gwerth mewn gwahaniaeth
delivering on distinction

Morlais Demonstration Zone

Further information on predicted changes in currents

Document Title: Further information on predicted changes in currents			
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1. INTRODUCTION

The following HR Wallingford Report “Further information on predicted changes in waves and currents” should be read in conjunction with HR Wallingford Coastal Process Report DER6261_RT001-R02-00. This supplementary report provides further information from the original study regarding the effect of the proposed scheme on speeds and directions of tidal currents throughout the tidal cycle to assist in discussions with navigational stakeholders and canoeists and kayakers in particular. This note presents predicted changes in current speeds and directions at hourly intervals throughout a Mean Spring Tide cycle.

It should be noted that the recently completed Navigation Risk Assessment (NRA) Addendum has already considered currents and tidal flows as presented in the original HR report in addition to published information for the region including tidal diamonds and the tidal stream atlas. Marico, who completed the independent NRA, have since reviewed this supplementary report and advised that the additional information does not change the risk scoring as the impacts of the MDZ to the tidal stream are considered to be of low significance in terms of additional impact to navigation risk over the existing sea conditions.

HR Wallingford
Working with water

Morlais Demonstration Zone

Further information on predicted changes in currents

DER6261-RT002-R05-00 October 2020

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		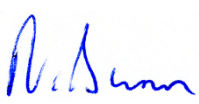

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07 Sep 2020	02-00	TMI	JS	NPB	
03 Sep 2020	01-00	TMI	NPT	JS	

Summary

Menter Mon Morlais Limited (MMML) is developing the Morlais Demonstration Zone (MDZ), situated to the west of Holy Island on the Isle of Anglesey. The MDZ will incorporate multiple tidal current device array projects from different project owners and with different technologies. HR Wallingford has undertaken a detailed study of the effects of the MDZ on currents, waves and sediment transport. This is described in HR Wallingford Report DER6261_RT001-R02-00. MMML has requested that further information be provided from the study regarding the effect of the proposed scheme on the direction and strength of the tidal currents, to assist it with discussions with stakeholder parties including kayakers. This note presents predicted changes in current speeds and directions at hourly intervals throughout a Mean Spring Tide cycle. In general there is a reduction in current speeds due to the tidal current scheme although the tidal stream is also diverted around the development causing a shift in the location of the tidal stream between the development area and the coast at some states of the tide. The pattern of the tidal eddy around North Stack Head is also changed.

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1. Introduction

1.1. Background

Menter Mon Morlais Limited (MMML) is developing the Morlais Demonstration Zone (MDZ), situated to the west of Holy Island on the Isle of Anglesey. The MDZ will incorporate multiple tidal current device array projects from different project owners and with different technologies.

HR Wallingford has undertaken a detailed study of the effects of the MDZ on currents, waves and sediment transport. This is described in HR Wallingford Report DER6261_RT001-R02-00 (Reference 1).

MMML has requested that further information be provided from the study regarding the effect of the proposed scheme on currents, to assist it with discussions with stakeholder parties. This note presents predicted changes in currents throughout a Mean Spring Tide cycle.

1.2. Report Structure

The remainder of this report includes two further sections. Section 2 briefly describes the devices considered in the study. Section 3 details changes in currents throughout a Mean Spring tide.

2. Characteristics of devices considered in the study

The HR Wallingford study (Reference 1) considers the worst case scenarios for the impact on the : 620 seabed-mounted devices, 112 electrical seabed hubs, 8 surface piercing electrical hubs and rock bag protection along 9 cable routes.

The seabed turbine characteristics assumed in the study are given in Table 2.1 below.

Table 2.1: Sea bed Turbine Characteristics

Characteristic	Assumed Value
Rotor diameter (D)	16.13 m
Rated flow speed	2.015 m/s
Cut-in flow speed	0.5 m/s
Rated mechanical (electrical) power	429 kW (387 kW)
Power Curve	Variable with flow speed
Thrust Curve	Variable with flow speed
Position in water column	Mid depth

3. Flow conditions

The following figures illustrate the flow conditions for a Mean Spring Tide from High Water minus 6 hours to High Water plus 6 hours at 1-hour intervals. For each time, there are 3 figures, one for the existing case, one for the scheme and one showing vectors for both, with blue arrows for the existing case and red arrows for the scheme. Point 3 is marked on these figures. This is one of the key points of interest referred to in Reference 1.

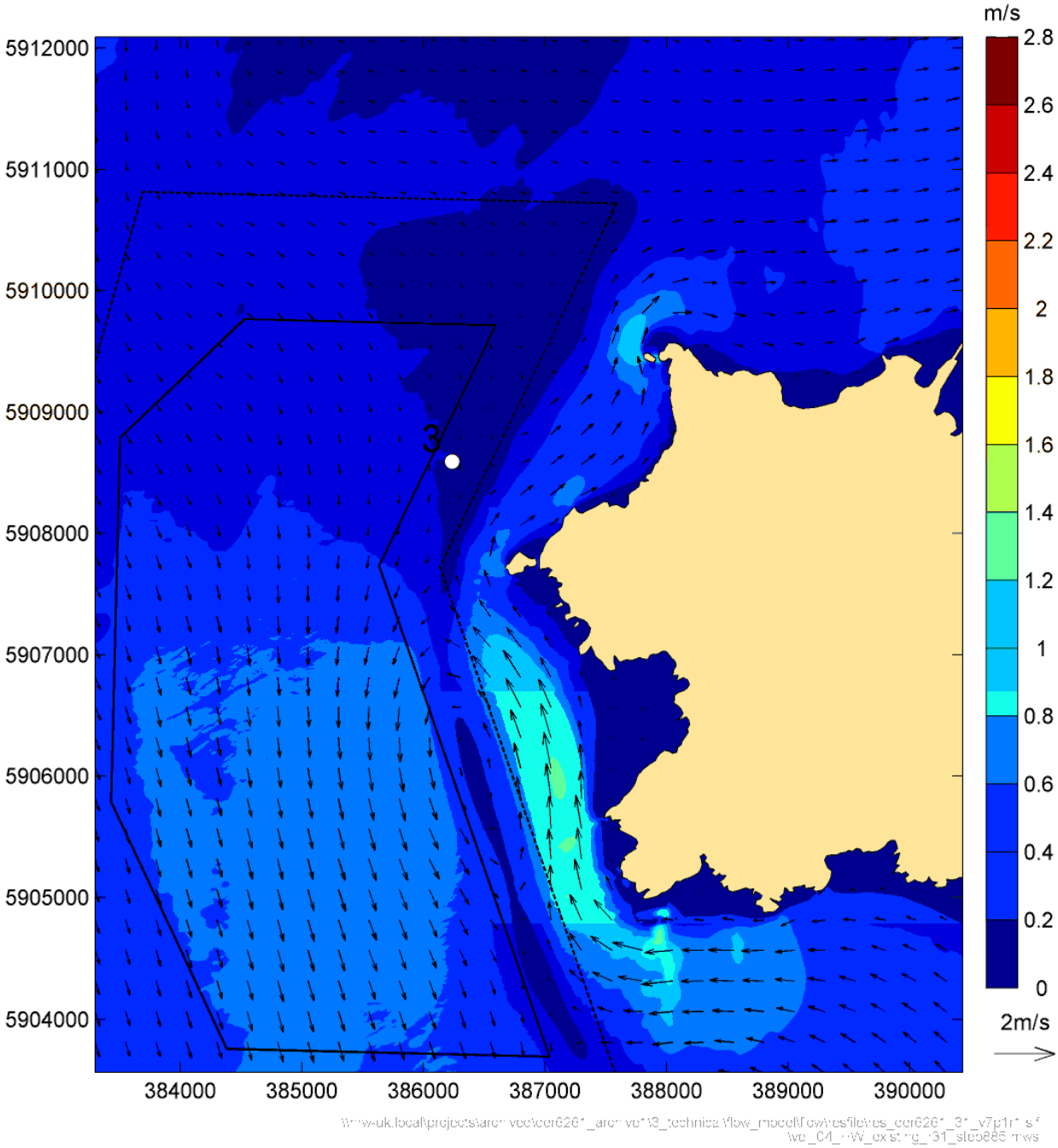

Figure 3.1: Existing flow velocity. High Water minus 6 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

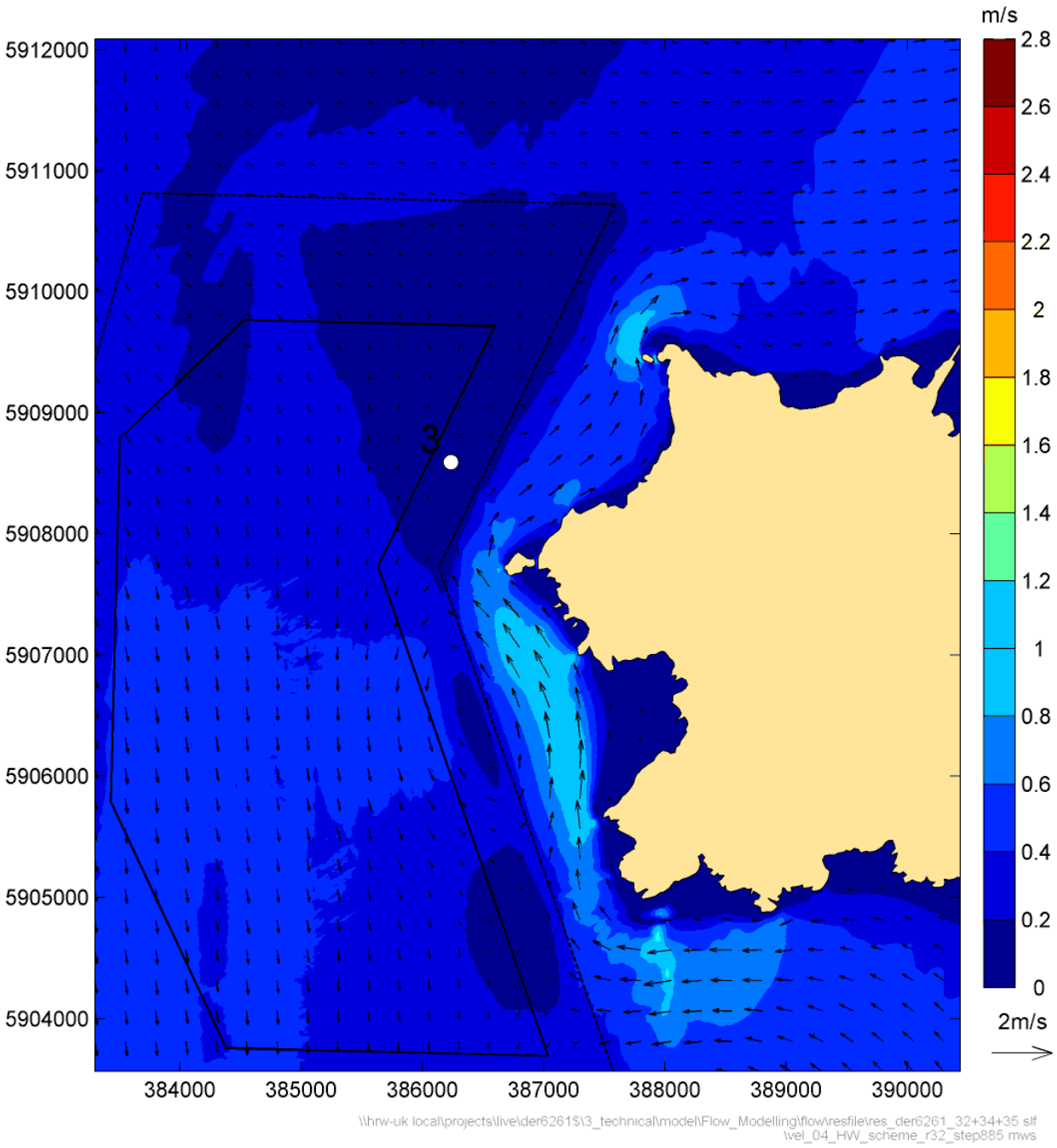

Figure 3.2: Scheme flow velocity. High Water minus 6 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

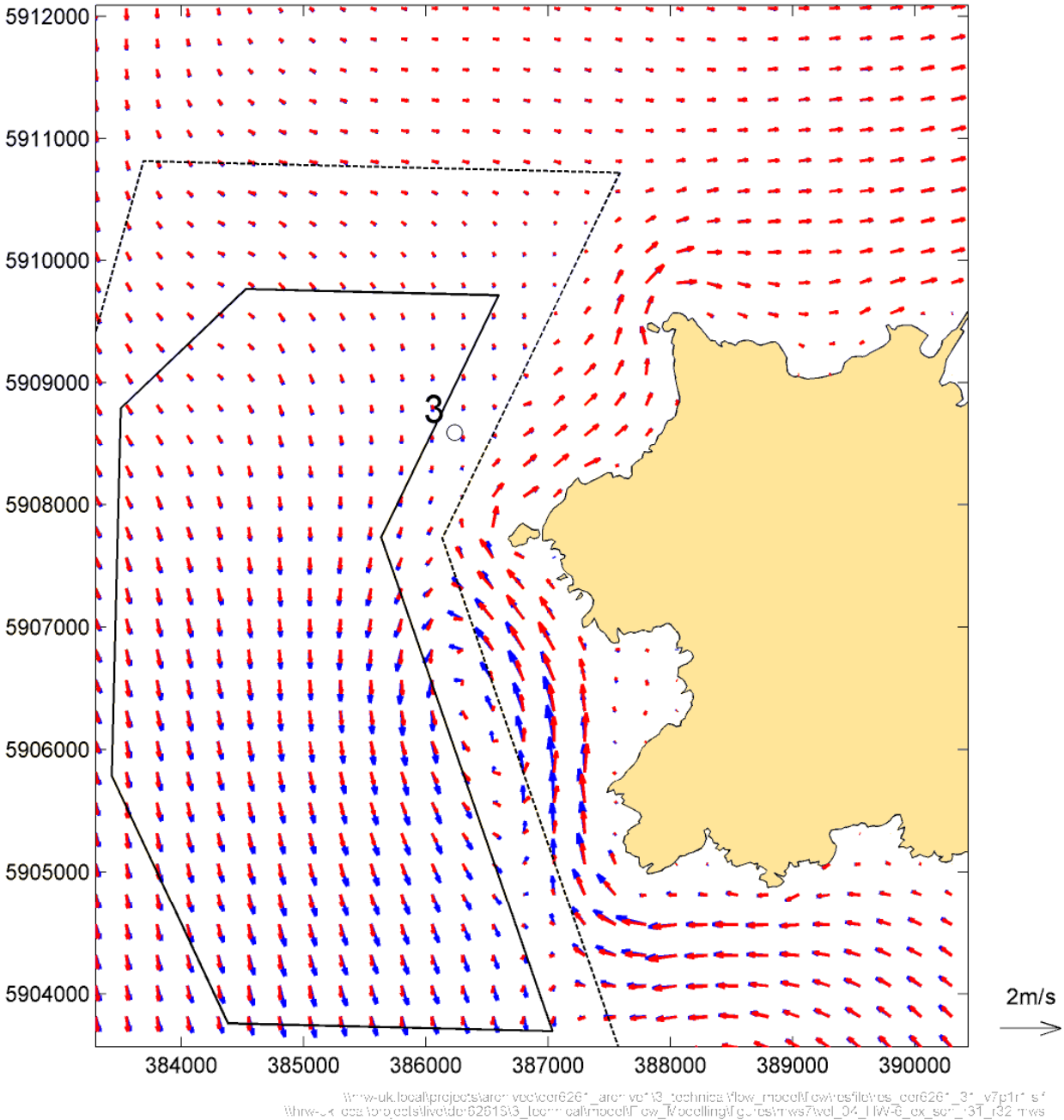

Figure 3.3: Existing (blue) and Scheme (red) flow velocity. High Water minus 6 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

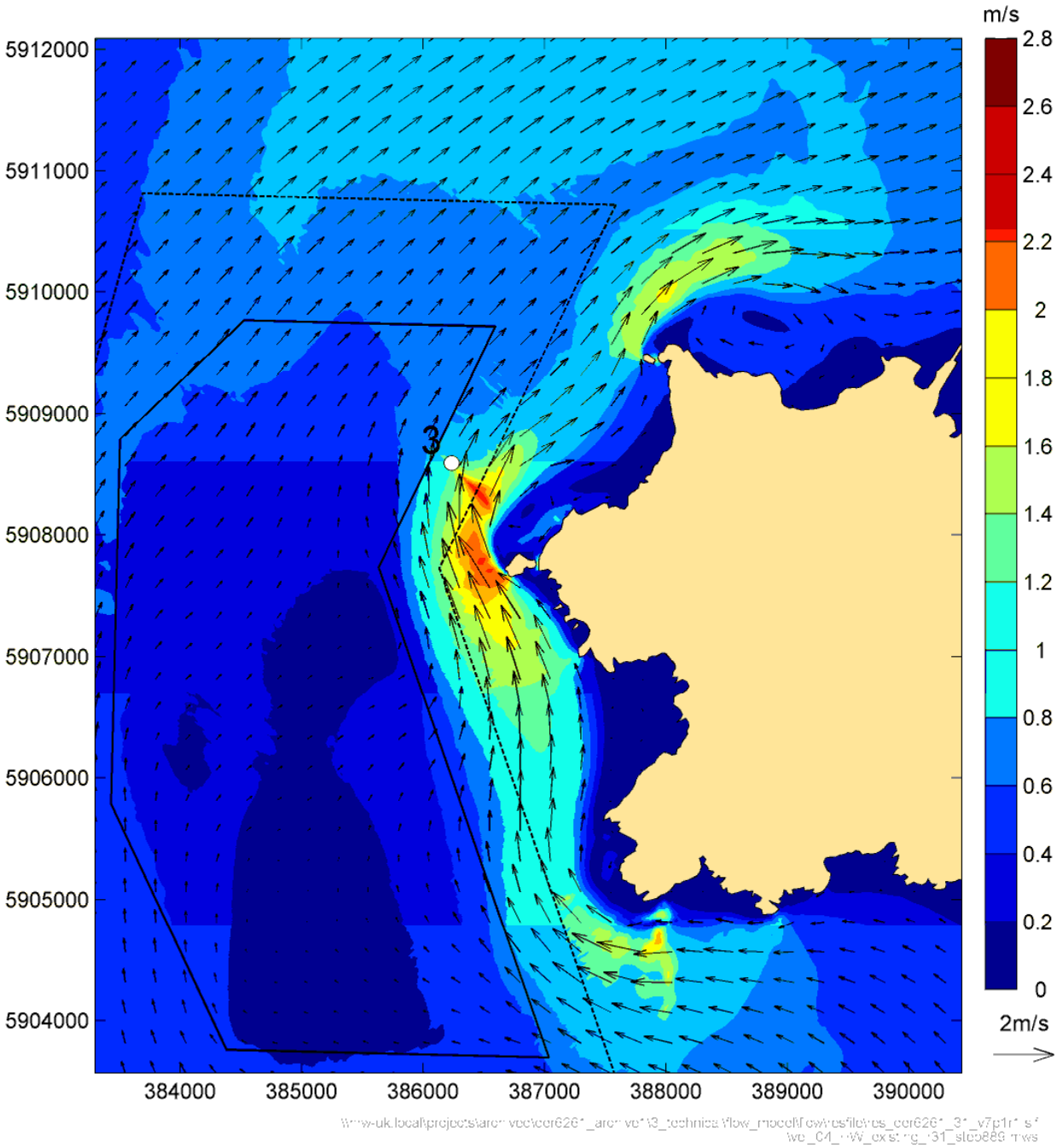

Figure 3.4: Existing flow velocity. High Water minus 5 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

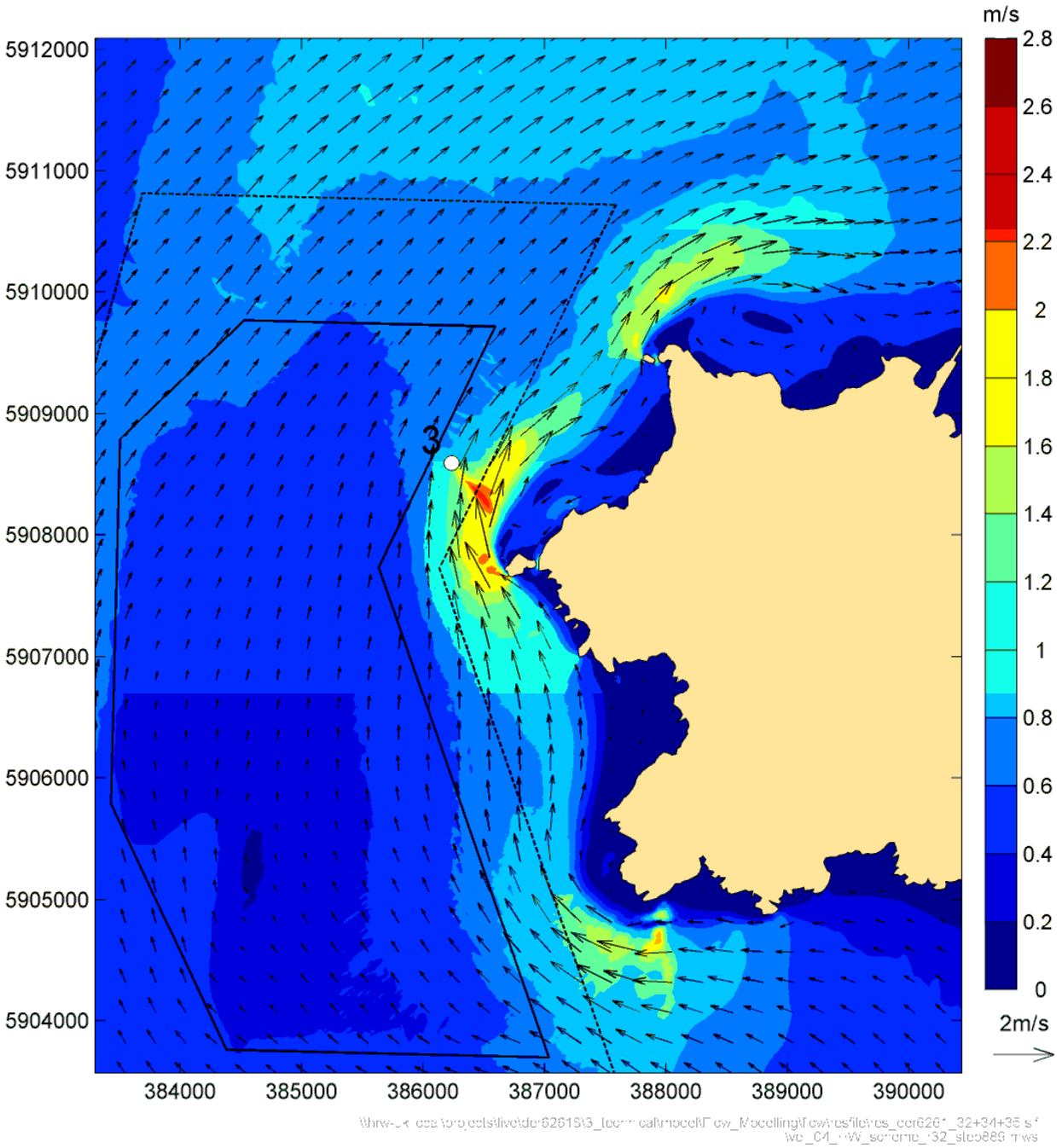

Figure 3.5: Scheme flow velocity. High Water minus 5 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

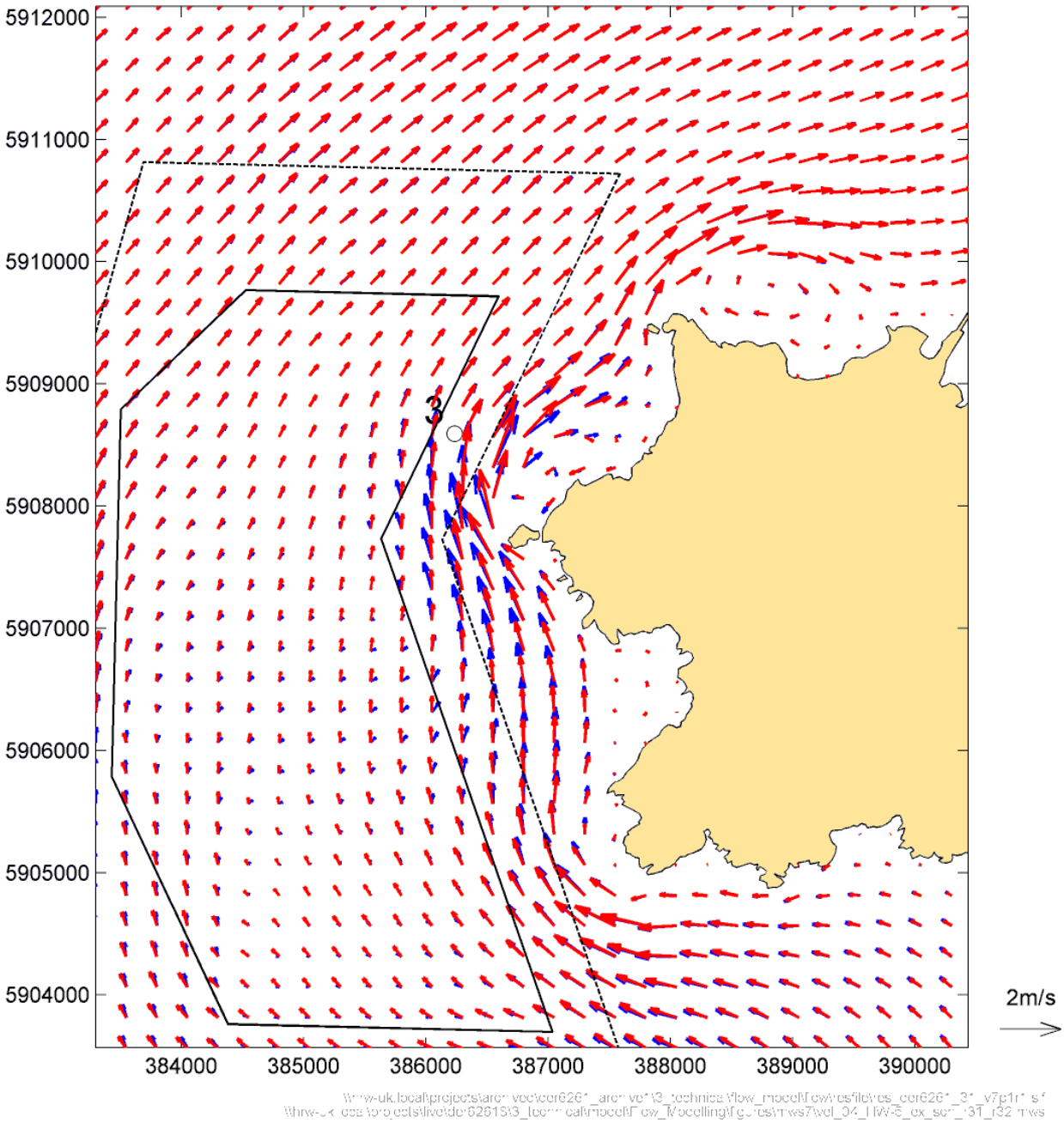

Figure 3.6: Existing (blue) and Scheme (red) flow velocity. High Water minus 5 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

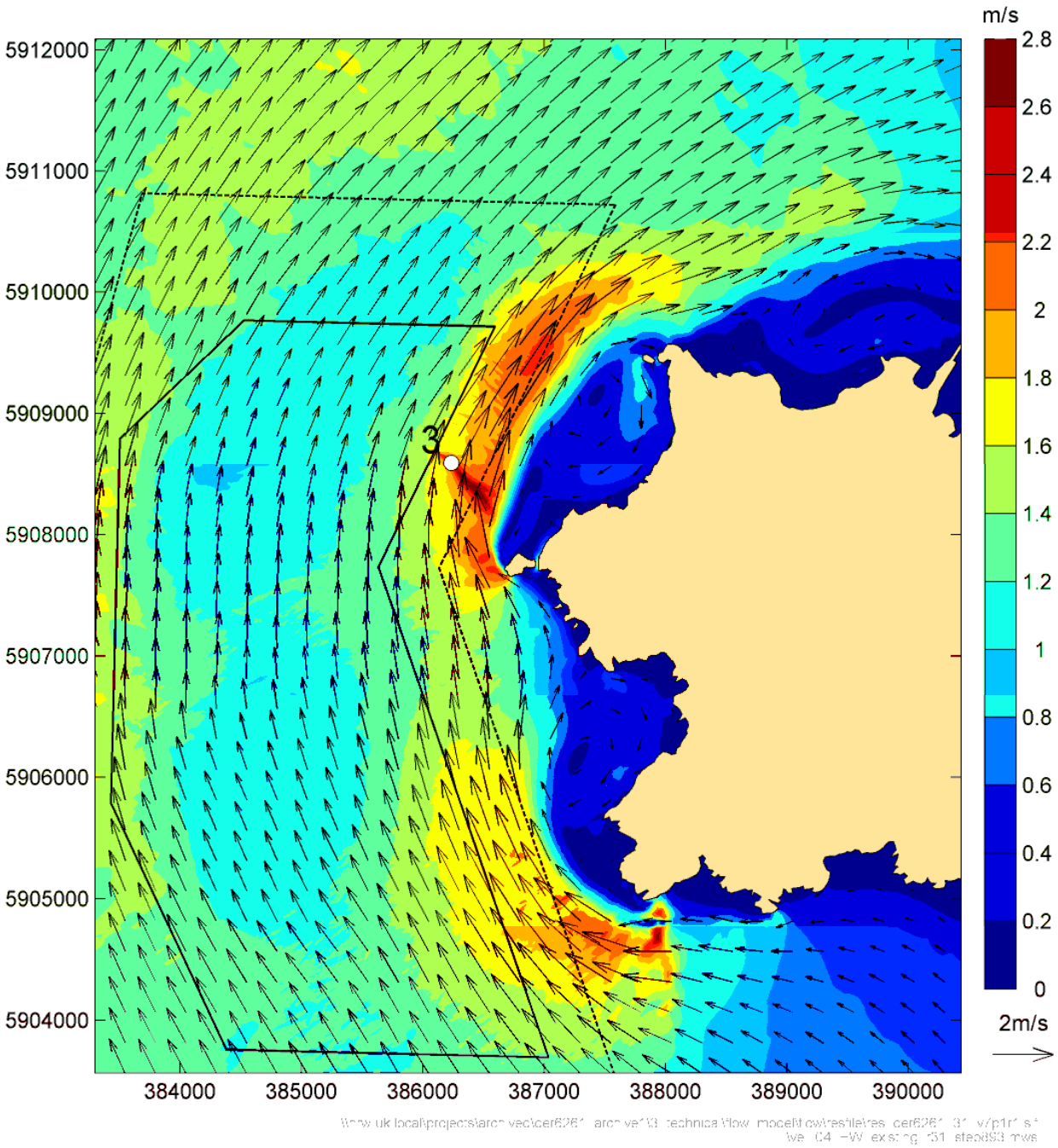

Figure 3.7: Existing flow velocity. High Water minus 4 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

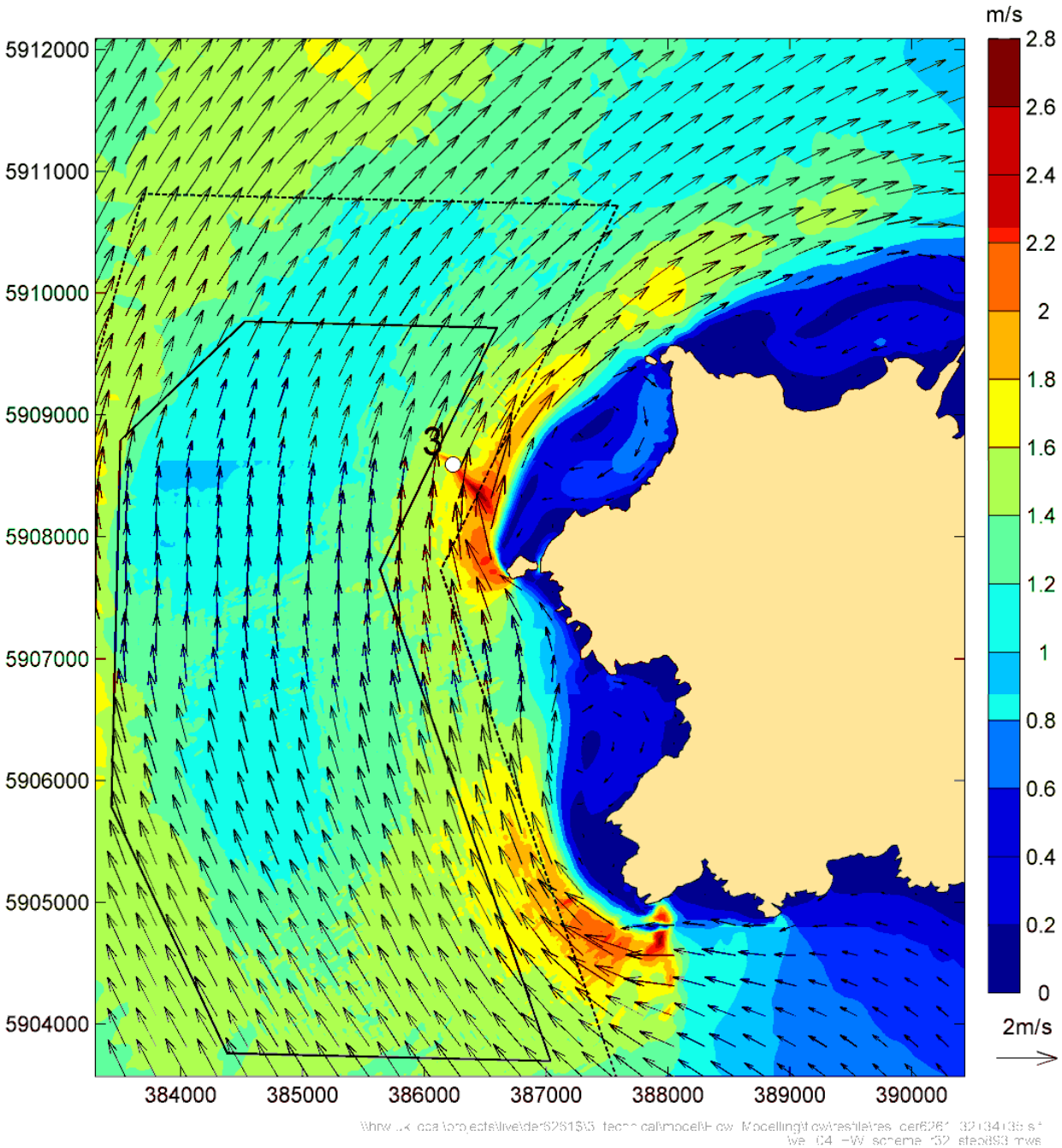

Figure 3.8: Scheme flow velocity. High Water minus 4 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

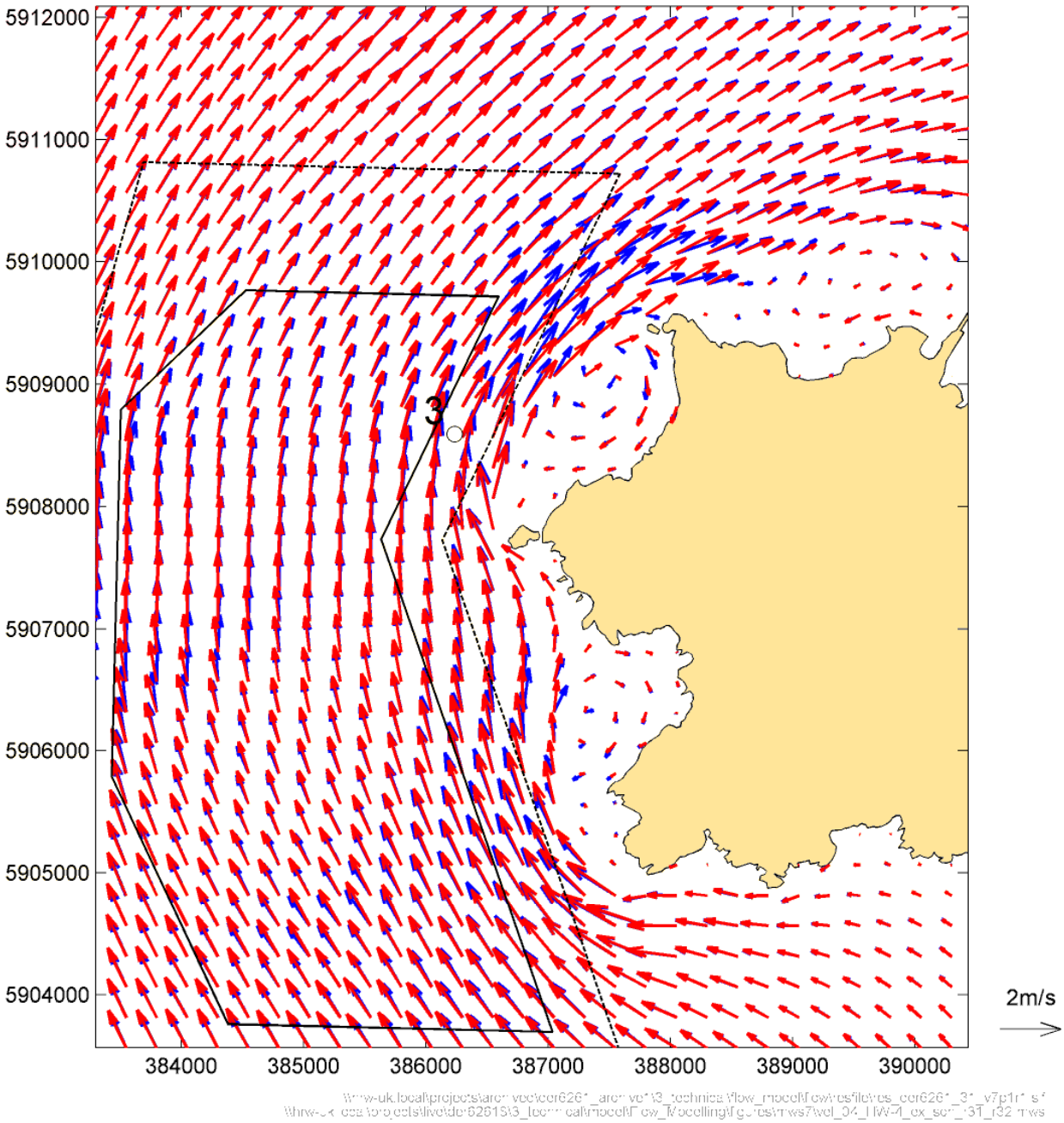

Figure 3.9: Existing (blue) and Scheme (red) flow velocity. High Water minus 4 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

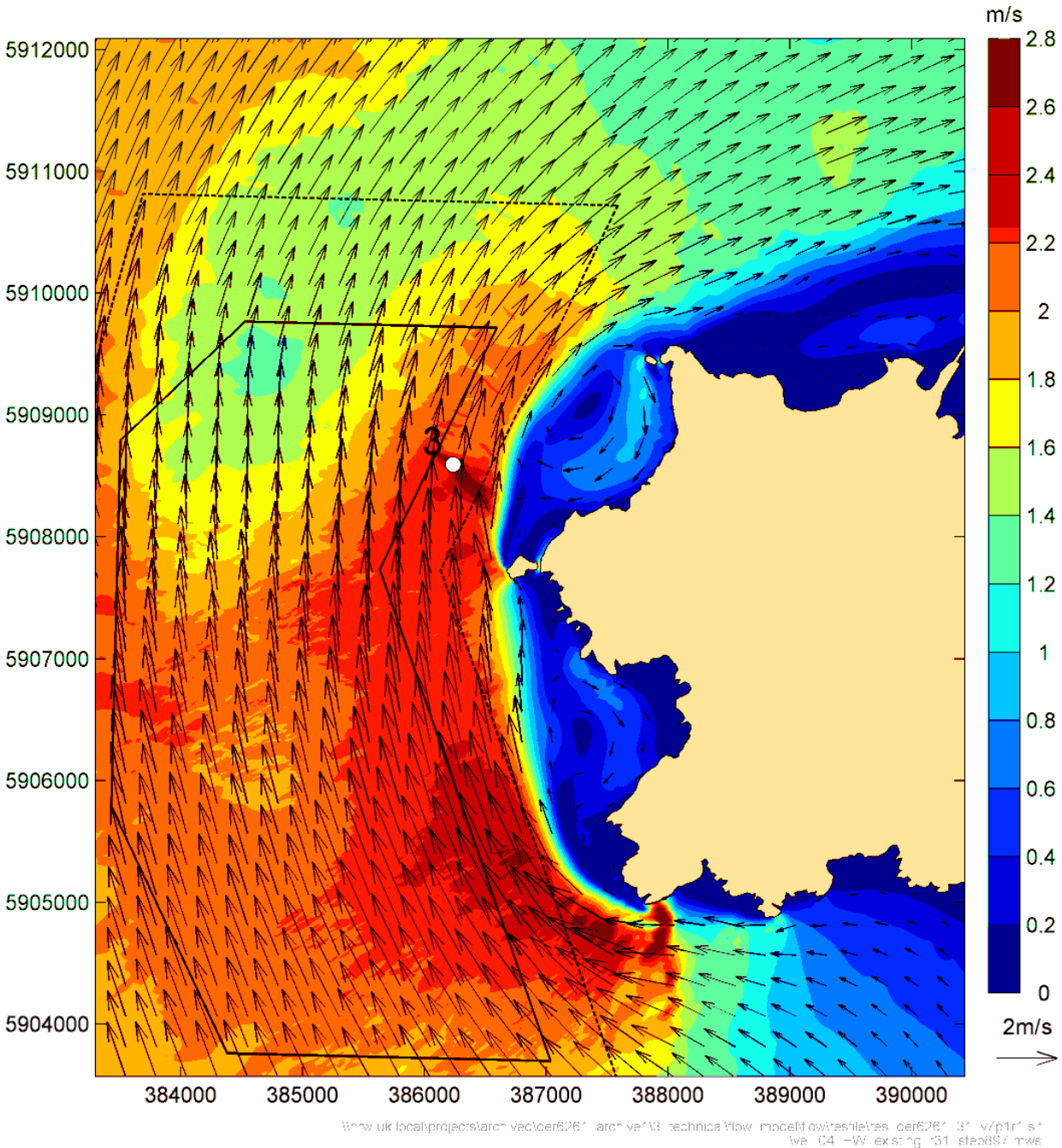

Figure 3.10: Existing flow velocity. High Water minus 3 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

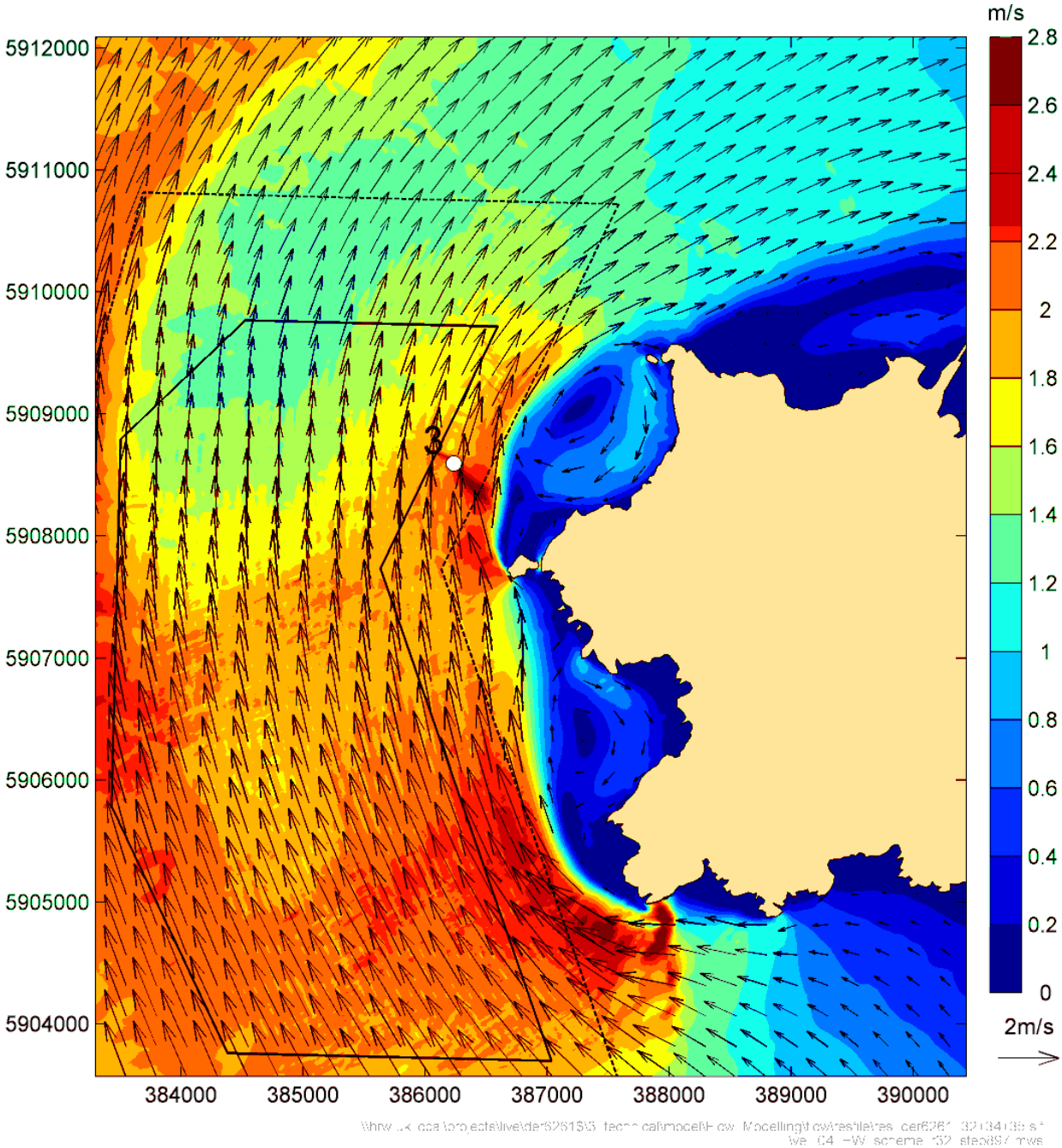

Figure 3.11: Scheme flow velocity. High Water minus 3 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

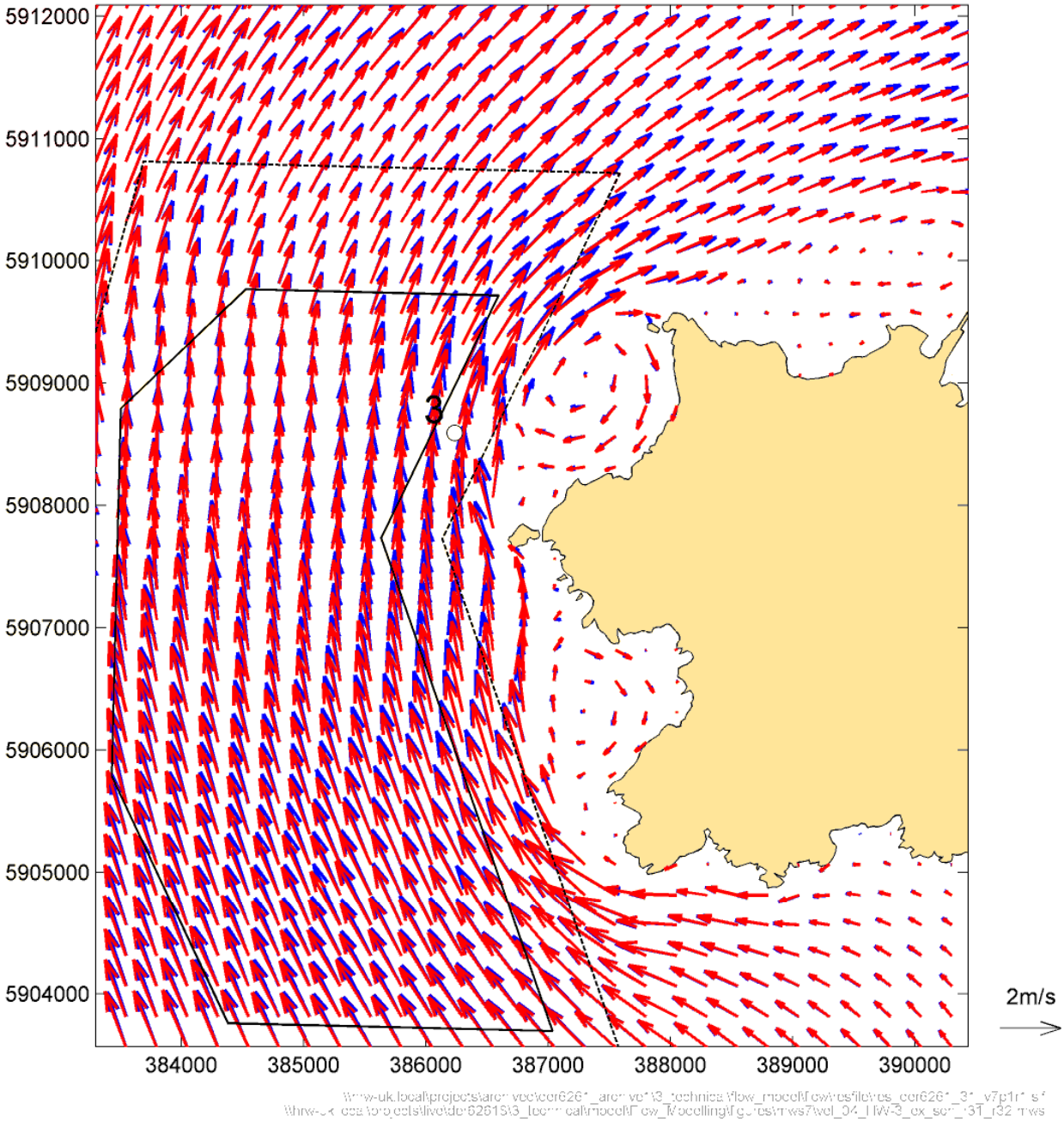

Figure 3.12: Existing (blue) and Scheme (red) flow velocity. High Water minus 3 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

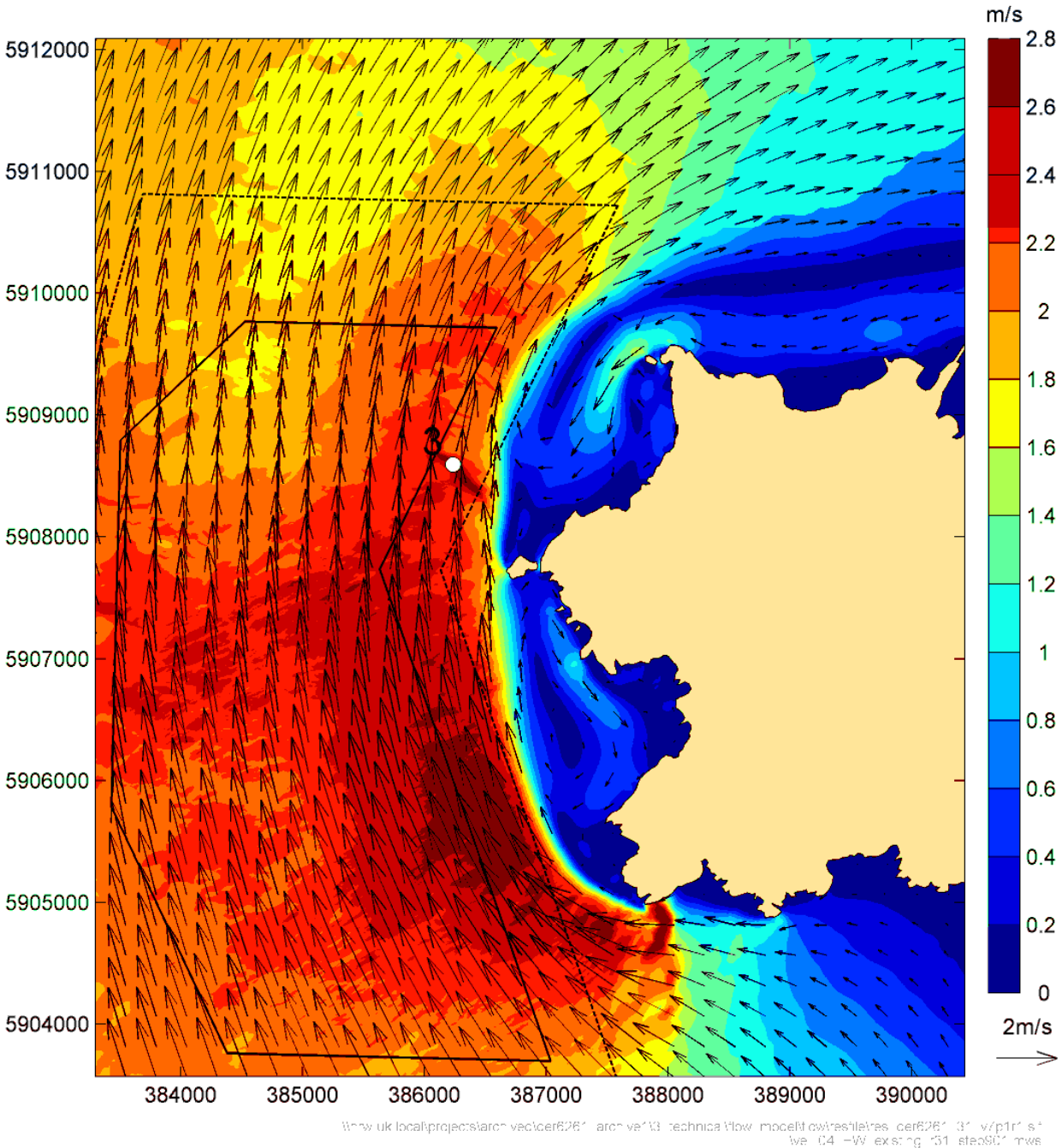

Figure 3.13: Existing flow velocity. High Water minus 2 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

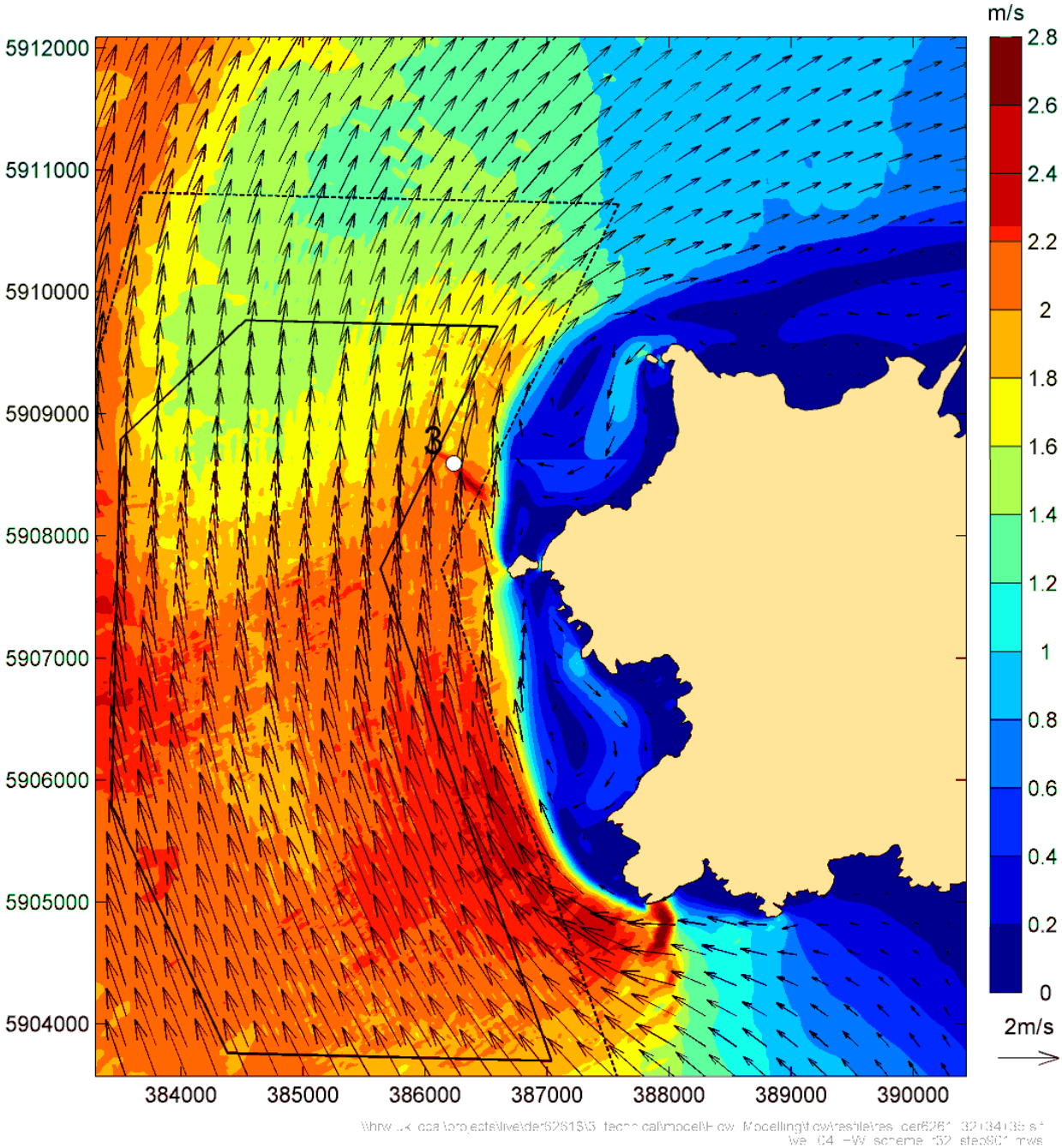

Figure 3.14: Scheme flow velocity. High Water minus 2 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

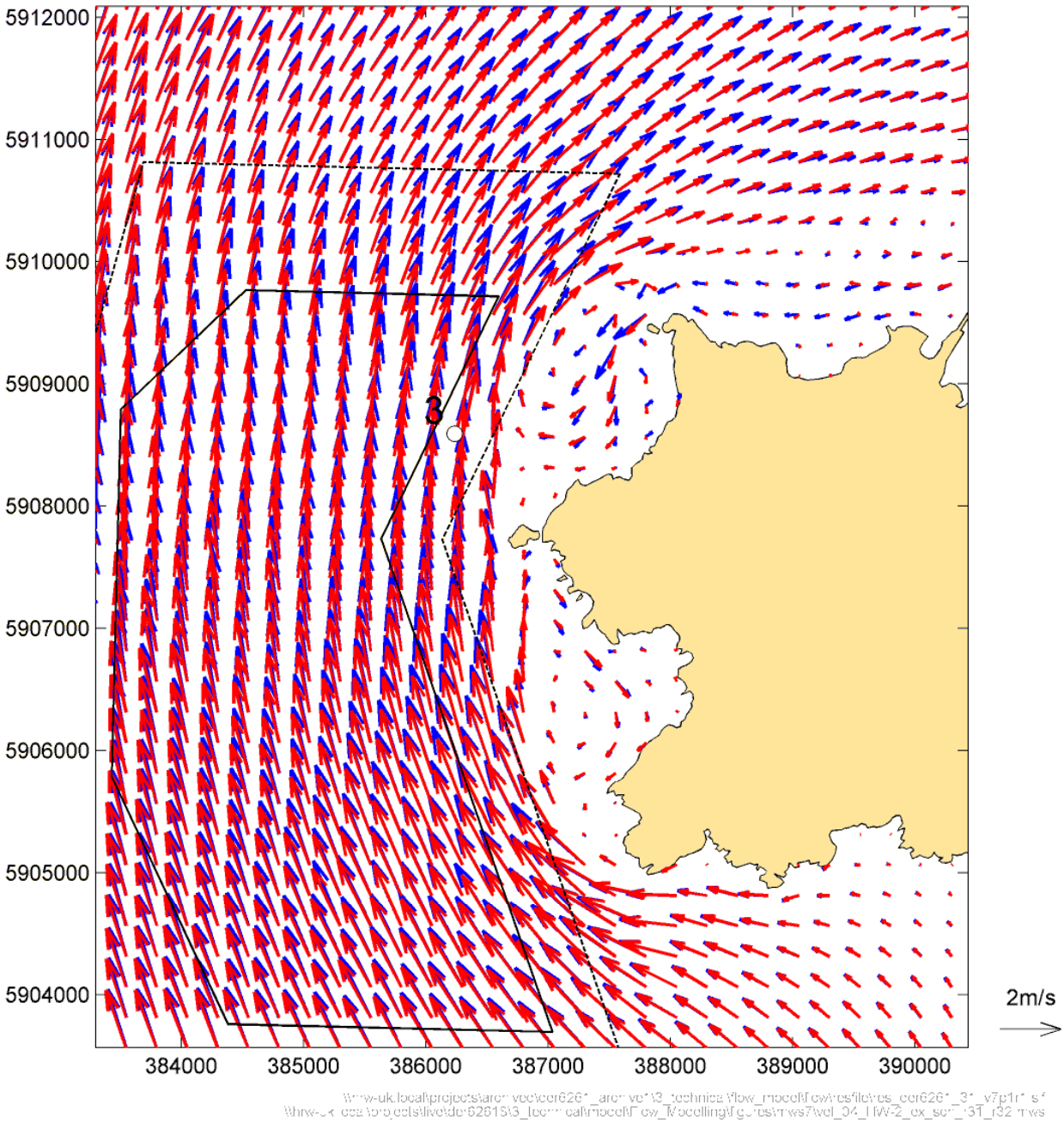

Figure 3.15: Existing (blue) and Scheme (red) flow velocity. High Water minus 2 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

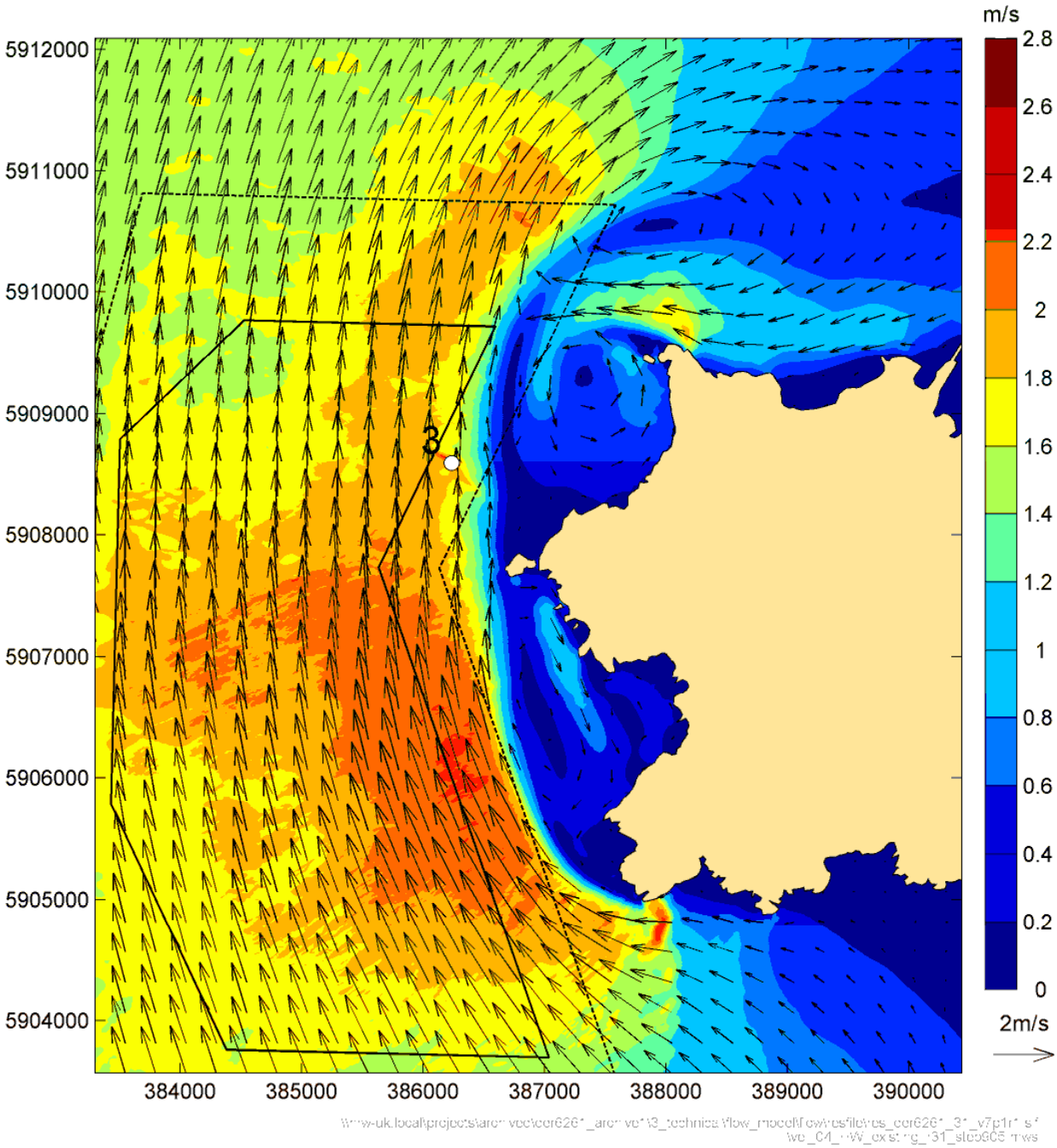

Figure 3.16: Existing flow velocity. High Water minus 1 hour

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

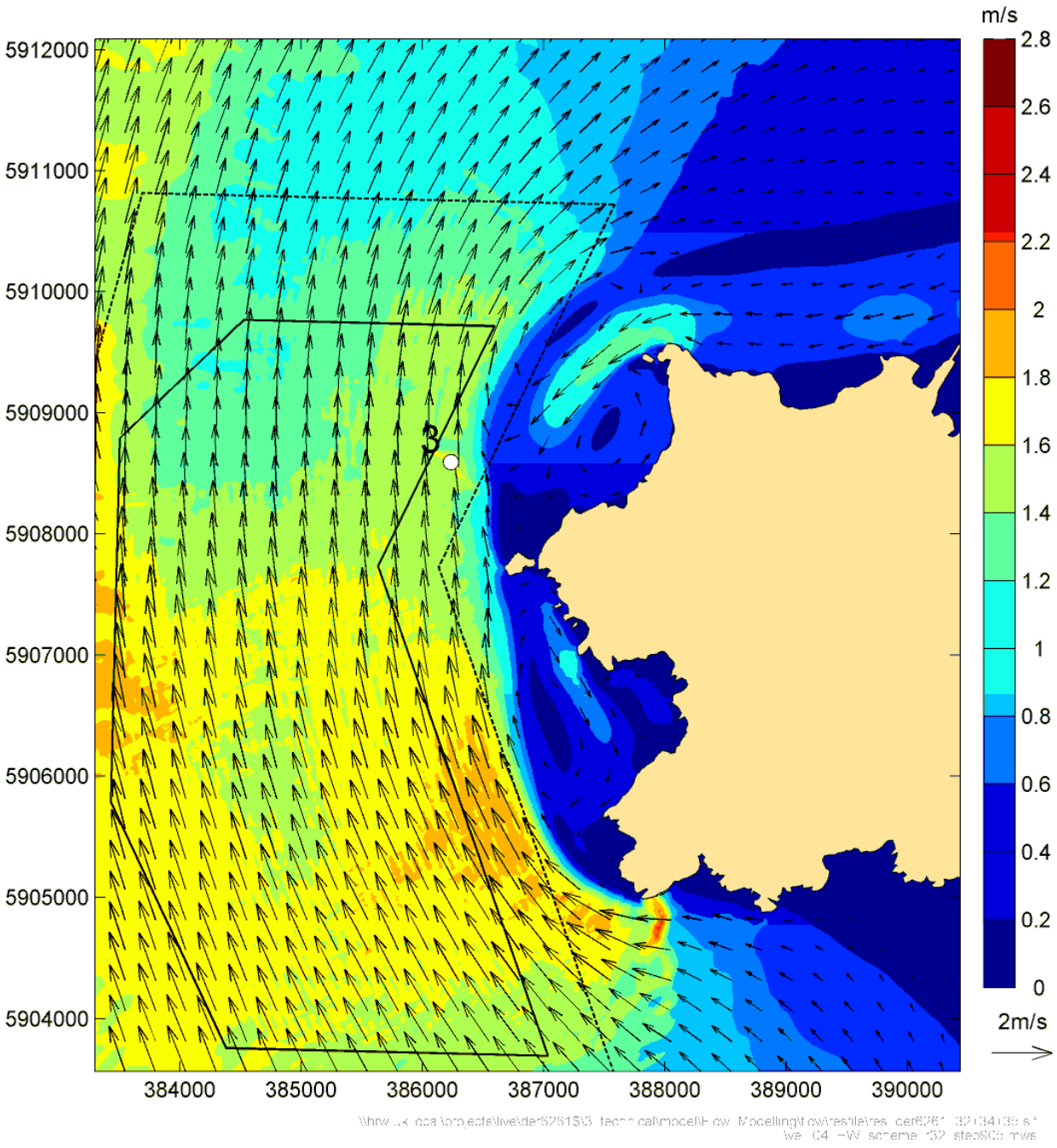

Figure 3.17: Scheme flow velocity. High Water minus 1 hour

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

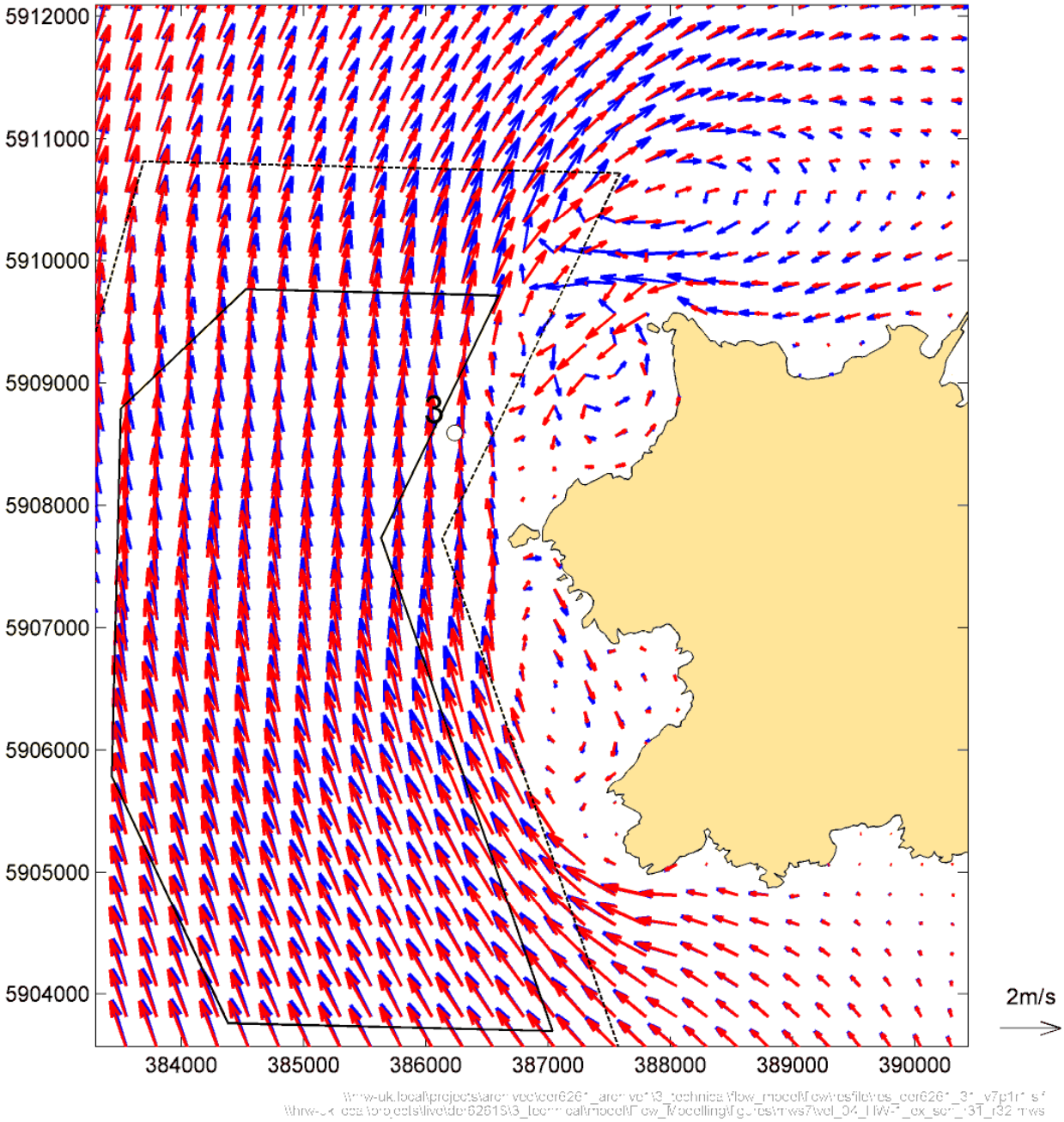

Figure 3.18: Existing (blue) and Scheme(red) flow velocity. High Water minus 1 hour

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

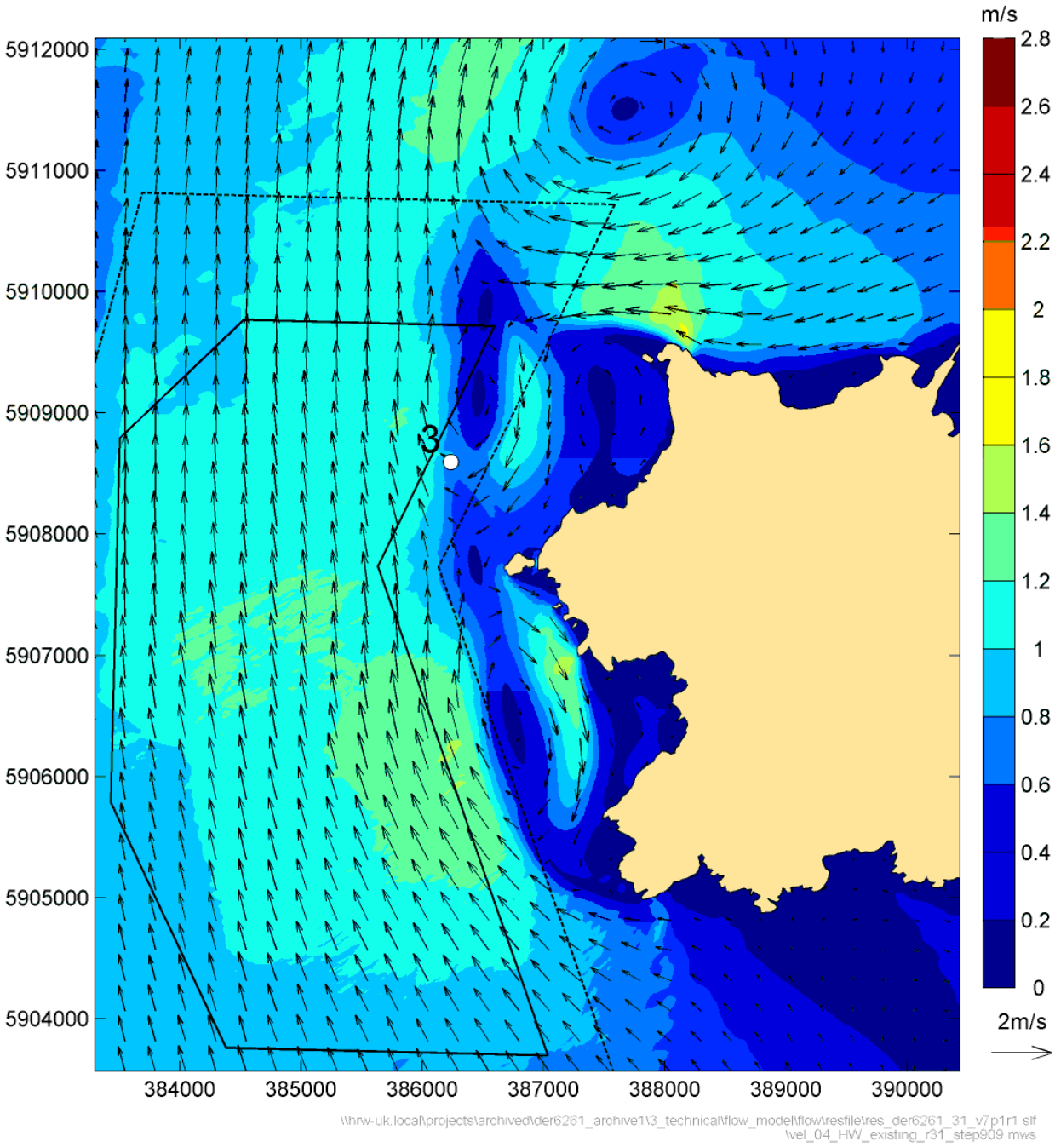

Figure 3.19: Existing flow velocity. High Water

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

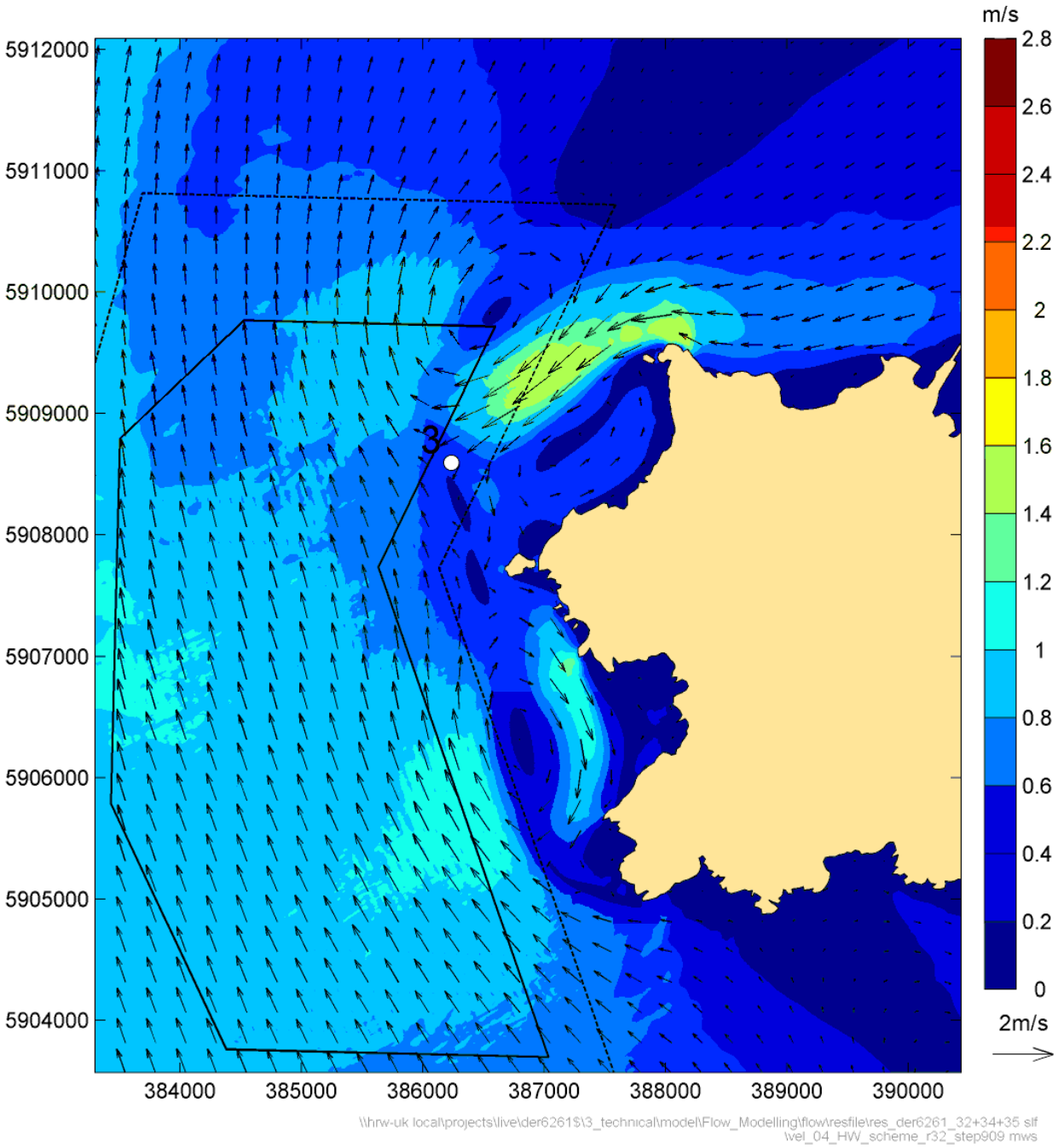

Figure 3.20: Scheme flow velocity. High Water

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

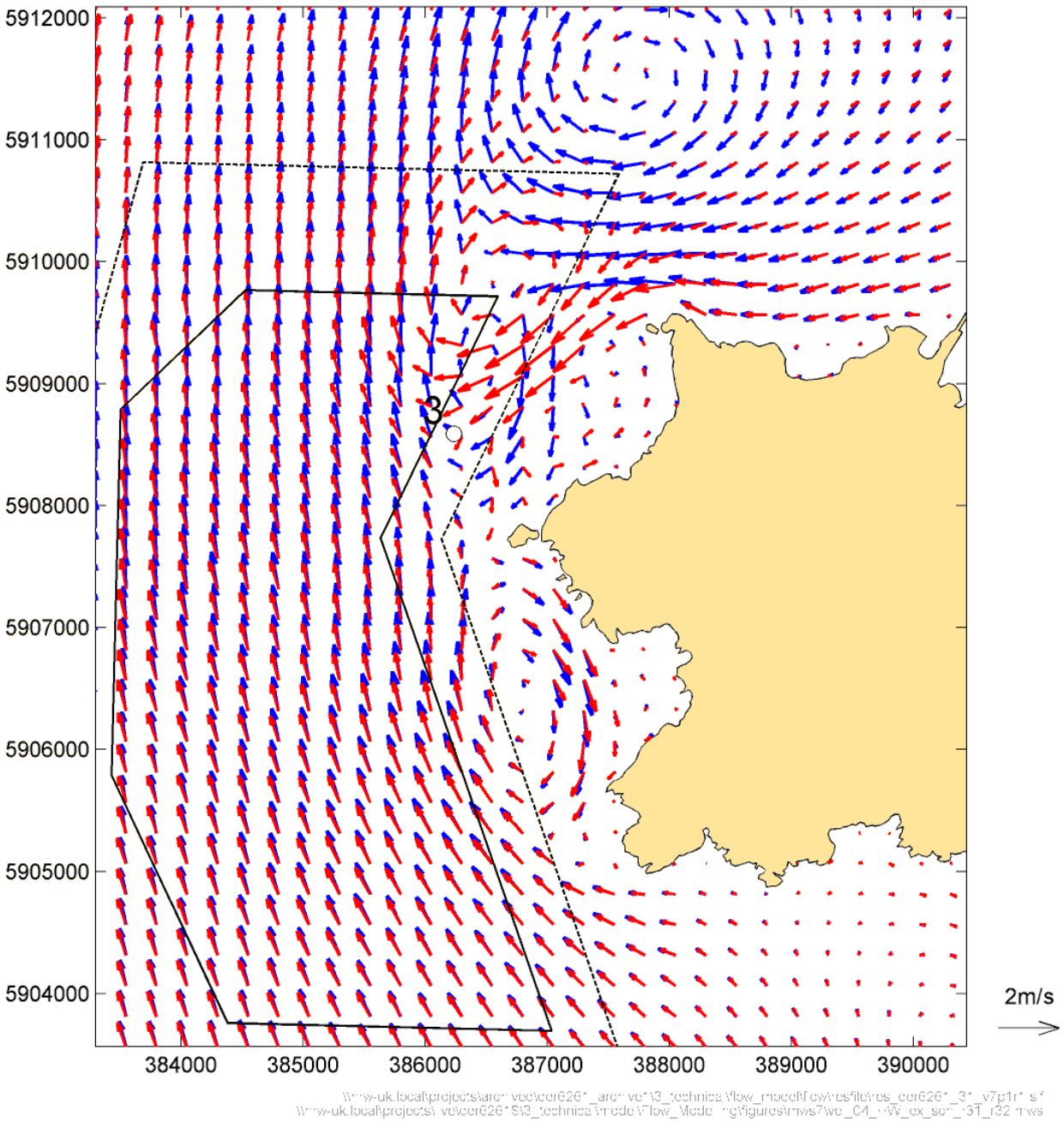

Figure 3.21: Existing (blue) and Scheme (red) flow velocity. High Water

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

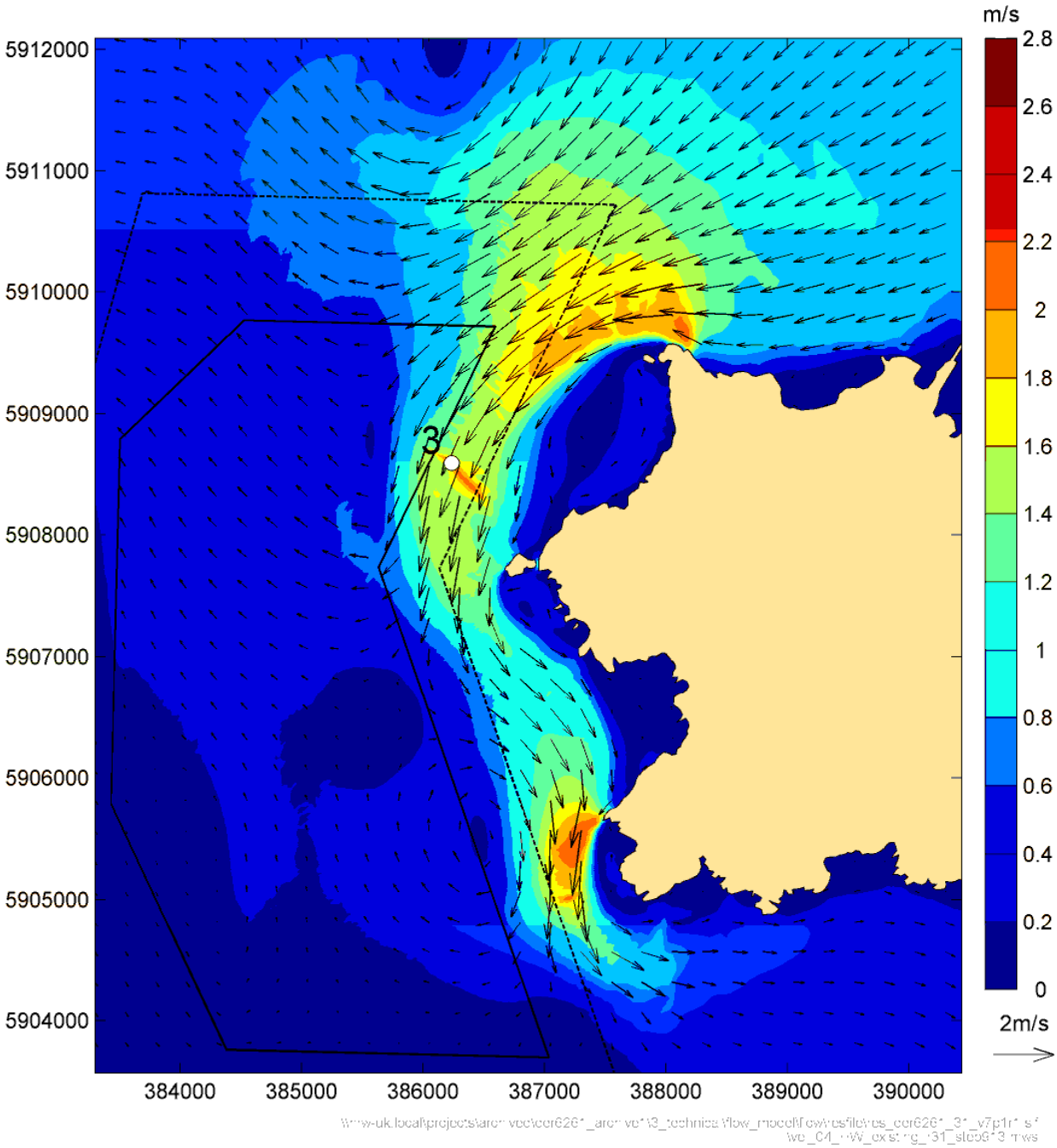

Figure 3.22: Existing flow velocity. High Water plus 1 hour

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

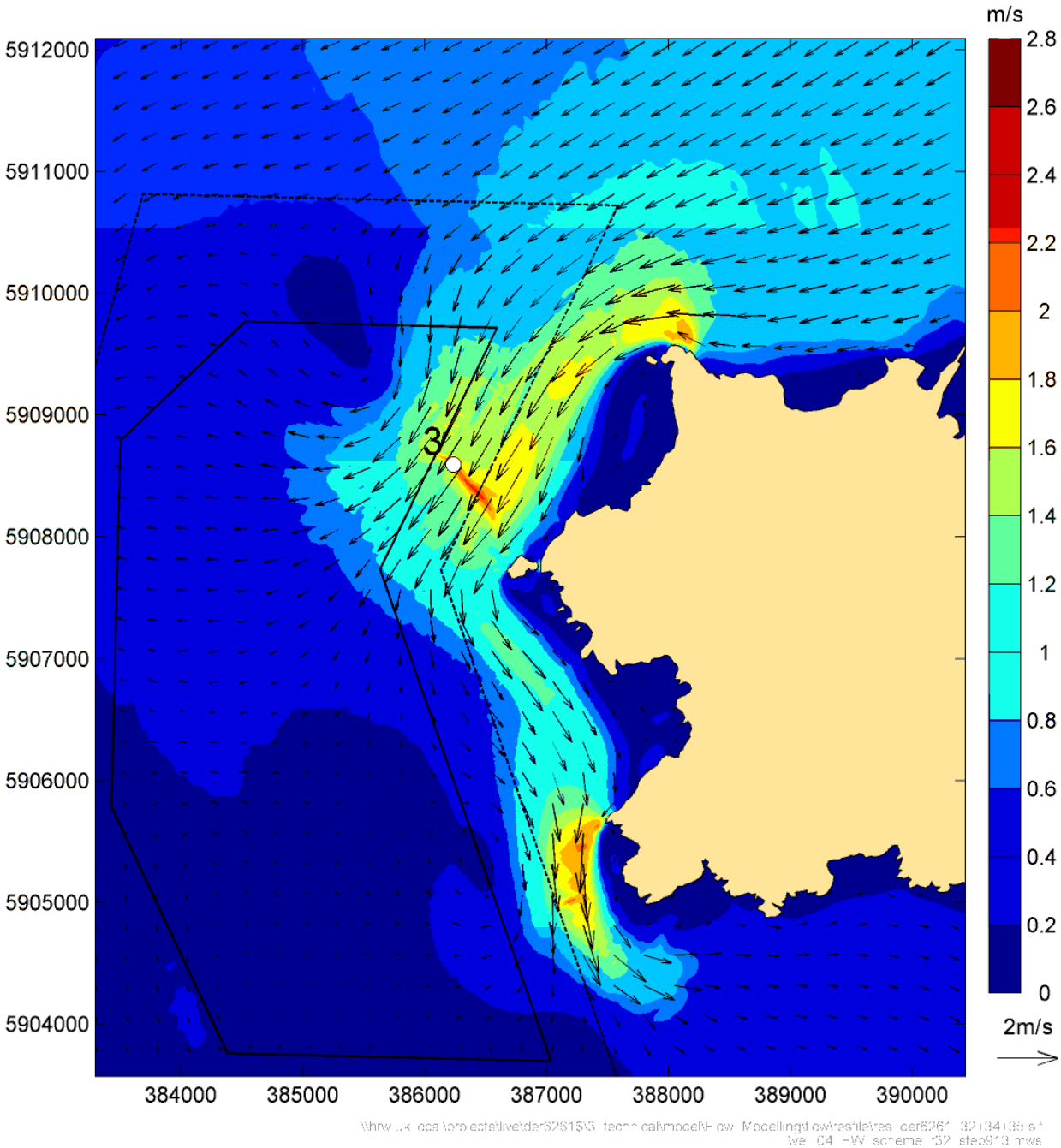

Figure 3.23: Scheme flow velocity. High Water plus 1 hour

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

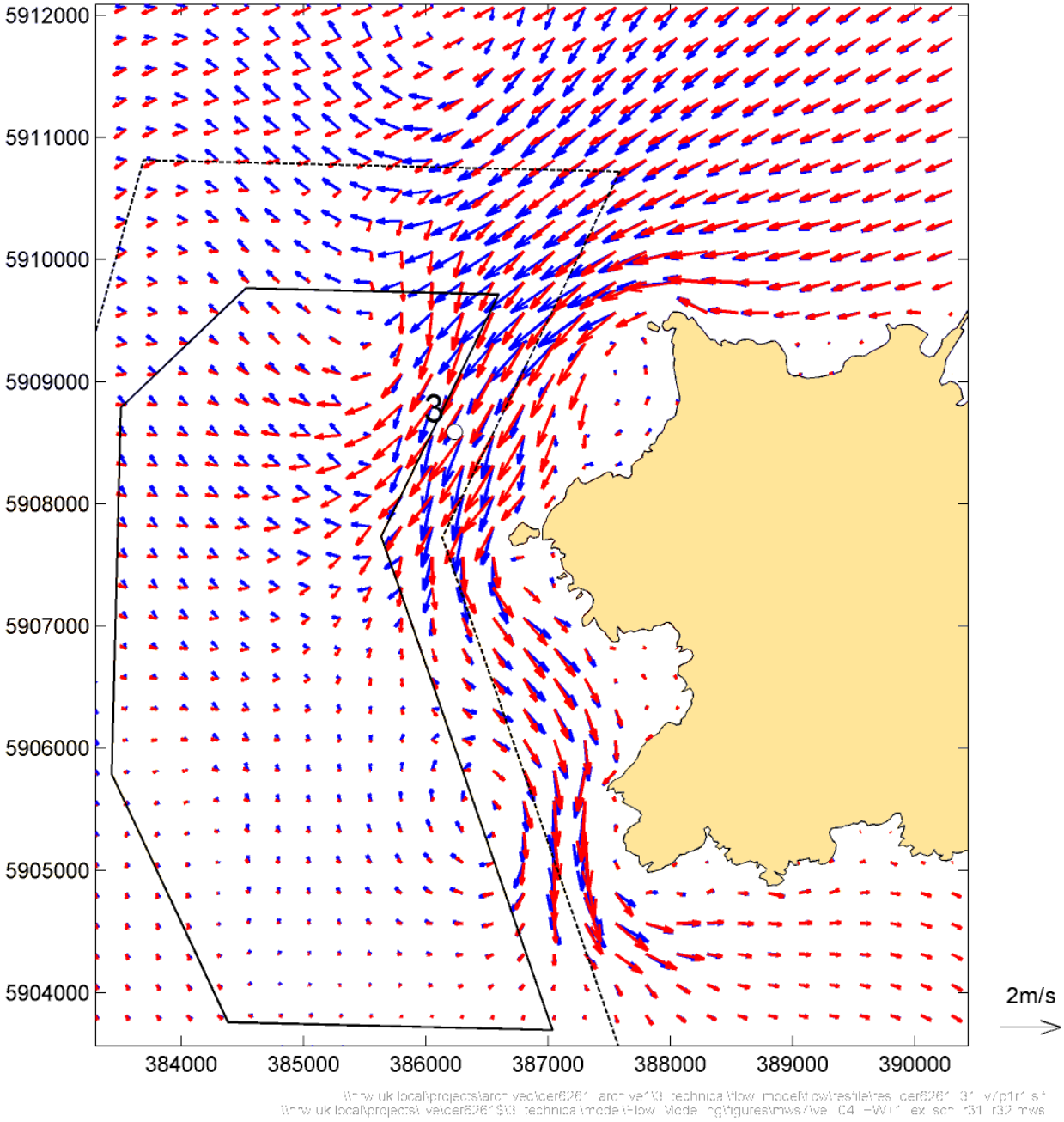

Figure 3.24: Existing (blue) and Scheme (red) flow velocity. High Water plus 1 hour

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

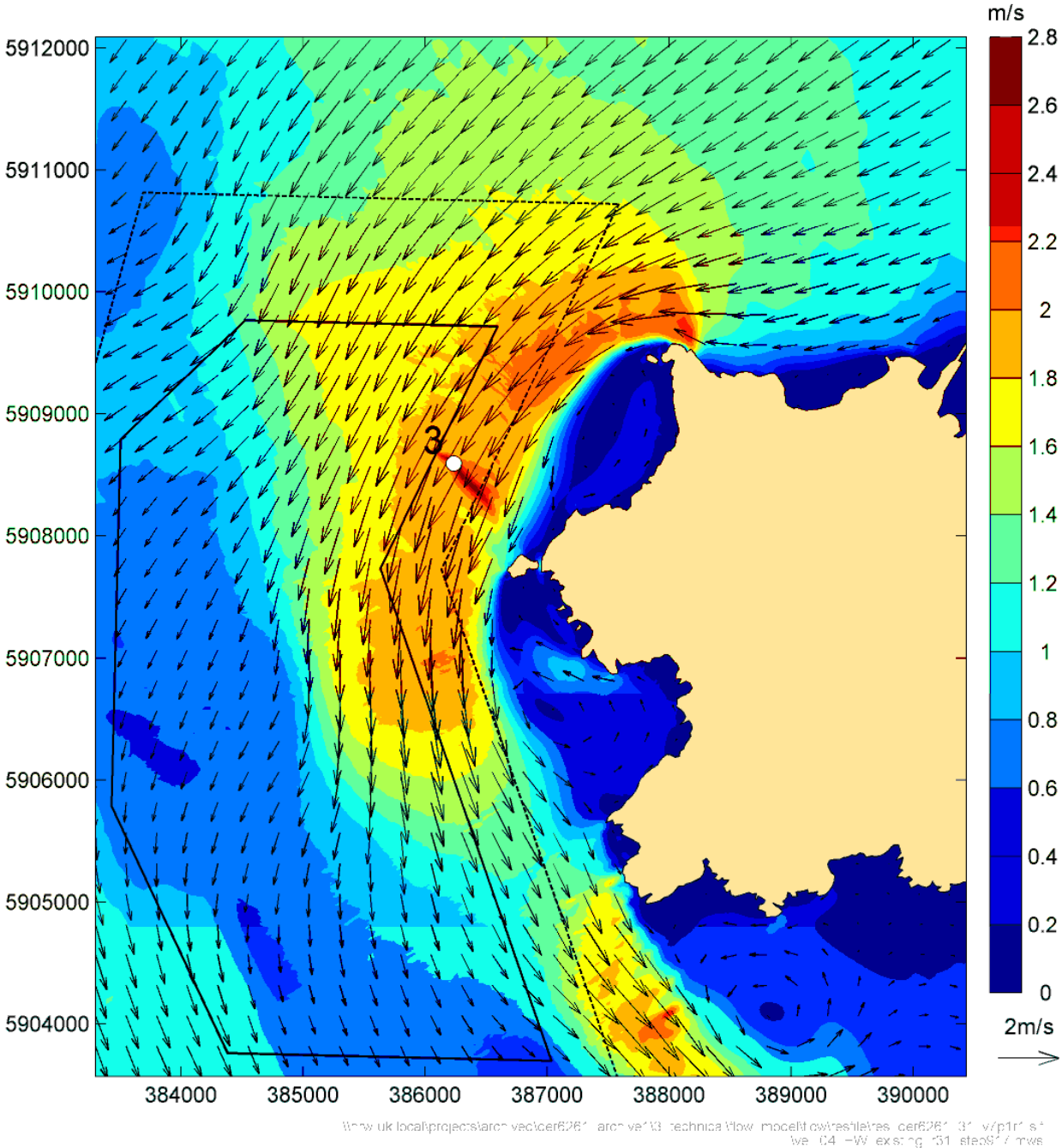

Figure 3.25: Existing flow velocity. High Water plus 2 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

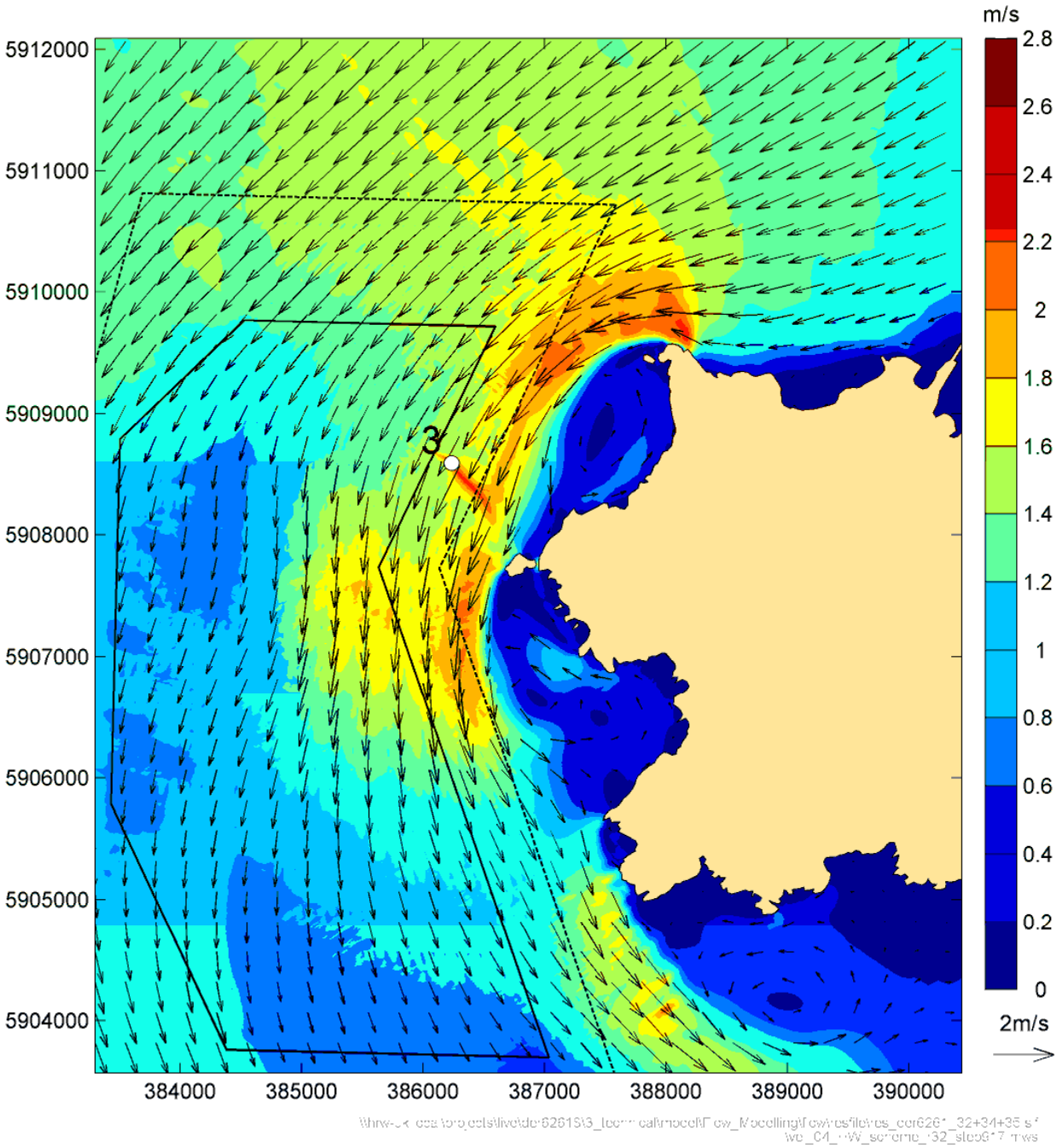

Figure 3.26: Scheme flow velocity. High Water plus 2 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

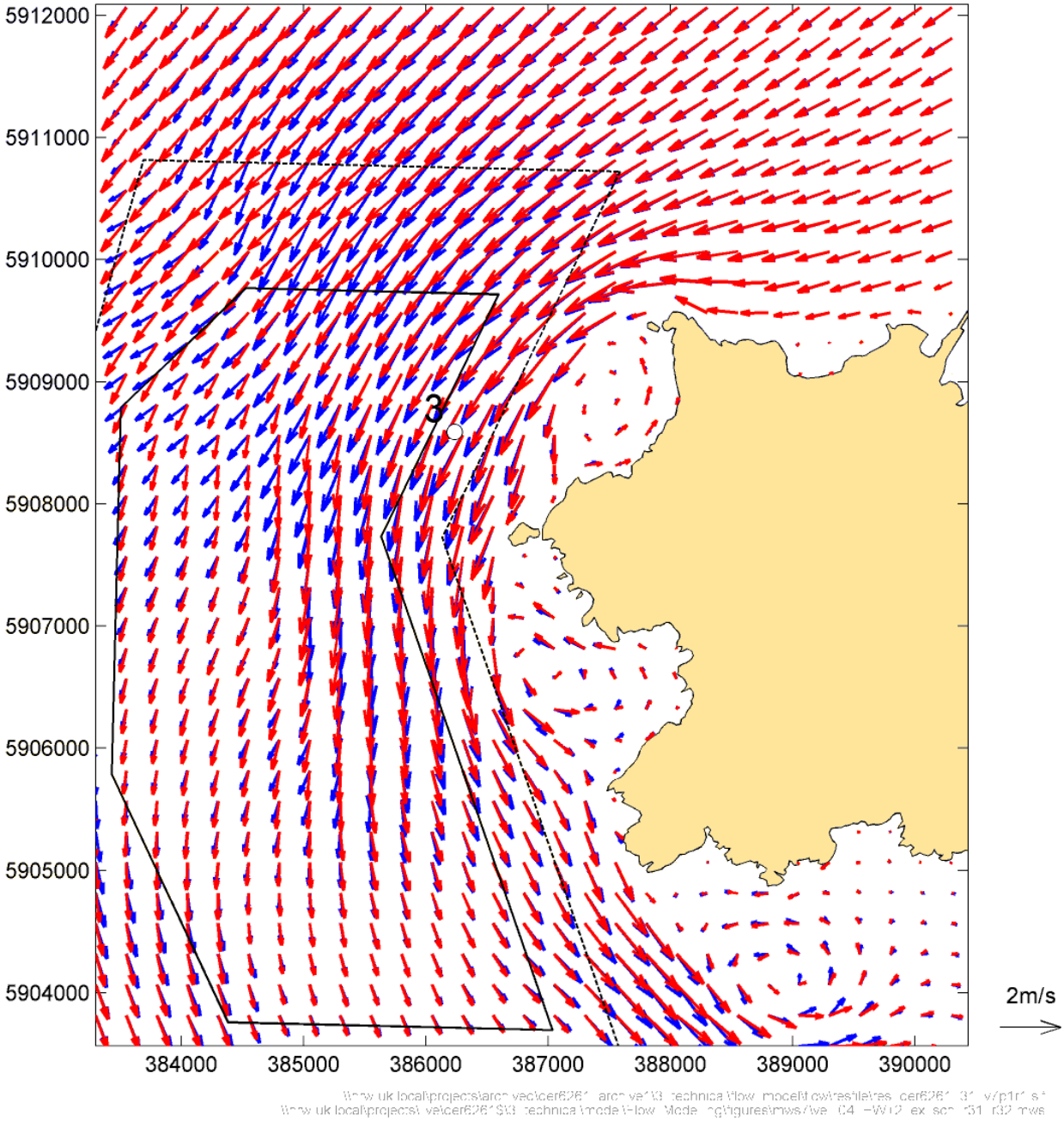

Figure 3.27: Existing (blue) and Scheme (red) flow velocity. High Water plus 2 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

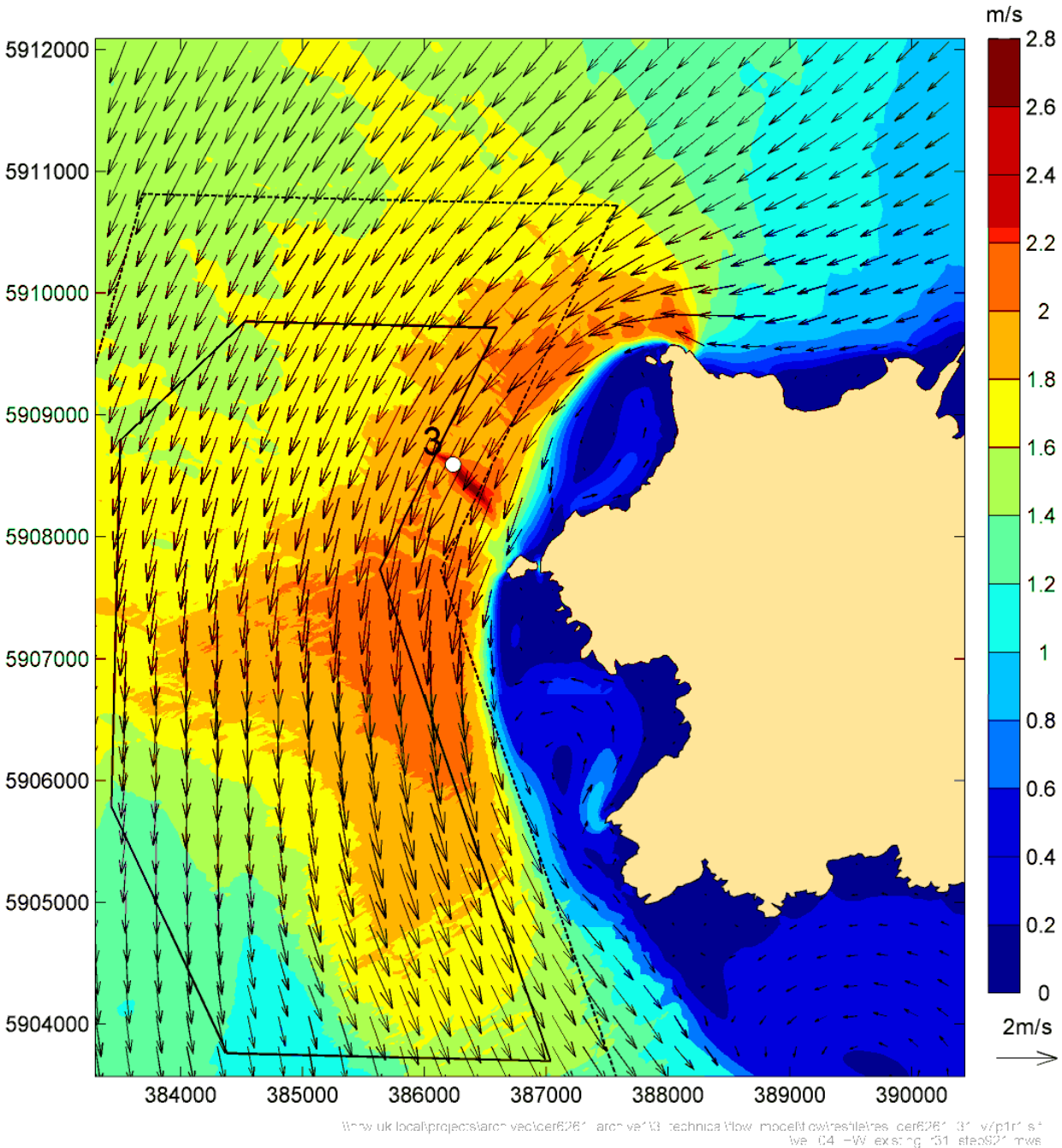

Figure 3.28: Existing flow velocity. High Water plus 3 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

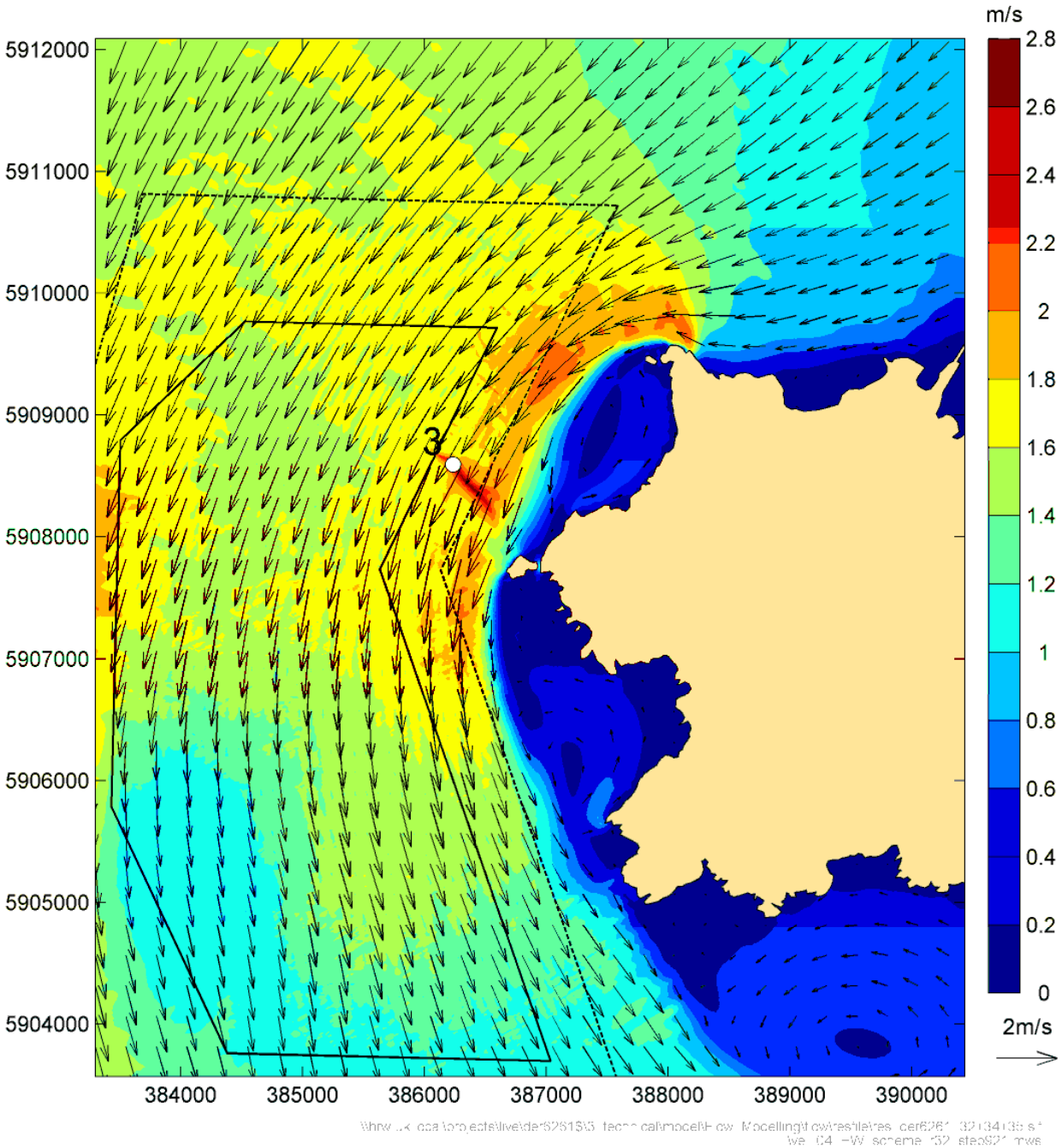

Figure 3.29: Scheme flow velocity. High Water plus 3 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

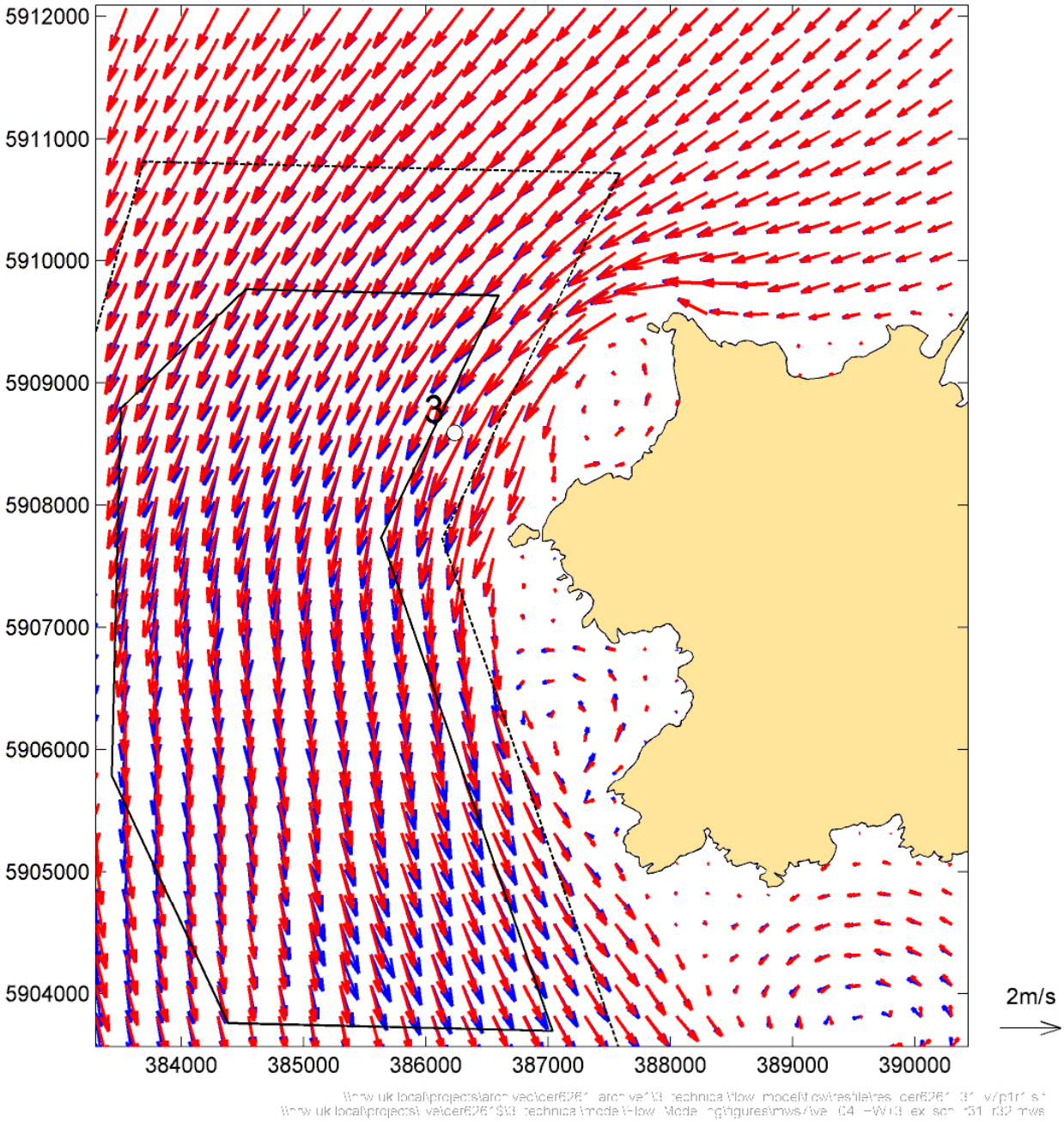

Figure 3.30: Existing (blue) and Scheme (red) flow velocity. High Water plus 3 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

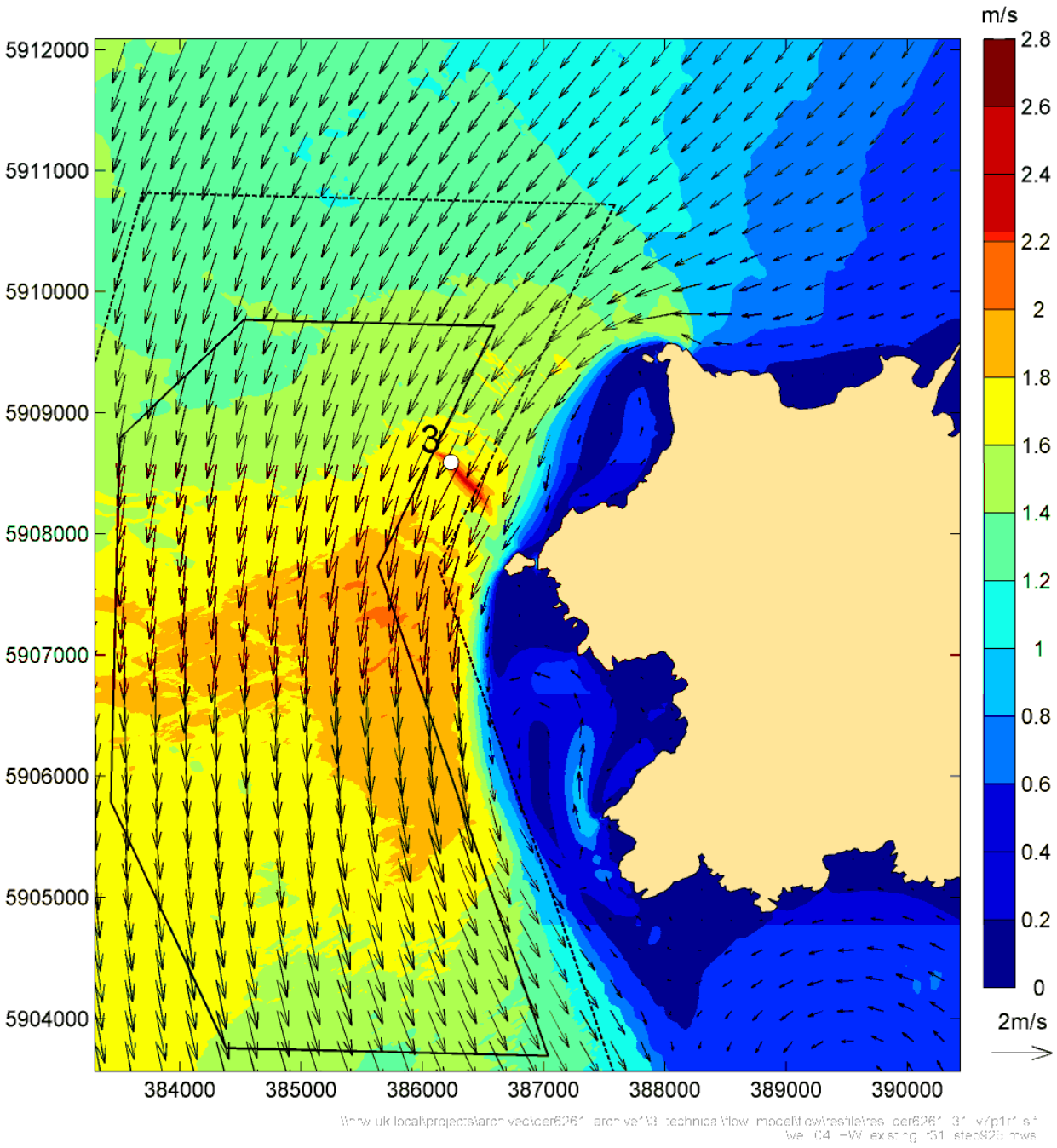

Figure 3.31: Existing flow velocity. High Water plus 4 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

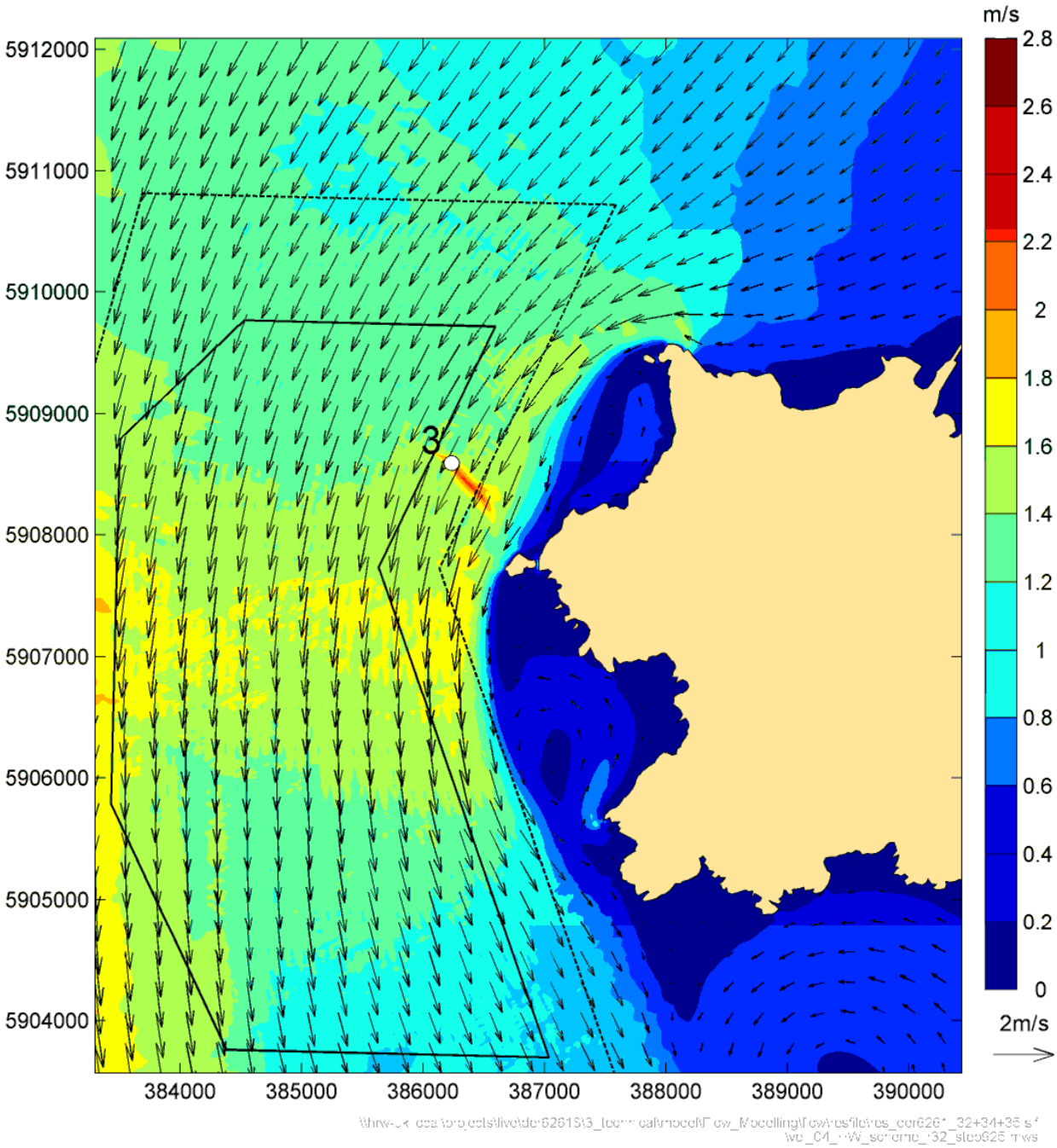

Figure 3.32: Scheme flow velocity. High Water plus 4 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

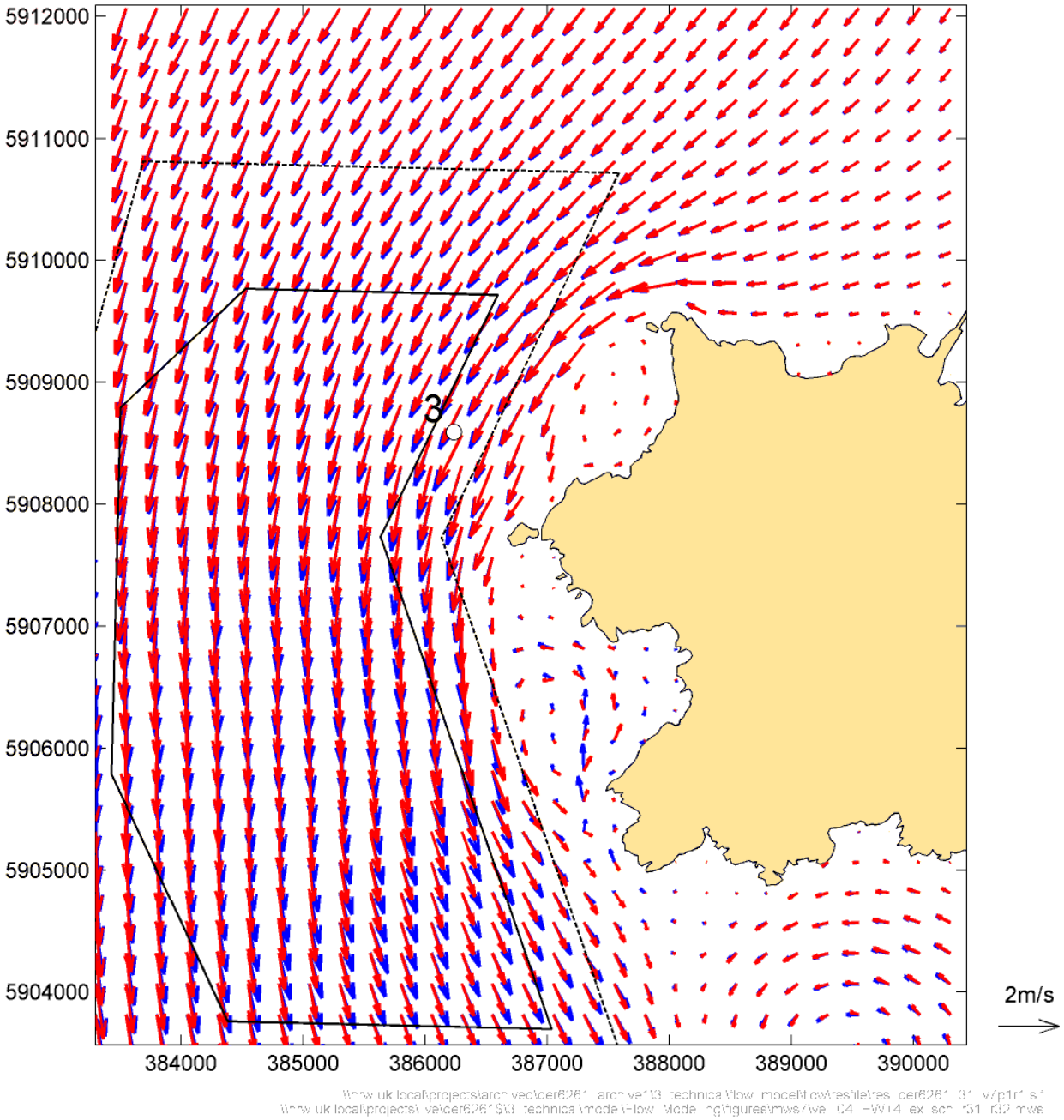

Figure 3.33: Existing (blue) and Scheme (red) flow velocity. High Water plus 4 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

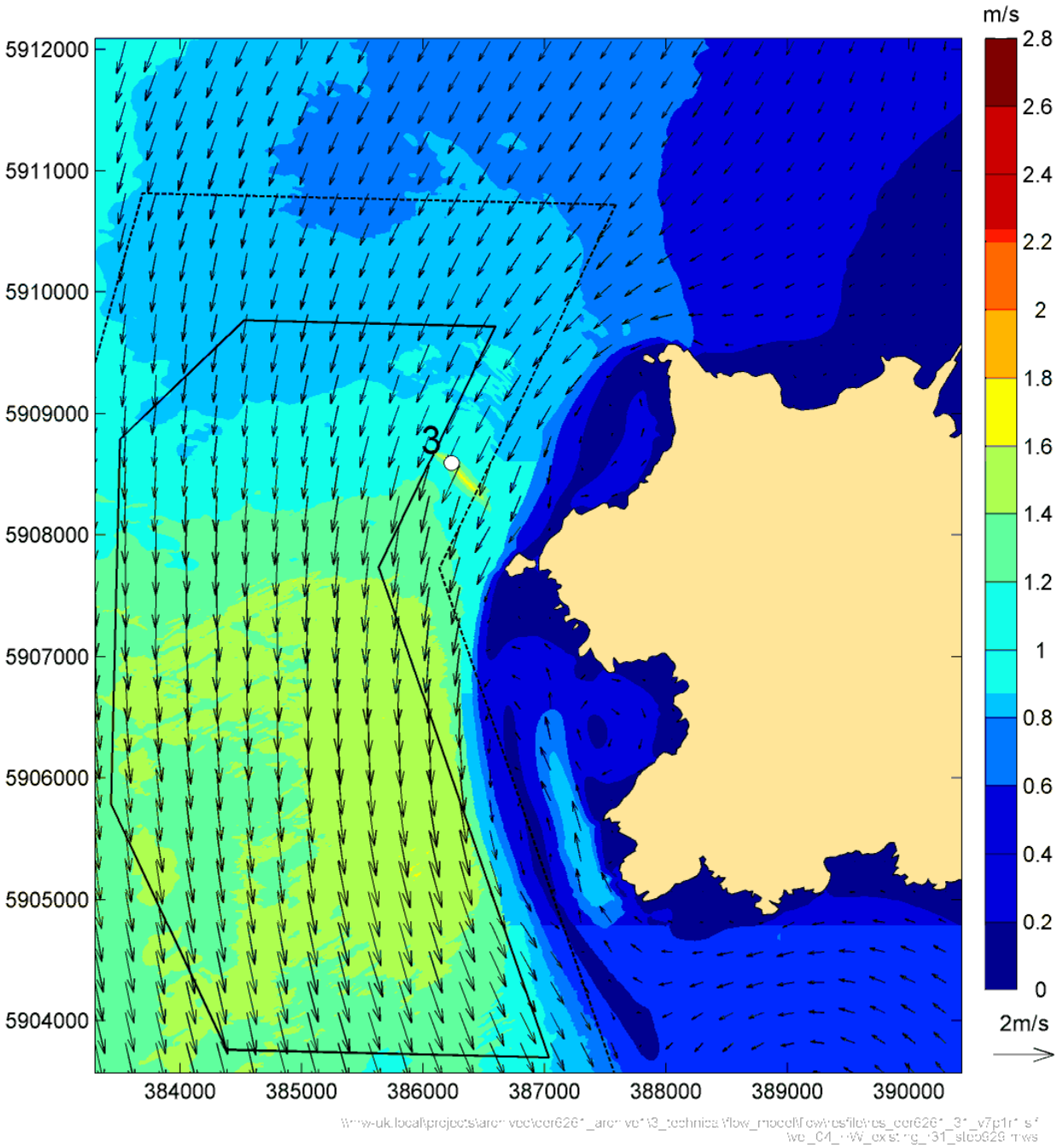

Figure 3.34: Existing flow velocity. High Water plus 5 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

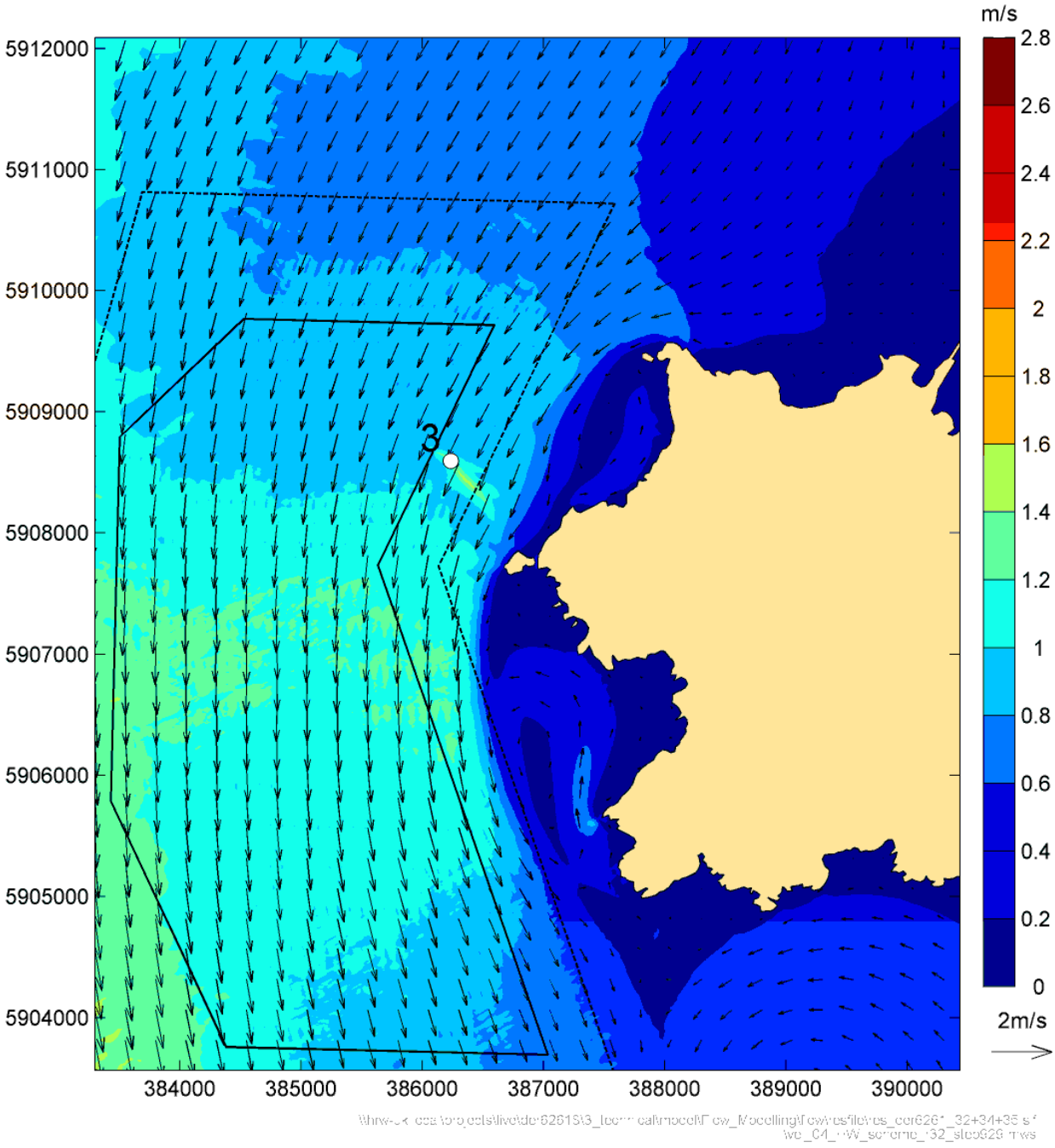

Figure 3.35: Scheme flow velocity. High Water plus 5 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

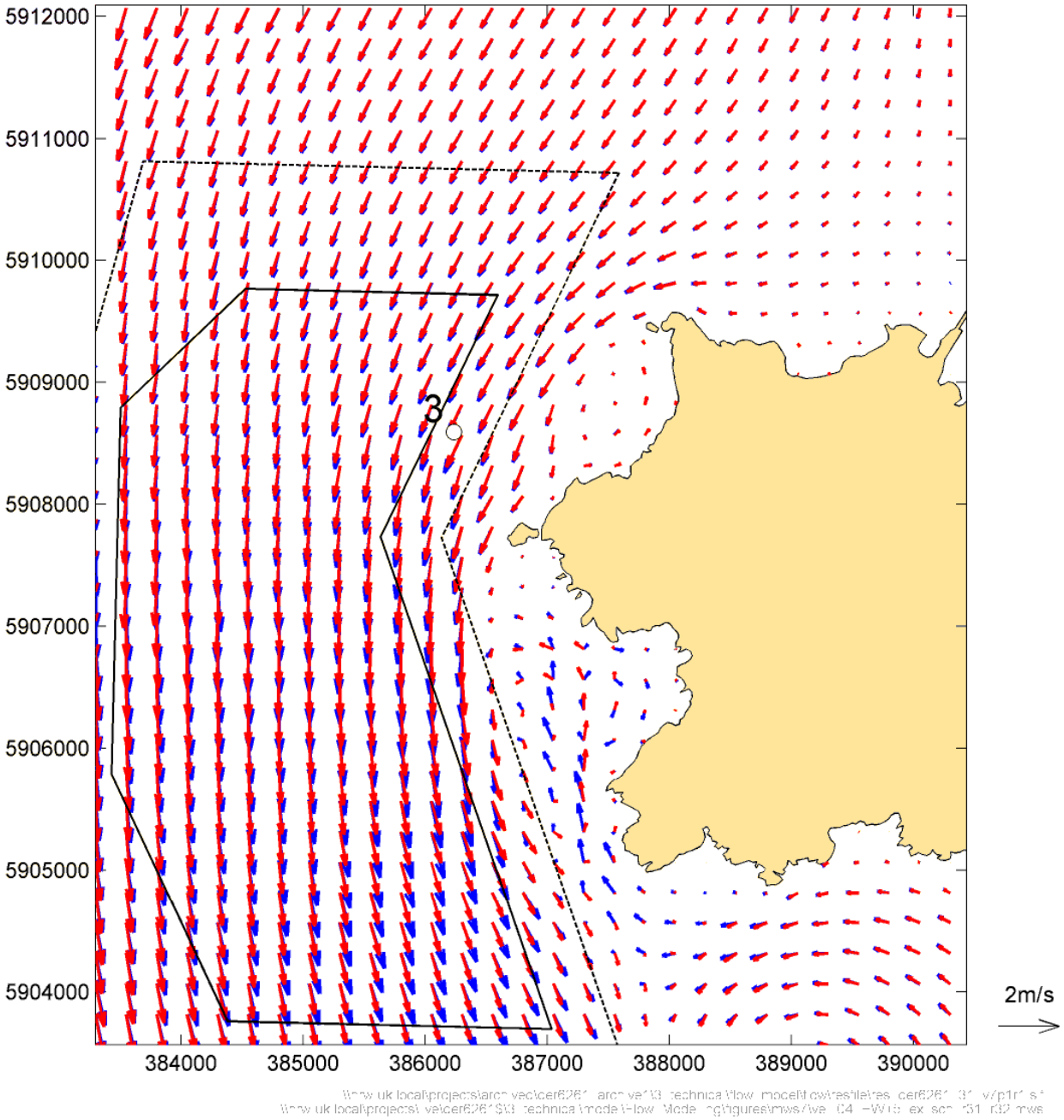

Figure 3.36: Existing (blue) and Scheme (red) flow velocity. High Water plus 5 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

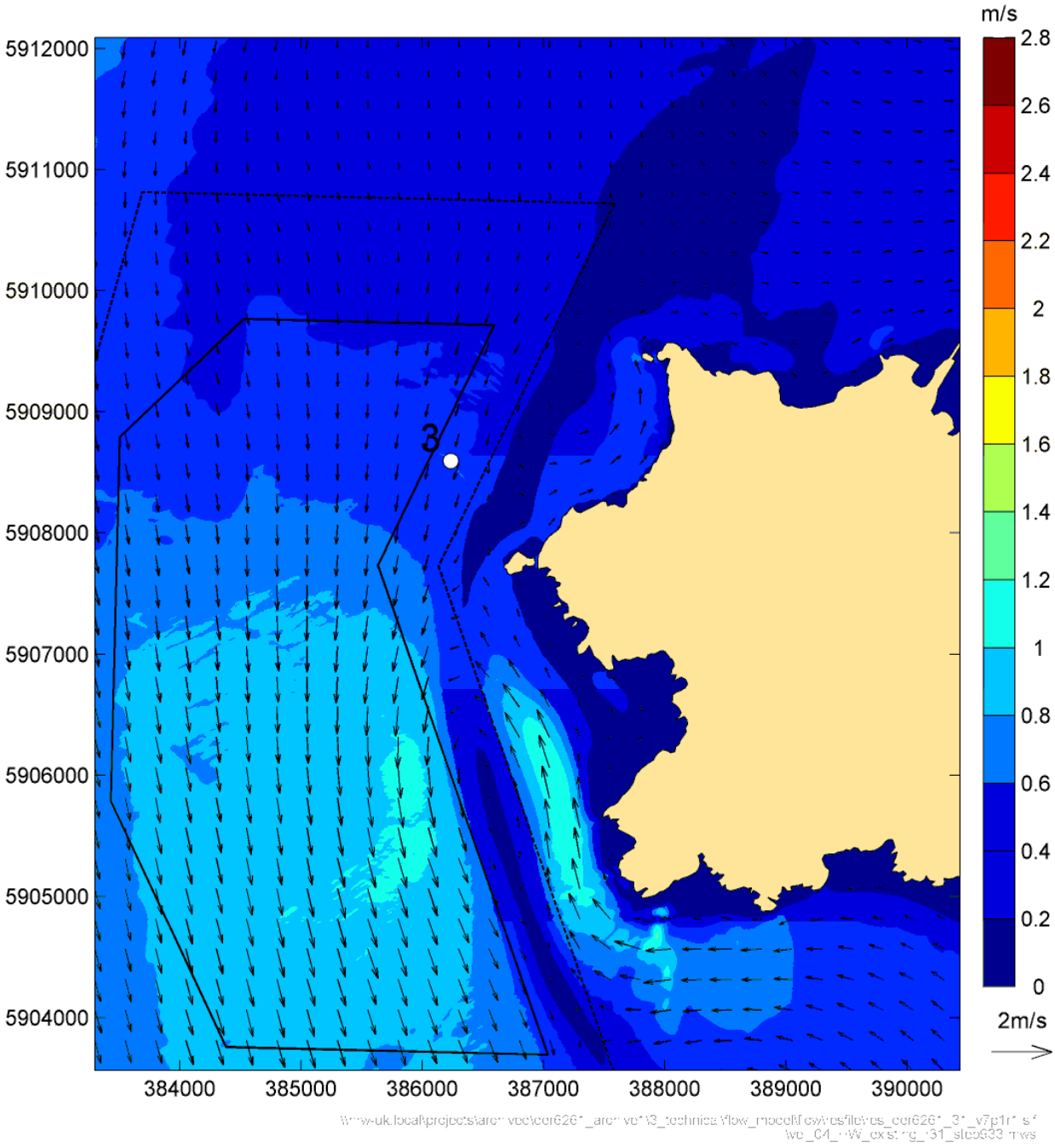

Figure 3.37: Existing flow velocity. High Water plus 6 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

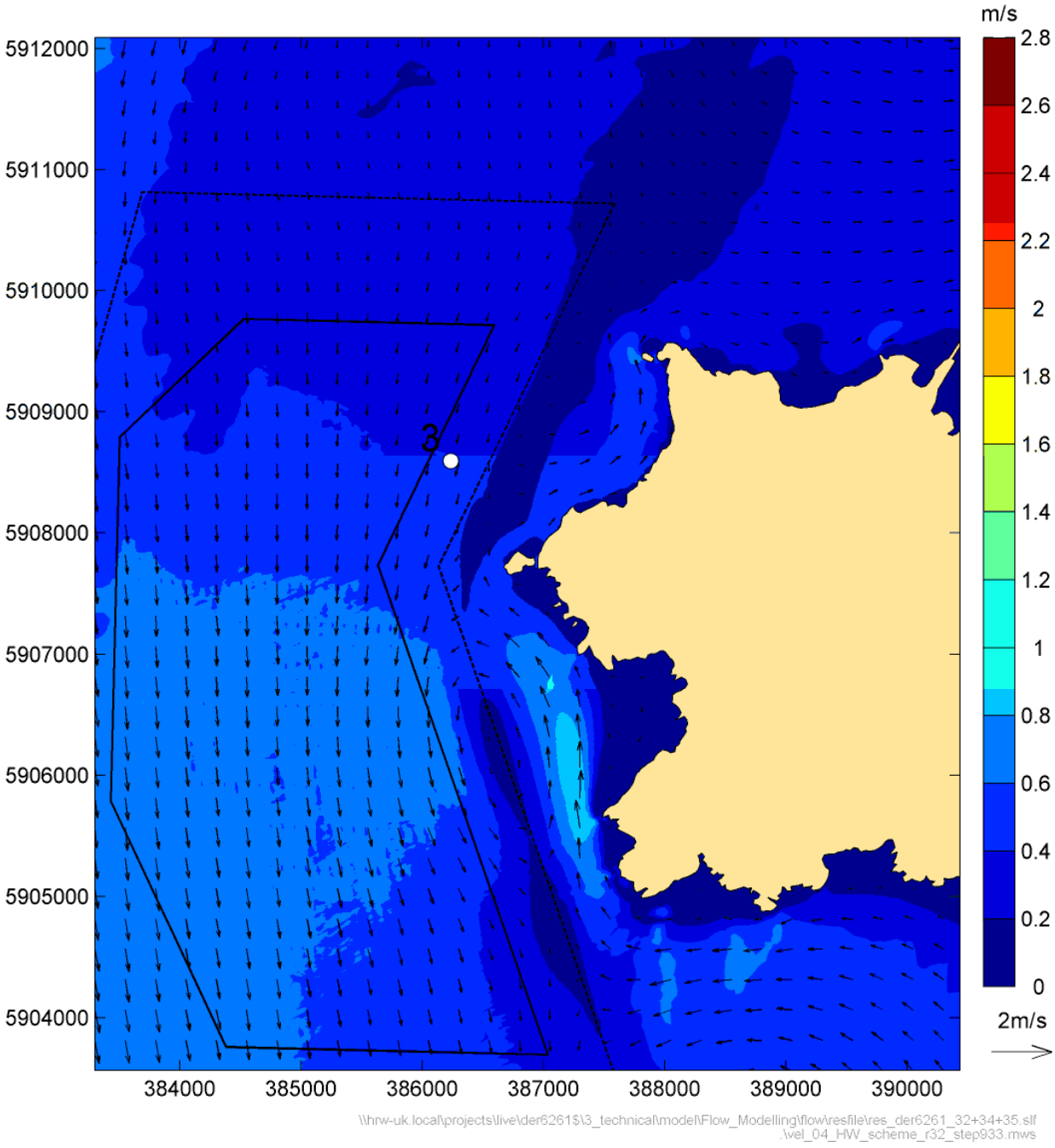

Figure 3.38: Scheme flow velocity. High Water plus 6 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

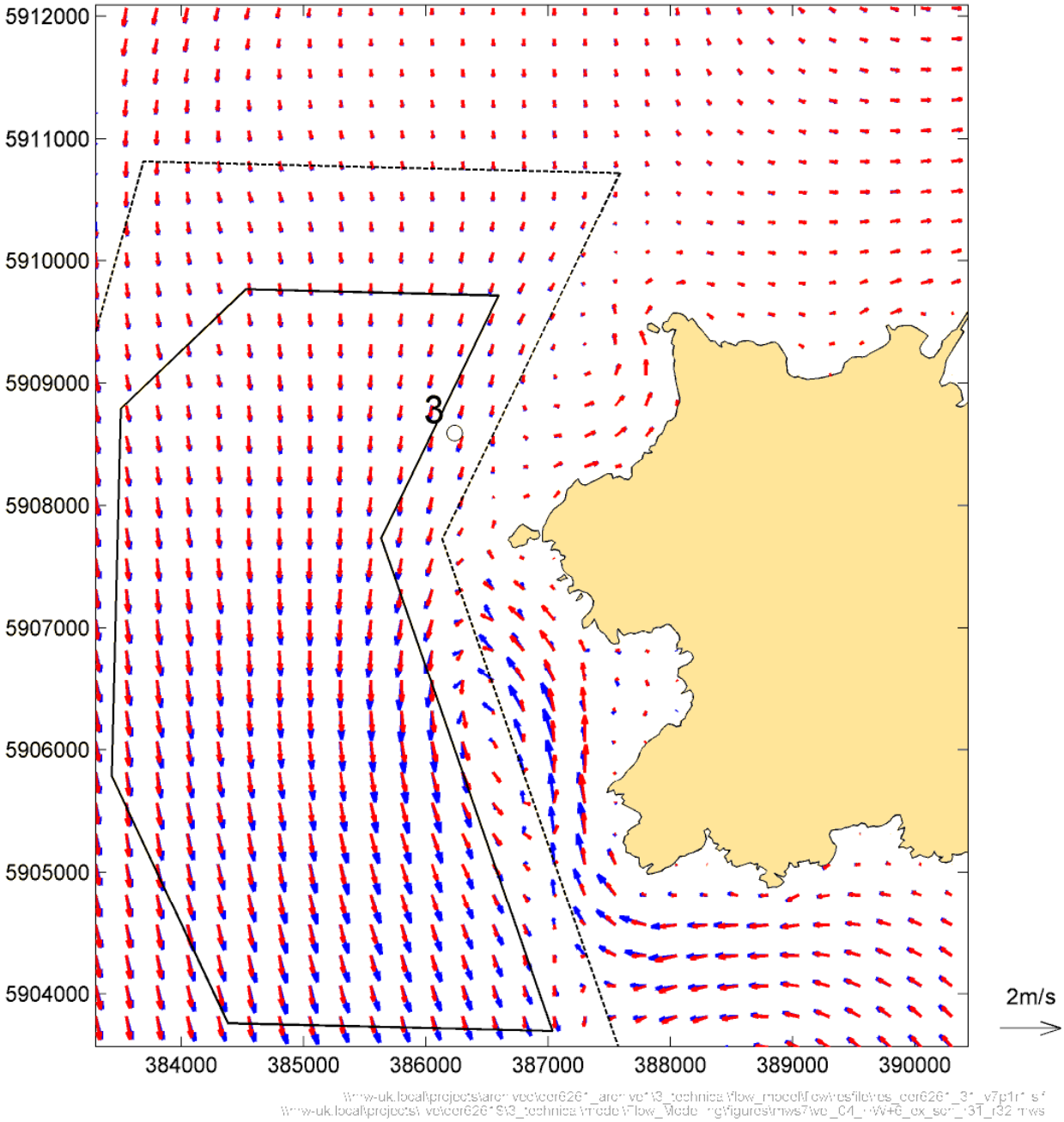

Figure 3.39: Existing (blue) and Scheme (red) flow velocity. High Water plus 6 hours

Source: *HR Wallingford*

Note: *Extent of Morlais Demonstration Zone (dashed line). Area within which surface devices may be present (continuous line)*

4. References

Morlais Demonstration Zone, Coastal Processes, HR Wallingford Report DER6261-RT001-R02-00, March 2020.

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HR Wallingford is an independent engineering and environmental hydraulics organisation. We deliver practical solutions to the complex water-related challenges faced by our international clients. A dynamic research programme underpins all that we do and keeps us at the leading edge. Our unique mix of know-how, assets and facilities includes state of the art physical modelling laboratories, a full range of numerical modelling tools and, above all, enthusiastic people with world-renowned skills and expertise.

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