



Nuclear
Decommissioning
Authority



Research Sites
Restoration Ltd



Research Sites Restoration Ltd 2008/9 Lifetime Plan Rev D (v 2) Executive Summary

Site refs:

12, 16, 38

Sites Overview

This document provides an overview of the sites of Research Sites Restoration Ltd (RSRL) encompassing Harwell (12), Winfrith (16) and Research Support South (38) (Site 38 is the combined support activities for the Harwell and Winfrith sites).

- Over 30% of the clean-up programme has been completed at Harwell & Winfrith.
- A significant amount of the original sites' areas have been released for commercial use, providing employment for over 5000 people.
- The combined decommissioning programme will finish in 2064 at a cost of £1.8 billion.



Contents

Sites Overview	2
Lifetime Plan Overview	4
Harwell Programme	6
Winfrith Programme	7
Lifetime Plan Costs	8
Support Areas	10

Figure 01 – Harwell Site key facts

Basics	Location	Oxfordshire
	Nearby towns/cities	Didcot, Newbury, Oxford, Reading
	Site Area	113.5 hectares
	Number of current employees	280 (including support staff)
Key dates	Waste Encapsulation Plant Operational	2010
	Historic arisings of intermediate level waste (ILW) passively safe or transferred off-site.	2020
	All reactors decommissioned	2031
	Export Facility operational	2043
	Vault Store emptied	2048
	Harwell ILW Store emptied	2060
	Site closure completed	2064
Plant description	B462 Complex - Solid Waste and Nuclear Materials Facility	Processing and storage of solid intermediate level waste (ILW) and low level waste (LLW) prior to transfer off-site
	LET - Liquid Effluent Treatment Plant	Treatment of low-level active liquid waste and processing of legacy tank sludges
	B459 - Active Handling Facility	Repackaging of ILW
	B220 - Radiochemical Facility	Processing, repackaging and temporary storage of ILW
	BEPO/H10 Complex	Care and maintenance of BEPO reactor and associated facilities
	Material Testing Reactors (MTRs)	Care and maintenance of DIDO and PLUTO reactors
	Western Storage Area (WSA)	Groundwater containment plant operations
	Minor Facilities	Decommissioning of other buildings
Unique factors	Established in 1946 as the Atomic Energy Authority Research Establishment, Harwell was the first site in Britain to house nuclear research reactors and facilities.	
	RSRL's decommissioning programme enables the Government's plan of creating a world class science park on the Harwell Science and Innovation Campus.	

The Harwell site, originally an RAF station, became the Atomic Energy Research Establishment in 1946. Most of the nuclear reactors and research facilities were built between 1946 and 1960. Operations continued until the early 1990's when there was no further need for research and development from the Harwell site. Decommissioning commenced in the 1990's. The Harwell site is located in an area of outstanding natural beauty in Oxfordshire. The designated area, managed and operated by RSRL, forms part of the Harwell Science and Innovation Campus, a major science and technology centre. The programme will release land and buildings, making them available for the campus.

Figure 02 – Winfrith Site key facts

Basics	Location:	Dorset, South of England
	Nearby Towns/Cities:	Dorchester, Wareham
	Site Area:	84 hectares
	Number of Employees:	119 (excluding Support staff)
Key Data	WETP and EAST Decommissioned	2011
	Dragon Reactor Decommissioned.	2032
	Dragon Reactor Demolished.	2032
	SGHWR Reactor Decommissioned.	2036
	SGHWR Reactor Demolished.	2038
	Site Closure Complete.	2048
Plant Description	Reactor Types:	Steam Generating Heavy Water Reactor & High Temperature Gas Cooled Reactor
	Number of Reactors:	Two (de-fuelled and in care and maintenance)
	Previous Operators:	UKAEA
	Adjacent Nuclear Power Station:	None
Unique Factors	The Winfrith site was acquired in the early 1950s to provide additional research and development facilities due to the Harwell Site having reached operational capacity.	
	Winfrith has had, at various times, nine R&D reactors with one supplying power to the National Grid. The eastern part of the site has been developed as a technology centre and transferred to English Partnerships for further development.	

In the 1950s the Winfrith site was acquired to provide additional research and development facilities. It is situated in an area of outstanding natural beauty much of which has an SSSI (Site of Special Scientific Interest) designation. The eastern part of the Winfrith site has also been developed as a technology centre and has been transferred to English Partnerships for further development.

Decommissioning of remaining nuclear facilities on the Winfrith site will be deferred until completion of the majority of Harwell decommissioning activities. The deferral reflects the NDA's national funding prioritisation of reducing the nation's most significant hazards first.

Lifetime Plan Overview



Significant progress has been made to restore the RSRL sites since the start of decommissioning in the early 1990s. Current efforts focus on processing legacy waste and maintaining buildings until final decommissioning commences.

Glossary

Item	Description
2m	two-metre
ALES	Active Liquid Effluent System
CHILW	Contact-handled ILW
EAST	External Active Sludge Tanks
GDF	Geological Disposal Facility
HVLA	High Volume Low Activity
ILW	Intermediate Level Waste
ISO	International Organisation for Standardisation
LETP	Liquid Effluent Treatment Plant
LLW	Low Level Waste
NDA	Nuclear Decommissioning Authority
NDS	National Disposal Service
PEW	Potentially Exempt Waste
RHILW	Remote-handled ILW
SGHWR	Steam Generating Heavy Water Reactor
TRS	Treated Radwaste Store
VLLW	Very Low Level Waste
WEP	Waste Encapsulation Plant
WETP	Winfrith EAST Treatment Plant
WRAT	Waste Requiring Additional Treatment
WSA	Western Storage Area



Introduction

The RSRL programme decommissions most of the Harwell site before resuming decommissioning of the Winfrith site. This sequence reflects the NDA's national funding prioritisation of reducing the nation's most significant hazards first. The Harwell programme will focus initially on legacy waste processing followed by decommissioning. Winfrith decommissioning will commence as the Harwell decommissioning programme finishes.

The end state of the Harwell site permits transfer of the land to the Harwell Science and Innovation Campus, where it will become part of the world-class science park. The Winfrith site end state supports the western area of the site being returned to open heath land and the eastern area of the site being transferred to the science and technology park.

Waste Treatment

Harwell waste treatment activities include:

- B462 Remote Handled Intermediate Level Waste (RHILW) Operations - retrieval, packaging, and encapsulation. The RHILW in drums is stored in the Vault Store where it will remain until it is transported to a Geological Disposal Facility (GDF).
- B462 Contact Handled ILW (CHILW) Operations - receipt, decontamination, packaging, encapsulation, and storage. The CHILW is stored on site where it will remain until it is transported to a GDF.
- B462 Low Level Waste (LLW) Operations - receipt and final packaging before shipping to the LLW disposal site.
- B459 RHILW Operations - repackaging / consolidating legacy Harwell and Winfrith RHILW and radioactive sources recovered



throughout the UK. The repackaged waste is sent to B462 for final processing.

- B220 RHILW Operations - packaging and encapsulation of radium-contaminated wastes and storage of drummed CHILW. The encapsulated waste is sent to B462 for final processing.
- Liquid Effluent Treatment Plant (LETP) LLW Operations - removal, packaging, and encapsulation of tank sludge that accumulated during the lifetime of the facility's tanks. The encapsulated waste is sent to B462 where it is processed as LLW. The LETP also processes radioactive organic liquids before transporting them to an off-site incinerator.
- Other Hazardous and Non-hazardous Waste produced at Harwell - packaged and shipped to off site disposal facilities.
- Groundwater Treatment Plant - recovers organic solvents from the groundwater and soil located under the remediated Western Storage Area (WSA).

Winfrith waste treatment which is occurring concurrent with Harwell activities include:

- LLW Operations - collection, treatment, storage and disposal to the LLW off-site repository sludge from the SGHWR tanks is removed, packaged, encapsulated and stored on site in the Treated Radwaste Store. The site also disposes of mildly contaminated materials, off site, as Very Low Level Waste (VLLW).
- Nuclear Material Operation - encapsulates and stores thorium in drums; and packages and stores uranium waste. The stored waste will be transported to a GDF.
- Hazardous Waste produced at Winfrith



including sodium metal - processed as necessary, packaged and transported to off-site disposal facilities.

Care and Maintenance

Facilities at Harwell and Winfrith awaiting decommissioning are subject to a care and maintenance programme to ensure that they safely contain their radioactive inventory until decommissioning. Major refurbishments are required at the Winfrith Dragon and SGHWR facilities to support the extended care and maintenance programmes. The refurbishments include structural repairs, re-roofing, re-cladding of walls, and prevention of water ingress. Other facilities will require routine maintenance to maintain their structural integrity.

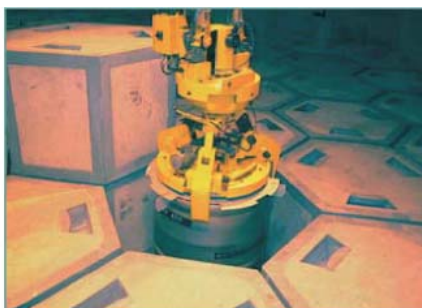
Decommissioning and Demolition

Decommissioning activities at Winfrith will resume as Harwell decommissioning activities finish. Contaminated components will be removed from the facilities followed by decontamination of structures and demolition. Building slabs will be removed and subsurface contamination will be removed to meet regulatory requirements.

Buildings that contain highly radioactive components will result in the generation of ILW. This material will be packaged and stored on site until its shipment to a GDF. The ILW storage facilities will be decommissioned after shipment of the ILW.

Site drains and other underground components will be decontaminated and either grouted and left in place or removed dependent on the contamination levels.

The Harwell programme includes construction of an on-site high volume low



activity waste facility to dispose materials with very low levels of radioactivity. However, efforts are underway to identify an off-site route for these materials. The on-site facility will not be constructed if an off-site route is identified.

Land Remediation

Land areas will be remediated as necessary to meet regulatory requirements. This will include the removal of contaminated soils and any materials previously buried on the sites.

Delicensing and Site Closure

Areas of the Harwell and Winfrith sites will be surveyed following decommissioning and remediation activities to verify that they meet regulatory requirements to allow licence termination. Licence termination will be requested as areas become available allowing a staged release of site areas. The NDA will be requested to remove its designation of the sites as they are de-licensed.



Harwell Programme

Decommissioning will be completed in two phases. The first phase includes radioactive waste processing, decommissioning of redundant facilities, and de-licensing of available areas. The second phase includes storage of intermediate level wastes, shipment to a Geological Disposal Facility, and decommissioning of the storage areas.

Waste Operations

RHILW is stored in subsurface storage tubes in B462. The waste is being recovered from the tubes with two purpose-built retrieval machines and processed along with RHILW from other Harwell facilities (B220 and B459). The processing includes sorting the waste and repackaging in the B462 Head End Cells (HEC). Some waste is sent to B220 and B459 for specialised processing before it is returned for packaging in the HEC. RHILW is placed in drums in the HEC and transferred to the Vault Store where it is stored before and after it is encapsulated in the newly built Waste Encapsulation Plant (WEP). RHILW will remain in the Vault Store until it is shipped to a GDF.

An additional ILW storage facility will be constructed to hold waste produced in decommissioning activities and other B462 processes. A waste export facility will be constructed to support transportation of the ILW to a GDF.

CHILW is stored in B462 and B220. It may also arise through decommissioning activities. The CHILW is decontaminated if possible, otherwise it is be drummed and encapsulated. CHILW operations also include processing of sea disposal drums which were stored on site when the sea dump programme ended.

LLW is packaged and transported to an LLW disposal facility. LLW is super-compacted and stored in an off-site facility if appropriate. The Harwell programme includes construction of an on-site high volume low activity waste facility to dispose of materials with very low levels of radioactivity. However, efforts are in progress to identify an off-site route for these materials. The on-site facility will not be constructed if an off-site route is identified. Tank sludge that accumulated in LETP tanks is being removed, packaged, and encapsulated before disposal at the off-site LLW disposal facility.

Radioactive liquid wastes are processed in the LETP before release through the Thames River discharge pipeline. A new treatment plant will be constructed and located at B462. The new plant will evaporate any radioactive liquid wastes. Condensate from the evaporator will contain very low levels of radioactivity and will be released to the sewer system allowing

decommissioning of the Thames River pipeline. The evaporator concentrate will be solidified and shipped off-site as LLW.

Hazardous and non-hazardous waste will arise from decommissioning activities. The waste will be disposed at offsite facilities.

Decommissioning

Harwell facilities will be decommissioned after their operations are complete and as levels of funding permit. In the interim, the facilities will be kept in care and maintenance to ensure they safely contain their radioactive inventory until decommissioning.

A number of significant decommissioning activities have occurred since the start of decommissioning in the 1990's. The LETP is the next scheduled significant decommissioning project due to its outlying location and potential subsurface contamination. The LETP decommissioning will be followed by B220, B459, and BEPO/H10. B462 will be decommissioned after it completes its waste processing activities. Finally, the material test reactors, DIDO and PLUTO will be decommissioned. The balance of site structures will be sequenced into the overall decommissioning programme. Decommissioning of some of these structures, for example, B393 and B488 will be accelerated to avoid further structural deterioration.

Contaminated Land and Groundwater Remediation

Land including that under facilities and land previously used for waste disposal activities will be remediated by removing contaminated soil and materials, to meet regulatory requirements.

Groundwater remediation is in progress to contain and remove organic solvents released into the groundwater through historic disposal activities in the WSA. A groundwater extraction plant prevents further migration of solvents from the WSA area by pumping and treating groundwater in the area. These activities are expected to continue until about 2025. Solvent vapours are also being extracted from the unsaturated zone under the remediated WSA and above the groundwater table to

prevent further migration of solvent into the groundwater. About 100 sampling wells are located throughout the site and surrounding areas to confirm the decline of solvent levels in the groundwater. The Environment Agency monitors the sample results and works with RSRL to manage the groundwater remediation activities.

Harwell land areas will be surveyed to demonstrate they meet regulatory requirements for termination of the nuclear licence. A de-licensing case will be developed for site areas upon completion of the associated decommissioning, remediation, and survey activities.

Site Closure

ILW will be stored at Harwell until a national GDF is available. ILW shipments will then commence at a frequency that will be determined as a part of a national ILW transportation programme. The on-site ILW storage facilities will be decommissioned and demolished. Surveys and de-licensing cases will be developed after land remediation is complete. The NDA will be requested to remove its designation of sections of the property as the areas are de-licensed, to be followed by the remaining areas of the site after the licence is terminated.

Winfrith Programme

The Winfrith reactors SGHWR and Dragon will be kept in care and maintenance until decommissioning resumes in 2023. Limited waste operations and decommissioning of support facilities will occur during this care and maintenance period. The site will be restored and de-licensed after decommissioning is completed.

Waste Operations

ILW will be produced during SGHWR and Dragon decommissioning. The waste will be packaged in specially designed containers and stored in a yet to be built on site storage facility until it is shipped to a GDF.

LLW is packaged and transported to a LLW disposal facility. LLW is super-compacted before disposal as appropriate. The site also disposes mildly contaminated materials at an off-site facility that is authorized to dispose Very Low Level Waste (VLLW).

Nuclear Materials Operations

Winfrith holds stocks of natural and depleted uranium and thorium. The uranium has been packaged and stored in the Treated Radwaste Store (TRS). The thorium wastes will be encapsulated in the Winfrith EAST Treatment Plant (WETP) before it is sent to the TRS for storage.

Hazardous Waste Operations

Hazardous and non-hazardous waste will arise from decommissioning activities. The waste will be disposed at off-site facilities. Sodium waste will be sent off-site for incineration.

Decommissioning

Decommissioning of the Steam Generating Heavy Water Reactor (SGHWR) and Dragon reactor will commence in 2023. In the interim, the facilities will be maintained in care and maintenance. Significant refurbishment work has begun to ensure the facilities' structural integrity during the extended care and maintenance period. Neither reactor contains fuel. The decommissioning activities include removal of the reactors and remaining components followed by structural decontamination and demolition.

The balance of site structures will be decommissioned at the same time as the reactors. The work scope includes off-site facilities associated with the sea discharge pipeline.

Site Closure

Soil will be remediated as necessary after completion of decommissioning and demolition activities. Final radiation surveys of the areas will be used to demonstrate that the licence for the areas may be terminated. The NDA will be requested to remove its designation from the areas after conclusion of regulatory actions.



Lifetime Plan Costs

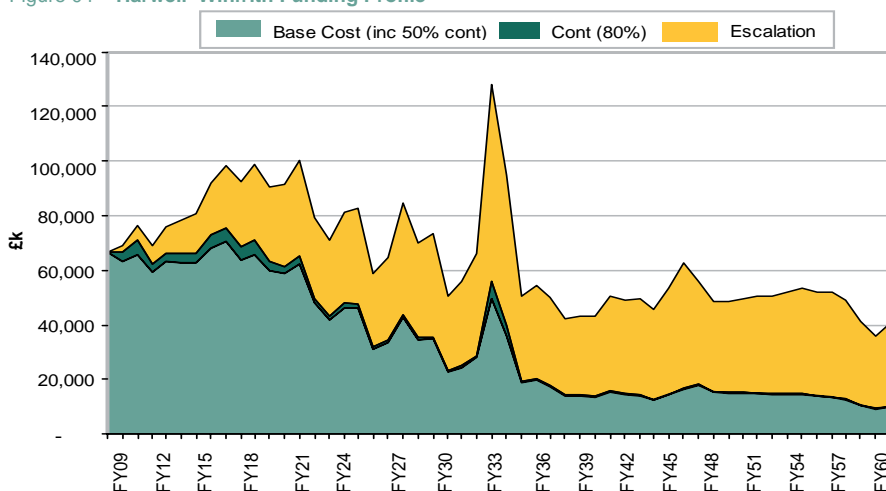
Funding is allocated across the various categories according to their requirements in support of the decommissioning programme. Various estimating techniques have been used to derive the cost estimates for the individual elements of the programme.

Figure 03 – Harwell–Winfrith Summary of costs – present day, escalated and discounted values

Category	Prior years cost to date 2005/08 (£k)	Previous year cost to date 2008/09 (£k)	FYs 2009-13				
			Year 1 (£k)	Year 2 (£k)	Year 3 (£k)	Year 4 (£k)	Year 5 (£k)
New Construction Projects (12/16.11)	20,867	3,615	567	257	2,250	1,757	3,198
Decommissioning & Termination (12/16.13)	75,692	10,198	10,390	14,102	15,696	15,320	18,451
Waste & Nuclear Materials Management (12/16.14)	95,254	29,018	29,632	29,552	30,544	22,879	22,065
Transition (38.10)	13,880	0	0	0	1,687	1,024	495
Site Support (38.15)	41,759	14,333	14,776	13,532	13,093	12,877	12,799
Support Services (38.16)	29,213	5,305	6,999	6,741	6,744	5,701	5,738
Stakeholder Support (38.17)	4,209	1,327	1,340	1,348	1,347	1,236	1,249
Subtotal*	280,875	63,796	63,704	65,532	71,361	60,795	63,996
Revenue Income (38.20)	33,487	5,794	4,970	2,420	1,371	902	902
Escalated value (Net Cost)			58,735	65,068	74,397	65,637	71,288
Discounted value (Net Cost)			58,735	61,753	67,009	56,108	57,834

* Values subject to rounding discrepancies

Figure 04 – Harwell–Winfrith Funding Profile



Numbers in the table above have been rounded in each case.

Escalation at 3.1% and discounting at 2.2% has been applied to the gross costs.

Successful fund management enables the delivery of the sites decommissioning programme.

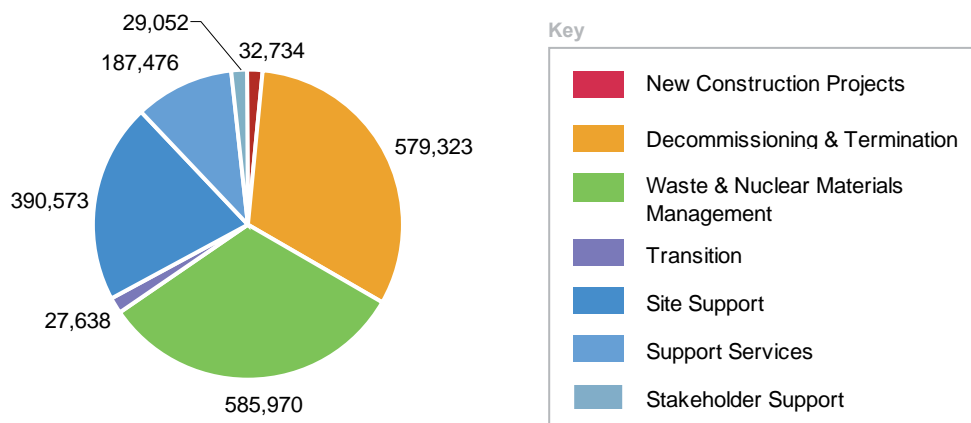


Clean demolition material is stored for later use, avoiding the cost of purchase.

Figure 03 – Harwell–Winfrith Summary of costs – present day, escalated and discounted values – continued

Subtotal years 1-5 (£k)	FYs 2014-18					Subtotal years 6-10 (£k)	Lifecycle Balance Years 11+ (£k)	Total to go cost (£k)
	Year 6 (£k)	Year 7 (£k)	Year 8 (£k)	Year 9 (£k)	Year 10 (£k)			
8,030	7,598	3,938	124	123	123	11,907	12,797	32,734
73,959	19,512	21,680	30,308	33,788	22,378	127,666	377,699	579,323
134,672	20,972	21,498	22,856	23,428	21,663	110,417	340,880	585,970
3,206	493	495	493	491	491	2,463	21,970	27,638
67,078	12,657	12,544	12,475	12,270	12,270	62,216	261,279	390,573
31,923	5,723	5,738	5,783	4,630	4,630	26,503	129,049	187,476
6,520	1,244	1,249	1,245	831	831	5,400	17,132	29,052
325,388	68,199	67,143	73,282	75,561	62,386	346,572	1,160,805	1,832,765
10,565	731	429	264	263	263	1,949	4,214	16,729
335,125	78,594	80,125	90,416	96,130	81,768	427,033	2,586,920	3,349,079
301,438	60,512	58,548	62,702	63,267	51,074	296,103	707,602	1,305,144

Figure 05 – Harwell–Winfrith Lifecycle category cost distribution (£k)



Support Areas

Transition

Staffing levels of both RSRL employees and contractors will be adjusted as necessary to support overall decommissioning programme. A management of change process is in place to ensure the staff are suitably qualified and experienced and that the RSRL organisation meets all of its licence responsibilities.

As the decommissioning programme nears completion at each site, staffing levels will be reduced significantly. This will be through retraining and redeployment; relocation; voluntary early release; and compulsory redundancy. Career advice and counselling will be provided to facilitate employee transitions and to encourage support of decommissioning projects at other sites.

Site Support

Site services provide and maintain a suitable site infrastructure to ensure efficient operations. The services are:

Emergency & Medical Services

Emergency and medical services respond to on-site accidents and emergencies arising from site operations. A third party occupational health service is provided at each site to assist in the management of work-related injury management and health issues.

Security

Appropriate levels of security are provided at the two sites consistent with the amount and types of nuclear materials stored on the sites. The Harwell site is protected by a security force provided by the Civil Nuclear Constabulary. The Winfrith site is protected by a private security force.

Property and Facilities Management

Facilities management staff manage the site land and general purpose buildings to ensure the grounds, offices and other buildings are maintained in appropriate operating condition. Buildings with significant radioactive material inventories are managed by their own dedicated operations staffs.

IT Management

The sites communications and computer networks as well as business information systems are maintained by a third party

contractor overseen by RSRL staff. This function is a significant component of the RSRL knowledge management system which ensures information is available to support on going operations and future decommissioning activities.

Programme Management

The Programme Office oversees RSRL's implementation of the decommissioning programme and ensures the programme meets NDA requirements. The office produces and maintains the RSRL Lifetime Plan with assistance from the projects. The office also ensures appropriate tools are available to manage and monitor the work to budget and schedule expectations.

Support Services

General Site Management

This covers the work of the RSRL Managing Director, the areas of policy and strategy development, resource and programme management and general site management.

Safety, Security, Health and Environment Support

The safety, security, health, and environment department oversees RSRL's activities to ensure they are compliant with regulatory requirements, other external requirements and RSRL standards of performance. The department provides expert technical support in occupational, nuclear, and environmental areas as well as emergency planning services.

Quality Assessment and Management Systems

This covers the management and independent assessment of the RSRL Management System. The costs of the archive and records contracts are included in this area.

Financial Management & Contract Support

This is the provision of contract management services to RSRL. It also includes the provision of financial services such as cash flow management, tax management and management accounting.

Human Resources

This involves the provision of support to the combined sites for the management and provision of human resources services. This area also coordinates and monitors the training and skills of RSRL staff.

Stakeholder Support

Stakeholder Engagement

RSRL maintains an active programme of community and governmental stakeholder engagement. This is achieved through a mixture of public meetings, publications, press releases, and site visits. Internal stakeholders including RSRL employees are provided with routine updates regarding developments within and external to RSRL. The communications group coordinates RSRL's response to media and freedom of information queries.

Community Support

RSRL manages the NDA funded community sponsorship programme where local groups receive support for selected activities.

Revenue Income

The majority of future revenue income will be from tenants. This includes rent, business rates, service charges and utilities cost recoveries.



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