International Association of Oil & Gas Producers

Geomatics Guidance Note 3

Contract area description

Revision history

Version	Date	Amendments
5.1	December 2014	Revised to improve clarity. Heading changed to 'Geomatics'.
4	April 2006	References to EPSG updated.
3	April 2002	Revised to conform to ISO19111 terminology.
2	November 1997	
1	November 1995	First issued.

1. Introduction

Contract Areas and Licence Block Boundaries have often been inadequately described by both licensing authorities and licence operators. Overlaps of and unlicensed slivers between adjacent licences may then occur. This has caused problems between operators and between licence authorities and operators at both the acquisition and the development phases of projects. This Guidance Note sets out a procedure for describing boundaries which, if followed for new contract areas world-wide, will alleviate the problems.

This Guidance Note is intended to be useful to three specific groups:

1. **Exploration managers** and **lawyers** in hydrocarbon exploration companies who negotiate for licence acreage but who may have limited geodetic awareness
2. **Geomatics professionals** in hydrocarbon exploration and development companies, for whom the guidelines may serve as a useful summary of accepted best practice
3. **Licensing authorities**.

The guidance is intended to apply to both onshore and offshore areas. This Guidance Note does not attempt to cover every aspect of licence boundary definition. In the interests of producing a concise document that may be as easily understood by the layman as well as the specialist, definitions which are adequate for most licences have been covered. Complex licence boundaries especially those following river features need specialist advice from both the survey and the legal professions and are beyond the scope of this Guidance Note. This Guidance Note is not applicable to onshore Canada and the US where licences are based on the DLS and PLSS cadastral survey systems.

2. Contract Area Definition – Recommended Practice

Descriptions of the extent of contract areas and licence block boundaries should have:

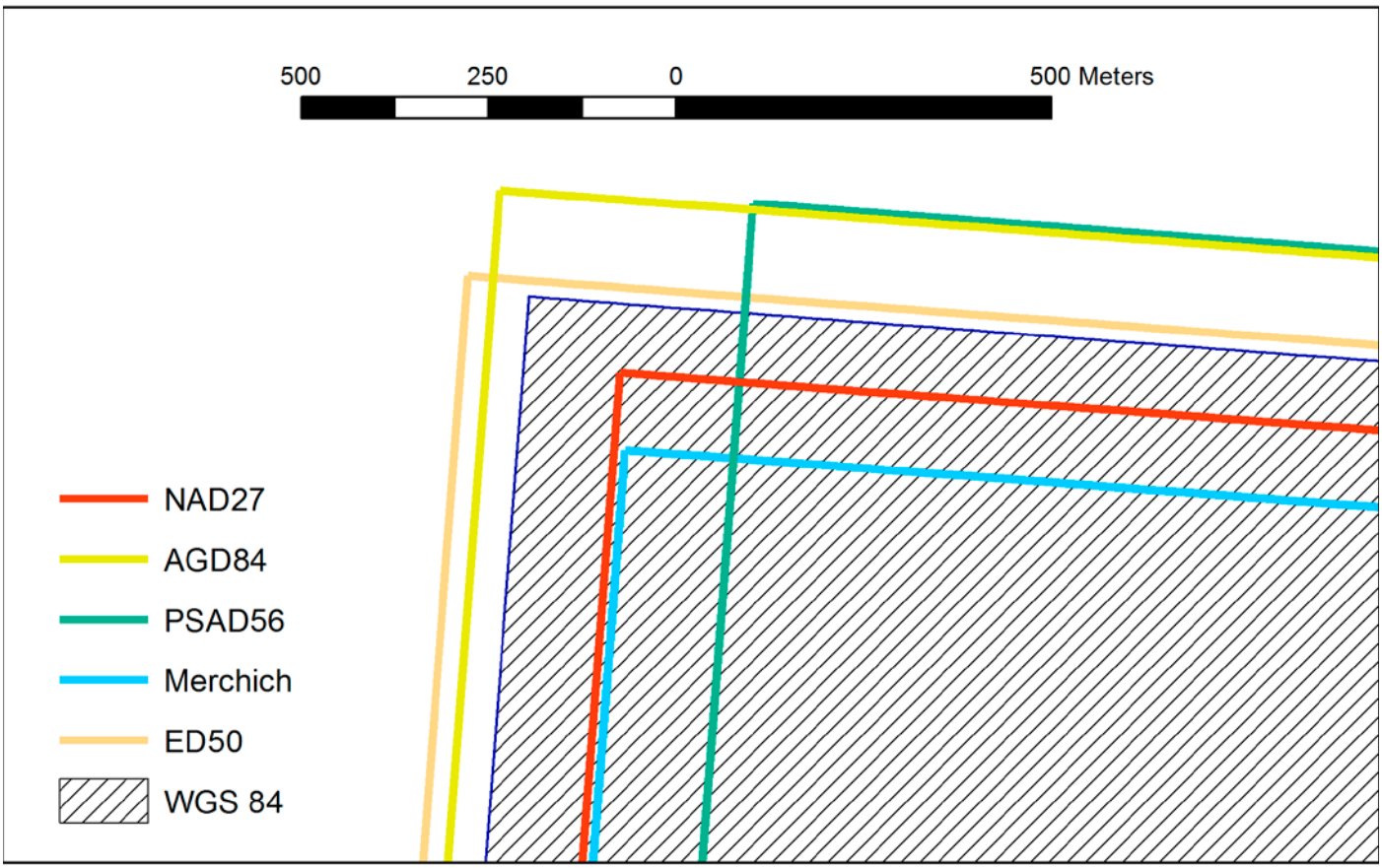
- a narrative description identifying features forming (a part of) the boundary
- a list of coordinates of boundary turning points
- identification of the type of line joining successive boundary turning points
- definition of the coordinate reference system to which coordinates are referenced
- a map depicting the licence and surrounding identifiable geographic features.

A statement giving the area of the licence block should be included.

3. Choice of Coordinate Reference System

Coordinates – including latitude and longitude – are ambiguous unless qualified by the relevant Coordinate Reference System (CRS) identification. The geodetic datum is an essential part of the CRS description. A lack of geodetic datum definition leaves a potential ambiguity in position of many hundreds of metres. Refer to OGP Geomatics Guidance Note 373-01 and see Figure 1.

Figure 1 – Differences from WGS 84 of a turning point having the same coordinates referenced to other geodetic datums



The definition of the coordinate transformation between onshore and offshore Coordinate Reference Systems defining licence areas, and between any defined geodetic datum and WGS 84 or other realization of the ITRF should be agreed between operators and the licensing authority and between operators of abutting licences. The definition of the coordinate transformation should be published and adopted for use by all operators. Note that an operator may use other coordinate transformations for specific Company purposes – e.g. for pipeline landfall work – but for the purposes of all data publication and exchange the agreed transformations should be used.

4. Defining the Coordinate Reference System

Coordinate Reference System (CRS) descriptions should follow OGP Geomatics Committee guidelines, which are consistent with the ISO 19111 data model. This Guidance Note summarizes the necessary set of coordinate reference system attributes to be defined. For a more detailed description of these parameters refer to OGP Geomatics Guidance Notes 5 and 7 (part 2) and to OGP's EPSG Geodetic Parameter Dataset.

For all contract areas a description of the horizontal coordinate reference system is essential. When both geodetic (geographic) and projected (map grid) coordinates are given there is potential for inconsistency and should this approach be taken the defining set should be stated. A description of the vertical coordinate reference system is required for licences that are limited by depth. Although not usually required for licence definition it is recommended that the vertical CRS to be used for operations is stated.

In all cases the units, whether angular and linear, must be fully described. If the standard SI unit for length (metre) is not used, the conversion factor to SI units for the unit used (the number of metres per unit) should be included in the CRS defining parameters.

The definition should include the code for the coordinate reference system as given in OGP's EPSG Geodetic Parameter Dataset.

Geographic Coordinate Reference System description

The following CRS attributes are required for coordinates given by latitude and longitude:

Entity	Descriptor	Example
Geographic CRS:	Name	ED50
Geodetic datum:	Name	European Datum 1950
Ellipsoid:	Name	International 1924
	Semi major axis (a)	6378388.000 m
	Inverse flattening (1/f)	1/297.00000
Coordinate system axes:	Axis name, order, units	Latitude, longitude, degrees
EPSG CRS identifier	Code	4230

Projected Coordinate Reference System description

Where boundaries are described on a particular map projection, the projection definition must be included to adequately describe the projected coordinate reference system. The following CRS attributes are required for a licence boundary description given by map grid coordinates:

Entity	Descriptor	Example
Projected CRS:	Name	ED50 / UTM zone 31N
Geodetic datum:	Name	European Datum 1950
Ellipsoid:	Name	International 1924
	Semi major axis (a)	6378388.000 m
	Inverse flattening (1/f)	1/297.00000
Map projection:	Name	UTM zone 31N
Method:	Name of map projection method	Transverse Mercator
Projection parameters:	A list of parameters and parameter values specific to the projection method, e.g. for Transverse Mercator:	
	Latitude of Natural Origin	0 degrees North
	Longitude of Natural Origin	3 degrees East of Greenwich
	Scale Factor at Origin	0.9996
	False Easting	500,000.0 m
	False Northing	0.0 m
Coordinate system axes	Axis name, abbreviation, order, units	Easting E, Northing N, metres
EPSG CRS identifier	Code	23031

For all other map projection methods, all parameters needed to fully describe that map projection method are required. Refer to OGP Geomatics Guidance Note 7 part 2.

Vertical Coordinate Reference System description

Entity	Descriptor	Example
Vertical CRS:	Name	Newlyn height
Vertical datum:	Name	Ordnance datum Newlyn
Coordinate system axis	Axis name, abbreviation, units	Height H, metres
EPSG CRS identifier	Code	5701

To avoid licence boundaries overlapping or gaps between licences being created due to coordinate reference system inconsistency, for new licence areas:

- boundaries for onshore licences should usually be described by turning points defined by projected (map grid) coordinates using the national map grid
- boundaries for offshore licences should usually be described by turning points defined by geographic coordinates (latitude & longitude) using the national geodetic coordinate reference system
- consistency with the CRS and line type used for adjacent existing licence definitions should be maintained where possible
- for new licence areas offshore where the licensing authority has not defined the Coordinate Reference System and there is no response to requests for clarifications about the system, then a realization of current International Terrestrial Reference Frame (ITRF) should be adopted.

5. Describing the boundary

The boundary may be described as an ordered series of coordinated turning points using either geographic (latitude & longitude) or grid (easting & northing) coordinates. For such areas the outline should be described as follows:

Point	Latitude	Longitude	Line from – to	Line Type
A	50°10′00.0″N	10°12′00.0″E		
			A – B	Parallel
B	50°10′00.0″N	10°24′00.0″E		
			B – C	Meridian
C	50°00′00.0″N	10°24′00.0″E		
			continue until…	
N	50°05′30.0″N	10°17′00.0″E		
			N – A	Geodesic
A	50°10′00.0″N	10°12′00.0″E		

Note that to close the polygon the start point (A) should be repeated as the last point.

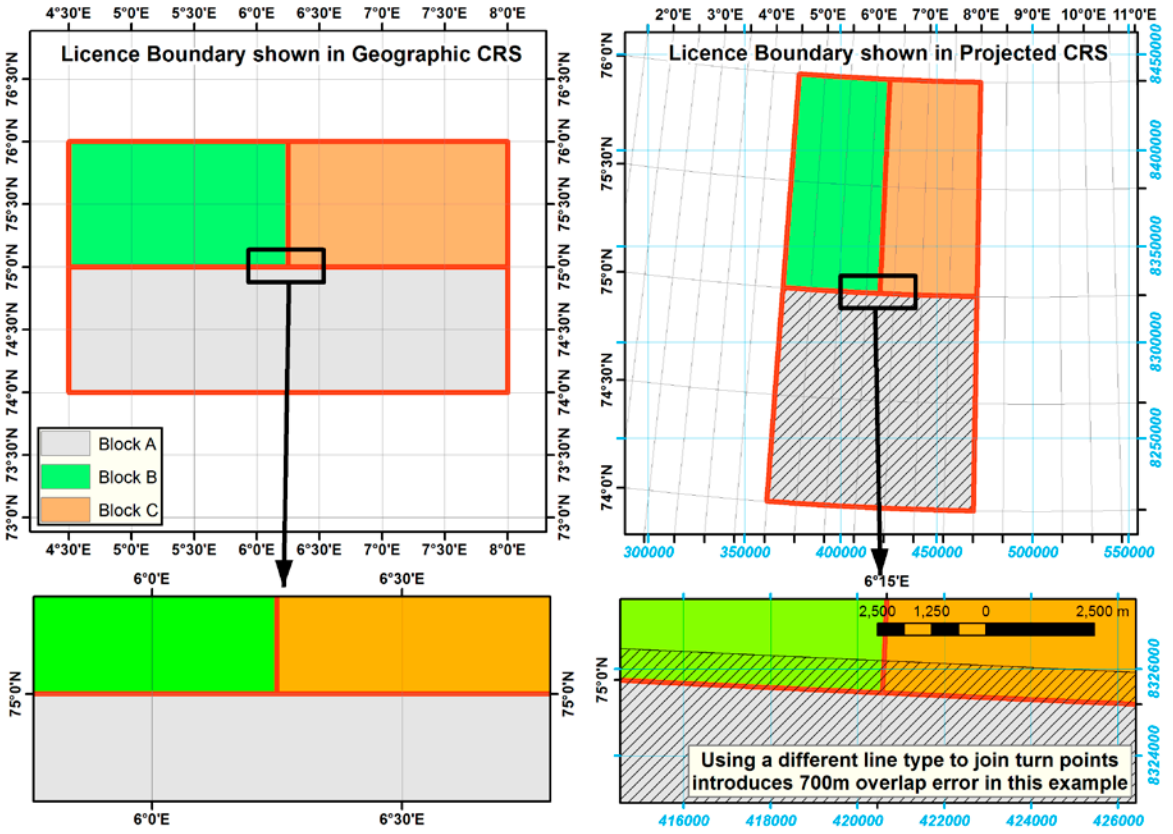
It is important to define the line type that joins the turning points. Line type may be:

Line Type	Property	Turning Point Defined by
Parallel	Line of equal latitude	Geographic coordinates
Meridian	Line of equal longitude	Geographic coordinates
Geodesic	Shortest distance on the ellipsoid used to model the Earth	Geographic coordinates
Loxodrome (rhumb line)	Line of constant direction on the ellipsoid used to model the Earth	Geographic coordinates
Grid	Straight line on a map	Grid coordinates

When parallels, meridians, geodesics and loxodromes are depicted on a map they usually project as curves. Care should be taken to use the curve and not the chord (straight line on the map) to define intermediate points along the boundary. Curve and chord can differ in path by a few metres to over a kilometre depending on line length, map projection and position on the earth. To illustrate the problem refer to Figure 2.

Block A is an existing licence whose northern boundary follows a parallel of latitude. Blocks B and C are to abut block A with their common boundary at a tripoint on the northern boundary of Block A. On a map grid such as UTM the trace of the northern boundary of Block A is a curve. Interpolating between the turning points defining the northern boundary of block A using the straight line on the map (the chord) to define the tripoint will introduce an overlap between Block A and Blocks B and C of 700 metres. Note that by default workstations and GIS applications may use the chord interpolation.

Figure 2 – Interpolation for different line types



6. Other types of boundary

The simple case above is for a licence of unlimited depth described through a set of defined turning points. More complex definitions include:

Boundary	Descriptors	Example
Existing legal boundary		International Median Line
	Statutory defining instrument	International agreement details
	Date	day/month/year
Physical feature	Name	Coastline
	Definition of boundary	Low water mark
	Defining instrument	Map, scale, date, publisher
Depth constraint	Vertical CRS description	Licence is limited to 3000ft depth

An irregular boundary such as a coastline will normally be held as a series of coordinated points digitized from the defining instrument – e.g. a topographic map – at an interval suitable to accurately describe the boundary as a set of straight grid lines joining these points.

Note that certain boundaries change with time. These may be physical features such as rivers, coastline. For these boundaries it is essential that the defining instrument descriptor carries a date stamp. For such features it is preferable, where legally possible, to describe the boundary as a set of coordinated points defining the boundary on the defining instrument, and then agree with the licensing authority and abutting licencees that these coordinates now take precedence over the physical feature, thereby making the licence definition independent of the feature.

Enclaves: An enclave is an area excluded from the licence which lies wholly within the licence external boundary. This can be addressed by defining the excluded internal boundary in the same way as for the licence external boundary, with the licence textual definition excluding the enclave from the licence area.

Line extensions: These are boundaries described by the projection of a defined line until it intersects with another feature, e.g. a coastline or a median line. A variation is to describe the extension as being from a given point in a defined direction (for which the distinction between true and map grid direction will generally be significant). The method of calculation of the computed coordinates of the intersection point should be agreed with the licensing authority and any abutting licence holders.

There are special cases of line definitions where the legal boundary definition is on a Coordinate Reference System different from that to be used for licence operations. In such cases it is generally not adequate to merely convert the boundary turning points. It may be necessary to describe the boundary as a series of interpolated points before executing the coordinate conversion.

7. Computation of the Area covered by the Licence

A licence area may be computed in three ways:

i. an area on the map grid: simple to compute, but affected by map projection scale error

ii. an area on the ellipsoid: a more complex computation but a nominally 'true' area that is traceable to the standard for length

iii. an area at ground level: easy to compute, also nominally 'true', but requires the scale factor for the CRS to be 1.0 at the mean ground height.

The three forms will provide a different area value, depending on the parameters that define the CRS of the licence polygon. The ellipsoidal form is suitable for any sized licence and is commonly used for large exploration areas, while grid and ground level areas tend to be used for smaller licences, particularly development licences. Grid areas have been commonly used in the past because computations were traditionally made using a planimeter measurement on a map and later were available in most GIS applications. Applications capable of computing ellipsoidal areas are now more common place and for new licences this area computation method should be adopted where appropriate.

OGP recommends that:

- the licensing authority adopt and document with the licence definition a single method to compute a licence area
- for licences defined by a geographic CRS the ellipsoid area is recommended because of its universal and unambiguous nature
- for licences defined by a projected CRS grid area is recommended
- the licence area is quoted with a precision of not more than 0.1% of the total area to limit numerical ambiguity. In SI units, this implies:

Area	Quote to the nearest:
> 1,000 km^2	1 km^2
< 1,000 km^2	0.1 km^2
< 100 km^2	0.01 km^2
< 10 km^2	0.001 km^2

OGP recommends that license authorities and holders consult with a Geomatics/geodetic professional to define a single, consistent method to compute and negotiate license areas.

8. Working with historic incomplete definitions

This section describes recommended working practice in areas for which licences have been issued but for which the descriptions are incomplete.

8.1. Inadequate definition by licensing authority:

a) Where the licence area definition issued by a licensing authority is incompletely described operators acquiring licences should adopt the following procedure:

- Request clarification from the licensing authority.
- Discuss with all abutting licence holders.
- Agree with licensing authority and abutting licence holders the de facto definition to be adopted to adequately define the boundaries.
- Ensure that any new abutting licensee is advised of the agreement and adopts the same de facto definition.

b) If licence turning points are given as both geodetic (geographic) and projected (map grid) coordinates there is potential for ambiguity. Operators should seek clarification using the procedure above.

c) Where no statement is included in existing licence definitions defining line types and no answers to clarifications have been received from the licensing authority, then the following assumptions should be made:

- Where grid coordinates are provided for turning points to describe the license boundary then grid lines on the relevant map projection joining these points should be assumed.
- Where geographic coordinates are provided to define the turning points then the following should be assumed:
  - If consecutive turning points have the same latitude, the boundary should be assumed to follow that parallel.
  - If consecutive turning points have the same longitude, the boundary should be assumed to follow that meridian.
  - If consecutive turning points have different latitude and different longitude, the boundary should be assumed to follow the geodesic (shortest line).

c) For licenses that include a disputed international maritime boundary, seek clarification regarding the status of the dispute.

8.2 Inconsistencies between boundaries of abutting licences

Where abutting licences are found to have inconsistent definitions for their common boundary, in conjunction with the licensing authority the licencees should agree to redefine their common boundary descriptions to be consistent.

In exceptional circumstances different coordinate reference systems may have to be used to describe the same boundary points. This may require special treatment of the description of boundary line for at least one of the licences.

9. Examples

Note: All examples are theoretical, to illustrate the principles recommended in these guidelines.

Example 1: Simple case, offshore North Sea licence

The licence area (shown for illustrative purposes on the following map) is bounded by:

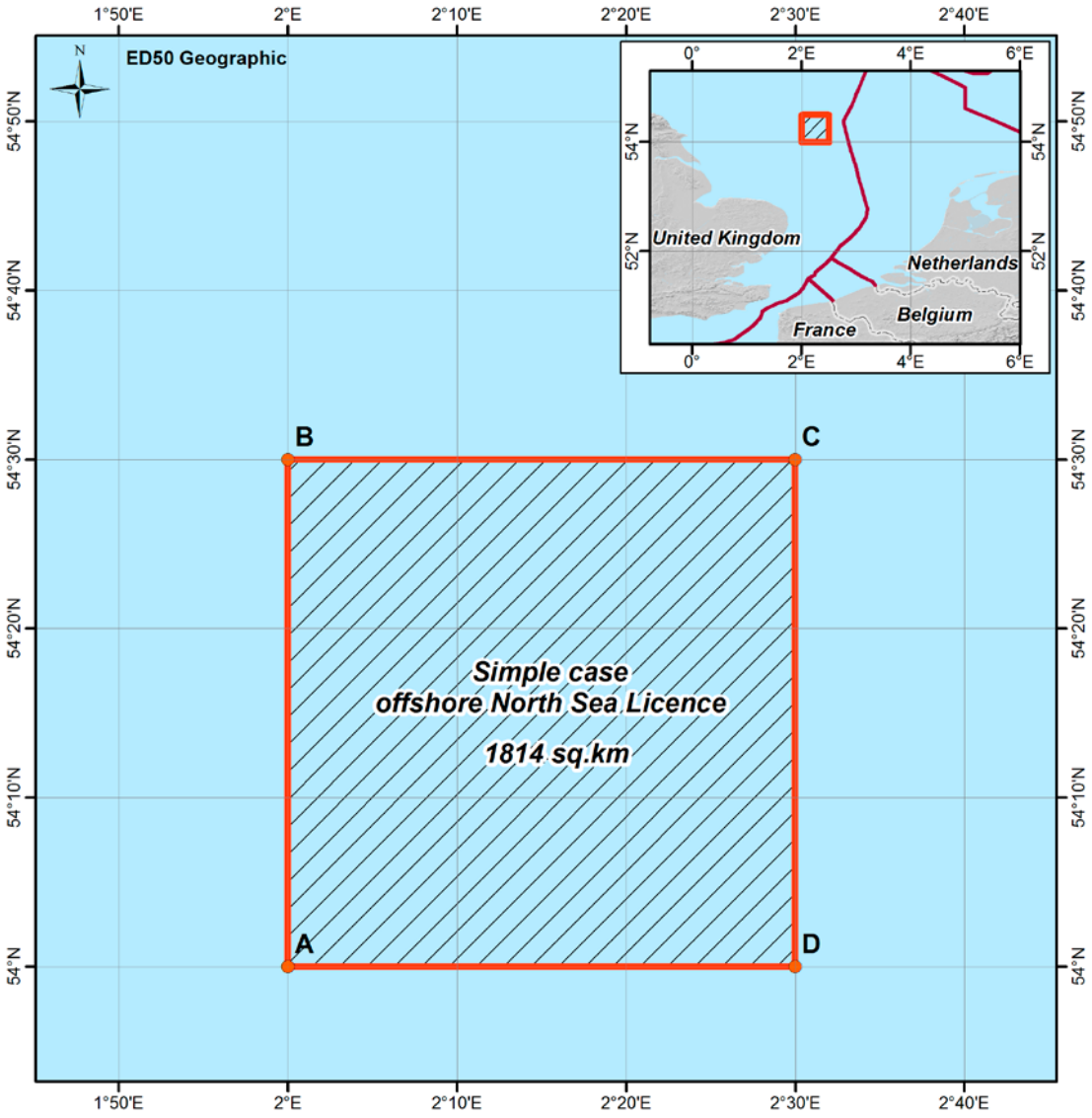
Point	Latitude	Longitude	Line from – to	Line Type
A	54°00′00.0″N	2°00′00.0″E		
			A – B	Meridian
B	54°30′00.0″N	2°00′00.0″E		
			B – C	Parallel
C	54°30′00.0″N	2°30′00.0″E		
			C – D	Meridian
D	54°00′00.0″N	2°30′00.0″E		
			D – A	Parallel
A	54°00′00.0″N	2°00′00.0″E		

Coordinates are referenced to the following system:

Coordinate Reference System name:	ED50
Geodetic datum name:	European Datum 1950
Ellipsoid name:	International 1924
Ellipsoid semi major axis (a):	6378388.000 m
Ellipsoid inverse flattening (1/f):	297.0
Coordinate system axes:	Latitude, longitude, degrees
EPSG CRS identifier	4230

On this reference system the area of the licence calculated in ellipsoidal terms is 1814 sq. km to 1 sq. km.[1]

[1] *Note: the equivalent grid area calculated to 0.1 sq. km. on the ED50 / UTM zone 31 projected coordinate reference system would be 1812.6 sq. km as opposed to 1814.0 sq. km.*


ED50 Geographic
N
1°50'E
2°E
2°10'E
2°20'E
2°30'E
2°40'E
54°50'N
54°40'N
54°30'N
54°20'N
54°10'N
54°N
0°
2°E
4°E
6°E
54°N
52°N
United Kingdom
Netherlands
Belgium
France
B
C
A
D
Simple case
offshore North Sea Licence
1814 sq.km

Example 2: Simple case, onshore UK Licence

The licence area (shown for illustrative purposes on the following map) is bounded by:

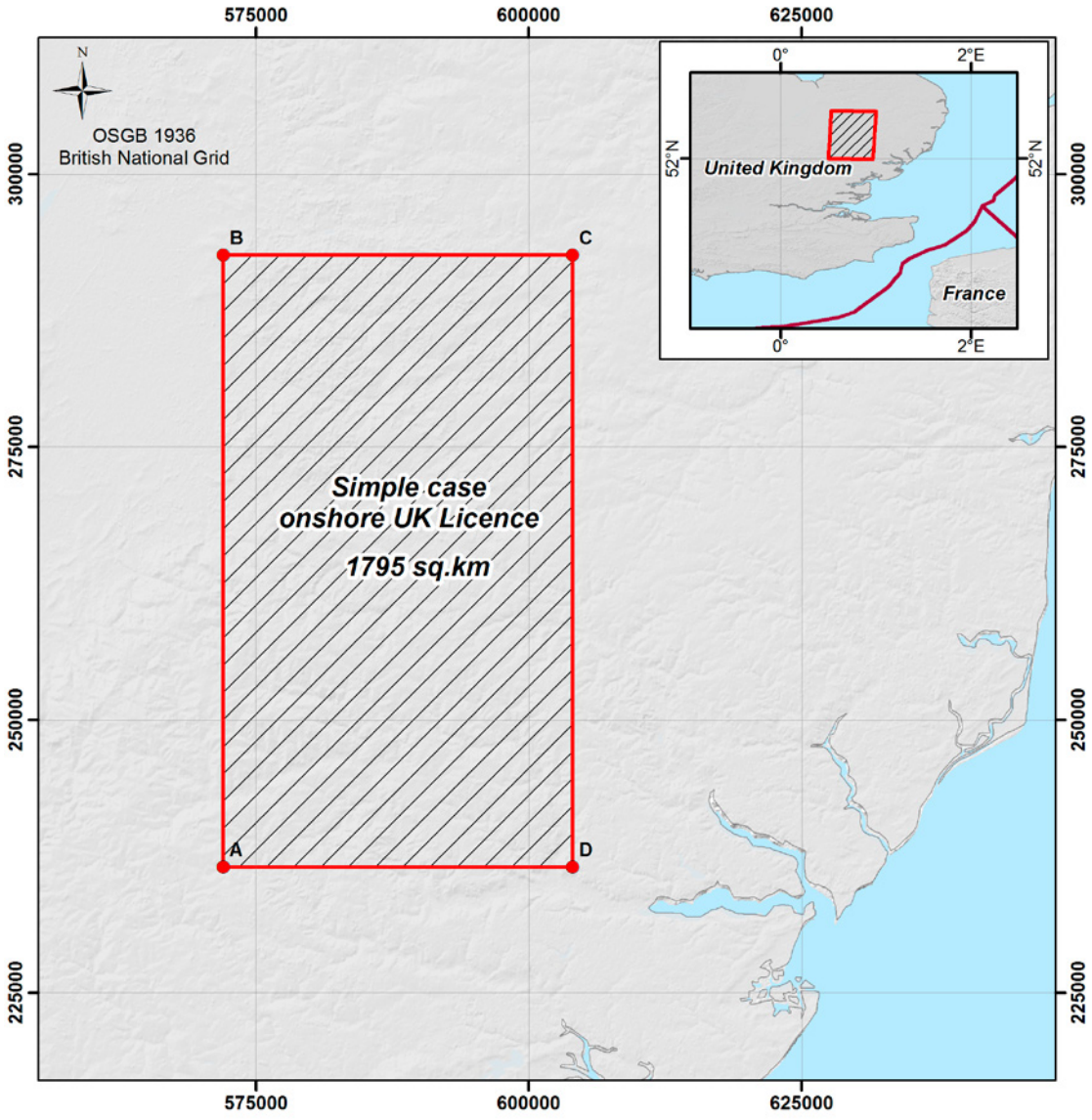
Point	Easting	Northing	Line from – to	Line Type
A	572000.00	236500.00		
			A – B	Grid
B	572000.00	292600.00		
			B – C	Grid
C	604000.00	292600.00		
			C – D	Grid
D	604000.00	236500.00		
			D – A	Grid
A	572000.00	236500.00		

Coordinates are referenced to the following system:

Coordinate Reference System name:	OSGB 1936 / British National Grid
Geodetic datum name:	OSGB 1936
Ellipsoid name:	Airy 1830
Ellipsoid semi major axis (a):	6377563.396 m
Ellipsoid inverse flattening (1/f):	299.3249646
Map projection:	British National Grid
Method:	Transverse Mercator
Latitude of Natural Origin	49 degrees North
Longitude of Natural Origin	2 degrees West of Greenwich
Scale Factor at Origin	0.999601272
False Easting	400,000.0 m
False Northing	-100,000.0 m
Coordinate system axes:	Easting, Northing, metres
EPSG CRS identifier	27700

On this reference system the area of the licence calculated in map grid terms is 1795 sq. km to 1 sq. km.

During licence operations heights and depths should be given in metres referenced to the Newlyn vertical coordinate reference system.


575000
600000
625000
N
OSGB 1936
British National Grid
300000
275000
250000
225000
B
C
A
D
Simple case
onshore UK Licence
1795 sq.km
0°
2°E
52°N
United Kingdom
France

Example 3: A more complex case.

Description:

The licence area boundary starts at point A situated at the intersection of the meridian of 1°07′26″E with the boundary of the UK Continental Shelf as defined in Continental Shelf (Designation of Additional Areas) Order 1982 published by HMSO on 30th day of July 1982, SI 1982/1072, ISBN 0 11 027072 X, runs northwards along this meridian to point B being its intersection with the mean low water line as shown on Ordnance Survey of Great Britain 1/25,000 scale mapping at the date of this contract agreement, follows the mean low water eastwards to point C being its intersection with the parallel of 51°05′58.0″N, then follows the said parallel eastwards to its intersection with the boundary of the UK Continental Shelf at point D which coincides with SI 1982/1072 coordinates (11), then follows the boundary of the UK Continental Shelf southwestwards back to point A which coincides with SI 1982/1072 coordinates (6).

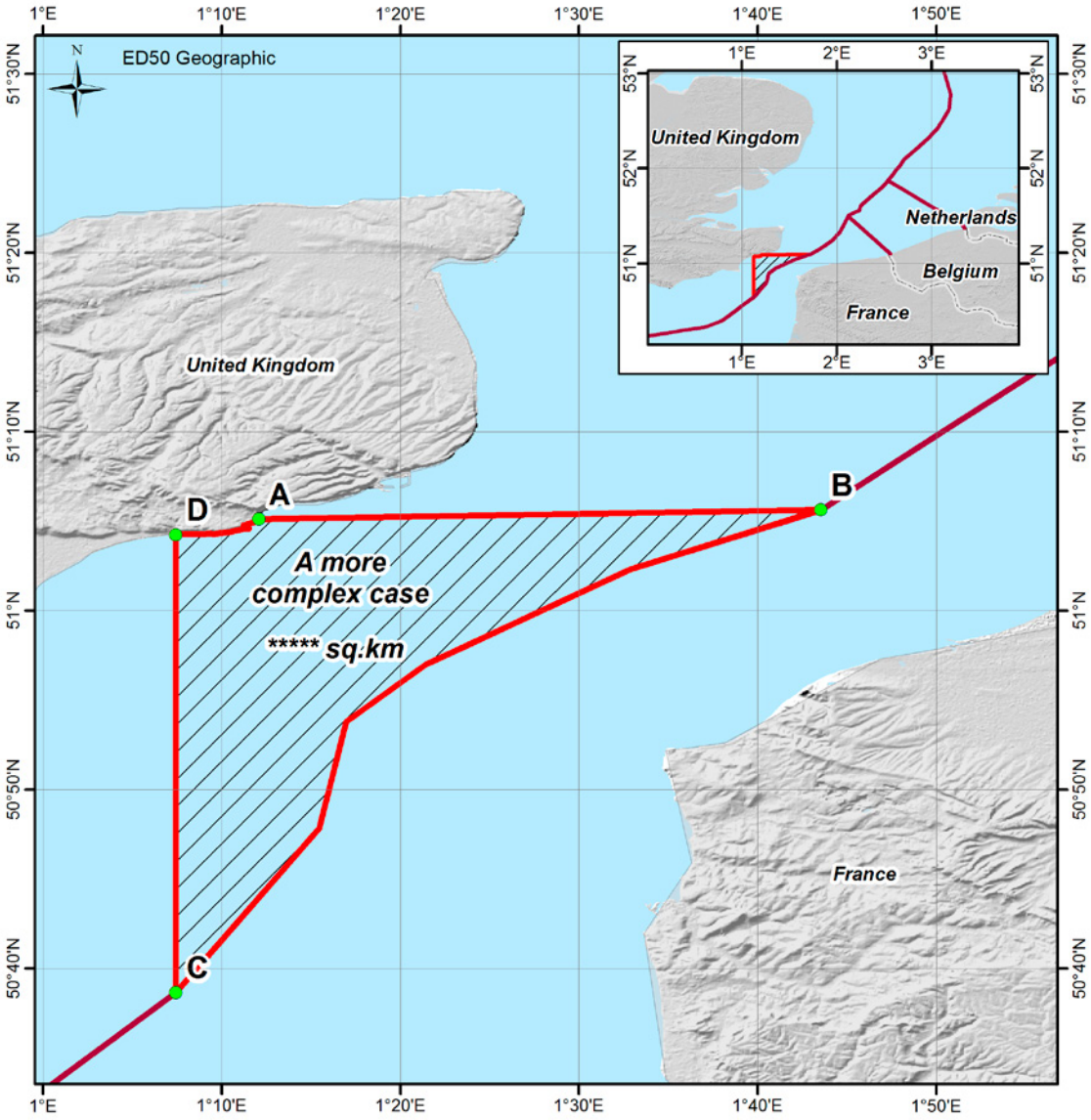
The licence area (shown for illustrative purposes on the map below) is bounded by:

Point	Latitude	Longitude	Line from – to	Line Type
A	50°38′38.0″N	1°07′26″E		
			A – B	Meridian
B	Approximately 51°04′15.0″N	1°07′26″E		
			B – C	Mean low water line as defined on Ordnance Survey of Great Britain 1/25000 scale map series as published at the date of this agreement. (Note: recommended practice is to include a list of coordinates of points representing this line in the licence agreement, these forming the authoritative licence boundary, but omitted in this example for brevity).
C	51°05′58.0″N	Approximately 1°12′06.0″E		
			C – D	Parallel
D (11)	51°05′58.0″N	1°43′31.0″E		
10	51°02′19.0″N	1°32′53.0″E	D – A	UK Continental Shelf boundary as defined in Continental Shelf (Designation of Additional Areas) Order 1982 published by HMSO on 30th day of July 1982, SI 1982/1072, ISBN 0 11 027072 X. This document defines each segment to be a geodesic between successive turning points 11 to 6.
9	50°57′00.0″N	1°21′25.0″E		
8	50°53′47.0″N	1°16′58.0″E		
7	50°47′50.0″N	1°15′28.0″E		
A (6)	50°38′38.0″N	1°07′26″E		

Coordinates are referenced to the following system:

Coordinate Reference System name:	ED50
Geodetic datum name:	European Datum 1950
Ellipsoid name:	International 1924
Ellipsoid semi major axis (a):	6378388.000 m
Ellipsoid inverse flattening (1/f):	297.0
Coordinate system axes:	Latitude, longitude, degrees
EPSG CRS identifier	4230

On this reference system the area of the licence calculated in ellipsoidal terms is 738.3 sq. km to 0.1 sq. km.



Example 4: Enclave

The licence area (shown for illustrative purposes on the attached map) is bounded by:

Point	Latitude	Longitude	Line from – to	Line Type
A	54°00′00.0″N	2°00′00.0″E		
			A – B	Meridian
B	54°30′00.0″N	2°00′00.0″E		
			B – C	Parallel
C	54°30′00.0″N	2°30′00.0″E		
			C – D	Meridian
D	54°00′00.0″N	2°30′00.0″E		
			D – A	Parallel
A	54°00′00.0″N	2°00′00.0″E		

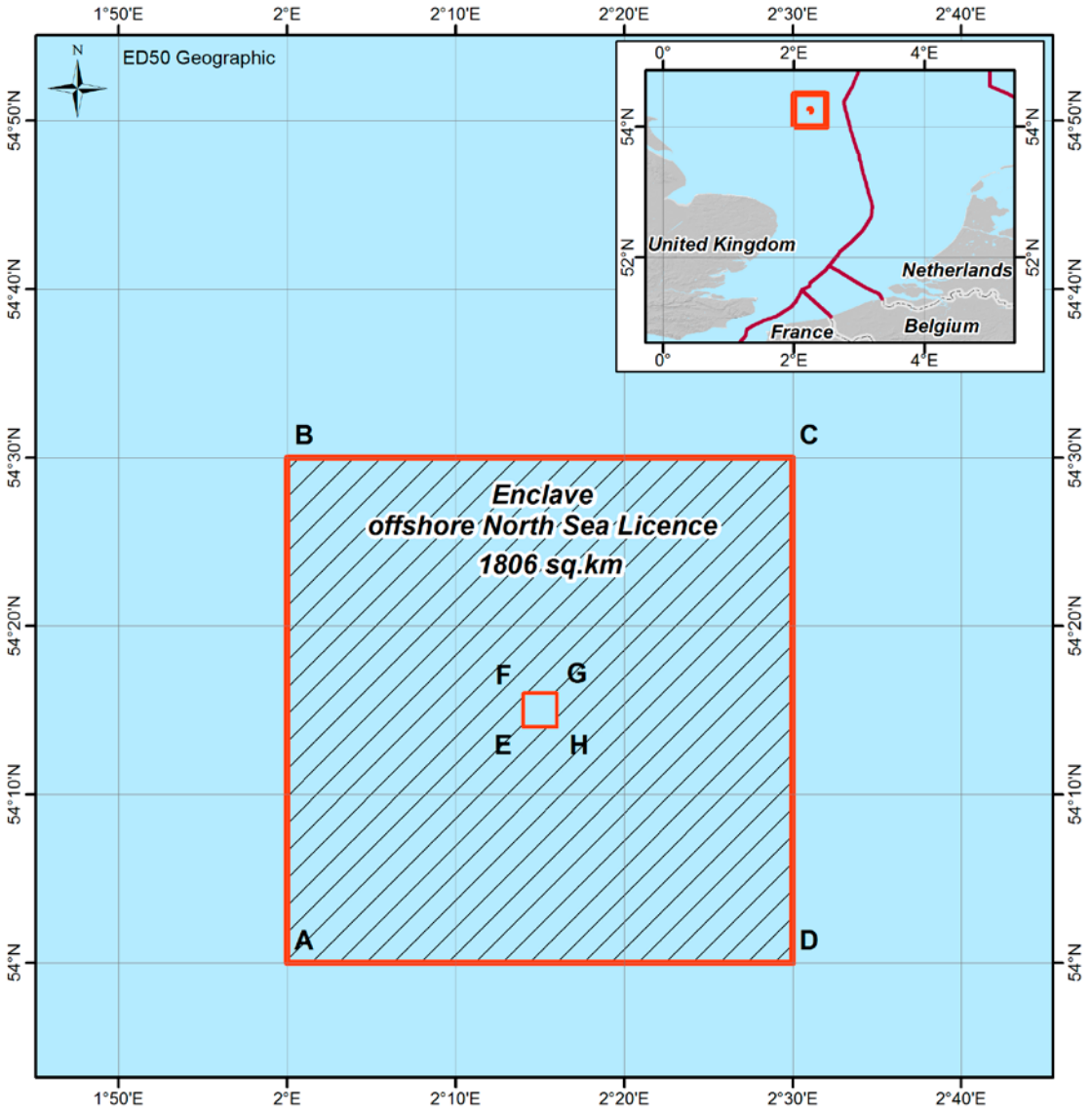
excluding the following enclave, which does not form part of the licence area:

Point	Latitude	Longitude	Line from – to	Line Type
E	54°14′00.0″N	2°14′00.0″E		
			A – B	Meridian
F	54°16′00.0″N	2°14′00.0″E		
			B – C	Parallel
G	54°16′00.0″N	2°16′00.0″E		
			C – D	Meridian
H	54°14′00.0″N	2°16′00.0″E		
			D – A	Parallel
E	54°14′00.0″N	2°14′00.0″E		

Coordinates are referenced to the following system:

Coordinate Reference System name:	ED50
Geodetic datum name:	European Datum 1950
Ellipsoid name:	International 1924
Ellipsoid semi major axis (a):	6378388.000 m
Ellipsoid inverse flattening (1/f):	297.0
Coordinate system axes:	Latitude, longitude, degrees
EPSG CRS identifier	4230

On this reference system the area of the licence calculated in ellipsoidal terms is 1806 sq. km to 1 sq. km.


ED50 Geographic
N
1°50'E
2°E
2°10'E
2°20'E
2°30'E
2°40'E
54°50'N
54°40'N
54°30'N
54°20'N
54°10'N
54°N
0°
2°E
4°E
54°N
52°N
United Kingdom
Netherlands
France
Belgium
B
C
A
D
Enclave
offshore North Sea Licence
1806 sq.km
F
G
E
H

10. References

EPSG Geodetic Parameter Dataset, http://www.epsg.org and http://www.epsg-registry.org

OGP (2007) Geomatics Guidance Note 1, *Geodetic Awareness*, OGP Report No. 373-01, available from http://www.ogp.org.uk/pubs/373-01.pdf

OGP (2009) Geomatics Guidance Note 5, *Coordinate reference system definition*, OGP Report No.373-05, available from http://www.ogp.org.uk/pubs/373-05.pdf

OGP (2013) Geomatics Guidance Note 7 part 2, *Coordinate conversions and transformations including formulas*, OGP Report No. 373-07 part 2, available from http://www.ogp.org.uk/pubs/373-07-2.pdf

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