3 DECOMMISSIONING PROGRAMMES DESCRIPTION

3.1 Consideration of decommissioning options

Requirement for Decommissioning Programmes:

Installations:
In accordance with the Petroleum Act 1998, the Section 29 notice holders of the Athena field are applying to the Department of Energy and Climate Change to obtain approval for decommissioning the installations detailed in Section 2.1 and 2.2 of the programmes.

Pipelines:
In accordance with the Petroleum Act 1998, the Section 29 notice holders of the Athena Field pipelines are applying to the Department of Energy and Climate Change to obtain approval for decommissioning the pipelines detailed in Section 2.3 of the programmes.

The BW Athena FPSO ceased production in January 2016; the subsea equipment was flushed with treated seawater, the STP buoy was disconnected and the vessel sailed away from the field in February 2016. The STP buoy is located -24m from the surface and is protected by a guard vessel meantime. (Figure 3.1)

Pre decommissioning activities are planned to remove the equipment in the water column comprising:

- STP buoy
- Mooring system including mooring chains/wire ropes and suction can anchors
- Mid Water Arch supporting risers, ESP & EHC between STP buoy and riser base. MWA is tethered to a clump weight base fixed to the seabed by steel piles
- Risers plus cable and umbilical dynamic sections

Installations programme:
Well P and A

- Wells
    - Four producing wells including ESP equipment
    - One water injection well
    - One suspended appraisal well
- Riser base to provide connection and isolation valves between the risers and the flexible flowlines
- Manifold consisting of;
    - Piping module
    - Control module
    - Protection frame
- Tie in spools, cables, hydraulic and chemical hoses between the manifold and the subsea wells including stabilisation features may be completely removed or left in situ depending on discussions with DECC.

Pipelines programme:

- Flowlines
    - One 8” flexible production flowline in two sections of approx. 1km each
    - One 8” flexible water injection flowline in two sections of approx. 1km each
    - One 3” flexible riser flowline in two sections of approx. 1km each
- Flowline risers
    - One 8” flexible production riser approx. 0.38km
    - One 8” flexible Water Injection riser approx. 0.38km
    - One 3” flexible service riser approx. 0.38km
- Electrical ESP Cable and EHC Umbilical
    - ESP Cable with 6 triads capable of powering ESP’s in 6 production wells, dynamic section between the STP buoy and the riser base with static section trenched and buried between the riser base and the production manifold. approx. 2.280km including dynamic riser section 0.38km
    - EHC Umbilical with multiple cores for electrical control, hydraulic fluids and chemicals, dynamic section between the STP buoy and the riser base with static section trenched and buried between the riser base and the production manifold. approx. 2.280km including dynamic riser section 0.38km

A Comparative Assessment was undertaken for the flowline decommissioning programme and the preferred options of the outcome are presented there.

In addition the project will develop detailed engineering and planning for the removal of the subsea equipment.

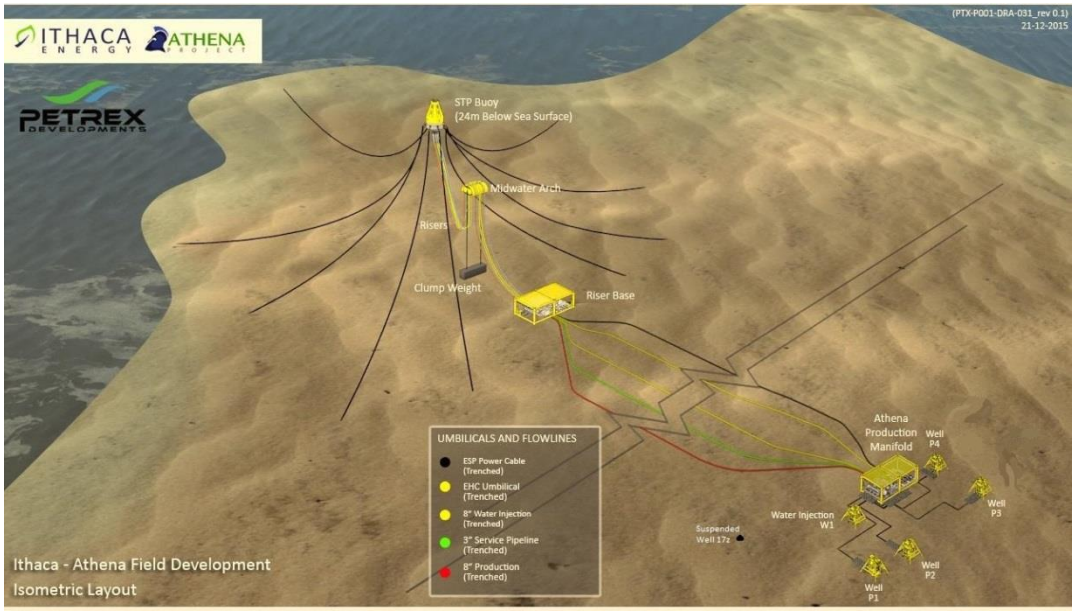


Figure 3.1 – Athena field layout

3.2 Decommissioning schedule

Ithaca considered a number of factors when planning the timing of decommissioning activities, including the availability of suitable rig and other vessels and the seasonal environmental sensitivity of the area.

Pre decommissioning scope to remove the equipment in the water column is expected to be completed in Q3 2016.

Actual subsea decommissioning scope is expected to be carried out between the 4th quarter of 2019 and 2nd quarter of 2020. An outline schedule of work is shown in Table 3.1, although this may be subject to slight change, depending on vessel availability.

Table 3.1 – Outline schedule for proposed Athena field decommissioning programmes

P and A wells	Q4 2019 – Q1 2020
Subsea equipment removal	Q1 2020-Q2 2020
Subsea flowline removal	Q1 2020-Q2 2020
Decommissioned	**May/June 2020**

Individual components of the environment vary in sensitivity over the course of a year (see the Description of the Environment in Section 4). The overall seasonal variability for this part of the North Sea against project schedule are summarised in Figure 3.2.

The overall environmental sensitivity in the vicinity of the proposed Athena Field Decommissioning Programmes and adjacent area is viewed as low to moderate. However there are periods of important seasonal sensitivity for example when rafts of flightless juvenile and moulting auks are present and activities which have the potential to impact on them, such as well P and A will be, as far as possible, avoided during these times. There is also a period of concern for drilling between July and August (JNCC) and any drilling P and A work will, as far as possible, be scheduled to avoid this time. (Figure 3.2)

Figure 3.2 – Summary of seasonal environmental variability in Athena (Block 14/18)

Aspect	Months of the Year: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Operations window	P and A of existing wells is expected to be carried out some time during Q4 2019 and Q1 2020. Removal of the subsea equipment and flowlines is also expected during Q1 and Q2. Sail away of the FPSO completed Q1 2016 and removal of the water column equipment is expected during Q2 2016. The graphic below shows activities for 2019 (top row) and 2020 (bottom). 2019 2020 ***Key: Most likely timing of drilling P&A of wells shown in grey. Blue shows timing of removal activities.***											
Periods of concern	There is a period of concern in Block 14/18 for drilling (July to August), e.g. because of potential adverse effects on bird migrations or fish spawning.											
Water column	Throughout most of the northern and central North Sea, a thermocline develops during summer. This stratification of the water column generally breaks up with the onset of autumnal gales. Wave heights are smallest in summer and greatest in winter.											
Plankton	A phytoplankton bloom occurs in spring, followed by a smaller peak in the autumn. Zooplankton abundance follows a similar seasonality to phytoplankton, although peak abundances lag slightly behind. The zooplankton is dominated in terms of biomass and productivity by Calanoid copepods, which constitute a major food resource for many commercial fish species. ***Key: Period of increased plankton abundance shown in darker blue***											
Benthos	Sensitivity similar throughout the year.											
Commercial fish and shellfish	The area overlaps with known spawning grounds of *Nephrops*, whiting, Norway pout and sprat (see below for timing). The area also supports known nursery grounds of *Nephrops*, blue whiting, Norway pout and sprat **2**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**
	Key: 1 = 1 species spawning, 2 = 2 species spawning, 3= 3 species spawning											
Seabirds and water birds	At an annual scale, the area may be considered to be of moderate importance for seabirds in the context of the North Sea as a whole. Seabird vulnerability to surface pollution in Block 14/18 varies between moderate-low from Dec-Jun and high-very high from Jul-Nov (JNCC 1999). The region is a considerable distance from important coastal water bird sites and seabird breeding colonies. Post breeding dispersal from the colonies sees rafts of adult and juvenile birds, primarily auks, congregate on the sea surface. This, along with birds migrating through the area, accounts for the high vulnerability. The main prey of many bird species is sandeels, which are not present in the fine sediments of the Fladen Ground. ***Seabird vulnerability to surface pollution for blocks: 14/18 (top) and 14/19 (bottom)***											
	4	**2**	**3**	**4**	**3**	**4**	**1**	**1**	**2**	**2**	**2**	**3**
	4	**3**	**4**	**4**	**3**	**4**	**2**	**2**	**3**	**2**	**2**	**3**
	Key: **1 = V High**	**2 = High**	**3 = Moderate**	**4= Low**								
Marine mammals	The most frequently occurring cetaceans in the general Athena area are harbour porpoise, white-beaked dolphin and minke whale. Atlantic white-sided dolphin may also occur in the area, particularly in summer. Limited sightings of killer whale and bottlenose dolphin have also been recorded in the general area. The Moray Firth and the coast of eastern Scotland is home to the only resident population of bottlenose dolphins in the North Sea; however, these are a primarily coastal species and are unlikely to be frequently present in the Athena area. Harbour and grey seals may occur in the proposed Athena area, but in very limited numbers and for fairly short periods of time as this area is beyond their typical foraging habitat. ***Key: Darker colour reflects months when marine mammals most frequently observed***											
Conservation sites	The coasts of north east Scotland, Orkney and Shetland have a variety of important habitats and species protected under international, national and local designations; however, these are all at least 116km from the Athena area. These sites have year round importance. A candidate Special Area of Conservation for pockmark habitat features lies 89km to the east (Scanner pockmark).											
Other users	The Athena area lies within ICES rectangle 45E9; this area receives considerable fishing effort, primarily from demersal trawlers targeting *Nephrops* and demersal fish. In 2006, UK landings into Scotland from rectangle 45E9 were worth approximately £4.5m. Fishing effort fluctuates considerably between months and years, although effort appears to be greatest from Feb-Apr and Aug-Oct. Twenty-five shipping routes pass within 10nm of the proposed Athena location. There are no Ministry of Defence exercise areas, dredging areas or marine disposal sites in the proposed Athena area. There are 17 wells and two gas pipelines within block 14/18. There are no telecommunication cables within Block 14/18. There are no designated protected wrecks in the area, but several wrecks are known. ***Key: Darker colour reflects months when fishing effort is typically greater***											

3.3 Pre Decommissioning scope

STP and mooring system

3.3.1 Removal of STP buoy

STP buoy removal is a reversal of the installation procedure where the risers are removed from the buoy and lowered to the seabed. The CSV crane is attached to the lifting point at the top of the buoy and the anchor chains are disconnected in sequence and lowered to the seabed. The buoy is then recovered to the CSV deck or attached to a tug for towing to an onshore port.

3.3.2 Removal of mooring system

A Single Point Mooring System (SPM) for the FPSO is employed based on the existing Submerged Turret Production (STP) system. This not only provided safe mooring for the FPSO with weather vaning capabilities, but also connection for the various risers and umbilicals. The mooring system comprises 9, equally spaced mooring lines, each line comprising an anchor, and 700m of 84mm R4 studless chain plus 200m of 80mm spiral strand wire rope connected to the STP buoy.

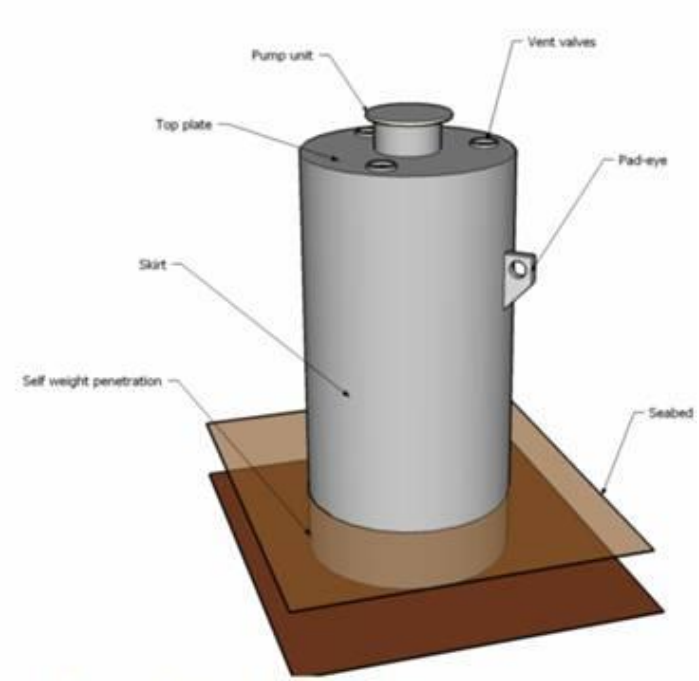
3.3.3 Removal of mooring lines

Each mooring line is disconnected from the associated suction can anchor and recovered to the CSV deck.

3.3.4 Suction can removal

The *BW Athena* was fixed to the seabed via mooring lines attached to 9 suction cans; each can approximately 7.5m in length by 10m diameter. Suction can extraction is achieved through pumping seawater in to the caisson (Figure 3.3).

Figure 3.3– Suction caisson after extraction



The vent valves are closed, allowing water to be pumped into the caisson. The penetration depth provides the required seal for pumping. The pump is lowered onto the caisson by means of docking cones and attaching onto the caisson with hydraulic latch pins. Water is then pumped into the can. The pressure difference between the out and inside of the caisson provides the force on the top plate that expels the caisson from the soil.

The caisson can be extracted to a depth equalling the self-penetration depth and the CSV crane can then completely remove the caisson.

Suction piles are widely used around the North Sea for a variety of applications including platform foundations, subsea manifold foundations and FPSO mooring piles.

3.3.5 Vessels for decommissioning of STP mooring system

Removal of the STP buoy itself is expected to tale *ca*. 4 days, with the mooring system estimated to take 40 days. A small number of vessels will be involved in the operation (Table 3.2).

Table 3.2 – Summary of the expected vessels involved in STP removal

Vessel type	Position fixing	Main activity	Expected time in field	Estimated fuel usage (tonnes /day)
Mooring removal vessel				
Construction Support Vessel	DP	STP mooring	40 days	20 (working) 24 (transit)
Other vessels				
Tug	DP	Mooring anchor recovery	14 days	15 (working) 19 (transit)
Pipe lay vessel	DP	Riser recovery	2 days	20 (working) 24 (transit)

3.3.6 Riser and umbilical removal

The risers, cable and umbilical will be removed in turn from the mid water arch and lowered to the seabed.
The risers may then be disconnected from the riser base and recovered to the pipe lay vessel for transport to onshore for re-use. This activity may however be combined with recovery of the flowlines, cable and umbilical to reduce transit times.

3.3.7 Mid Water Arch

The mid water arch is connected to a clump weight base structure by 2 tethers removal of the tethers requires the mid water arch buoyancy neutralised by pumping water into the stabilisation tanks. The CSV vessel crane can then be connected to the MWA lifting points.

The tethers can then be disconnected and removed. The mid water arch structure is then be floated to the surface by controlled management of the MWA buoyancy.

The MWA may then be recovered to the CSV deck or towed by tug to the selected onshore decommissioning site for cleaning and re-use.

3.4 Well P&A Scope

The P&A scope for the Athena field decommissioning comprises four production wells, one water injection well and one previously suspended appraisal well.

The total P&A programme will be conducted over a period of *ca*. 210 days.

3.4.1 Drilling rig and support

The wells P and A will be completed using an anchored semi-submersible rig, which is yet to be selected. The rig will have in place all the necessary permits and certification to allow it to operate in the UKCS. This type of rig is effectively a deck supported on pontoons which contain ballast tanks. The height of the deck can be altered above the sea surface by pumping seawater in or out of the pontoons. The main deck supports the drilling derrick and associated equipment and storage facilities, with fuel stored in separate tanks in the pontoons

Figure 3.4 – Typical semi-submersible

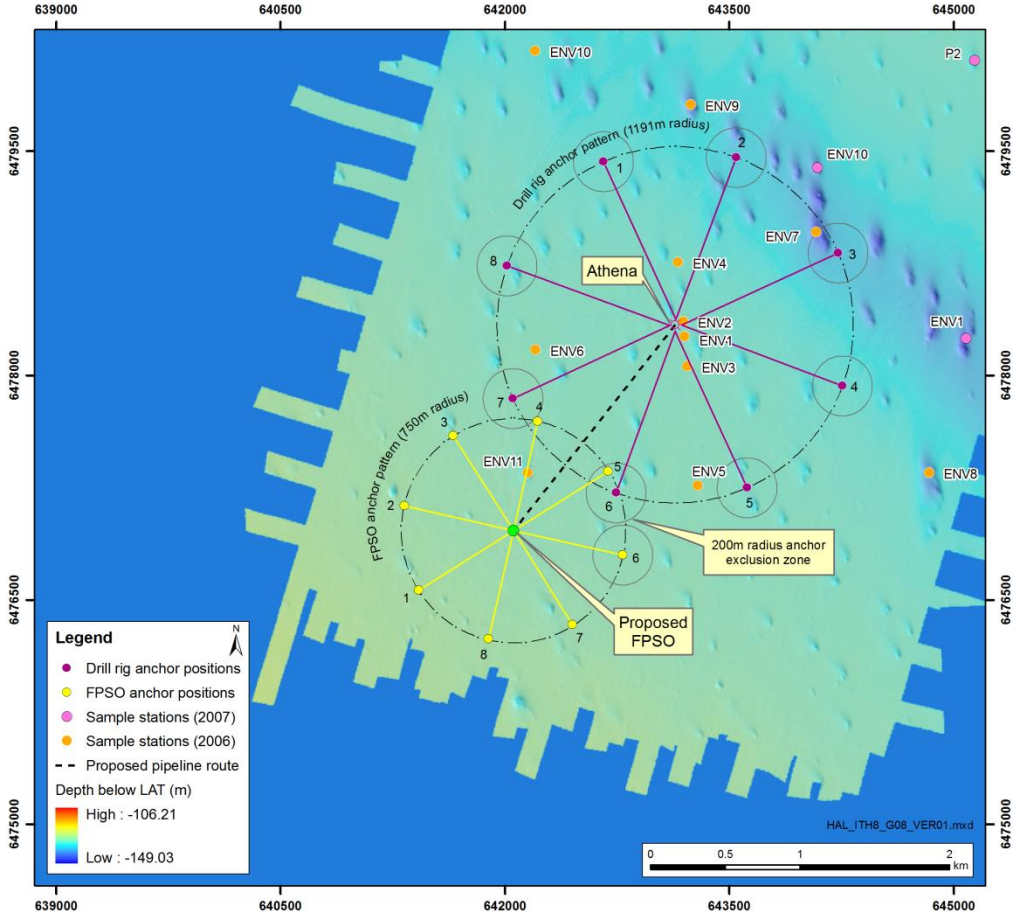
The main deck measures approximately 80mx80m and the draught during drilling P and A is in the region of approximately 20-25m. The drilling derrick, which is located above the drill floor, bears the weight of the "liners",
Two anchor handler vessels are normally used to tow the rig to a well location, each with a minimum bollard pull of 120 tonnes.

Source:
http://www.rigzone.com/news/image_detail.asp?img_id=3174

The rig tow out route is still unknown, but this will be selected in consultation with other users of the sea to minimise interference with other vessels. A third anchor handler may be brought in to run and deploy the rig anchors. The anchors are attached to the rig by cable and near the anchor by chain, of which a proportion lies on the seabed. Hauling or paying out of cable can subsequently make minor adjustments to the rig position.

The precise arrangement of anchors around the rig will be defined by a mooring analysis which will be undertaken prior to bringing the rig into the field and taking account of the water depth, tidal and other currents, winds and seabed features, in the case of the Athena field, the numerous pockmark features. An indicative anchor mooring pattern for an 8 anchor spread, along with the anchor pattern for the FPSO is show in Figure 3.5.

Figure 3.5 – Mooring pattern for an 8 anchor spread



Once the rig is on location and anchors set, the rig will skid across by adjusting the anchors to P&A the water injection well and production/suspended wells in turn. With a semi-submersible the complete rig is moved over the slot on the seabed by pulling on the anchor cables at one side, while relaxing the cables on the opposite side, then re-tensioning. Therefore there will only be one rig anchor deployment.

Whilst in position, a statutory 500m exclusion zone will be established around the drilling rig, in accordance with safety legislation. Unauthorised vessels including fishing vessels and commercial shipping are not permitted access to this area. A standby vessel will be on-station throughout the drilling operations in case of any emergency necessitating evacuation or in the case of man-overboard situation and to warn any non-authorised vessels approaching the exclusion zone.

Mobile rigs have facilities for well P&A, power generation, supporting utilities and accommodation. In addition facilities are provided for well kill activities and cementing.

A typical semi-submersible rig has the following systems:

System	Overview
P&A system	
Kill fluid handling system	Kill fluid tanks with a combined volume of ca. 350m^3 Mixing hoppers and associated mix pumps Bulk pods with a capacity of ca. 300m^3 Mud pumps Surge tank, capacity ca. 4m^3
Cement system	TBA
Utilities	
Power generation	Diesel powered main and back up generators
Diesel sulphur specification	Less than 0.2%
Expected maximum diesel inventory during drilling	*Ca*. 1000 tonnes
Diesel consumption	During drilling – *ca*. 12-18 tonnes/day During non-drilling – *ca*. 6-9 tonnes/day
Helifuel inventory and storage facilities	Helifuel is typically stored in up to three purpose designed, mobile tanks located on the main deck The maximum inventory would be ca. 8m^3
Waste disposal arrangements	Scrap metal and other solid operational wastes are segregated and stored in designated skips for onshore disposal Galley and domestic waste are compacted and stored in compactor bags for onshore disposal Liquid wastes are stored in labeled tanks or drums for onshore disposal Food waste is macerated prior to disposal
Sewage treatment	Rig generally provided with sewage treatment units and has containment facilities for contingency but treated sewage is normally discharged.
Accommodation	Accommodation facilities for ca. 125 personnel Accommodation facilities for ca. 125 personnel. Expected personnel onboard (POB) during development would range between 80 and 100.
Drainage and bilge water treatment systems	Rig floor normally drains to a collecting tank from which fluids are routed to the drain tank and pumped to the dirty pit for back loading to shore Bilges in the pontoons and the machinery space drainage is piped to the dirty water tanks and oily-water separator oil is retained for shipment to shore and cleaned water discharged Helifuel storage area and fuel tank vents all bunded Clean rain water from the main deck would normally be discharged to sea, however the main deck drains can be plugged if necessary

The rig will meet MARPOL standards required for emissions and discharges within Special Areas. During the drilling and completion programme, the rig will require bunkering.

Bunkering will be conducted in favourable sea states and according to the selected rig operator's procedures. Bunkering procedures will be audited by Ithaca as part of the rig selection and contracting process. Hoses will be subject to formal inspection and have colour coded markings according to service and fitted with dry breakaway fittings. All bunkering valves will be locked in the closed position when not in use. Ithaca recognises that there are periods of very high seabird vulnerability during the well P and A period, and so far as practicable, bunkering will be conducted during daylight hours

Any spills on deck will be contained and cleaned-up and the rig will hold supplies of absorption mats and granules for this purpose. Containment absorbents will be segregated for appropriate onshore disposal.

While on site, supply vessels will transport P and A equipment, supplies, water, fuel and food to the rig and return wastes and surplus equipment to shore. It is anticipated that rig supply trips will be required 1-2 times a week, from a supply base in Peterhead/Aberdeen. An estimated 2 helicopter trips per week will make rig personnel transfers to and from Aberdeen.

Once the P and A programme has been completed, a post drilling debris survey will be conducted to confirm that no debris remains on the seabed.

Two or three anchor handlers will be brought into the field and the anchors will be retrieved by sliding pennant wires down each anchor cable towards the anchor allowing a relatively vertical retrieval and assisting the anchor to breakout from the seabed. The rig will discharge ballast (seawater) and then be towed off location.

An indicative drilling P and A schedule for the production suspended and water injection wells is shown in Table 3.3a and b.

Table 3.3a – Indicative drilling P and A schedule for production wells

	Operation	**DAYS**
1	Skid rig and rig up	0.5
2	Recover debris cap	2.0
3	Run BOPs & Kill well	3.0
4	Pull completion	5.0
5	Set isolation plugs	2.0
6	Set cement plugs	8.0
7	Pull BOP and recover Xmas tree,	8.0
8	Run wellhead recovery tool	2.0
9	Cut casing and recover wellhead	3.0
10	Waiting on weather contingency	2.0
11	Operational contingency	2.0
	Estimated Time (including weather and operational contingency)	**37.5**

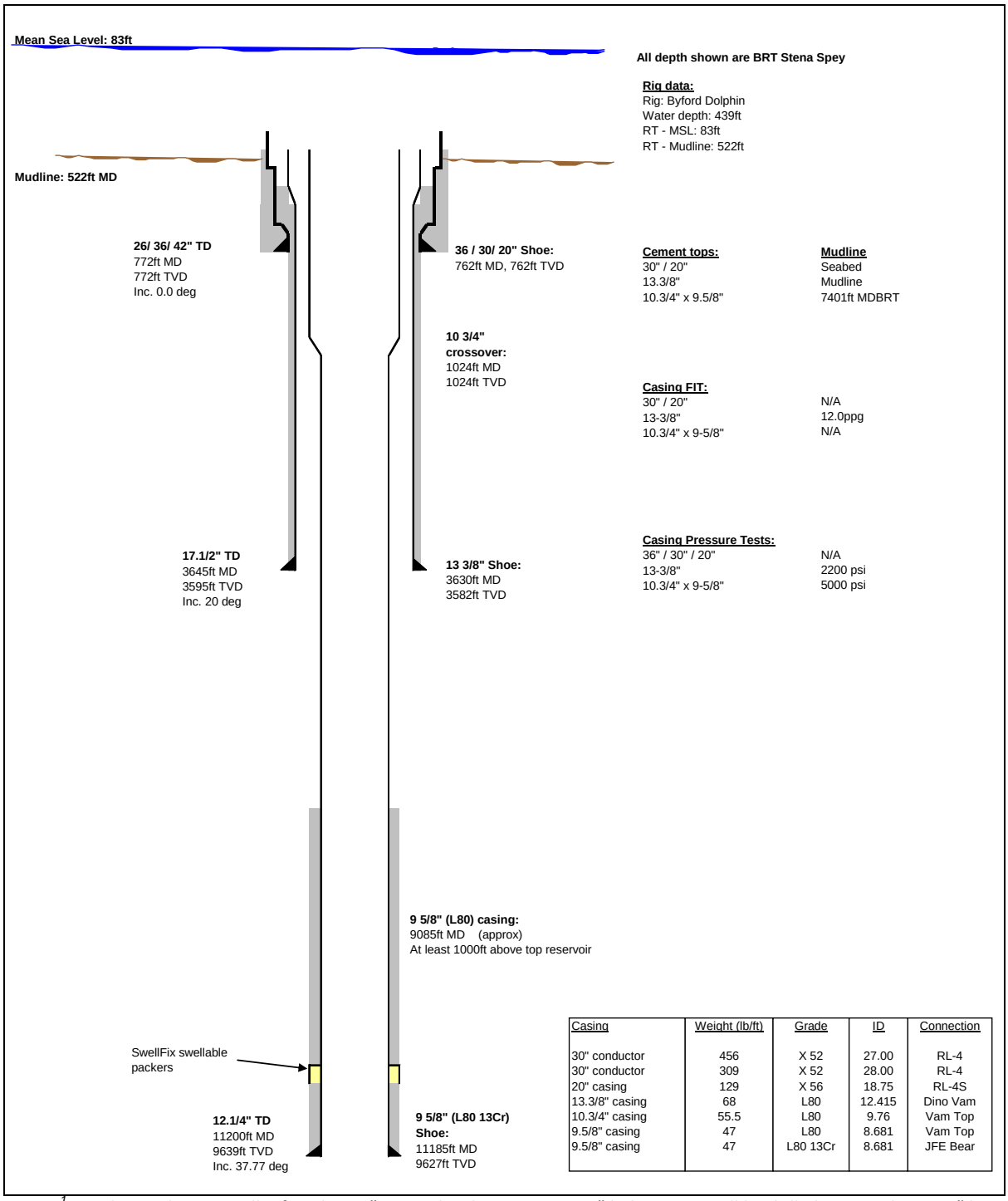
Table 3.3b – Indicative drilling P and A schedule for water injection/suspended wells

	Operation	**DAYS**
1	Skid rig and rig up	0.5
2	Recover debris cap	2.0
3	Run BOPs & Kill well	3.0
4	Set isolation plugs	2.0
5	Set cement plugs	8.0
6	Pull BOP and recover Xmas tree	5.0
7	Run wellhead recovery tool	2.0
8	Cut casing and recover wellhead	3.0
9	Waiting on weather contingency	2.0
10	Operational contingency	2.0
	Estimated Time (including weather and operational contingency)	**29.5**

3.4.2 Well P and A cementing and chemical discharge

A range of P and A cementing chemicals necessary to seal the wells and a summary of their use, discharge and function is given in Appendix 3.

Figure 3.6 – Indicative well casing cementing schematic



Casing	Weight (lb/ft)	Grade	ID	Connection
30" conductor	456	X 52	27.00	RL-4
30" conductor	309	X 52	28.00	RL-4
20" casing	129	X 56	18.75	RL-4S
13.3/8" casing	68	L80	12.415	Dino Vam
10.3/4" casing	55.5	L80	9.76	Vam Top
9.5/8" casing	47	L80	8.681	Vam Top
9.5/8" casing	47	L80 13Cr	8.681	JFE Bear

Notes: [1] For the production well, after the 9⅝" casing has been set, an 8½" hole section will be drilled to TD, where a 7" liner will be set.

Indicative cementing requirements for the wells are shown in Table 3.4. The majority of the cement remains in the casing. Some of the cement used in setting the top sections in place may be discharged to the seabed around the wellhead. To minimise this discharge, cement returns to seabed surface are monitored by ROV.

A range of other chemicals may be selected for contingency use to deal with unplanned drilling events such as stuck tubing or loss of kill fluid circulation. A proportion of these chemicals may be discharged during P and A activities dependant on their nature and function. Although final chemical selection is still to be completed, a full inventory of all chemicals, together with their environmental risks, will be provided by the submission of a PON15B to DECC before drilling P and A commences. All drilling, P and A, utility and contingency chemicals will be selected based both upon their technical specifications and their environmental performance. It is planned that no chemicals listed as endocrine disruptors that cause tainting of fish or which have heavy metal warnings will be used. Similarly, chemicals with substitution warnings will be avoided, where possible.

For the purposes of this assessment, an indicative suite of chemicals, along with estimated use and discharge quantities have been provided in Appendix 3.

Table 3.4 – Indicative cementing requirements for the wells

Hole Section	Casing (inches)	Comments
36"	30 x 20	Cut casing and conductor 2-3m below seabed and recover to rig
17½"	20 x 13⅜	Perforate 20" &13⅜" casing at 750' set 150' plug from 750' to 600' to cover the inside and outside of the 20" &13⅜" casing
12¼"	13⅜ x 9⅝	Perforate 9⅝ casing at 3800' set 500'plug from 3800' to 3300' to cover both inside and outside of the 9⅝ casing
8½" (production well only)	9⅝"x7	Set 800' Combination plug from 10800' to 10000'

After the completions are recovered all wells will be plugged and abandoned in accordance with Oil and Gas UK Guidelines for Abandonment of Wells. Issue 5, July 2015.

3.5 Subsea Installations Removal

3.5.1 Manifold

The manifold incorporates the piping and control modules within a protection frame and facilities for connections of tie-in spools and umbilical's jumpers, support and protection for the production valves. The manifold protection structure is 20m x 9m x 6m and secured to the seabed by 4 x 0.666m diameter piles.
Removal is a reverse of the installation with the piping and control modules disconnected and lifted individually to a CSV. The piles will be cut >0.6m below the seabed and the manifold protection structure also lifted to a CSV.

3.5.2 Riser base

The riser base incorporates a simple distribution system for connecting the pipelines to the risers and fixing clamps for the dynamic sections of the ESP cable and EHC Umbilical. The riser protection frame is 20m x 4.75m x 4m and is secured to the seabed by 4 x 0.666m diameter piles.

Removal is a reverse of the installation with disconnection of the flowlines and fixing clamps for the dynamic sections of the ESP cable and EHC Umbilical and the base lifted to a CSV. The piles will be cut >0.6m below the seabed.

3.5.3 MWA clump weight base

The clump weight base provides an anchor for the mid water arch and the structure comprises a protection frame incorporating two cylindrical containers filled with steel chain. The structure is secured to the seabed by 2 x 30m x 0.666m diameter piles.
Removal is a reverse of the installation with disconnection of the tethers to the mid water arch and the base lifted to a CSV. The piles will be cut >0.6m below the seabed.

3.6 Pipeline Removal

The proposed flowline removal option is to completely remove the flowlines by reverse reeling. The sandy clay soil should allow the flowlines to be reeled directly from the trench on to the CSV or small lay barge: The trench will effectively self-fill on removal of the flowlines, cable and umbilical.
This option causes least disruption to the environment and should reduce vessel time infield.

3.6.1 Flowlines, power cable and EHC umbilical details

The flowlines, power cable and EHC umbilical between the manifold and the riser base are as follows;

- 8” Static flexible duplex carcass production flowline 1900m
- 8” flexible duplex carcass water injection flowline 1900m
- 3” flexible duplex carcass service flowline 1900m
- 8” ESP Power cable 2280m 1900m static section and 380m dynamic section.
- 8” EHC umbilical 2280m 1900m static section and 380m dynamic section.

3.6.2 Stabilisation features and tie in spools

Each of the wells has tie-in spools running from the well to the manifold. Flexible concrete mattresses (6m x 3 x 150mm) have been used to provide protection of the spools and jumpers and reduce snagging surfaces. There are approximately 110 concrete mattresses at the drill centre location. These may be removed or left in situ depending on discussions with DECC.

Each of the flowlines, cable and EHC umbilical has concrete mattresses on the approaches to both the manifold and riser base. These will be recovered and returned onshore for potential re-use prior to reverse reeling the flowlines etc.

3.6.3 Vessels for removal of pipelines and subsea equipment

A number of different vessel types will be involved in the decommissioning of the Athena pipelines and subsea equipment (Table 3.5).

Table 3.5– Summary of the expected vessels involved in pipeline and subsea equipment installation

Vessel type	Position fixing	Main activity	Expected time in field	Estimated fuel usage (tonnes/day)
Survey vessels				
Survey vessel	Dynamic positioning (DP)	As left condition survey post equipment removal	14 days	15 (working) 19 (transit)
ROV	DP	As found surveys of wells, pipeline routes and as-installed equipment	21 days	15 (working) 19 (transit)
Other vessels				
Manifold pipelines riser base & clump weight base removal	DP	Remove manifold, riser base, clump weight base and reverse reel of flowlines from manifold to riser base	12 days	20 (working) 9 (transit)
Riser and umbilical removal vessel	DP	Remove riser and umbilical between riser base reverse reel and STP	15 days	20 (working) 24 (transit)
Diver flowline and tie-ins disconnection	DP	Subsea tie-in removal activities	35 days	21 (working) 24 (transit)
Concrete mattressing vessel	DP	Recovery of concrete mattresses at manifold and riser locations	7 days	3 (working) 9 (transit)
Guard vessel	None	Monitor vessel activity, inform other vessels of decommissioning operations, guard temporary laid pipes	30 days	3 (working) 9 (transit)

None of the vessels are expected to refuel in the field. All vessels will meet MARPOL required standards for emissions and discharges within Special Areas. Oily water from bilges and machinery space drainage will be separated and oily residues retained and shipped to shore.