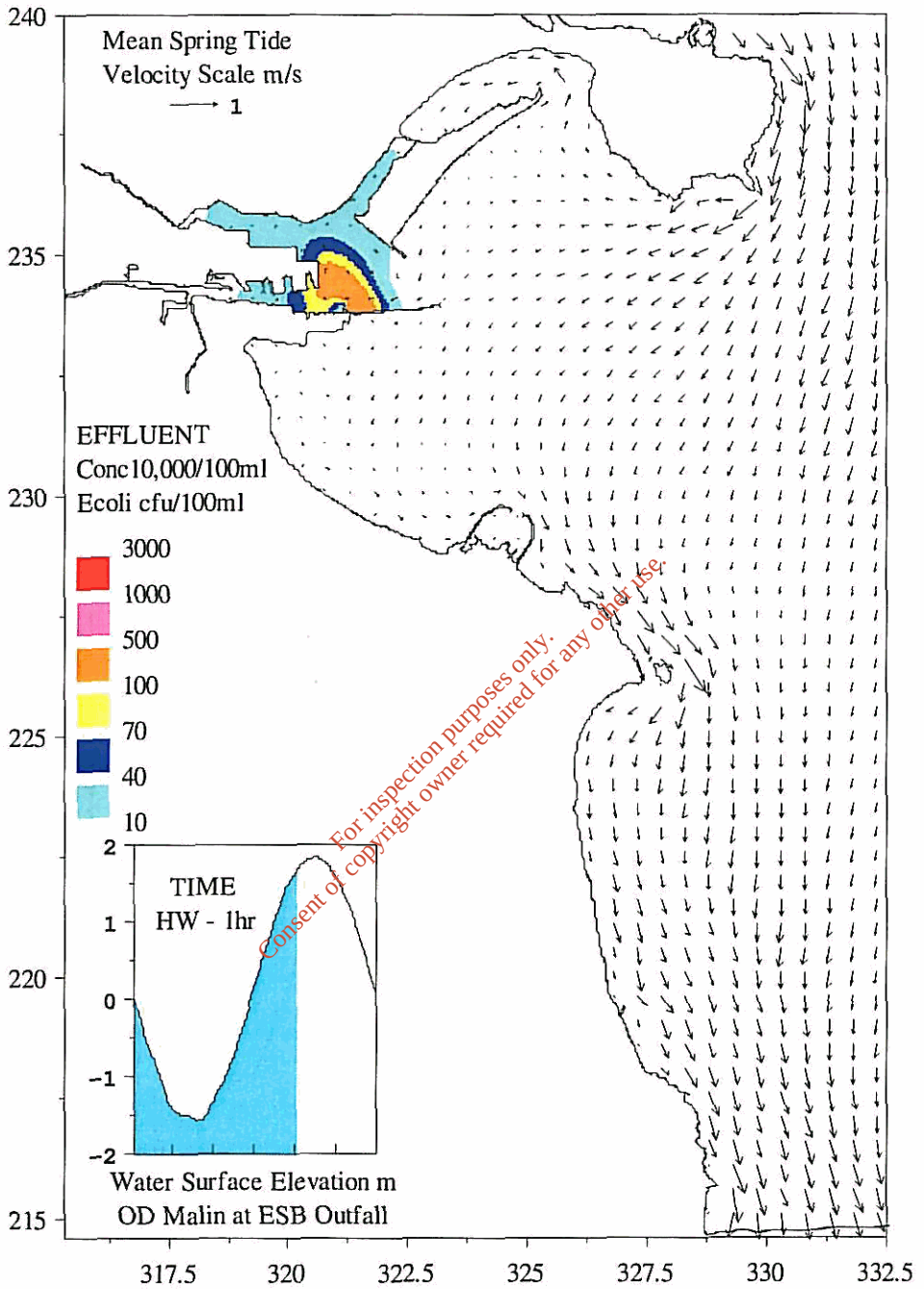


Figure 9: 1 Hour before High Water of Mean Spring Tide

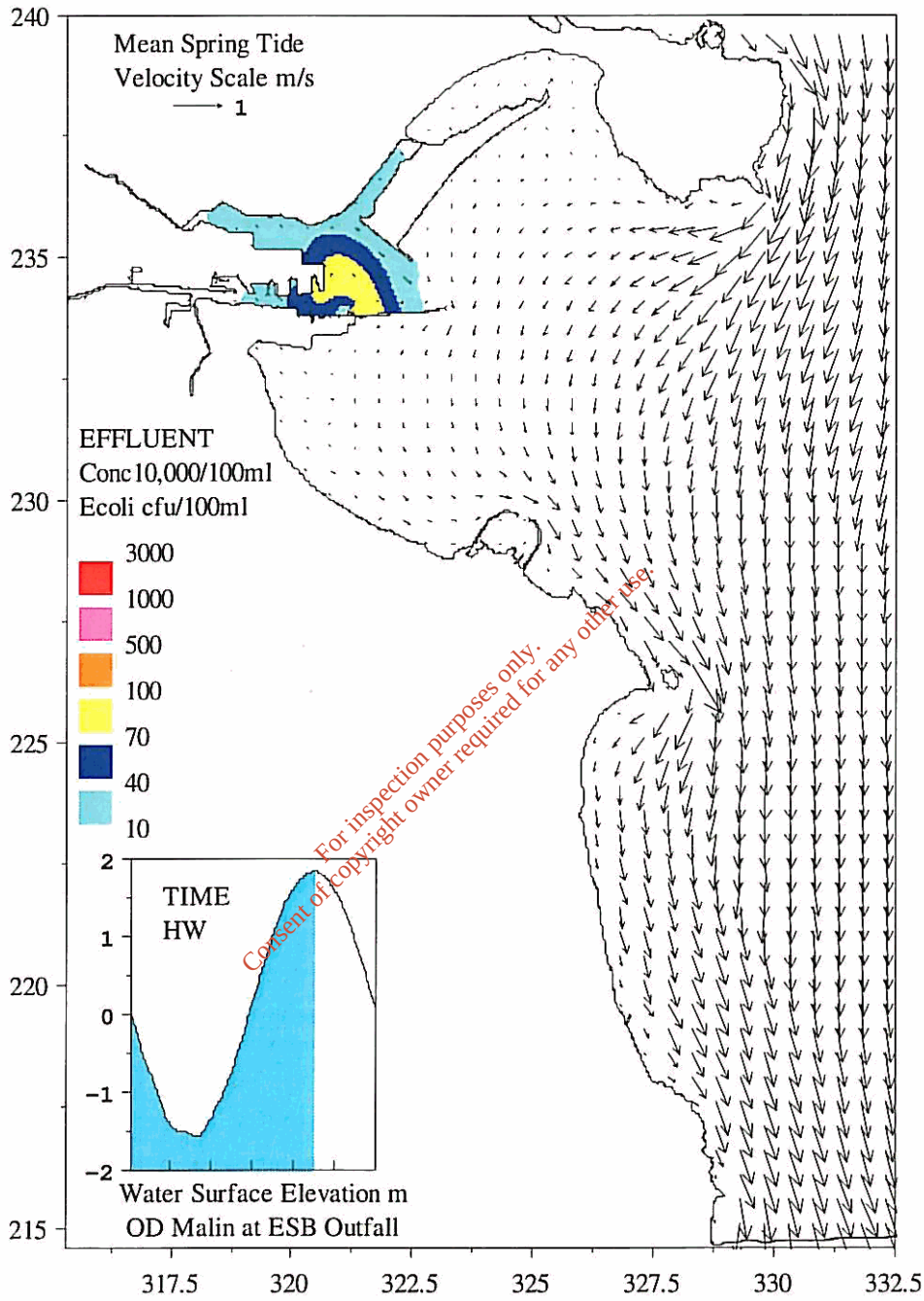
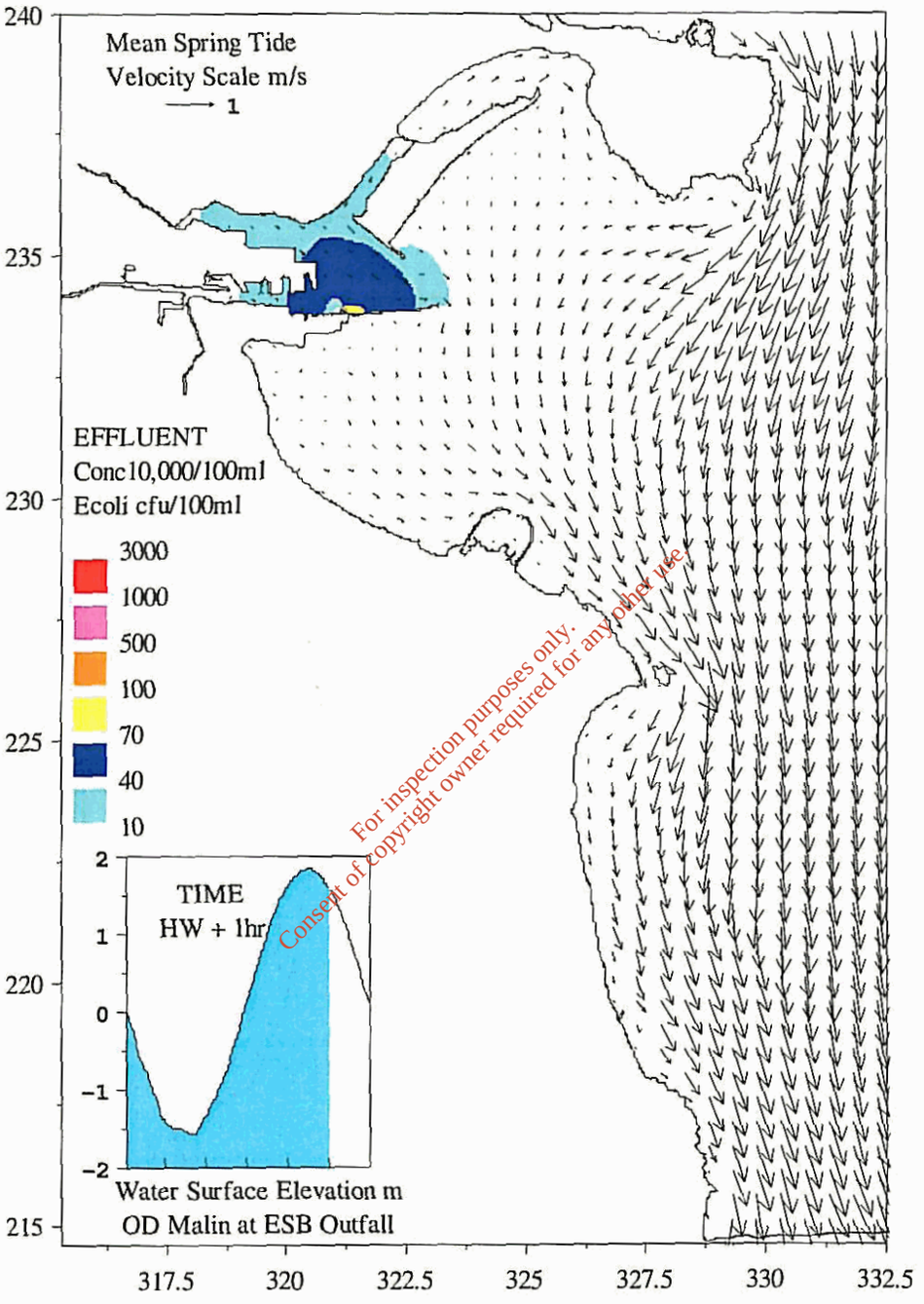


Figure 10: High Water of Mean Spring Tide



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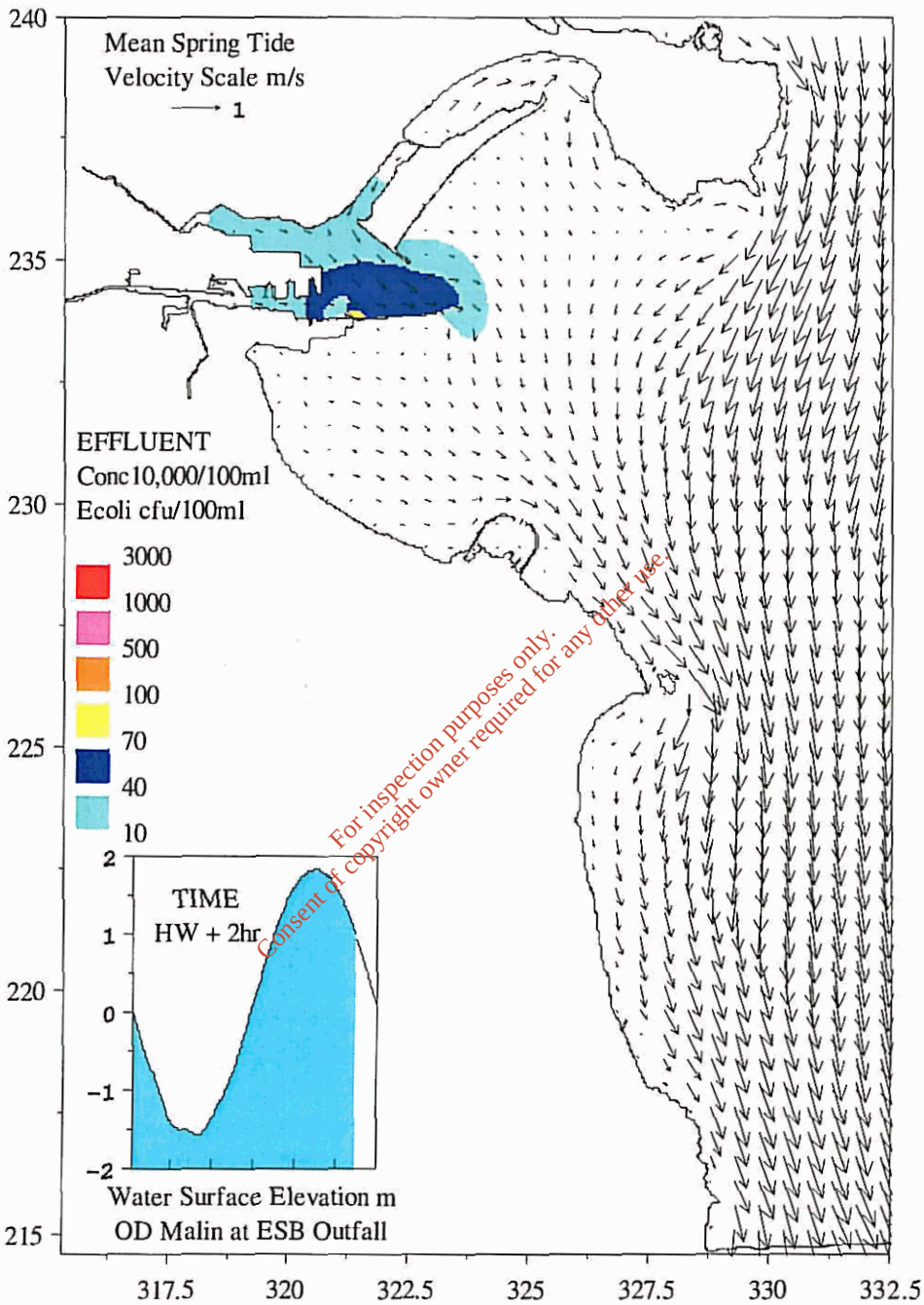

Figure 12: 2 Hours after High Water of Mean Spring Tide

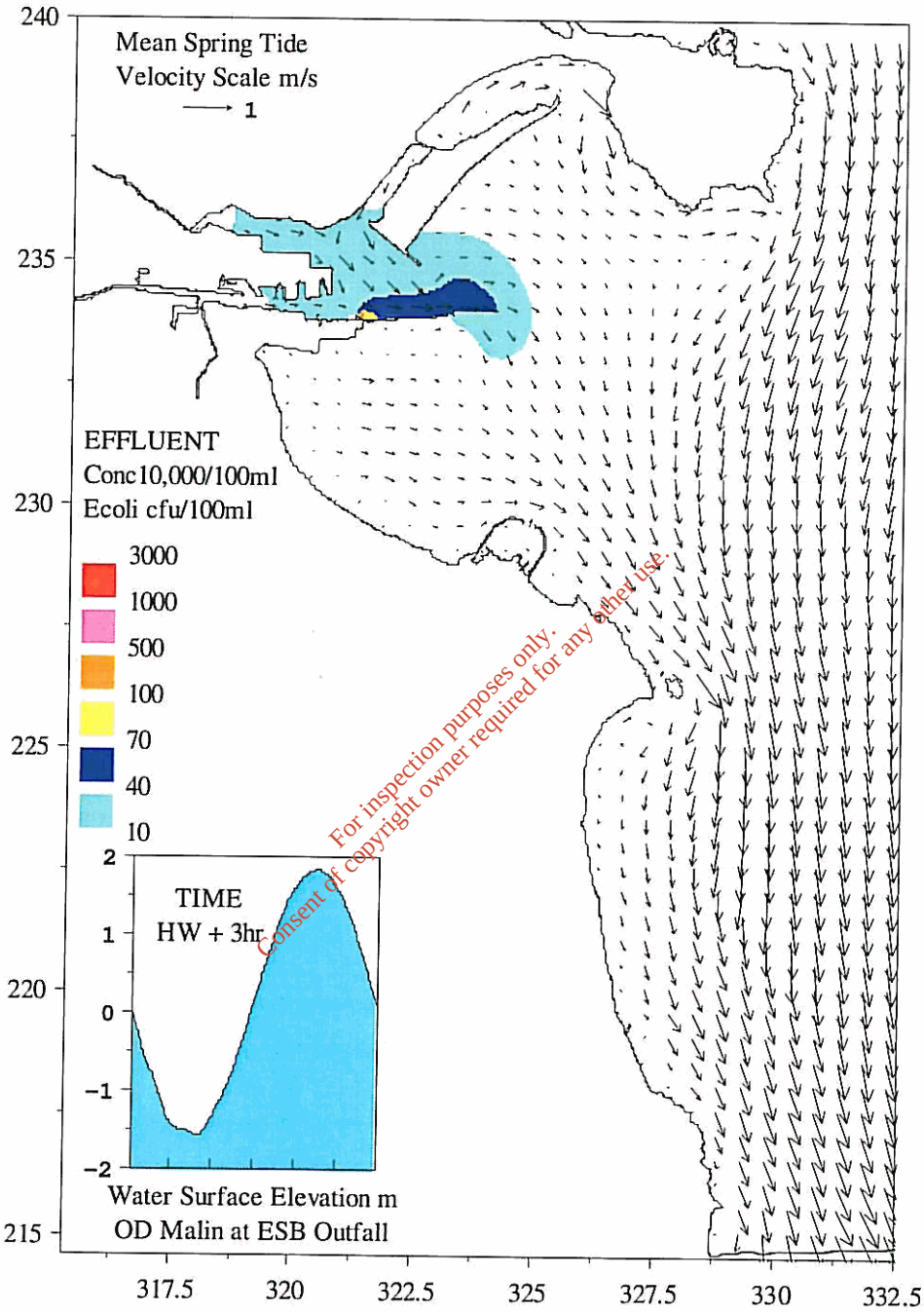

Figure 13: 3 Hours after High Water of Mean Spring Tide

Modelling of Ringsend Discharge

Effluent Concentration $20,000 cfu/100ml$

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1. $100,000 cfu/100ml$
2. $20,000 cfu/100ml$
3. $10,000 cfu/100ml$
4. $5,000 cfu/100ml$

The values of the variables common to all four cases are as follows:

- Low river flow in the Liffey estuary $4.0 m^3/s$
- Ringsend effluent flow $500,000 m^3/day$, or $5.79 m^3/s$
- ESB warm cooling water dilution flow $4.5 m^3/s$
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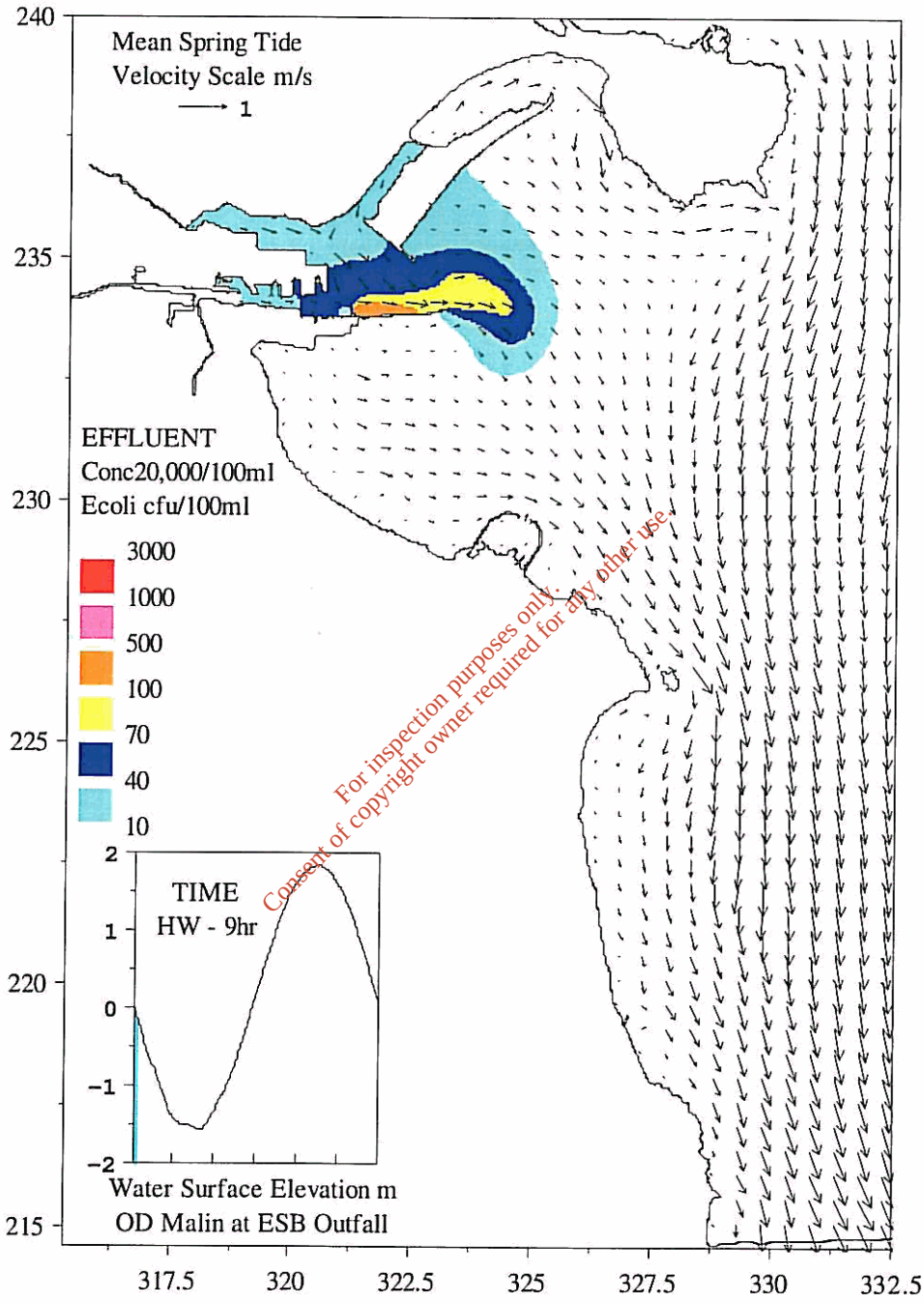
Effluent Concentration 20,000cfu/100ml



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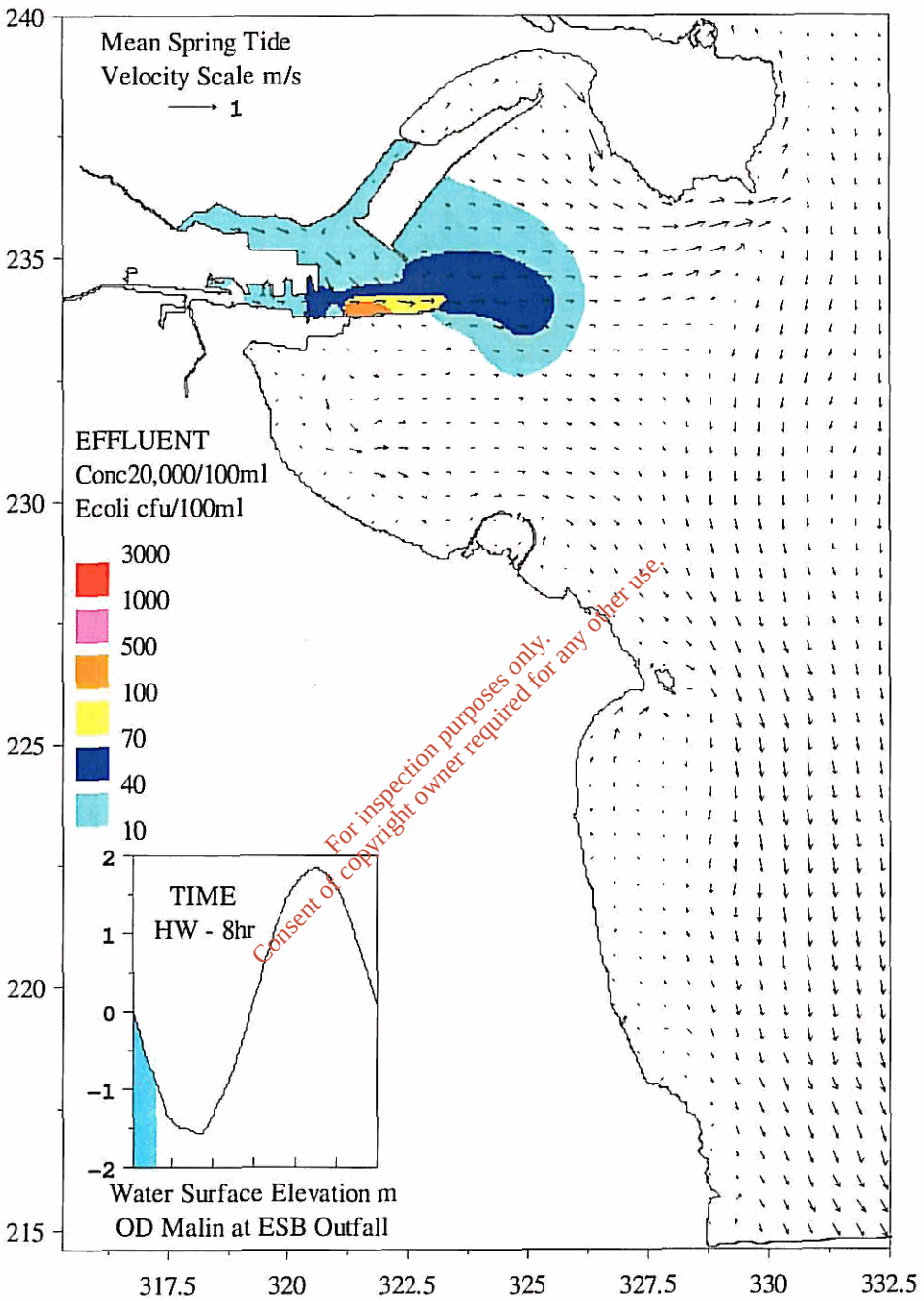
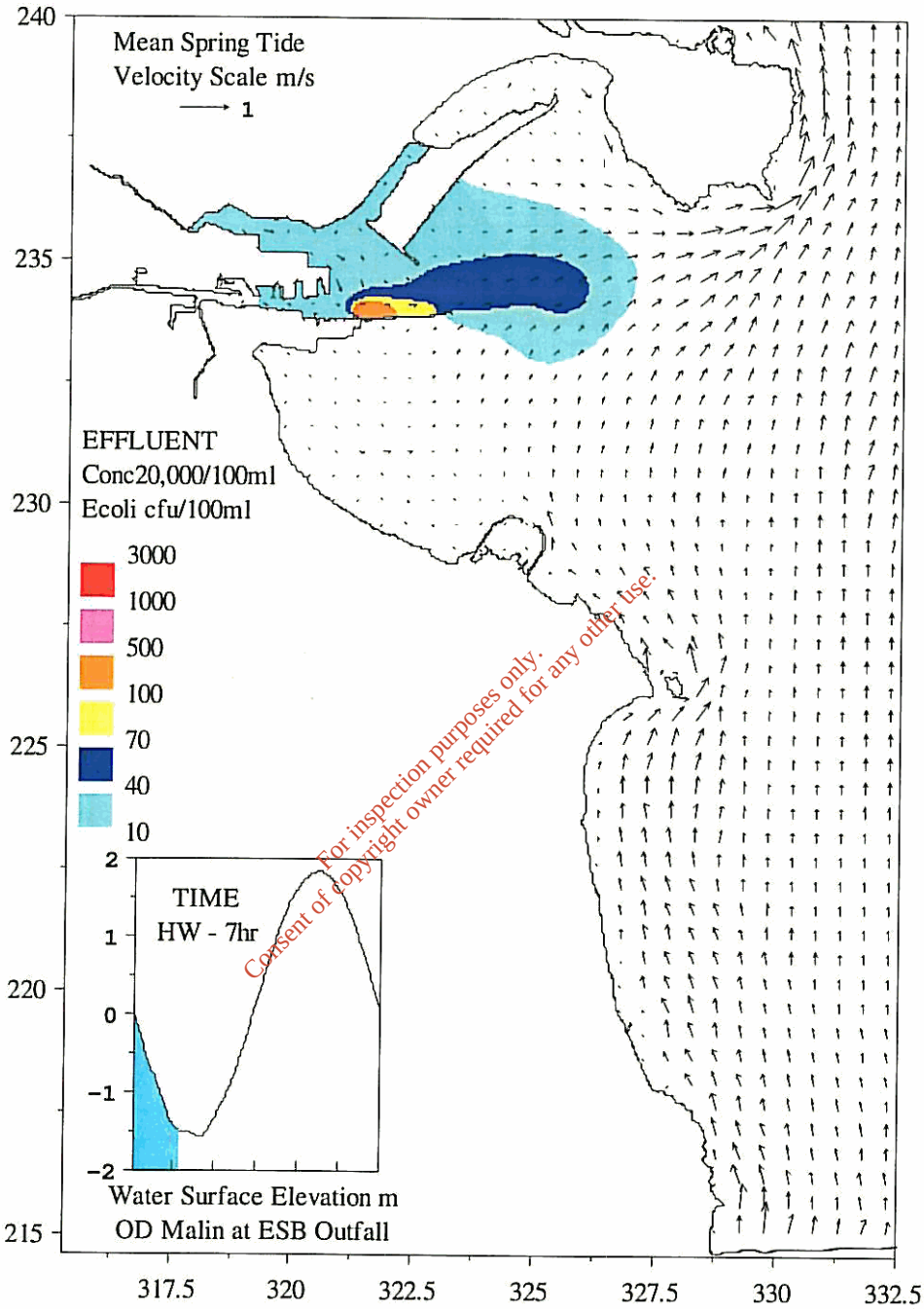


Figure 2: 8 Hours before High Water of Mean Spring Tide



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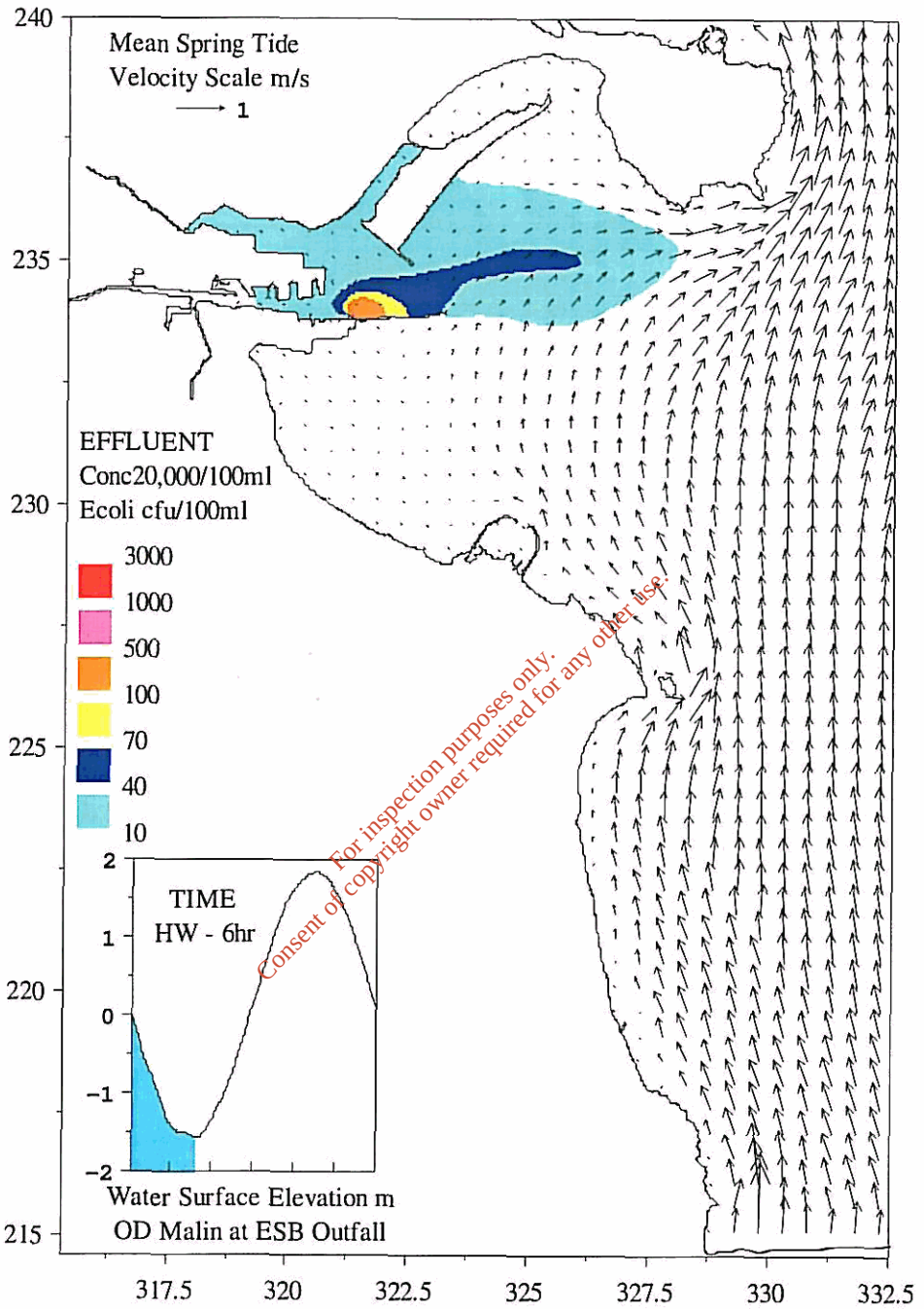


Figure 4: 6 Hours before High Water of Mean Spring Tide

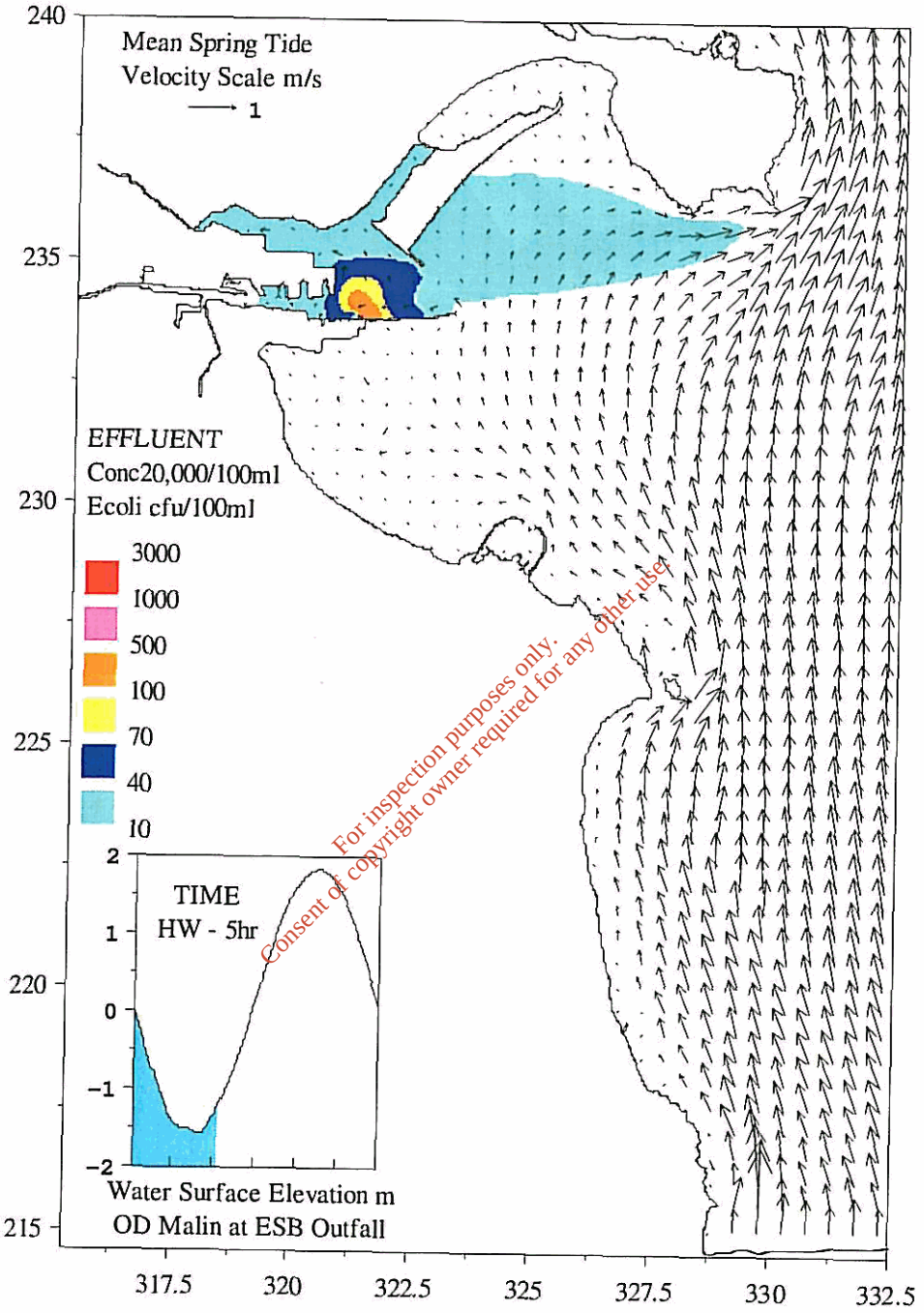


Figure 5: 5 Hours before High Water of Mean Spring Tide

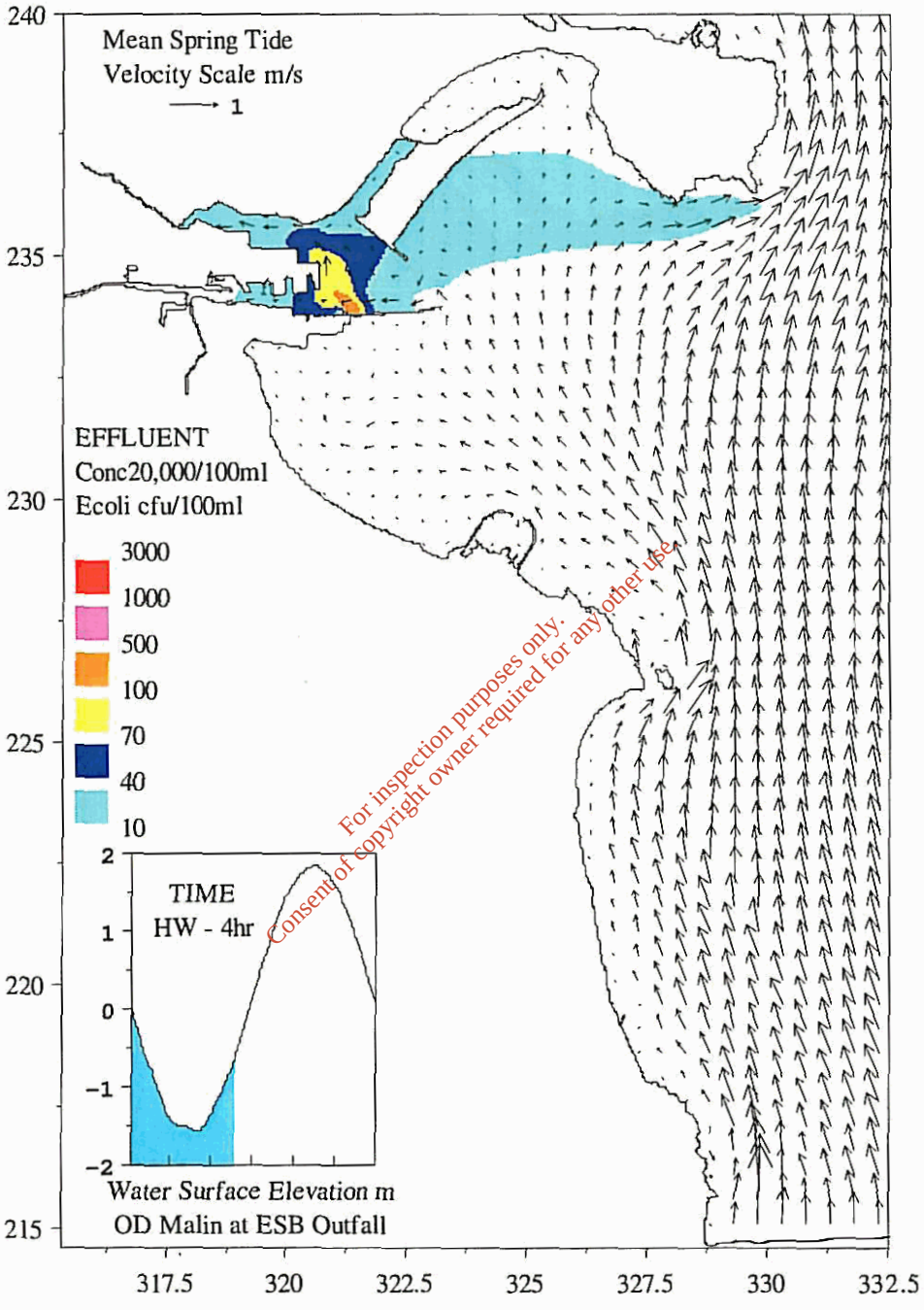


Figure 6: 4 Hours before High Water of Mean Spring Tide

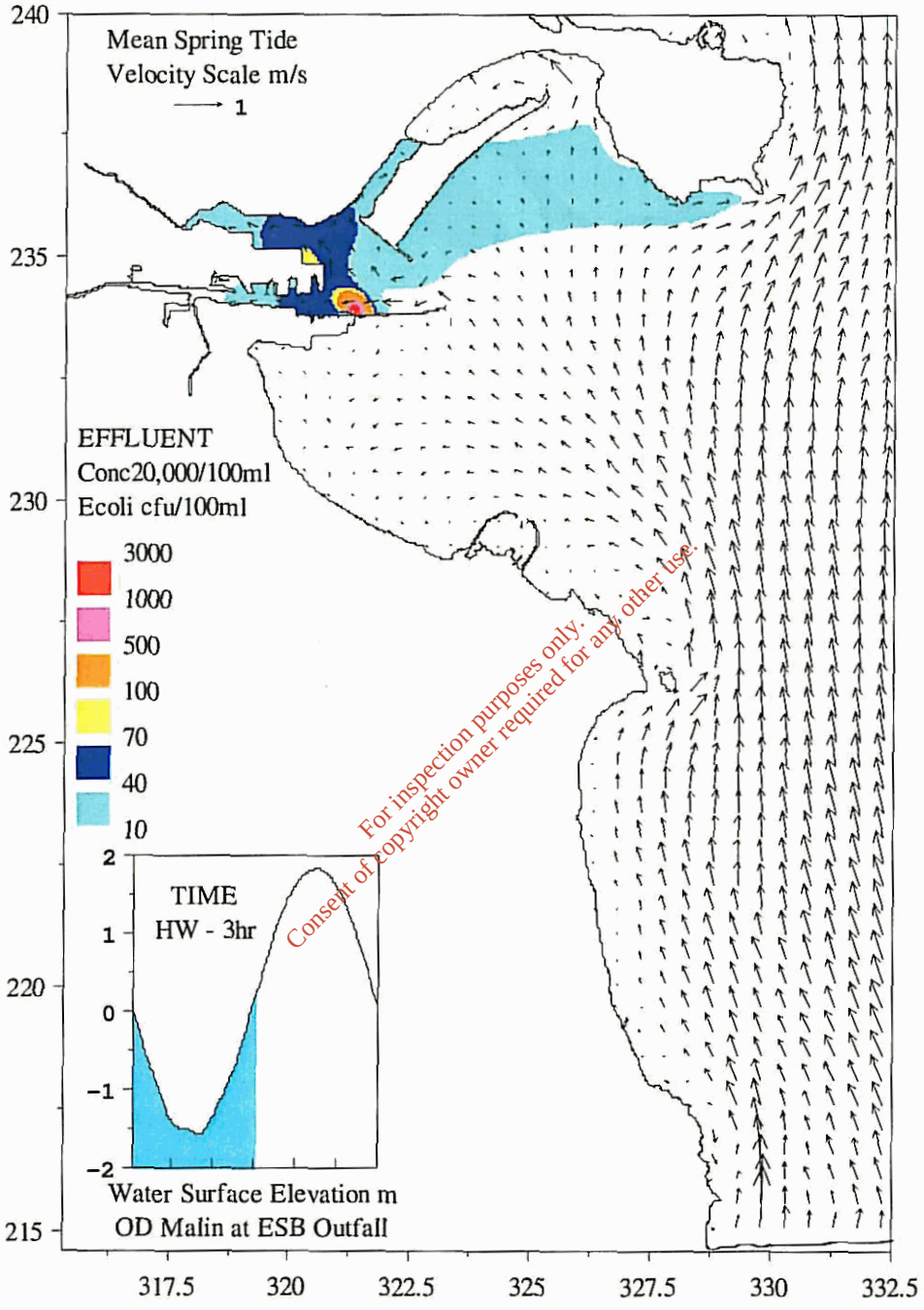


Figure 7: 3 Hours before High Water of Mean Spring Tide

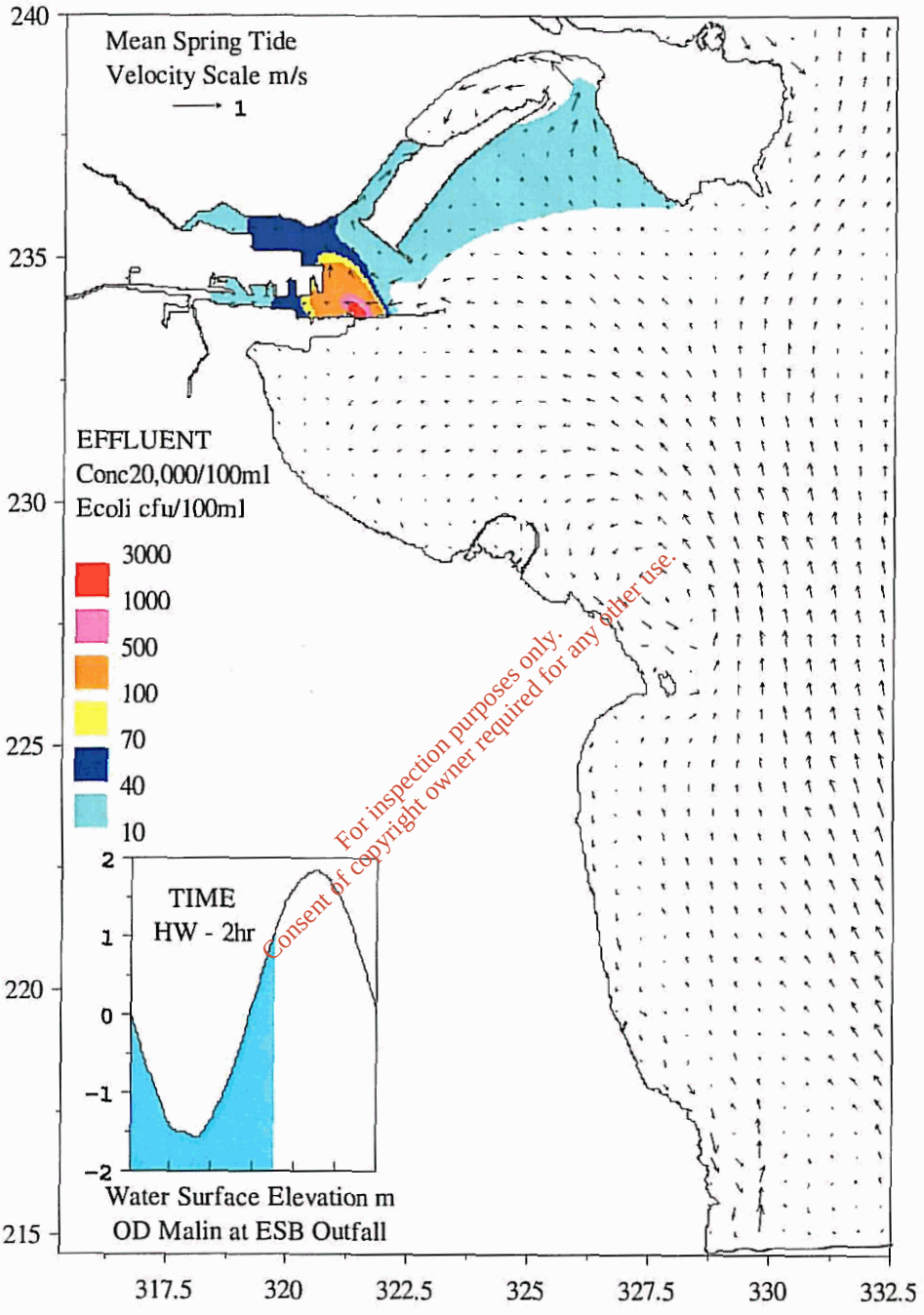


Figure 8: 2 Hours before High Water of Mean Spring Tide

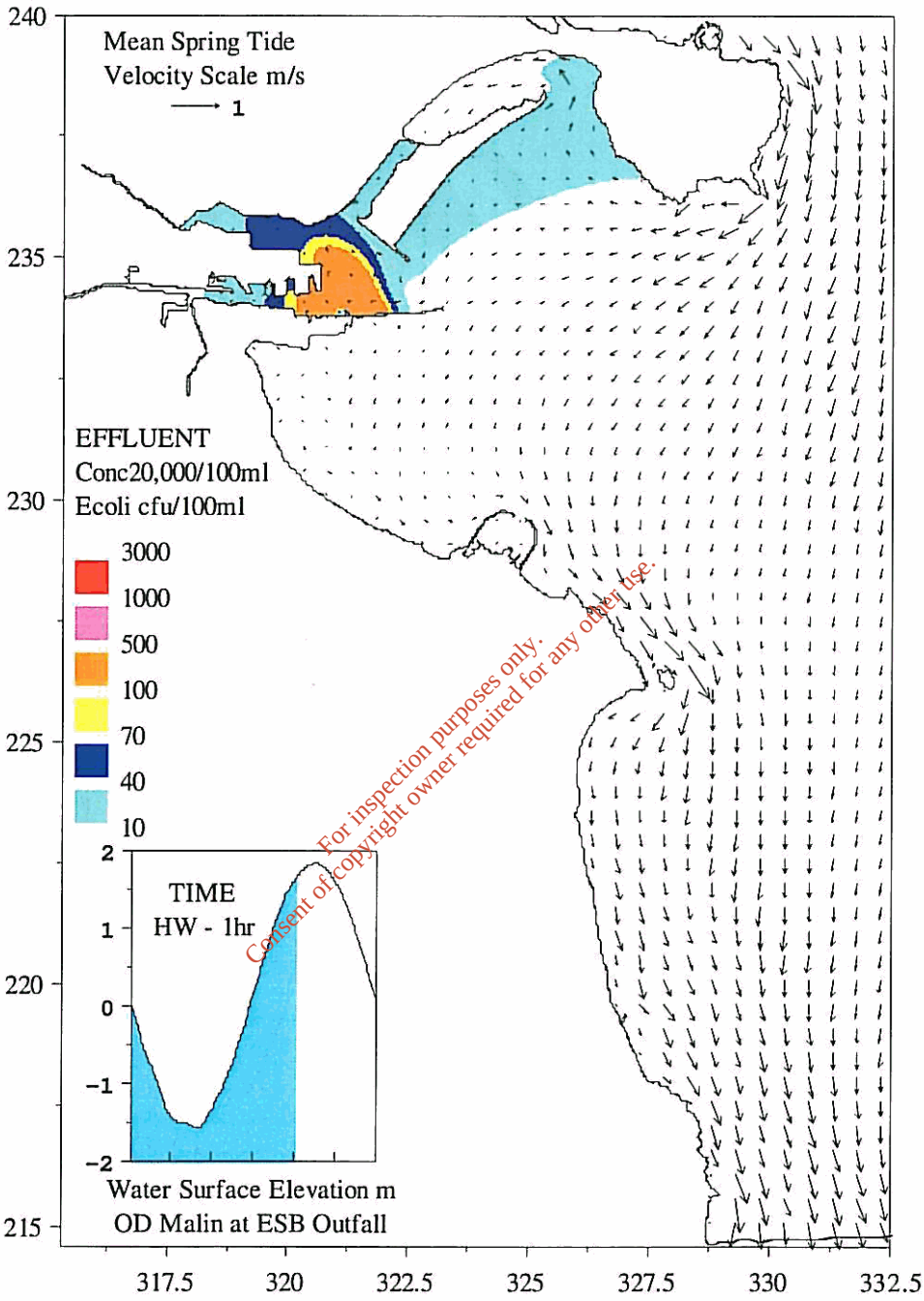


Figure 9: 1 Hour before High Water of Mean Spring Tide

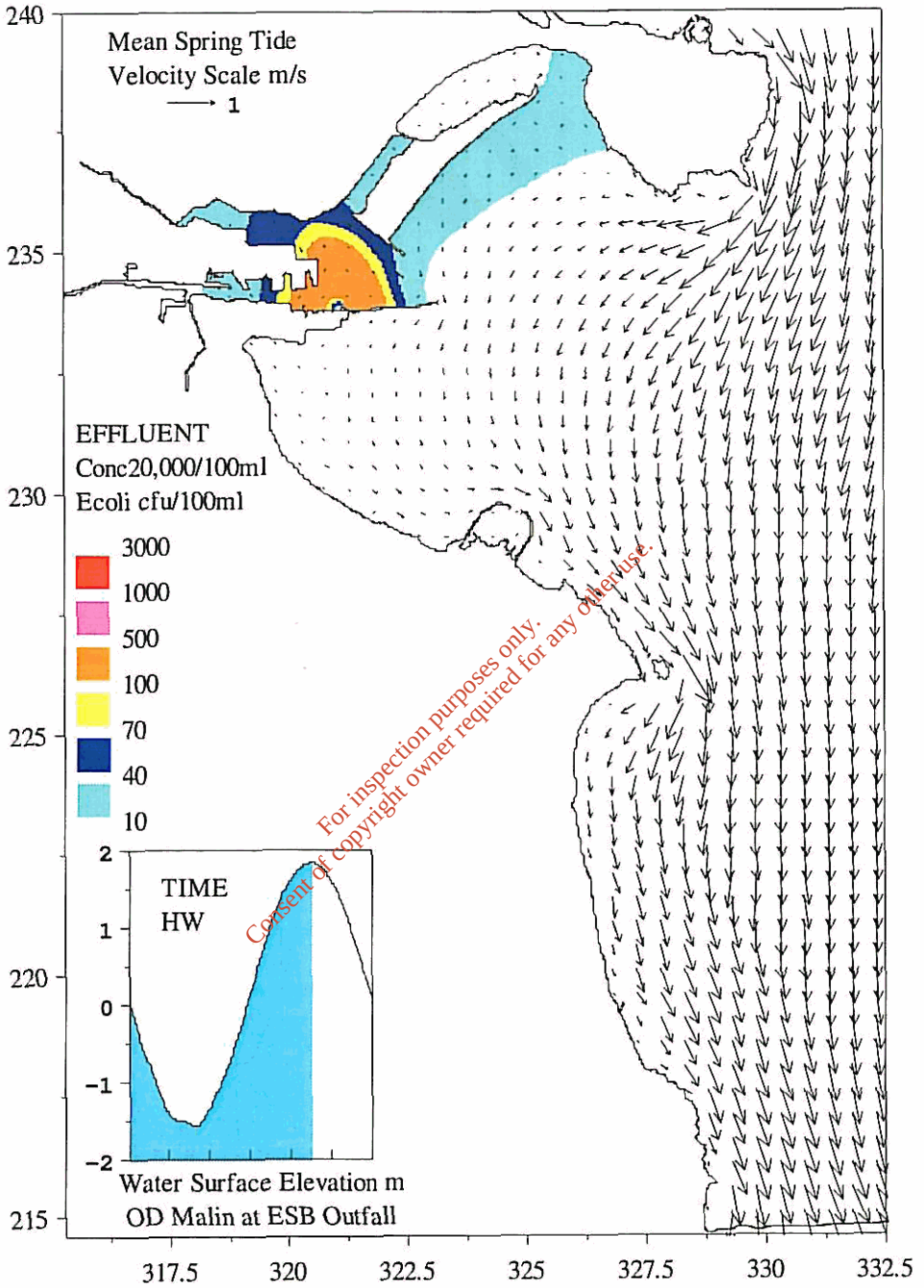
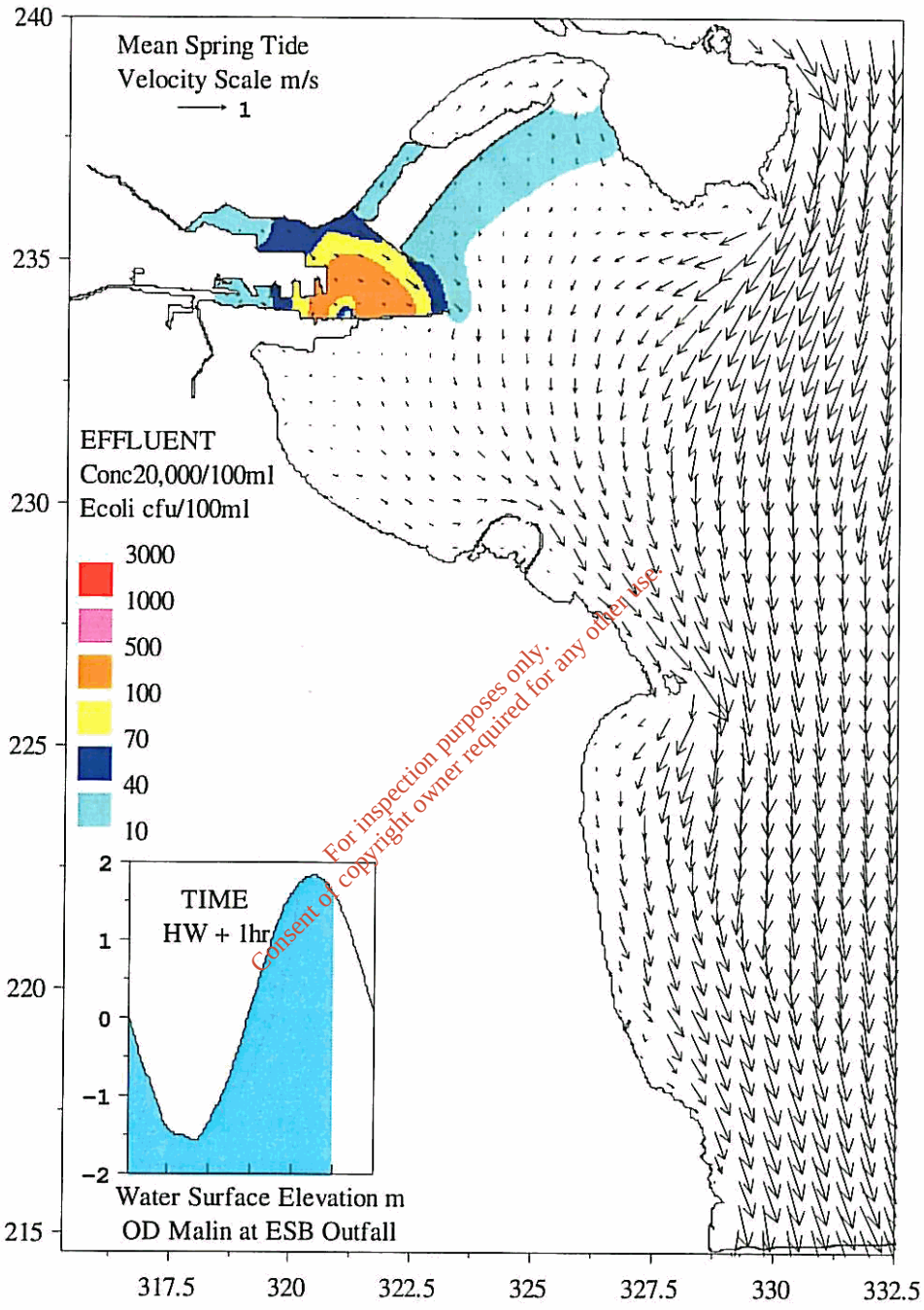


Figure 10: High Water of Mean Spring Tide



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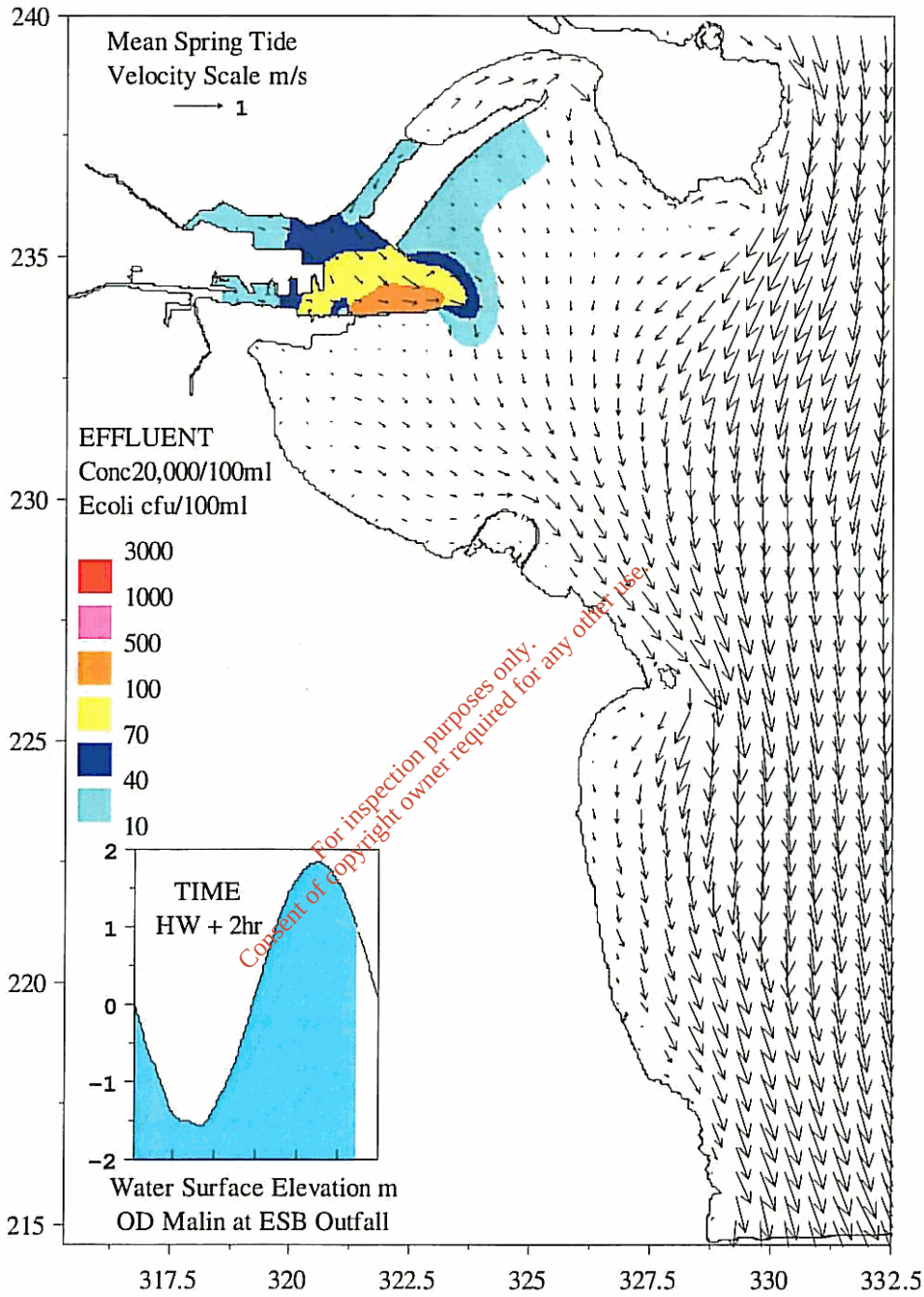
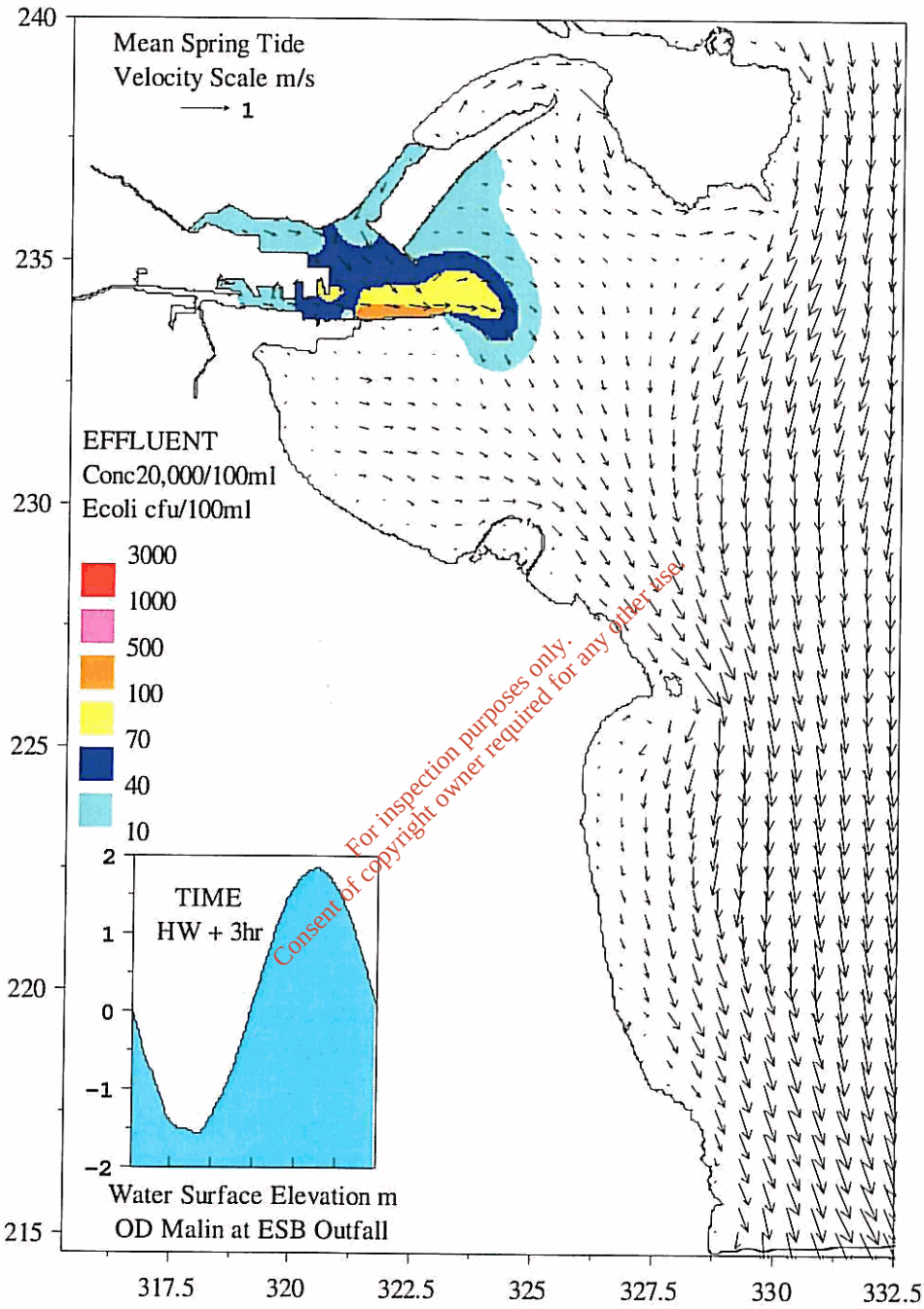


Figure 12: 2 Hours after High Water of Mean Spring Tide



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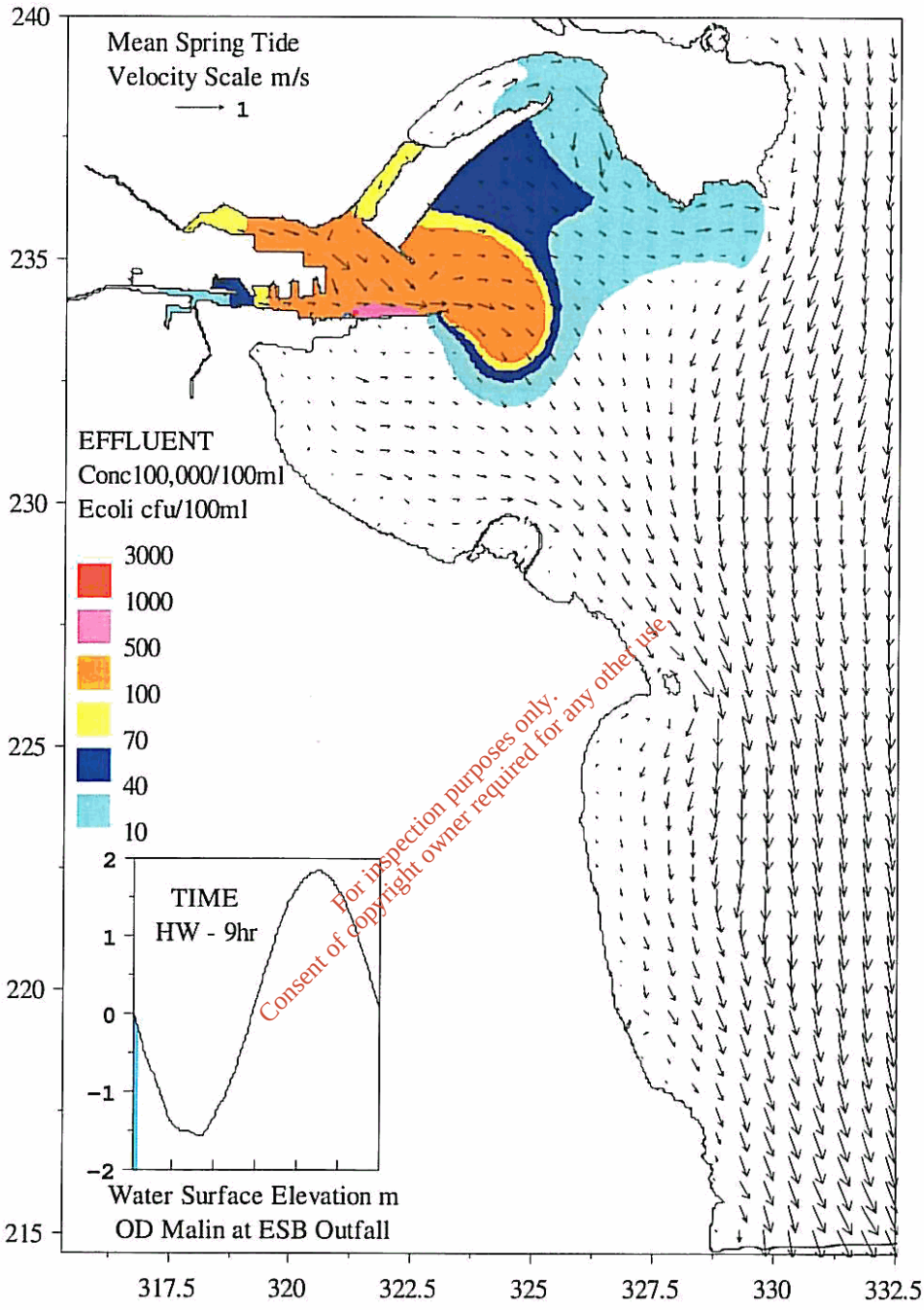

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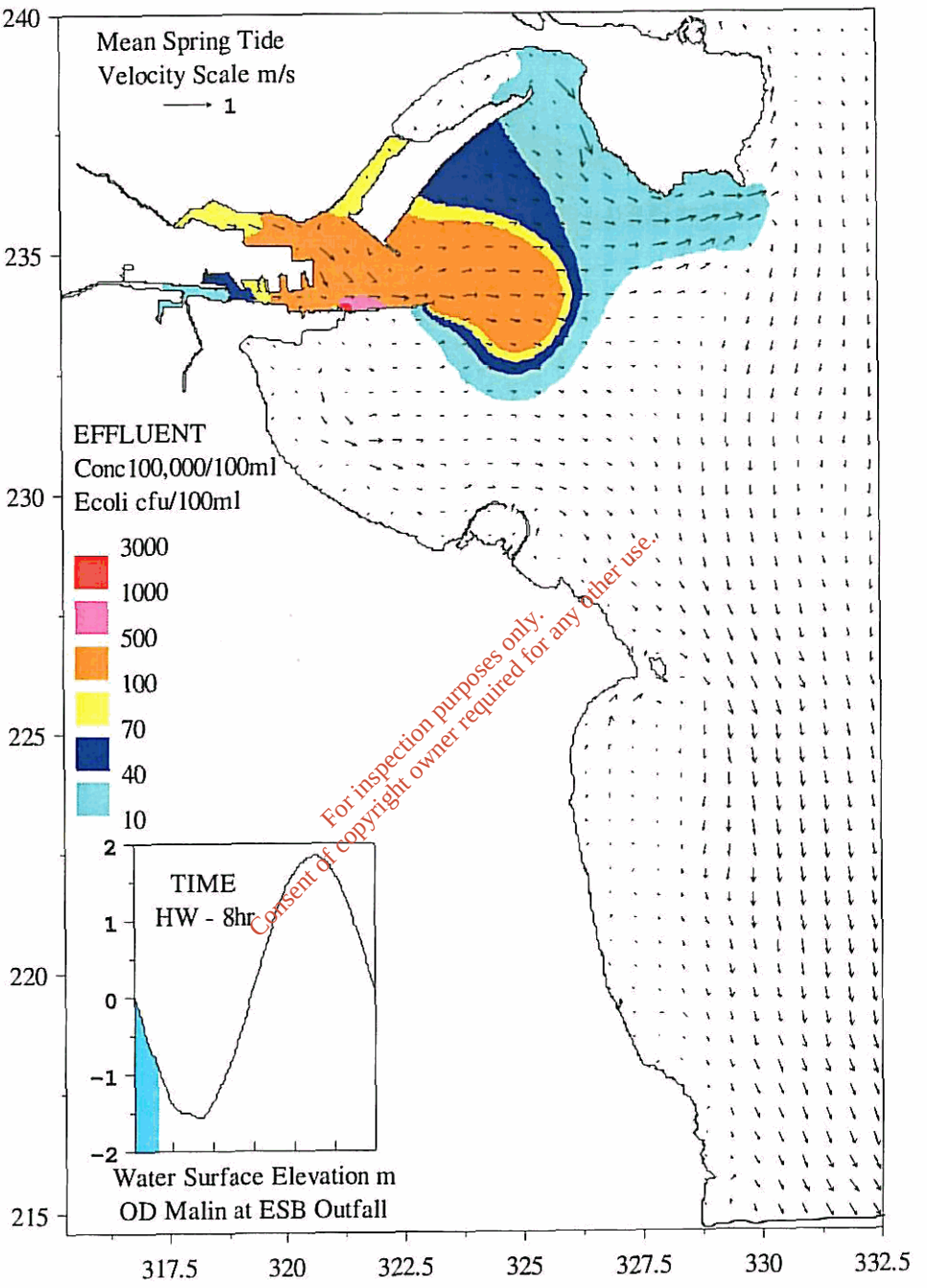
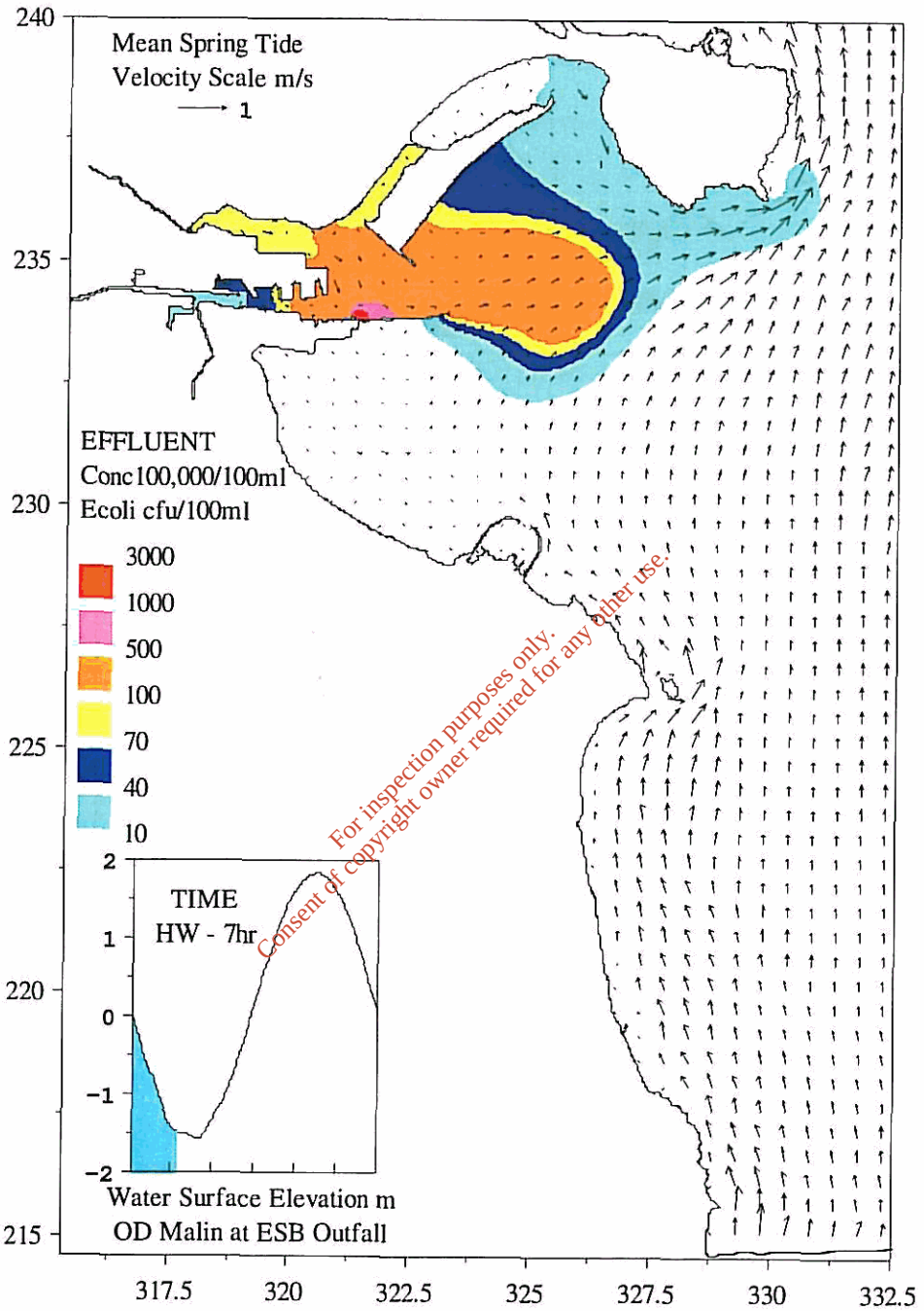


Figure 2: 8 Hours before High Water of Mean Spring Tide



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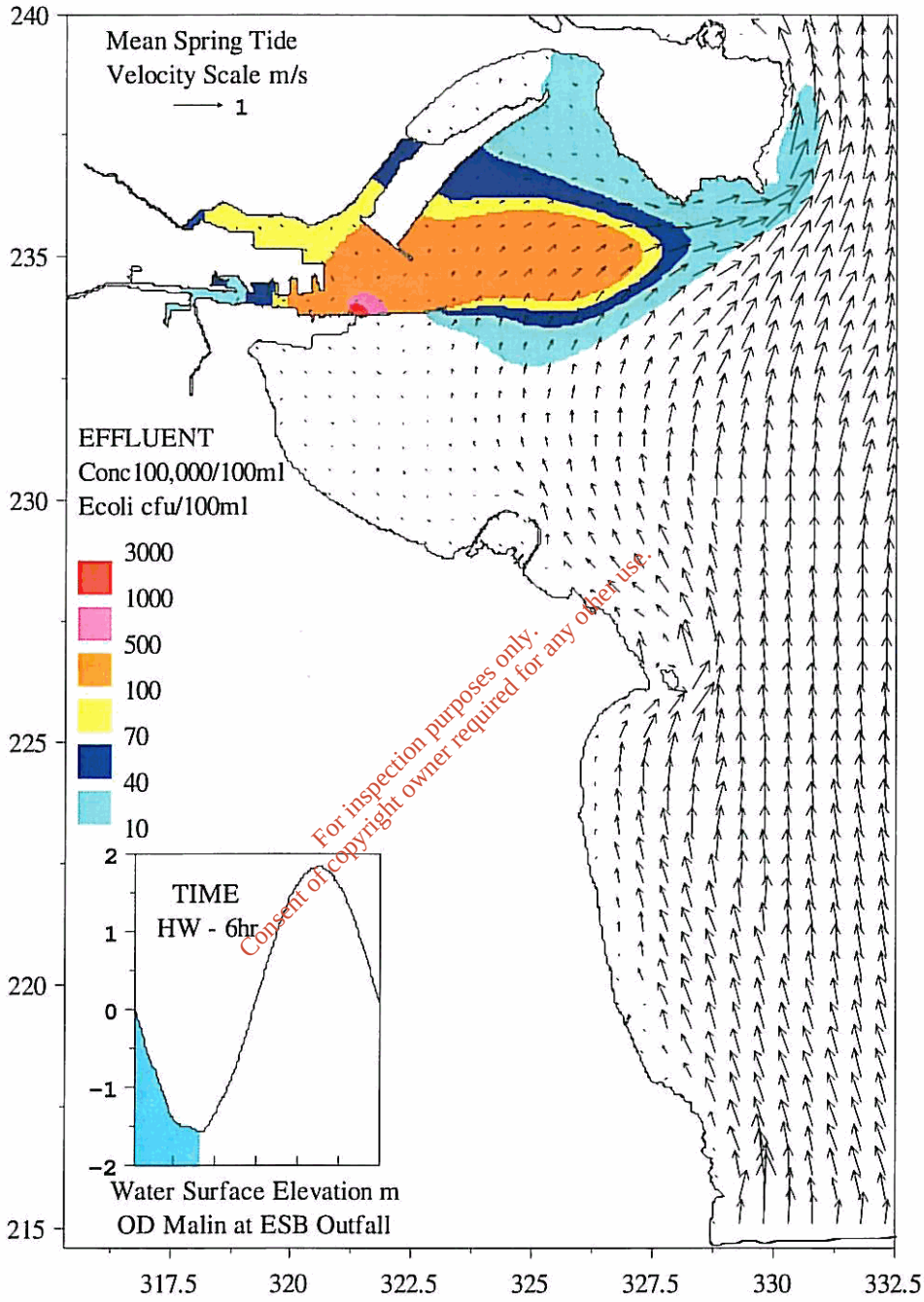

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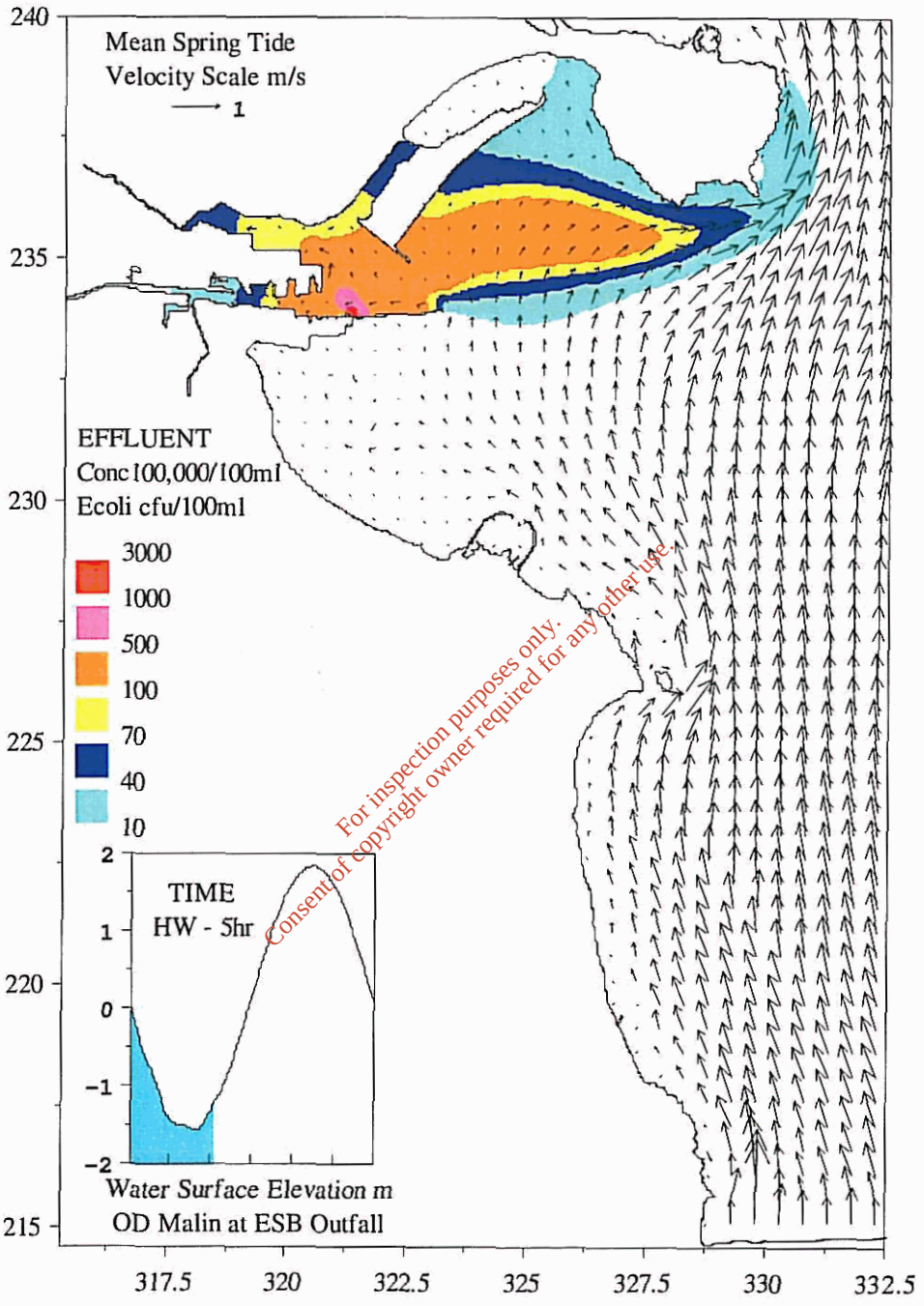

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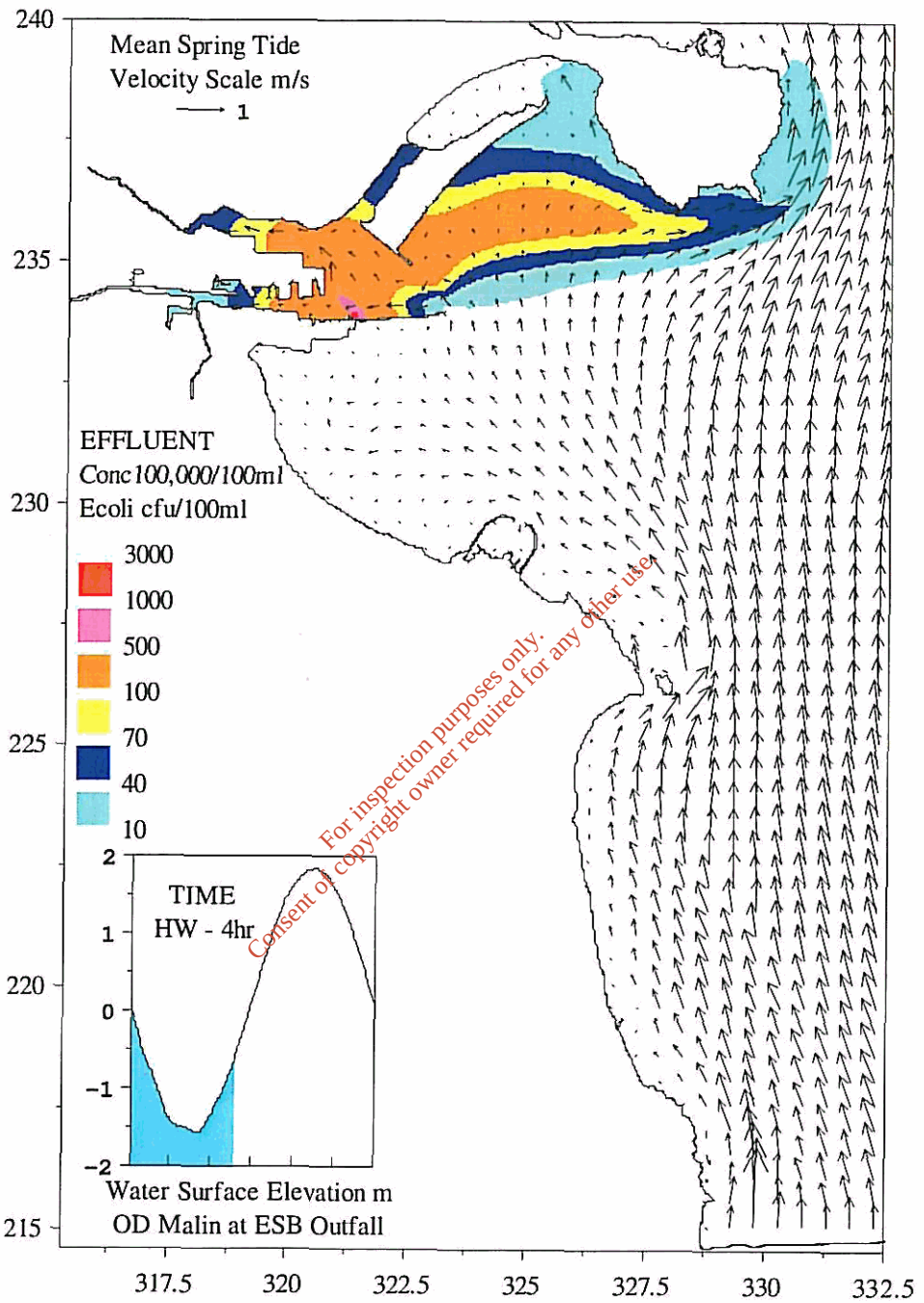


Figure 6: 4 Hours before High Water of Mean Spring Tide

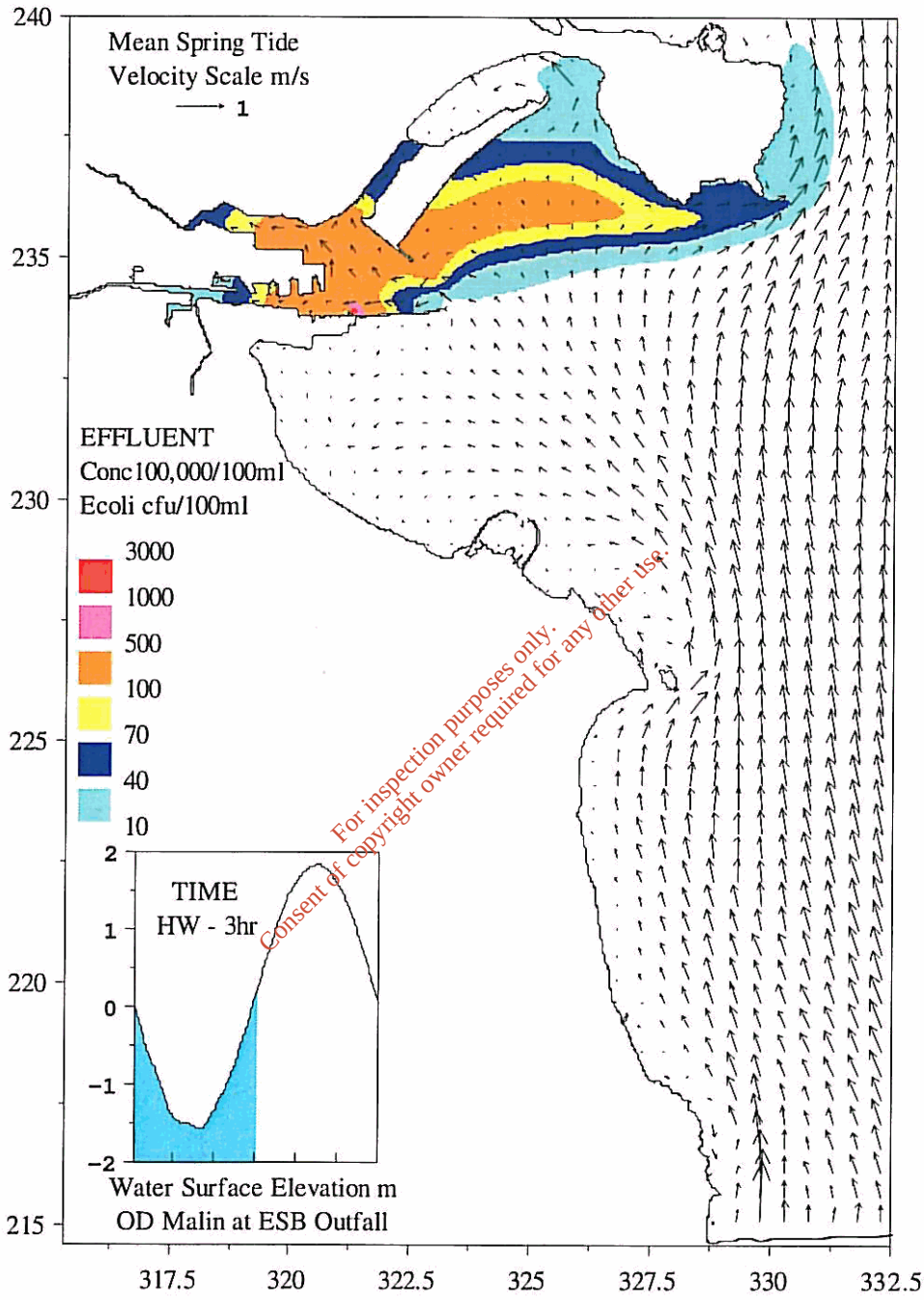


Figure 7: 3 Hours before High Water of Mean Spring Tide

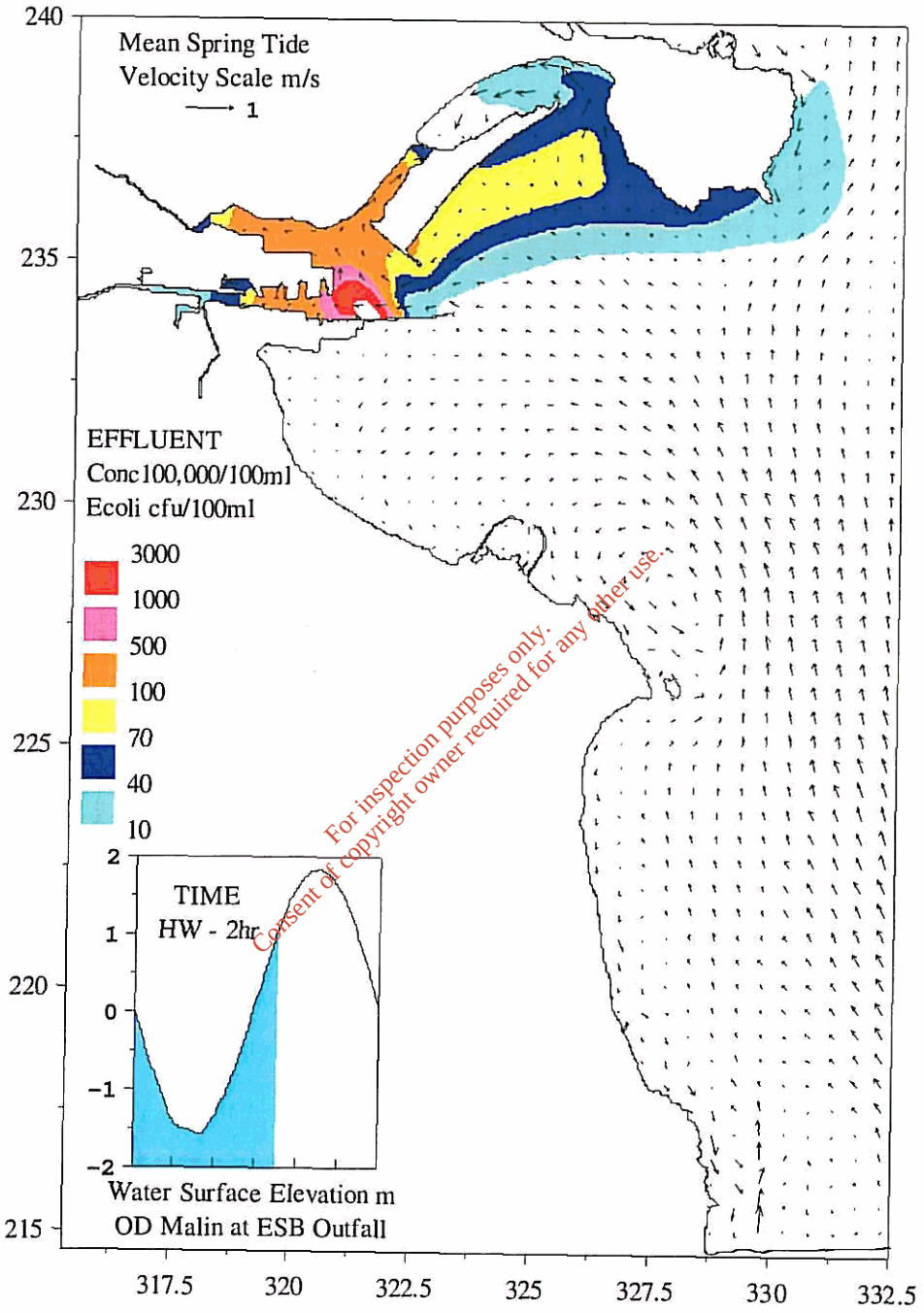
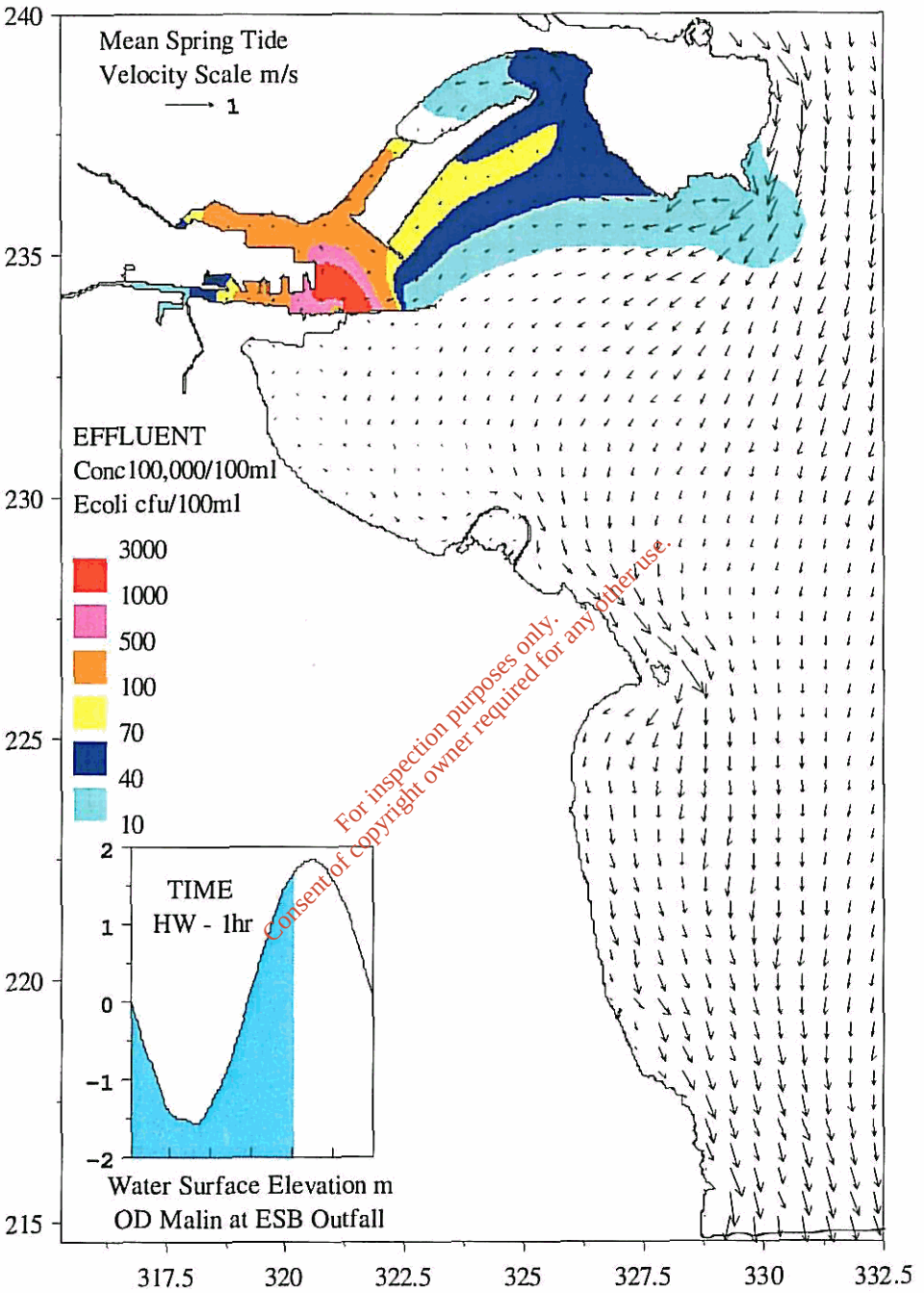


Figure 8: 2 Hours before High Water of Mean Spring Tide



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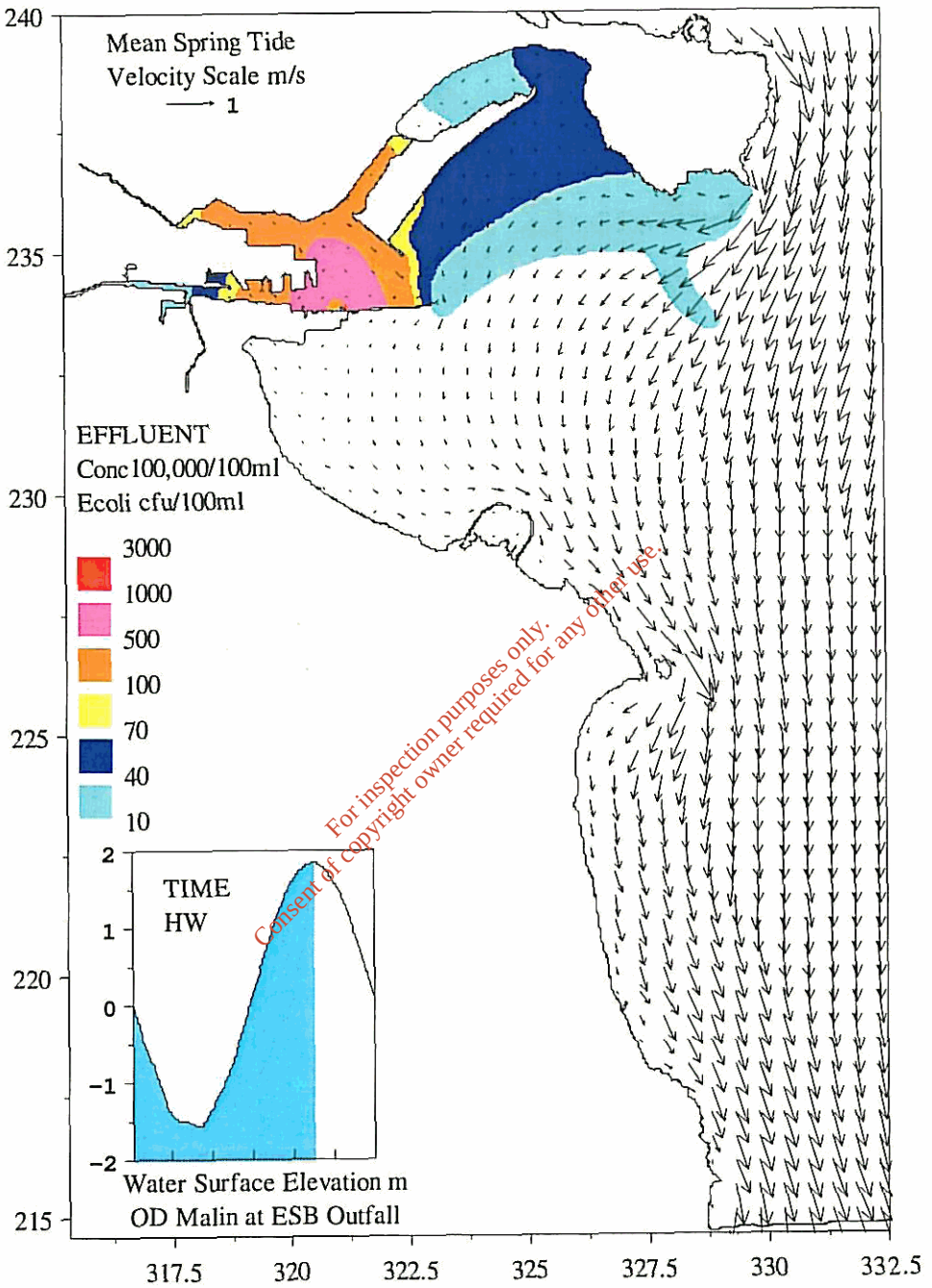

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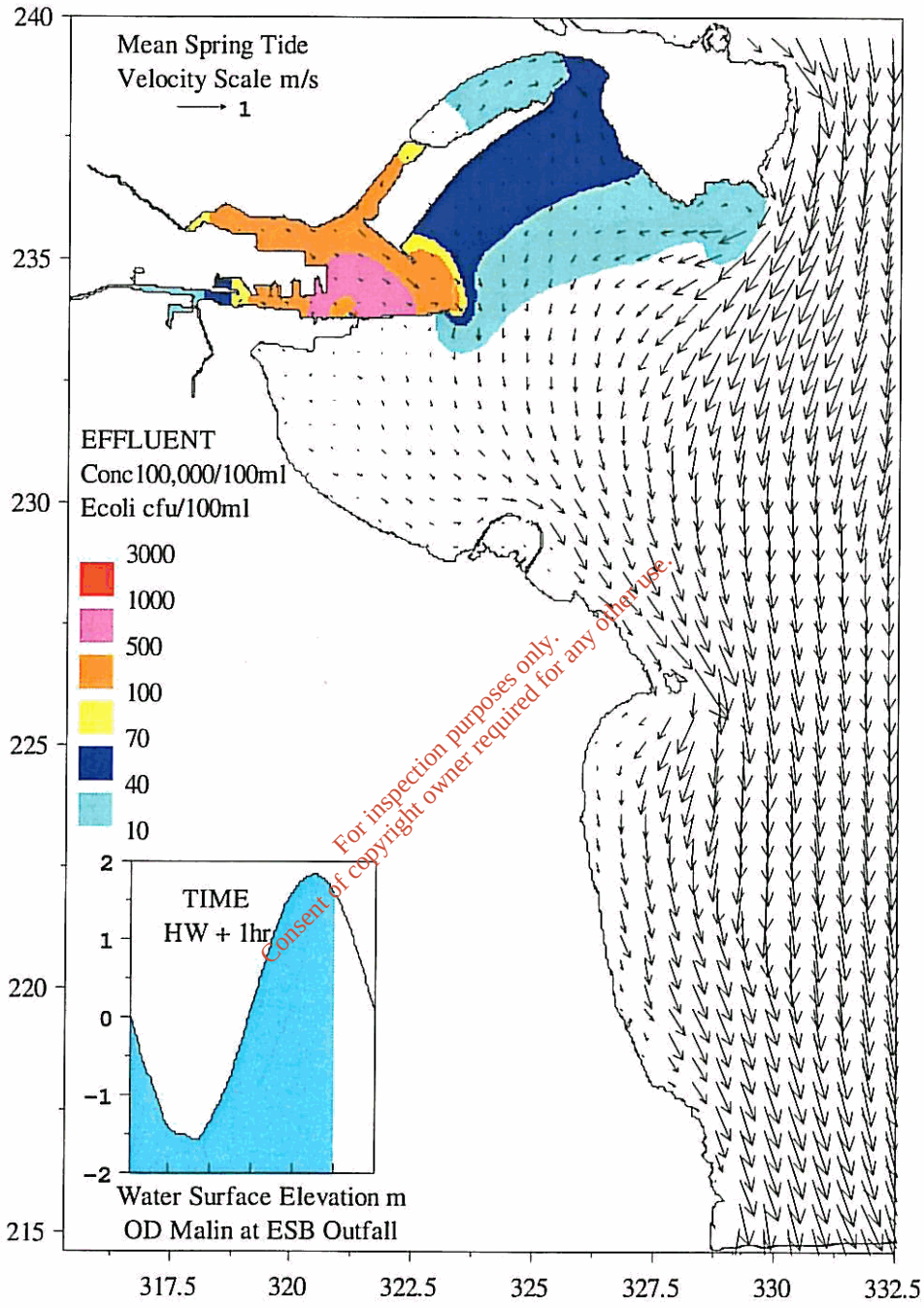

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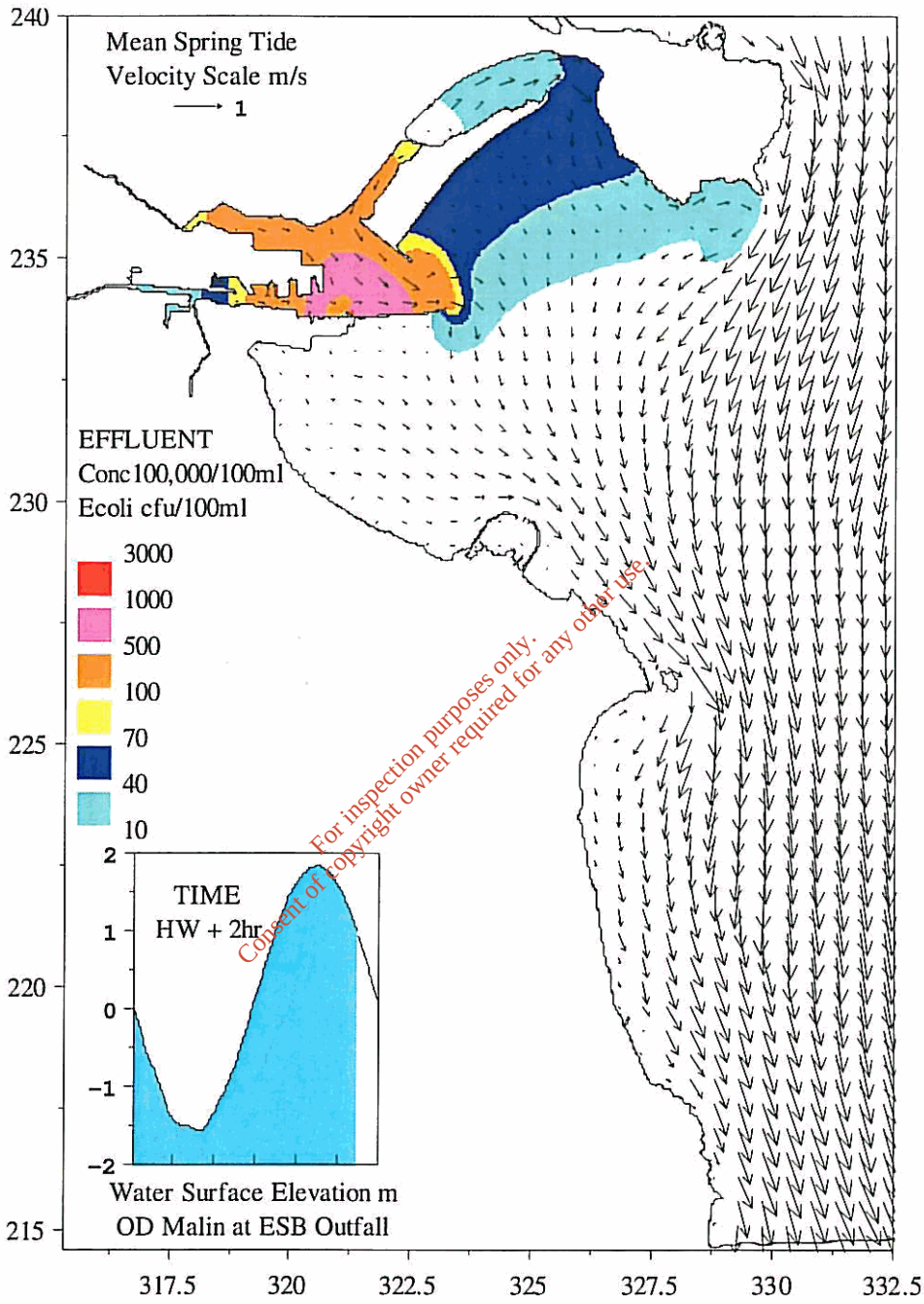

Figure 12: 2 Hours after High Water of Mean Spring Tide

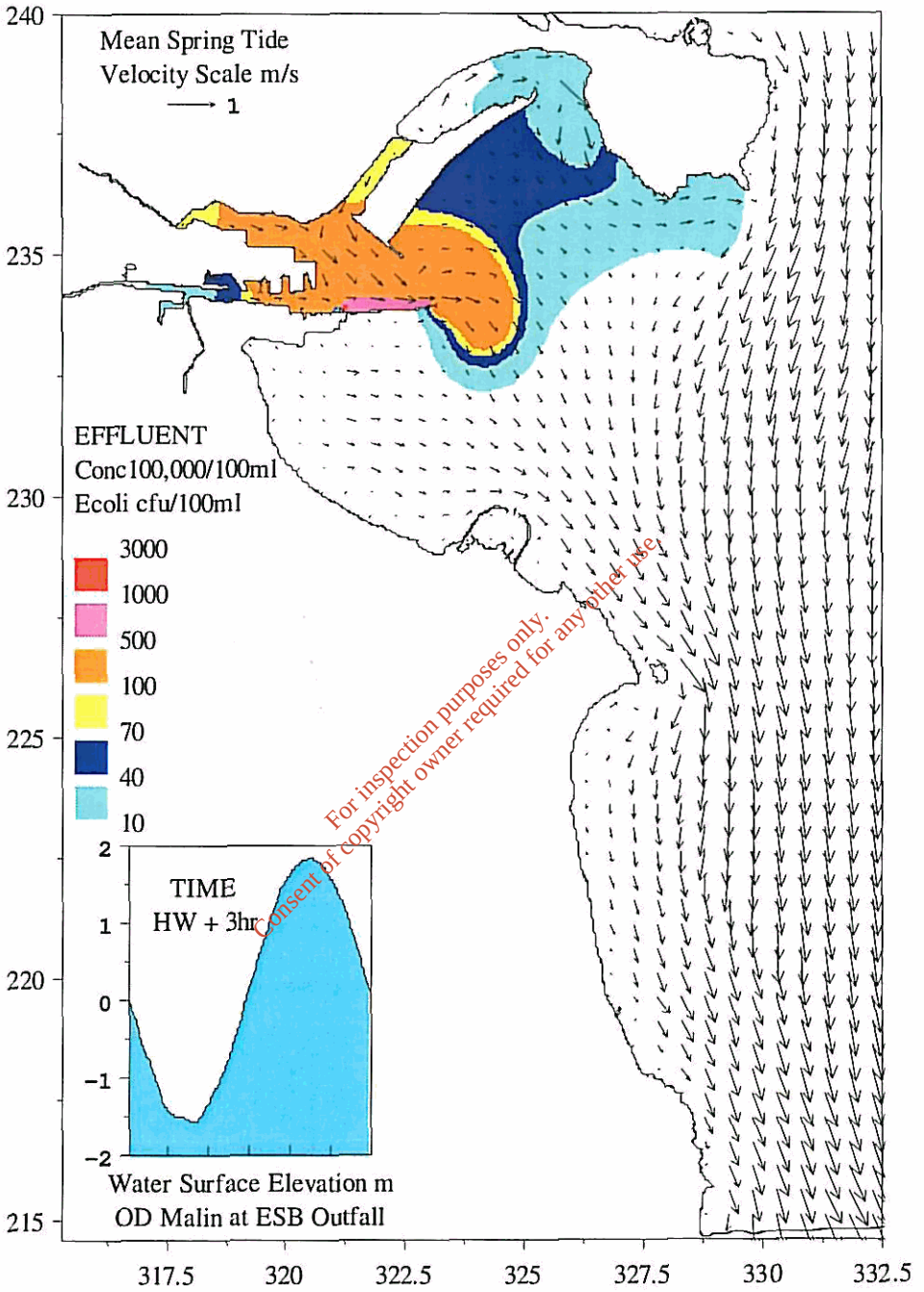

Figure 13: 3 Hours after High Water of Mean Spring Tide

Requirement 6 - Impact on Natura Sites

Circular L8/08, issued by the DoEHLG in September 08, provides “basic guidance on identifying potential issues relating to the protection of natural heritage (including sites, habitats and species) and archaeological heritage in order to prevent avoidable delays in the planning and implementation of individual schemes under the Water Services Investment and Rural Water Programmes.”

We note the circular refers throughout to individual schemes/development projects and is not readily transposable to our scenario of discharges across a very large geographic area. However, as required in your letter, we have adopted the methodology outlined in the flow chart in that circular insofar as practically applicable to this submission.

The flow chart outlines how to establish if a fully appropriate assessment is required in respect of any given development.
It should be noted that all of our major drainage projects identified in other sections of this submission will, of course, be subject to full compliance with this circular.

Following discussions with our Biodiversity Officer, an exercise to establish if an appropriate assessment is required has been carried out using the flow chart as a guide.
While it is difficult to give sweeping answers that would cover all potential discharges over all times that they might operate, we feel that, at this stage, no further assessment is required.

We base this on both following the methodology in the flow chart and using cross compliance with other statutory requirements as evidence of no significant impact.

Cross compliance can be demonstrated across the fields of water quality, habitat protection and species protection as follows:

Under the Bathing Water Regulations, water quality standards are specified for designated bathing waters. Dublin City Council has achieved Blue Flag status for the bathing waters on Bull Island in two of the past three years. This location, Bull Island, is probably our most designated Natura 2000 site.

Further examples of cross compliance, which we feel substantiate our conclusion of no significant impact, is the fact that there is no change in the conservation status of either the North Dublin Bay cSAC (206) or the South Dublin Bay cSAC (210) as assessed under the methods drawn up by the European Topic Centre for Nature Conservation (ETCNC). Additionally, there is no change in the conservation status, as assessed above, of the annexed species for which both the North Bull Island SPA (4006) and the South Dublin Bay and Tolka Estuary SPA (4024) were designated.

The above examples of cross compliance substantiate our conclusion that there is no significant impact caused by discharges.

In the specific case of the primary discharge from Ringsend Treatment Works, a more detailed study of future impacts will be required as part of the proposed extension to the plant.

Requirement 7 – Impact of Stormwater from SW-2

The stormwater treatment system at Ringsend has a total capacity of 58,414 cubic metres (6 tanks). Stormwater is normally returned for treatment upstream of the primary settlement tanks after a rainfall period. Only in the event of sustained influent volume to the stormwater treatment system does a discharge occur to the Liffey Estuary.

Based on the 12 months flow monitoring (01/11/03 to 31/10/07) carried out during the Licence application period, storm water discharged to the Liffey Estuary on 24 invividual dates.

Monitoring of the sewage flow diverted to stormwater has not been required under Urban Wastewater Regulations. In the absence of live data, an estimate can be made, using dilute influent sewage, of the loadings to the discharge in the Liffey Estuary at SW-2. Estimates are based on maximum and average stormwater discharges recorded.

Sampling and 3-dimensional modelling exercises need to be carried out to comprehensively detail the impact of SW-2 discharges in varying tidal conditions for all relevant parameters.

Requirement 7

Estimate of Loadings from Stormwater Discharge Point to Liffey Estuary

01/11/06 to 31/10/07.

SW-2 (Grid Reference 320332, 233800)

	Volume Discharged	**50,000 m3/day**	**100,000 m3/day**	**200,000 m3/day**	**350,000 m3/day**
UWW Parameter/ Concentration (mg/l)		Loading from SW-2	Loading from SW-2	Loading from SW-2	Loading from SW-2
SS (mg/l) **125**		6.25 tonnes	12.50 tonnes	25.00 tonnes	52.50 tonnes
BOD (mg/l) **125**		6.25 tonnes	12.50 tonnes	25.00 tonnes	52.50 tonnes
COD (mg/l) **300**		15.00 tonnes	30.00 tonnes	60.00 tonnes	105.00 tonnes
Total N (mg/l) **30**		1.50 tonnes	3.00 tonnes	6.00 tonnes	10.50 tonnes
Total P (mg/l) **10**		0.50 tonnes	1.00 tonnes	2.00 tonnes	3.50 tonnes

Requirement 8 - Assessment of Impacts of CSOs

Similar to our responses to Items 4 and 6, cross compliance with other statutory requirements is the mechanism used to support our conclusion of no significant impacts.

In addition to this, following discussions between the DoEHLG, the EPA and ourselves, approval has just been given for a programme to monitor water quality in Dublin Bay over the next twelve months. This will provide valuable data especially of conditions during the Winter season.

We have previously submitted details to you of our short term flow study of selected overflows along the Quays. This study confirms that the overflows respond to rainfall events as indeed, they were designed to.

We have no knowledge of any of our overflows operating during periods of dry weather. The only scenario in which this would happen would be in the event of a major blockage in a pipeline. Our maintenance crews would respond immediately to such a situation and repair/release any such blockages.

Requirement 9

Q9. In relation to the Urban Wastewater Treatment Directive, provide details of how it is proposed to comply with the discharge concentration limit values specified in S.I. No. 254 of 2001 and S.I. No. 440 of 2004 by the prescribed dates. Your response shall as a minimum provide:

- **Consideration of changes in the population equivalent requiring treatment at the Ringsend Treatment Plant and changes associated with connection of secondary discharges, sewer upgrades, redesign and upgrade of storm water overflows and expansion of agglomeration;**

Progressive improvements in the water stream and particularly the biological process at the Ringsend Treatment Plant have meant that the plant is substantially compliant with the specified limit values for BOD, COD and TSS in 2008. A further study of the receiving waters as directed by the EPA has commenced. The results of this study should provide data on what effect nutrient reduction will have on the level of eutrophication of the receiving waters as per Article 4, sub-article (4)(b) of the Regulations[1] and thus the compliance of the Ringsend Treatment Works with respect to limits set for nutrients. The results of this study are due in 2009.

With regard to changes in the population equivalent it is felt that all secondary discharges are currently connected to the Ringsend Treatment Plant so there should be no increase in population equivalent requiring treatment at the plant from this source. Sewer upgrades in the agglomeration are ongoing and as such improve the performance of the sewer network principally by reducing flooding and blockages. Again it is felt that these upgrades will not cause an increase the population equivalent requiring treatment at the plant.

In terms of the redesigning and upgrading of storm water overflows, there is a feasibility study currently underway to improve the performance of storm water overflows along the North and South Quays of the River Liffey. Beyond this there are no upgrades due to occur to storm water overflows. Presently the Ringsend Treatment Plant can deal with dry weather loads so any upgrades should reduce spills from the system in storm events and not increase the load beyond dry weather levels.

Currently the projected population of 1.1m is in line with the 2020 design horizon for the Ringsend Treatment Plant. The growth rate measured to date is 0.8% per annum. This would increase confidence in projected expansion figures for the agglomeration. Further to this industrial load is expected to fall further in coming years. This is due to relocation of industry to green-field sites outside the agglomeration and changing practices within industry. This is in line with recent trends of the load reaching the plant. With this in mind it is expected that the plant will be compliant with the discharge concentration limit values specified in the above legislation for the predicted agglomeration expansion.

[1] 4. (4) (b) Sub-article (3) shall not operate to require the reduction of nutrients in discharges to estuaries, bays or coastal waters where the sanitary authority is satisfied that such reduction will have no effect on the level of eutrophication in the receiving waters.

- **Details of the measures and works to be carried out at the Ringsend Treatment Plant, including measures to optimise existing capacity, provide nutrient removal and increase treatment capacity within the existing wastewater treatment plant and any redeveloped plant (including results of any preliminary assessments);**

In it's first years of operation the existing Ringsend Treatment Plant was plagued with a number of reliability issues, subsequent to retrofitting of some key equipment the reliability of the plant has improved and its operation is constantly being optimised. There are now a number of critical areas where redundancy has been built in to the plant reducing the occurrences of non-compliance. In terms of existing capacity it is presently being optimised by reducing the need for cosettling of Surplus Activated Sludge (SAS) in the Lamella tanks. This means there is a decrease in load going forward to the biological SBR tanks.

Currently the biological processes operate in nitrifying mode. Some preliminary investigations are currently being carried out on the operation of the biological processes at the plant to investigate the potential for nutrient removal. However as previously stated the extent of this removal is dependant on the study currently being undertaken on the receiving waters.

The biological processes at the plant can also be optimised to increase treatment capacity. Firstly the depth in the SBR tanks can be increased allowing greater treatment. This improvement can be undertaken when a means of controlling wind effects on the surface water in the tanks can be realised. Further to this, aeration pipework was installed in the SBR's at construction stage to allow for increased aeration. This allows treatment capacity can be improved with the addition of blower capacity.

Preliminary assessments of the redeveloped plant are subject to the study currently being undertaken on the receiving waters. This will indicate what level of nutrient removal is required and thus what technologies need to be employed.

- **Details of measures/alternative arrangements to be taken to mitigate the impact of the proposed cessation of the ESB Poolbeg generation cooling water discharge, and assess alternative arrangements for the discharge and dispersion of the primary effluent;**

As the discharge of the Ringsend Treatment Plant is not of primary effluent but secondary / tertiary effluent the proposed cessation of the ESB Poolbeg generation cooling water discharge should have little if no impact. This arrangement was initially designed to mitigate the impact of the discharge from the primary treatment plant. Since the upgrade to the plant the final effluent is of significantly higher standard and largely meets the specified limit values set our in the Urban Wastewater Treatment Directive.

The position of the treatment plant outfall will be examined in detail as part of the extension to the plant.

- **Details of measures to upgrade the sewer network, in particular redevelopment of inappropriately functioning storm overflows.**

Any upgrades to the sewer network shall be in accordance with the First Schedule of S.I. No. 254 of 2001[2]. Currently the City Centre Sewerage Scheme Feasibility Study is the only project to upgrade the sewer network. The objective of this study is to investigate options to improve the performance of the CSO's along the North & South Quays of the River Liffey. It is split into 2 phases. The first phase involves the development of the existing GDSDS City Centre Model for detail option-development and design. The second phase is the implementation of schemes, in advance of the main scheme, that can remove storm water from the combined City Centre Interceptor Sewers, primarily The North King St. Scheme. Any future projects of this type will reduce hydraulic load at the Ringsend Treatment Plant while not increasing the biological load beyond its dry weather levels.

[2] First Schedule

A collecting system shall take into account wastewater treatment requirements.
The design, construction and maintenance of a collecting system shall be undertaken in accordance with the best technical knowledge not entailing excessive costs, notably regarding;
- volume and characteristics of urban waste water.
- prevention of leaks, and
- limitation of pollution of receiving waters due to storm water overflows.

Requirement 10.

Section F.1(i) received from Dublin City Council by the EPA on 28/07/08, detailed summary data, as required, for the final year of the Dublin Bay Water Quality Management Plan. Tables 1 and 2 in Section F.1(i) highlight water quality compliance data where it is possible to do so. Text in this section also provides relevant interpretations. Until a final report is completed comprehensive conclusions cannot be further drawn.

Dublin City Council has recently commenced a new monitoring programme on this area. Data emerging from this programme during 2009 may further assist requirements of this licence application.