

Appendix 12A: Policy Context, Survey Methodologies and Evaluation of Ecological Importance

Policy Context

1. European Union Directives created a network of protected areas across the European Union of international importance. They are called ‘Natura 2000’ sites. Annex I of the European Union Habitats Directive (92/43/EEC) lists 189 habitats and the 788 species listed in Annex II are to be protected by means of a network of sites. Special Areas of Conservation (SACs) are designated under the European Union Habitats Directive and Special Protection Areas (SPAs) are designated under the European Union Wild Birds Directive (79/409/EEC).
2. Nationally important sites are designated as Sites of Special Scientific Interest (SSSIs) in England, Scotland and Wales and are conferred protection under various statutes including the Wildlife and Countryside Act 1981 (as amended) and the Nature Conservation (Scotland) Act 2004.
3. The Nature Conservation (Scotland) Act 2004 requires Scottish Ministers to publish a list of habitats and species considered to be of principal importance for biodiversity. In addition the Act requires that all public bodies fulfil an obligation to further biodiversity in the course of carrying out all their public duties.
4. The UK Biodiversity Action Plan (BAP) [1] is the UK government’s response to the Convention on Biological Diversity. As part of the UK and other BAPs (including local BAPs), Habitat and Species Action Plans (HAPs and SAPs respectively) have been developed to guide conservation action for the ecological feature concerned. The presence of a HAP or SAP reflects the fact that the habitat concerned is in a sub-optimal state and requires conservation action. It does not imply any specific designation or level of importance, but establishes a framework for the conservation of the habitat and identifies current factors causing loss and decline of that feature. Furthermore, implementation of BAPs, whether at the UK or local level, is perceived as a fundamental requirement for public bodies to meet their obligations under the relevant national legislation.
5. The UK Biodiversity Action Plan (BAP) sets out a programme of action to conserve and enhance biological diversity throughout the UK. Local Biodiversity Action Plans (LBAPs) integrate these measures at the local or regional level (see below).
6. The UK Biodiversity Steering Group publishes individual action plans for 45 priority habitats and some 400 of our most threatened and endangered species. Priority Habitats are those habitats that are particularly important or that are vulnerable to habitat loss and damage and for which conservation action should be targeted.

7. In addition to the national Biodiversity Action Plans, a series of LABPs have been developed throughout Scotland. The Dounreay area falls within the Highland Region and the Caithness District. The LABP that covers this district is the Caithness Biodiversity Action Plan (Local BAP for Caithness) [2].
8. The Highland Structure Plan recognises the Caithness Biodiversity Action Plan (and other LBAPs) in three main policies concerned with nature conservation. Policy N1 seeks to protect sites and species of international importance, national importance, and regional and local importance. Developments should seek to minimise the impact on the nature conservation resource and enhance it wherever possible. Policy N4 requires that the development process takes regard of LBAPs while Policy N5 gives a commitment to the implementation of the local BAP.

Species Surveys

Breeding Birds

9. A breeding bird survey (BBS) of the site and wider study area was carried out during spring and early summer 2002 (late April and late May) [3].
10. The areas surveyed comprised the whole of the Dounreay site within the perimeter fence, and a buffer zone around the site, which extended to around 1 km along the coast to the east and west and to the main A836 road to the south (Figure A5.1). Access was not gained to the interior of the Vulcan facility but observations were made within and from the car park by the main entrance, and through the perimeter fence surrounding the site.
11. Breeding bird populations were assessed by dedicated site surveys during which all birds seen or heard during the survey were recorded. Surveys were undertaken by quartering the study area so as to ensure that species could be effectively identified visually or by song. All observations made at other times of year were also recorded. All birds seen or heard were recorded onto field maps.
12. Evidence for breeding was sought from specific behaviour patterns such as the broadcast of territorial song, paired birds showing site fidelity, distraction displays or pair-bonding displays, birds carrying nesting material or food items and by locating nests or eggs. Where behavioural cues were sufficient to indicate a strong probability of nesting, no further searching was undertaken to minimise disturbance to the breeding pair. In all cases, the use of telescope or binoculars to observe from a distance also reduced disturbance to the nesting birds.
13. The data on which this section is based was collected in 2002. Numbers and species composition of breeding birds within the study area could potentially have changed in the subsequent 4-year period.

Wintering Birds

14. Wintering bird populations were sampled during one visit in February 2003 [3]. The survey sought sites with particular concentrations of bird species or species groups present, and sites that offered feeding areas or roosting space. Numbers at these sites were counted. Additional documented information on wintering bird populations around Dounreay was available in the proposed windfarm ES [4]. These surveys were vantage point surveys undertaken from between January and April 2001 and September to December 2001 and covered the area adjacent to the north east of the proposed development site.

Otters

15. Watercourses were searched systematically for signs of otter [5] including spraints, footprints, lying-up sites, potential holts or couches and meal remains. Otters are active throughout the year [6], but the optimum period to carry out surveys is between May and September when water levels are less variable [5]. In total, data was collected during seven visits between September 2001 and February 2003 [3]. Survey efforts were concentrated along the Mill Lade watercourse (Target Note 13, Figure A3.1) and the accessible foreshore.

Water voles

16. During the otter searches [3; 7], the Mill Lade watercourse was searched systematically for signs of water vole including burrows, runs, footprints, feeding stations, latrines and faeces. The optimum period to carry out surveys is between April and October, when the likelihood of locating breeding territories is highest [7]. While Dounreay is considered to be outside the known range of this legally protected and declining species, in the uplands of Scotland, water voles are often found around watercourses which flow through areas of deep peat with marshy floodplains [8].

Bats

17. A bat survey was undertaken in September 2001 [3] involving an evening visit just after sunset to scan selected sampling points on the site for ultrasound signals using a hand-held Pettersson D200 detector. Three main areas were sampled over a time period of around 1.5 hours, the central coastal section around the Dounreay Castle, the Mill Lade and old Dounreay Farmhouse (now demolished), the western section adjacent to the MoD Vulcan facility and the eastern section of the Dounreay site. In addition, the roof space of the old Dounreay Farmhouse was scanned with the detector and checked for any visual evidence for bats during mid summer in 2002 [3].

Reptiles

18. There are no open water habitats, or seasonal pools, within or adjacent to the current Dounreay site. Amphibia were not considered for survey. However, the site does include habitats that would be considered potentially suitable for certain reptile species and targeted surveys were therefore undertaken [3].

19. Reptiles may be recorded by the placement of refuges, normally in the form of heat-absorbing sheets, e.g. from roofing material, which attract reptiles for basking or concealment underneath the sheet. Six refuges made from roofing felt, measuring approximately 75 x 50 cm were laid out in two sites within the perimeter fence, one in the area of wet heath in the north, the other in tall grasslands along the edge of the Mill Lade (located by Target notes 11 and 15 respectively on the habitat map, Figure A3.1) [3]. A combination of sunny and shaded habitats with a good cover of vegetation was available in both sites. The refuges were placed during the May field-visit and checked weekly for the duration of the season until the end of September.

Freshwater Invertebrates

20. The aquatic invertebrate community was sampled from the Mill Lade during June and September 2002 [3] with species identified to the level of family and genus for the purpose of setting a baseline for community diversity in relation to water quality.
21. Sampling included the hand collection of animals attached to the surfaces of the larger stones submerged within the stream channel and by kick sampling (1-minute effort) from a number of locations within the watercourse. Five samples were taken during each visit, with the sites selected to reflect the variation present in current flow and substrate type along the length of the stream within the site but with sufficient flow to carry the dislodged invertebrates into a standard Freshwater Biological Association (FBA) collecting net.
22. Identification of the resulting samples was achieved using identification keys [9, 10, 11, 12 and 13]. These results were then expressed as a Biological Monitoring Working Party System score (BMWP) which is a biological classification of river quality [14] and further expressed as an ASPT score (Average Score Per Taxa) dividing the BMWP score by the number of taxa thus eliminating the bias of sampling effort.

Phase 1 Habitat Survey and NVC Surveys

Phase 1

23. In addition to the Phase 1 and National Vegetation Classification (NVC) system Surveys undertaken for the baseline terrestrial ecology report (Figure A3.1 Appendix 4) a Phase 1 Habitat Survey update was undertaken in October 2005 using the standard methodology as outlined in the Handbook for Phase 1 Habitat Survey¹, a technique for environmental audit [15]. This has become a widely accepted method for surveying semi-natural habitats and is regarded as an essential part of the EIA process whenever ecological receptors are likely to be affected by a development [15; 16]. Botanical taxonomic nomenclature follows that of Stace [17].

¹ The Phase 1 Habitat survey methodology was developed in the 1980s for the purpose of mapping terrestrial and freshwater habitats within SSSIs and nature reserves, and for larger scale strategic surveys.

24. On the 18th October 2005, all habitats within and immediately adjacent to the proposed development site were recorded and mapped according to standard survey methods. Additional target notes were made where applicable to record key habitat features; urban ecological features not covered in sufficient detail in the Phase 1 Methodology; important habitats too small to be mapped and to identify dominant species and other features of ecological interest.
25. October is not an optimal time of year in which to carry out botanical and habitat surveys since flowering plants have generally passed the flowering stage and annuals may have died back. However, much of the flora was still in leaf and identification of all present vegetation was possible. No survey of wildlife can guarantee that all biological cues are recorded, and early or late flowering species may be under represented. Reference to the previous Phase 1 Habitat Survey [3] however, ensured that early flowering species were recorded.

NVC

26. Where habitat has previously been identified as being of high value or sensitivity, the NVC is used to establish a further level of detail than Phase 1 Habitat Surveys provide.
27. The NVC was carried out following the methods outlined in Rodwell [18]. At each NVC location surveyed, five quadrats were sampled. A quadrat size of 2 x 2 metres was used as the standard size for the assessment of all habitats. Within each quadrat, species abundance was expressed on the Domin scale (Table 12.1) which is a variation of the Braun-Blanquet scale [19], a method of describing an area of vegetation. This method provides a quantitative measure of the abundance of plant species recorded in a quadrat. The percentage cover of each species is assessed by eye as a vertical projection on the ground of all the live, aboveground parts of the species in the quadrat.

Table 12.1 - The Domin scale

% Cover	Domin Value
91 – 100% cover	10
76 – 90%	9
51 – 75%	8
34 – 50%	7
26 – 33%	6
11 – 25%	5
4 – 10%	4
<4% – with many plants	3
– with several plants	2
– with few plants	1

28. Quadrat data were entered into the computer program MATCH – NVC Classification 2.0 [20]. The resulting community classifications generated according to the nomenclature in Rodwell [18] were then examined in detail in order to select the best community fit.

Ecological Evaluation

Breeding Birds

29. In the UK all wild birds, their nests and their eggs are protected under the Wildlife and Countryside Act 1981 (as amended) under which it is an offence to intentionally kill, injure or take any wild bird; intentionally take, damage or destroy the nest of any wild bird while it is in use or being built; intentionally take or destroy the egg of any wild bird; and intentionally disturb any wild bird listed on Schedule 1 while it is nest building or is at (or near) a nest with eggs or young; or disturb the dependent young of such a bird. Schedule 1 birds are protected by penalties at all times.
30. The Nature Conservation (Scotland) Act (2004) [21] extends the protection of birds, animals and plants by ensuring that public bodies further biodiversity in their functions, changes arrangements for the establishment and protection of Sites of Special Scientific Interest (SSSIs) and revising Part 1 of the Wildlife and Countryside Act (1981).
31. The leading government and non-government conservation organisations in the UK have jointly reviewed the population status of 247 bird species that are regularly found within the United Kingdom using data from national monitoring schemes to draw up a list of the Joint Nature Conservation Committee (JNCC) Birds of Conservation Concern 2002-2007 [22].
32. On the basis of seven quantitative criteria, each species was placed on one of three lists, these being: **Red, Amber and Green**. Red List species are those that are globally threatened, or considered to be under severe threat in the UK. Amber Listed species are those that have had an historical population decline in the UK but are recovering, or species with unfavourable conservation status in Europe also known as SPEC (Species of European Conservation Concern) species. Green Listed species have no identified threat to their population status).
33. The UK Biodiversity Action Plan (UK BAP) [1] was the UK's response to the commitments of the Rio Convention on Biological Diversity. The plan outlines action for 26 species of bird of conservation importance/concern. In addition to having national priorities and targets, action for biodiversity was also taken at a local level. The Caithness LBAP at present does not outline action for any priority species or habitats but does promote farming practices that increase the biodiversity of the area.
34. No Wildlife and Conservation Act (WCA) Schedule 1 breeding birds were recorded during the SWES surveys although three JNCC Red List species were recorded within a 250m boundary of the proposed construction site: grey

partridge, skylark and song thrush (skylark and grey partridge are also UKBAP species). Seven JNCC Amber List species were also recorded within a 250m boundary of the proposed development site during the surveys: snipe, meadow pipit, curlew, ringed plover, lapwing, oyster catcher and common gull.

35. Although there are birds present that are recognised at a national level, they are not scarce within this area or region. Therefore this area was evaluated as being of **authority area importance**.

Wintering Birds

36. The above legislation cited in the breeding bird section also applies in this wintering bird section. The area surrounding the proposed development surveyed for the proposed windfarm ES has shown use by two JNCC Red Listed species, hen harrier and starling (hen harrier is also WCA Schedule 1, part 1) and the following WCA Schedule 1 species; lapland bunting, snow bunting, fieldfare, merlin, peregrine and redwing [4]. These species have been foraging on the site with the passage of whooper swan, whimbrel, dunlin, greylag, white fronted-geese and pink-footed geese (all Amber Listed) reported. Due to the numbers of nationally scarce and Schedule 1 listed birds this area has been evaluated as being of **regional importance** for birds.

Otter

37. Signs of otter were found to the south of the Dounreay site around the foreshore and the Mill Lade. The otter is listed on Appendix I of the Convention on International Trade of Endangered Species (CITES), Appendix II of the Bern Convention and Annexes II and IV of the European Union Habitats Directive. Annex II species require the designation of Special Areas of Conservation (SACs) which contribute to the “coherent European ecological network” Natura 2000. The European sub-species is also listed as ‘globally threatened’ on the International Union for the Conservation of Nature (IUCN)/World Conservation Monitoring Centre Red Data List.
38. In the UK otters are fully protected under the Wildlife and Countryside Act 1981 (as amended) through inclusion in Schedule 5. The Nature Conservation (Scotland) Act (2004) extends the protection of birds, animals and plants by revising Part 1 of the Wildlife and Countryside Act 1981. The obligations laid down by the EU Habitats Directive have been transposed into UK legislation by the Conservation (Natural Habitats, etc.) Regulations 1994 and otters are also included in Schedule 2 of these regulations (Regulation 38). Under the above legislation it is an offence to *inter alia*: intentionally kill, injure or take otters; deliberately disturb otters; and/or intentionally or recklessly obstruct, damage or destroy otter holts or couches. The Countryside and Rights of Way Act 2000 makes the addition of ‘recklessly’ to this provision.
39. The UK Biodiversity Action Plan defines otter as a priority species, mainly due to its general trend of decline. Otter are also included under the Sea and Rivers and Lochs habitats in the Caithness LBAP [2]. Otter are a species currently

under threat in the area due to modern expansion and land use changes and are therefore evaluated as being of **international importance**.

Bats

40. Several indications of pipistrelle bat were recorded to the south of the Dounreay complex near the now demolished farmhouse and Dounreay castle. A pair of bats was also found to be roosting in the modern office buildings on the Dounreay site. All bats except for the pipistrelle are included in Appendix II of the Bern Convention. Barbastrelle, Bechstein's bat and Greater and Lesser horseshoe bats are listed in Annex II of the European Union Habitats Directive and all bats are listed in Annex IV.
41. In the UK all bats are fully protected under the Wildlife and Countryside Act 1981 (as amended) through inclusion in Schedule 5. The Nature Conservation (Scotland) Act (2004) extends the protection of birds, animals and plants by revising Part 1 of the Wildlife and Countryside Act 1981. The obligations laid down by the EU Habitats Directive have been transposed into UK legislation by the Conservation (Natural Habitats, etc.) Regulations 1994 and bats are also included in Schedule 2 of these regulations (Regulation 38). Under the above legislation it is an offence to *inter alia*: intentionally or recklessly kill, injure or capture, recklessly disturb bats (whether in a roost or not); damage, destroy or obstruct access to bat roosts.
42. The UK Biodiversity Action Plan defines bats as a priority species, mainly due to its general trend of decline. Bats are included under the Forest and Woodland and Town and Village habitats. Although pipistrelles are a UK BAP species they are common and widespread in areas of suitable habitat throughout Scotland and are currently not under threat. The pipistrelle species are therefore evaluated as being of **local importance**.

Fresh Water Invertebrates

43. Fresh water invertebrate samples were taken at the Mill Lade primarily as a means of assessing water quality. Using the BMWP and the ASPT indices this watercourse was determined to be diverse and clean (Table A6.1). Although the Mill Lade is a highly modified drainage channel, use of the watercourse by otters was frequent. Otters are often mainly coastal, in areas with good marine fish stocks but they require fresh water for bathing and terrestrial areas for resting and breeding holts. The Mill Lade provides both food in the form of brown trout together with suitable habitat, such as vegetated river banks and reedbeds. Otter are probably using this habitat to travel to and from the foreshore. The high freshwater invertebrate indices, combined with frequent usage by otter, determine the evaluation of the Mill Lade to be of **authority area importance**.

Grasslands

44. The fragments of species rich semi-improved neutral grassland, although not covered by statutory legislation or a national BAP, are important habitats. No

local or national BAP species were found on the Phase 1 update visit. However, the previous baseline survey recorded a number of eyebrights of unknown species. Many eyebrights are covered by national BAPs and the wider area is known to contain some rare and local species [1 ; 2] and thus further attention to this group may be required.

45. These rough grasslands support good populations of small mammals including brown hares and field voles, which, along with rabbits, form an important part of the diet of hunting raptors and wildcats. They also support high populations of invertebrate upon which birds like grey partridge and skylarks feed and are valuable habitat for ground nesting birds. Unidentified eyebrights have been discovered here which may include rare species. These areas are also a refuge for species that could provide founder populations for habitat recovery following Dounreay decommissioning. This habitat is also covered in the Caithness LBAP [2] and is therefore evaluated as being of **authority area importance**.
46. The fragment of grassland within the plantation perimeter, akin to the UK BAP habitat [1] purple moor grass, rush pasture, is too small to be of national or regional significance. It does however highlight the potential for habitat regeneration should the surrounding land use change to less intensive agriculture. This area is therefore evaluated as being of **local importance**.
47. The improved grassland and species poor semi-improved grassland which covers most of the site is of low species diversity and low nature conservation value. This habitat is evaluated as being of **less than local importance**.

Coastal Heaths

48. There is an area of coastal heath NVC community H7 c heather-spring squill heath, crowberry sub-community on the northerly edge of the site. North Atlantic wet heath with cross-leaved heath is listed under Annex I of the EC Habitats Directive. Under this Directive, such habitats require the designation of areas as Special Areas of Conservation.
49. In the Scottish Highlands there are extensive areas of wet heath, and SAC sites are mainly selected for designation if they are large, of high quality and where the heath structure has been well conserved. The coastal heath on this site is a small fragmented habitat but is also a priority habitat in the Upland and Lowland Heathland Habitat Action Plan in the UK and is covered in the Caithness local BAP. It is this area in which the nationally scarce Scottish primrose and small adder's tongue were previously recorded [3].
50. The Scottish primrose is a nationally scarce species, thought to be endemic to Scotland and confined to coastal areas of Caithness, Sutherland and the Orkneys. The United Kingdom has an International responsibility to protect these populations under the IUCN Red List Categories and Criteria version 3.1 [23], as the UK holds more than 25% of the world's population. Coastal heath is threatened in general due to encroaching agriculture; these factors together with its priority habitat status determine its evaluation as being of **national**

importance. The areas of transitional areas of maritime grassland at the cliff edge are also included in this section of the evaluation as potential habitat for Scottish primrose.

Woodland

51. The small area of densely planted coniferous plantation woodland to the north-east of the Dounreay complex does not comprise species that are native to the area. It is a small area of little nature conservation value and is therefore evaluated as being of **less than local importance**.

References

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- [21] Nature Conservation (Scotland) Act (2004)
- [22] Red and Amber Listed Species <http://www.jncc.gov.uk>
- [23] IUCN Red List Categories and Criteria Version 3.1 http://www.redlist.org/info/categories_criteria2001.

Appendix 12B : 2002 Survey Species Lists – Breeding Birds and Freshwater Invertebrates

Bird Species List*

Site Wide Bird Species and Status

Bird Species (# denotes breeding within Site compound)	Community type/location					Notes
	Site	Farm-land	Picea wood	Wet heath	Coast	
Arctic tern*					++	Breeding colony on shore in Castle Bay (Annex 1 species)
Blackbird*	+	+	++			Resident breeding species in pine wood
Buzzard		++	+	++		Observed overhead and by pinewood
Carrion crow		++			+	Resident breeding species in wider countryside
Chaffinch	+	+	++			Resident breeding species in pinewood
Collared dove	+	+	++			Resident breeding species in pinewood
Common gull* #	++	+			++	Significant breeding colonies on shore and within Site
Common Scoter***					++	Noted in Castle Bay during September visit
Coot		++				On Loch Achbuiligan
Cormorant					++	Offshore only
Curlew***		++		++		Common in surrounding farmland
Dabchick		++				On Loch Achbuiligan
Eider*					++	Feeding close offshore and in rock pools along shore
Fulmar					++	Breeding within Castle walls and along coastal cliffs
Gadwall		++				Noted in pond in field to the south of Vulcan
Gannet					++	Feeding offshore
Golden plover***		++		+		Large flocks in fields during spring visit
Greater black-back gull					++	Breeding along coast
Greenfinch	+	+	++		++	Resident breeding species in pinewood
Guillemot***						Feeding offshore
Heron	+				+	Feeds in the Mill Lade
Herring gull* #	++				++	Nests on flat roofs within Site and along coast
Hooded crow		++				Small numbers present in wider countryside
House sparrow #	++	+	+			Resident breeding species, declining populations
Jackdaw #	++	+			++	Breeding within the Site and on the Castle walls
Kestrel	+	+		+		Presumed present from pellets found in field barn to the south of the Vulcan facility, dead bird found in Dounreay Castle
Lapwing *	+	++		++		Abundant, breeding in surrounding farmland

Site Wide Bird Species and Status contd.

Bird Species (# denotes breeding within Site compound)	Site	Farm -land	<i>Picea</i> wood	Wet heath	Coast	Notes
Linnet**	+	+	+		++	Resident breeding species in pinewood
Mallard		+				In the Mill Lade, outside the Site
Meadow pipit	+	++		++		Resident breeding species
Moorhen		++				On Loch Achbuiligan
Oystercatcher*	++	++			++	Breeds within the Site and along the shore
Pied wagtail	++				++	Resident breeding species
Raven						Breeding on the cliffs to the east of the Site
Robin	+	+	++			Resident breeding species in the pinewood
Redshank***	+	+		+	++	Resident breeding species
Ringed plover***#	++				++	Breeding within the Site
Rock dove #	+				++	Breeds within the Castle walls and on the sea cliffs
Rock pipit #	+				++	Breeding within the Site and along the coast
Rook		++				Feeding in farmland
Sedge warbler		++				In reed and willow scrub by Loch Achbuiligan
Shelduck***					++	Breeding along the coast to the west of the Site
Shag*					++	Feeding offshore
Skylark**		++		++		Common in the land around the Site
Song thrush**	+		++			Resident breeding species
Snipe*				++		Probably breeding in wet heath to the east of the Site
Starling* #	++	+				Resident breeding species
Swallow*		+		+	+	Summer visitor, breeding in barns, stables etc.
Teal***		+				Noted in pond in field to the south of Vulcan
Tufted duck		++				On Loch Achbuiligan
Turnstone***					++	Not thought to be breeding
Wheatear		++				Probably breeding in farmland walls
Widgeon***		+			+	Noted in pond in field to the south of Vulcan
Willow warbler		++				In scrub by Loch Achbuiligan
Wren		++				Resident breeding species in gorse communities
Yellowhammer**		++				Resident breeding species in gorse communities

* Data taken from Atkins 2002/3

++ Principal habitat.

+ Provides key resource - feeding or roosting area

*** Red data book species.

** Red list and,

* Amber list of conservation concern (BTO 2002)

Scientific Names of Bird Species Referenced Within the Text

Blackbird	<i>Turdus merula</i>
Common gull	<i>Larus canus</i>
Curlew	<i>Numenius arquata</i>
Eider	<i>Somateria mollissima</i>
Fulmar	<i>Fulmarus glacialis</i>
Great black-backed gull	<i>Larus marinus</i>
Grey partridge	<i>Perdix perdix</i>
Hen harrier	<i>Circus cyaneus</i>
Herring gull	<i>Larus argentatus</i>
Jackdaw	<i>Corvus monedula</i>
Lapwing	<i>Vanellus vanellus</i>
Merlin	<i>Falco columbarius</i>
Peregrine	<i>Falco peregrinus</i>
Pink-footed goose	<i>Anser brachyrhynchus</i>
Oystercatcher	<i>Haematopus ostralegus</i>
Raven	<i>Corvus corax</i>
Redshank	<i>Tringa totanus</i>
Ringed plover	<i>Charadrius hiaticula</i>
Skylark	<i>Alauda arvensis</i>
Snipe	<i>Gallinago gallinago</i>
Song thrush	<i>Turdus philomelos</i>
Snow bunting	<i>Plectrophenax nivalis</i>
Starling	<i>Sturnus vulgaris</i>
Turnstone	<i>Arenaria interpres</i>
Whimbrel	<i>Numenius phaeopus</i>
White-fronted goose	<i>Anser albifrons</i>

Mill Lade Invertebrate Surveys*

Results of Freshwater Invertebrate Surveys of the Mill Lade

Taxa are recorded by the DAFOR system, where:

D = dominant (to the exclusion of other sp.) A = abundant (> 100 individuals/sample)

F = frequent (11 - 100 individuals) O = occasional (1 - 10 individuals)

R = rare (notified rarity)

SITE		Mill	Lade		
Taxa	BMWP Score		Taxa	BMWP Score	
MAYFLIES			SNAILS		
Leptophlebiidae	10	F	Lymnaeidae	3	O
Siphonuridae	10	F	Hydrobiidae	3	F
Baetidae	4	A	COCKLES		
STONEFLIES			Sphaeriidae	3	O
Leuctridae	10	F	LIMPETS		
CADDIS FLIES			Ancilydae	6	O
Phyrganeidae	10	O	LEECHES		
Sericostomatidae	10	F	Glossiphoniidae	3	O
Lepidostomatidae	10	O	FLIES		
Glossosomatidae	10	O	Simulidae	5	O
Odontoceridae	10	O	Tipulidae	5	O
Rhyacophilidae	7	F	Chironomidae	2	F
Polycentropidae	7	O	WORMS		
Hydropsychidae	5	O	Oligochaeta	1	O
SHRIMPS			MITES		
Gammaridae	6	O	Hydracarina	0	F
BEEFLIES			FLATWORMS		
Elminthidae	5	F	Turbellaria	5	F
Halplidae	5	O			
Dytiscidae	5	O	TOTAL TAXA	28	
BUGS			BMWP Score	165	
Veliidae	5	O	ASPT	5.89	

* Data taken from Atkins 2002/3

BMWP - Biological Monitoring Working Party (DoE 1980) - a weighted scoring system

ASPT - Average Score Per Taxon

Appendix 12C : Phase 1 Update Target Notes

1. The majority of the site is covered in improved pasture grassland, much of which has been recently reseeded. It is dominated by *Lolium perenne* with frequent *Poa annua* and *Holcus lanatus*. *Bellis perennis*, *Cirsium arvense*, *Trifolium repens* and *T. pratense* and *Ranunculus repens* are also frequent.
2. The species rich semi-improved grassland is still dominated by *Lolium perenne* with frequent *Poa annua* and *Holcus lanatus* but it also has frequent *Cynosurus cristata*, *Anthoxanthum odoratum* and *Agrostis stolonifera*. *Festuca rubra* and *Luzula campestris* are occasional and *Nardus stricta* is rare. In the herb layer *Bellis perennis*, *Cirsium arvense*, *Trifolium repens* and *T. pratense* and *Ranunculus repens* are still frequent with the addition of *Cirsium vulgare*, *Plantago lanceolata* and *P. media*, *Lotus corniculata*, *Prunella vulgaris* *Hypochaeris radical*, *Urtica dioica* and *Cerastium fontanum*. *Dactylorhiza purpurella* is rare.
3. This is small area of damp rough semi-improved neutral grassland. The area is grazed by cattle and is heavily poached. This area is co-dominated by *Holcus lanatus* and *Juncus conglomeratus* with frequent *Dactylis glomerata* and occasional *Deschampsia cespitosa*. *Carex panicea* starts to become frequent. Also frequent are *Centaurea nigra*, *Cirsium palustre* and *Epilobium palustre*. *Viola canina* is occasional.
4. There is a small area of semi-improved acid grassland that is too small to map that grades into coastal heath. There is abundant *Deschampsia flexuosa* and *Nardus stricta* with frequent *Molinia caerulea* tussocks. *Festuca rubra* and *Eriophorum vaginatum* are occasional. *Carex nigra* becomes frequent as do *Potentilla erecta* and *Viola canina*.
5. The coastal heath is dominated with *Molinia caerulea* with occasional *Deschampsia flexuosa*, *Nardus stricta* and *Juncus conglomeratus*. Frequent ericoids are *Calluna vulgaris*, *Erica tetralix* and *Empetrum nigrum*. Sedges become more frequent such as *Carex panicea*, *C. nigra* and *C. flacca* is occasional. *Potentilla erecta* is again frequent and *Dactylorhiza maculata* is occasional. *Salix repens* is also occasional.
6. There is a small area of densely planted *Picea sitchensis*. Surrounding this plantation within the fenced off area there is un-improved acid grassland. It is dominated by *Molinia caerulea* with frequent *Nardus stricta* and occasional *Deschampsia flexuosa*, *Holcus lanatus*, *Luzula multiflora*, and *Juncus conglomerates*. In the herb layer, *Plantago lanceolata* is dominant with frequent *Heracleum sphondylium* and *Rhinanthus minor* are frequent. *Rumex acetosa* is occasional. *Salix repens* may dominate the area eventually if grazing is permanently excluded.

Phase 1 Update Floral Species List

Species List

Scientific Name	Common Name
<i>Agrostis stolonifera</i>	Creeping bent-grass
<i>Anthoxanthum odoratum</i>	Sweet vernal-grass
<i>Bellis perennis</i>	Daisy
<i>Calluna vulgaris</i>	Ling heather
<i>Carex flacca</i>	Glaucous sedge
<i>Carex nigra</i>	Common sedge
<i>Carex panicea</i>	Carnation sedge
<i>Cerastium fontanum</i>	Common mouse-ear
<i>Cirsium arvense</i>	Creeping thistle
<i>Cirsium palustre</i>	Marsh thistle
<i>Cirsium vulgare</i>	Spear thistle
<i>Cynosurus cristatus</i>	Crested dog's-tail grass
<i>Dactylis glomerata</i>	Cock's-foot grass
<i>Dactylorhiza maculata</i>	Heath spotted orchid
<i>Dactylorhiza purpurea</i>	Northern marsh orchid
<i>Dechampsia cespitosa</i>	Tufted hair-grass
<i>Dechampsia flexuosa</i>	Wavy hair-grass
<i>Epilobium palustre</i>	Marsh willowherb
<i>Empetrum nigrum</i>	Crowberry
<i>Erica tetralix</i>	Cross-leaved heath
<i>Eriophorum vaginatum</i>	Common cotton-grass
<i>Festuca rubra</i>	Fed fescue
<i>Heracleum sphondylium</i>	Hogweed
<i>Holcus lanatus</i>	Yorkshire fog-grass

Scientific Name	Common Name
<i>Hypochaeris radicata</i>	Cat's-ear
<i>Juncus effusus</i>	Soft rush
<i>Juncus conglomeratus</i>	Compact rush
<i>Lolium perenne</i>	Perennial rye-grass
<i>Lotus corniculatus</i>	Lesser bird's-foot trefoil
<i>Molinia caerulea</i>	Purple moor-grass
<i>Nardus stricta</i>	Mat grass
<i>Picea sitchensis</i>	Sitka spruce
<i>Plantago lanceolata</i>	Ribwort plantain
<i>Plantago media</i>	Round-leaved plantain
<i>Prunella vulgaris</i>	Self heal
<i>Poa annua</i>	Annual meadow-grass
<i>Potentilla erecta</i>	Tormentil
<i>Ranunculus repens</i>	Creeping buttercup
<i>Rhinanthus minor</i>	Yellow rattle
<i>Rumex acetosa</i>	Common sorrel
<i>Rumex obtusifolius</i>	Common dock
<i>Salix repens</i>	Creeping willow
<i>Stellaria media</i>	Common chickweed
<i>Trifolium repens</i>	White clover
<i>Trifolium pratense</i>	Red clover
<i>Urtica dioica</i>	Nettle
<i>Viola canina</i>	Dog violet

Appendix 12D : Baseline NVC Data*

Table A12D.1 – Grasslands, Samples 1-5

Sample Number	1	2	3	4	5		
<i>Festuca rubra</i>	4	3	4	5	5	V	Red fescue
<i>Holcus lanatus</i>	5	8	5	5	5	V	Yorkshire fog
<i>Ranunculus repens</i>	4	2	4	1		V	Creeping buttercup
<i>Anthoxanthum odoratum</i>	5	3	4		5	IV	Sweet vernal grass
<i>Cerastium fontanum</i>	3	3	2			IV	Common mouse-ear
<i>Dactylorhiza purpurella</i>	3		1	2	2	IV	Northern marsh orchid
<i>Juncus effusus</i>	3	5	4			IV	Soft rush
<i>Plantago lanceolata</i>	3	3		3	1	IV	Ribwort plantain
<i>Trifolium repens</i>	2	4	4		3	IV	White clover
<i>Agrostis capillaris</i>	4	4			4	III	Bent-grass
<i>Cardamine pratensis</i>	2	2	3			III	Cuckoo flower
<i>Cynosurus cristatus</i>	5		5		4	III	Crested dogstail
<i>Dactylis glomerata</i>	4			3		II	Cocksfoot
<i>Heracleum sphondylium</i>		3		2		II	Hogweed
<i>Juncus articulatus</i>	2		2			II	Jointed rush
<i>Lolium perenne</i>	4		5		3	II	Rye grass
<i>Alopecurus geniculatus</i>	2		3			II	Marsh foxtail
<i>Bellis perennis</i>	3		3			II	Daisy
<i>Carex nigra</i>	4		3			II	Common sedge
<i>Centauria nigra</i>	2			1		II	Knapweed
<i>Cirsium palustre</i>		4		3		II	Marsh thistle
<i>Nardus stricta</i>			3	4		II	Mat grass
<i>Ranunculus acris</i>	2			3		II	Meadow buttercup
<i>Rumex acetosa</i>		3		3		II	Common sorrel
<i>Achillea millefolium</i>	3					I	Yarrow
<i>Carex flacca</i>	2				3	II	Glaucous sedge
<i>Euphrasia officinalis</i> agg.	3				3	II	Eyebright
<i>Hypochoeris radicata</i>	3				3	II	Catsear
<i>Linum catharticum</i>	2					II	Flax
<i>Lotus corniculatus</i>	2				3	II	Birdsfoot trefoil
<i>Luzula multiflora</i>	2					II	Heath woodrush
<i>Molinia caerulea</i>				5	4	II	Purple moorgrass
<i>Myosotis arvensis</i>	2					II	Field forget-me- not
<i>Poa pratensis</i>	3					II	Meadowgrass
<i>Poa trivialis</i>	4					II	Rough meadowgrass
<i>Potentilla erecta</i>				3	3	II	Tormentil
<i>Prunella vulgaris</i>	3			1	3	II	Self heal
<i>Ranunculus flamula</i>			1	1	2	II	Lesser spearwort

Sample Number	1	2	3	4	5		
Rhinanthus minor				3		II	Eyebright
Rumex crispus	2					II	Curled dock
Salix repens agg.				3	2	II	Creeping willow
Senecio aquaticus				2		II	Marsh ragwort
Stachys palustris		2				II	Marsh woundwort
Trifolium dubium	2				3	II	Lesser trefoil
Cirsium arvense				1		II	Creeping thistle
Deschampsia cespitosa			2			II	Tufted hairgrass
Agrostis vinealis	4					I	Brown bent
Achillea ptarmica				3		I	Sneezewort
Agrostis stolonifera		3				I	Creeping bent
Calluna vulgaris					2	I	Ling
Caltha palustris				2		I	Marsh marigold
Eriophorum angustifolium				3		I	Cotton grass
Potentilla anserina		4				I	Silverweed
Salix aurita					1	I	Eared willow
No. species per sample	32	16	19	19	20		

* Data taken from Atkins 2002/3

Community types:

1 - Runway edge - MG6b 52.8, MG 5a 50.9

2 - Yorkshire fog field/coastal heath transition - MG10a 51.9, MG 10 50.5

3 - Rush pastures to N of Dounreay - MG6b 47.4, MG6 46.1

4 - Strip by spruce stand - MG5c 33.2, MG9 32.3,

5 - Mown grasslands adjacent within Dounreay

Table A12D.2 – Grasslands, Samples 6-8 *

Sample Number	6	7	8		
<i>Agrostis capillaris</i>	4	4	4	V	Bent grass
<i>Anthoxanthum odoratum</i>	4	4	4	V	Sweet vernal grass
<i>Cerastium fontanum</i>	3	2	3	V	Common mouse-ear
<i>Cynosurus cristatus</i>	5	4	4	V	Crested dogstail
<i>Festuca rubra</i>	5	4	5	V	Red fescue
<i>Cardamine pratensis</i>	2	3		IV	Cuckoo flower
<i>Carex nigra</i>	4	3		IV	Common sedge
<i>Euphrasia officinalis</i> agg	1	2		IV	Eyebright
<i>Holcus lanatus</i>	5	6		IV	Yorkshire fog
<i>Hypochoeris radicata</i>		3	3	IV	Catsear
<i>Juncus effusus</i>	2	7		IV	Soft rush
<i>Lathyrus pratensis</i>		3	3	IV	Meadow vetchling
<i>Lolium perenne</i>	5	5		IV	Rye grass
<i>Poa trivialis</i>	4	5		IV	Rough meadowgrass
<i>Prunella vulgaris</i>	3	3		IV	Self heal
<i>Ranunculus acris</i>	1	2		IV	Meadow buttercup
<i>Ranunculus repens</i>	4	4		IV	Creeping buttercup
<i>Rumex acetosa</i>	3	3		IV	Common sorrel
<i>Trifolium pratense</i>	2	2		IV	Red clover
<i>Trifolium repens</i>	3	3		IV	White clover
<i>Achillea millefolium</i>			3	II	Yarrow
<i>Agrostis stolonifera</i>		4		II	Creeping bent
<i>Arrhenatherum elatius</i>			5	II	False oatgrass
<i>Bellis perennis</i>	3			II	Daisy
<i>Carex ovalis</i>		3		II	Oval sedge
<i>Carex panicea</i>		3		II	Carnation sedge
<i>Centaurea nigra</i>			3	II	Knapweed
<i>Cerastium glomeratum</i>	1			II	Sticky mouse-ear
<i>Leucanthemum vulgare</i>			3	II	Ox-eye daisy
<i>Cirsium arvense</i>	2			II	Creeping thistle
<i>Cirsium palustre</i>		3		II	Marsh thistle
<i>Dactylis glomerata</i>			5	II	Cocksfoot
<i>Galium verum</i>			3	II	Lady's bedstraw
<i>Glyceria fluitans</i>	1			II	Flote grass
<i>Heracleum sphondylium</i>			3	II	Hogweed
<i>Juncus articulatus</i>	1			II	Jointed rush
<i>Juncus conglomeratus</i>	2			II	Compact rush
<i>Lotus corniculatus</i>			3	II	Birdsfoot trefoil
<i>Matricaria discoidea</i>	1			II	Pineapple mayweed

Sample Number	6	7	8		
Myosotis discolor		3		II	Changing forget-me-not
Nardus stricta		3		II	Mat grass
Odontites vernus		2		II	Red batsia
Poa annua	1			II	Annual meadowgrass
Polygonum aviculare	1			II	Knotgrass
Stellaria media		2		II	Chickweed
Vicia cracca			3	II	Tufted vetch
Vicia sepium			2	II	Bush vetch
Vicia sativa			3	II	Common vetch
<i>Number of species per sample</i>	<i>26</i>	<i>21</i>	<i>18</i>		

* Data taken from Atkins 2002/3

Community types:

6 - Fields by control tower MG6b 53.9, MG8 50.33

7 - Rush pasture across road MG6b 56.8, MG8 53.0

8 - Old-road verge to south MG1e 52.2, MG5a 47.3, MG5b 46.6

Table A12D.3 – Coastal Heath*

Sample Number	9	10	11	12		
<i>Anthoxanthum odoratum</i>	4	3	3	4	V	Sweet vernalgrass
<i>Carex nigra</i>	4	4	4	4	V	Common sedge
<i>Erica tetralix</i>	4	5	4	3	V	Crossleaved heath
<i>Holcus lanatus</i>	5	2	5	6	V	Yorkshire fog
<i>Calluna vulgaris</i>	1	5	4	3	IV	Ling
<i>Carex panicea</i>		2	2	2	IV	Carnation sedge
<i>Festuca rubra</i>	4		4	5	IV	Fed fescue
<i>Juncus conglomeratus</i>	5	4	4		IV	Compact rush
<i>Molinia caerulea</i>	5	5	5		IV	Purple moorgrass
<i>Potentilla erecta</i>	3	3	1	3	IV	Tormentil
<i>Prunella vulgaris</i>	3	2	1	3	IV	Self heal
<i>Ranunculus repens</i>	2		2	4	IV	Creeping buttercup
<i>Succisa pratensis</i>		2	3	3	IV	Devilsbit scabious
<i>Achillea ptarmica</i>	3		3		III	Sneezewort
<i>Agrostis capillaris</i>	4			4	III	Bent grass
<i>Caltha palustris</i>		3		1	III	Marsh marigold
<i>Cardamine pratensis</i>			2	3	III	Cuckoo flower
<i>Carex echinata</i>		2	2		III	Star sedge
<i>Carex flacca</i>			3	3	III	Glaucous sedge
<i>Cerastium fontanum</i>			1	3	III	Common mouse-ear
<i>Cirsium palustre</i>	3		3		III	Marsh thistle
<i>Dactylorhiza maculate ericetor</i>		2		2	III	Heath spotted orchid
<i>Epilobium palustre</i>	3	2			III	Marsh willowherb
<i>Equisetum palustre</i>	2		2		III	Marsh horsetail
<i>Eriophorum angustifolium</i>	2	4			III	Cottongrass
<i>Euphrasia officinalis agg</i>		2		1	III	Eyebright
<i>Hypochoeris radicata</i>	2			3	III	Catsear
<i>Juncus articulatus</i>		4		3	III	Jointed rush
<i>Lotus pedunculatus</i>			3	3	III	Marsh birdsfoot trefoil
<i>Luzula multiflora</i>		2		3	III	Heath woodrush
<i>Nardus stricta</i>	4			4	III	Mat grass
<i>Ranunculus flammula</i>		2	2		III	Lesser spearwort
<i>Salix repens agg.</i>	4		4		III	Creeping willow
<i>Agrostis stolonifera</i>		3			II	Creeping bent
<i>Alopecurus geniculatus</i>				2	II	Marsh foxtail
<i>Angelica sylvestris</i>			2		II	Angelica
<i>Bellis perennis</i>				3	II	Daisy
<i>Carex pulicaris</i>			2		II	Flea sedge
<i>Cynosurus cristatus</i>				3	II	Crested dogstail

Sample Number	9	10	11	12		
Deschampsia cespitosa	4				II	Tufted hairgrass
Empetrum nigrum nigrum		2			II	Crowberry
Hypericum pulchrum		2			II	Slender St. Johns wort
Lolium perenne				3	II	Ryegrass
Lotus corniculatus			2		II	Birdsfoot trefoil
Ophioglossum azoricum			1		II	Small adderstongue
Parnassia palustris			1		II	Grass-of-Parnassus
Pedicularis palustris		2			II	Lousewort
Plantago lanceolata				3	II	Ribwort plantain
Polygala vulgaris		2			II	Milkwort
Potentilla anserina			2		II	Silverweed
Ranunculus acris				3	II	Meadow buttercup
Rhinanthus minor			2		II	Yellow rattle
Rumex acetosa				3	II	Common sorrel
Schoenus nigricans		5			II	Black bog rush
Senecio aquaticus			2		II	Marsh ragwort
Trifolium pratense				3	II	Red clover
Trifolium repens				3	II	White clover
Drepanocladus revolgen	1				II	Moss sp.
Sphagnum subnitens	1				II	Bog moss
<i>Number of species per sample</i>	<i>20</i>	<i>26</i>	<i>30</i>	<i>30</i>		

* Data taken from Atkins 2002/3

Community types:

9 - Main heath/bog - H7c 35.1, M26b 34.9.

10 - Towards coast with black bog rush - M15a 40.2, M25 37.2,

11 - In Dounreay site - M26b 38.6, M24c 38.2

12 - Field to west - MG6b 49.5, MG8 49.2

Table A12D.4 – Mill Lade Corridor

Sample Number	13	14	15		
<i>Angelica sylvestris</i>	2	3		IV	Angelica
<i>Anthriscus sylvestris</i>	3		2	IV	Cow parsley
<i>Caltha palustris</i>	3	4		IV	Marsh marigold
<i>Deschampsia cespitosa cespitos</i>	3	3		IV	Tufted hairgrass
<i>Epilobium palustre</i>	2	3		IV	Marsh willowherb
<i>Festuca rubra</i>	2		6	IV	Fed fescue
<i>Filipendula ulmaria</i>	5	4		IV	Meadowsweet
<i>Heracleum sphondylium</i>	3		2	IV	Hogweed
<i>Holcus lanatus</i>	4		7	IV	Yorkshire fog
<i>Hypochoeris radicata</i>	2		3	IV	Catsear
<i>Centaurea nigra</i>	1		1	IV	Knapweed
<i>Juncus effuses</i>	2	3		IV	Soft rush
<i>Lathyrus pratensis</i>	1		1	IV	Meadow vetchling
<i>Myosotis laxa caespitosa</i>	2	4		IV	Tufted forget-me- not
<i>Phalaris arundinacea</i>	6	6		IV	Reed canary grass
<i>Senecio aquaticus</i>	2	2		IV	Marsh ragwort
<i>Urtica dioica</i>		1	2	IV	Nettle
<i>Agrostis capillaris</i>			4	II	Bent grass
<i>Bellis perennis</i>			3	II	Daisy
<i>Cardamine flexuosa</i>		3		II	Cuckoo flower
<i>Cirsium arvense</i>			3	II	Creeping thistle
<i>Cirsium vulgare</i>			2	II	Spear thistle
<i>Dactylis glomerata</i>	5			II	Cocksfoot
<i>Dactylorhiza purpurella</i>		1		II	Northern marsh orchid
<i>Dryopteris filix-mas</i>	1			II	Male fern
<i>Glyceria fluitans</i>		3		II	Flote grass
<i>Lolium perenne</i>			4	II	Rye grass
<i>Lotus corniculatus</i>			3	II	Birdsfoot trefoil
<i>Lysimachia nummularia</i>		2		II	Creeping jenny
<i>Mentha aquatica</i>	1	4		II	Water mint
<i>Mimulus guttatus</i>	1	4		II	Monkey flower
<i>Myosotis arvensis</i>			2	II	Field forget-me- not
<i>Myosotis scorpioides</i>		4		II	Water forget-me- not
<i>Odontites vernus</i>			3	II	Red bartsia
<i>Plantago lanceolata</i>			3	II	Ribwort plantain
<i>Potentilla anserina</i>			4	II	Silverweed
<i>Prunella vulgaris</i>			3	II	Self heal
<i>Ranunculus aquatilis</i>		4		II	Water crowfoot
<i>Ranunculus hederaceus</i>			1	II	Ivy-leaved water crowfoot

Sample Number	13	14	15		
Ranunculus repens			3	II	Creeping buttercup
Rumex obtusifolius			3	II	Broad leaved dock
Senecio jacobaea	3			II	Ragwort
Silene dioica	1			II	Red campion
Sonchus oleraceus			2	II	Sow thistle
Trifolium pratense			2	II	Red clover
Trifolium repens			3	II	White clover
Tussilago farfara			3	II	Coltsfoot
Veronica beccabunga		3		II	Brooklime
Veronica chamaedrys			3	II	Birdseye speedwell
Vicia cracca	3			II	Tufted vetch
Vicia sepium	3			II	Bush vetch
Fontinalis antipyretica		5		II	Willow moss
Leucanthemum maximum	1			II	Shasta daisy
<i>Number of species per sample</i>	<i>20</i>	<i>20</i>	<i>24</i>		

* Data taken from Atkins 2002/3

Community types:

13 - Stream banks outside site MG2a 30.0, MG 9 29.9

14 - In channel M27 27.9, S11b 27.7 Reed canary-grass swamp

15 - Rough grassland S of castle - MG5a 42.0, MG6b 39.6

Table 12D.5 – Loch Achbuiligan and Surrounding Habitats *

Sample Number	16	17	18	19		
Holcus lanatus		1	3	6	IV	Yorkshire fog
Potentilla erecta		3	3	3	IV	Tormentil
Anthoxanthum odoratum			4	4	III	Sweet vernalgrass
Calluna vulgaris		2	5		III	Ling
Caltha palustris	4	3			III	Marsh marigold
Carex flacca			3	2	III	Glaucous sedge
Carex nigra	5	4			III	Common sedge
Cerastium fontanum		1		3	III	Common mouse-ear
Dactylorhiza fuchsii		2	2		III	Northern marsh orchid
Erica tetralix		3	5		III	Cross-leaved heath
Filipendula ulmaria	1	5			III	Meadowsweet
Juncus acutiflorus	6		2		III	Sharp flowered rush
Juncus articulatus		3	3		III	Jointed rush
Juncus effusus	4			4	III	Soft rush
Menyanthes trifoliata	6	3			III	Bogbean
Molinia caerulea		6	5		III	Purple moorgrass
Myrica gale		3	2		III	Bog myrtle
Potentilla palustris	6	3			III	Marsh cinquefoil
Salix repens agg.		2	3		III	Creeping willow
Succisa pratensis		3	3		III	Devilsbit scabious
Achillea ptarmica		3			II	Sneezewort
Agrostis canina			3		II	Brown bent
Agrostis capillaris				5	II	Bent grass
Angelica sylvestris		4			II	Angelica
Bellis perennis				3	II	Daisy
Cardamine pratensis				2	II	Cuckoo flower
Carex hostiana	3				II	Tawny sedge
Carex panicea			3		II	Carnation sedge
Carex rostrata	7				II	Bottle sedge
Cirsium arvense				2	II	Field thistle
Cirsium palustre		3			II	Marsh thistle
Cirsium vulgare				1	II	Spear thistle
Cynosurus cristatus				5	II	Crested dogstail
Dactylorhiza purpurella				1	II	Northern marsh orchid
Deschampsia cespitosa		3			II	Tufted hairgrass
Eleocharis palustris	4				II	Spike rush
Empetrum nigrum nigrum			2		II	Crowberry
Eriophorum angustifolium	4				II	Cotton grass
Euphrasia officinalis agg			3		II	Eyebright

Sample Number	16	17	18	19		
Festuca rubra				4	II	Fed fescue
Galium palustre		3			II	Marsh bedstraw
Hydrocotyle vulgaris		4			II	Marsh pennywort
Hypochoeris radicata				3	II	Catsear
Juncus squarrosus			2		II	Heath rush
Lolium perenne				4	II	Rye grass
Nardus stricta			4		II	Mat grass
Odontites vernus				3	II	Red bartsia
Parnassia palustris			2		II	Grass-of-Parnassus
Pedicularis palustris			2		II	Lousewort
Poa trivialis				4	II	Rough meadowgrass
Prunella vulgaris				3	II	Self heal
Ranunculus repens				3	II	Creeping buttercup
Rumex acetosa				3	II	Common sorrel
Trifolium repens				3	II	White clover
Ulex europaeus (s)				5	II	Gorse
Salix cinerea (g)			1		II	Common willow
Salix aurita (g)			1		II	Eared willow
<i>Number of species per sample</i>	<i>11</i>	<i>22</i>	<i>24</i>	<i>23</i>		

* Data taken from Atkins 2002/3

Community types:

16 - Loch emergents - S9b 45.5, S27 38.5

17 - Loch edge - M25c 42.1, M26a, 35.7

18 - Grass/heath - M16b 39.9, M15 37.1,

19 - Gorse/grassland - MG6b 54.7, MG6a 48.5

Table A12D.6 – Coastal Vegetation *

Sample Number	20	21	22	23		
<i>Festuca rubra</i>	5	7	4	4	V	Red fescue
<i>Cochlearia officinalis</i>		3	3	3	IV	Scurvy grass
<i>Holcus lanatus</i>	3	3		6	IV	Yorkshire fog
<i>Ranunculus repens</i>	3	2		3	IV	Creeping buttercup
<i>Elytrigia repens</i>			3	3	III	Couch grass
<i>Agrostis stolonifera</i>	3	3			III	Creeping bent
<i>Anthoxanthum odoratum</i>	4	4			III	Sweet vernalgrass
<i>Bellis perennis</i>		3		2	III	Daisy
<i>Carex nigra</i>	4	4			III	Common sedge
<i>Carex flacca</i>	1	2			III	Glaucous sedge
<i>Carex panicea</i>	1	1			III	Carnation sedge
<i>Cerastium fontanum</i>		3	3		III	Common mouse-ear
<i>Euphrasia officinalis</i> agg	2	3			III	Eyebright
<i>Galium aparine</i>			2	2	III	Goosegrass
<i>Juncus effusus</i>	1	1			III	Soft rush
<i>Lolium perenne</i>			3	3	III	Rye grass
<i>Lotus corniculatus</i>	3	3			III	Birdsfoot trefoil
<i>Pedicularis palustris</i>	1	2			III	Lousewort
<i>Plantago lanceolata</i>			2	3	III	Ribwort plantain
<i>Potentilla anserine</i>			3	3	III	Silverweed
<i>Potentilla erecta</i>	3	2			III	Tormentil
<i>Scilla verna</i>	3	3			III	Spring squill
<i>Silene uniflora</i>		3	1		III	Sea campion
<i>Succisa pratensis</i>	3	1			III	Devilsbit scabious
<i>Tripleurospermum maritimum</i>		2	3		III	Sea mayweed
<i>Ammophila arenaria</i>			4		II	Marram grass
<i>Anthriscus sylvestris</i>				2	II	Cow parsley
<i>Anthyllis vulneraria</i>		3			II	Kidney vetch
<i>Armeria maritima</i>		4			II	Thrift
<i>Atriplex prostrata</i>		2			II	Hastate orache
<i>Calluna vulgaris</i>	5				II	Ling
<i>Cardamine pratensis</i>		2			II	Cuckoo flower
<i>Cirsium arvense</i>				3	II	Creeping thistle
<i>Cirsium vulgare</i>				2	II	Spear thistle
<i>Dactylorhiza maculata</i> ericetor	2				II	Heath spotted orchid
<i>Leymus arenarius</i>			4		II	Lyme grass
<i>Empetrum nigrum</i> nigrum	4				II	Crowberry
<i>Erica tetralix</i>	5				II	Cross-leaved heath
<i>Glaux maritima</i>		2			II	Sea milkwort

Sample Number	20	21	22	23		
Heracleum sphondylium				2	II	Hogweed
Honckenya peploides			4		II	Sea sandwort
Hypochoeris radicata		3			II	Catsear
Ligusticum scoticum		2			II	Scots lovage
Luzula multiflora		2			II	Heath woodrush
Mertensia maritima			3		II	Oyster plant
Nardus stricta	3				II	Mat grass
Odontites vernus				5	II	Red bartsia
Plantago coronopus		3			II	Buckshorn plantain
Plantago major		3			II	Greater plantain
Plantago maritima		3			II	Sea plantain
Primula vulgaris		1			II	Primrose
Primula scotica		1			II	Scottish primrose
Puccinellia distans var. borealis		2			II	Salt-marsh grass
Rumex crispus				2	II	Curled dock
Rumex obtusifolius				2	II	Broad-leaved dock
Ranunculus flamula	1				II	Lesser spearwort
Sagina maritime		2			II	Sea pearlwort
Sedum rosea		2			II	Roseroot
Senecio vulgaris			3		II	Groundsel
Sonchus asper				2	II	Sow thistle
Thymus polytrichus		2			II	Thyme
Trifolium repens				4	II	White clover
Tussilago farfara				3	II	Coltsfoot
Urtica dioica				3	II	Nettle
Tripleurospermum inodorum				2	II	Scentless mayweed
Viola canina		2			II	Dog violet
<i>Number of species per sample</i>	<i>16</i>	<i>26</i>	<i>13</i>	<i>22</i>		

* Data taken from Atkins 2002/3

Community types:

20 - transitional heath H7d 51.1, H7c 49.9

21 - cliff-top grasslands MC10a 48.5, MC8f 47.3

22 - sand-dune by castle, grass-dominated MG11c 40.8, dunes SD5c 33.9

23 - grassland/tall herb by castle MG11a 40.3, OV25b 36.6

Appendix 12E : Summary Tables of Ecological Impacts and Mitigation

Summary of Ecological Impacts (prior to mitigation)

Receptor	Impacts	Receptor Value	Nature of effect	Timescale of effect	Significance of impact
Breeding birds	Direct mortality of birds' eggs/unfledged young will potentially occur as a result of pre-construction habitat clearance. No further loss of habitat during operation is anticipated.	Authority area	Medium Negative	Temporary	Moderate
	Breeding and foraging habitat will be permanently lost as a direct result of pre-construction clearance (approx. 16ha of the coastal wet heath along with 10ha of the semi improved grassland (species rich)).	Authority area	High Negative	Temporary	Moderate
	No habitat fragmentation and isolation is anticipated.	Authority Area	Neutral	N/A	Neutral
Wintering birds	Disturbance to birds located in adjacent habitats will potentially occur during habitat clearance, construction and operation of the facilities.	Authority area	Medium Negative	Temporary	Moderate
	Pollution from machinery and particulate matter and the water treatment areas may have an indirect impact upon birds due to a diminishing quality of the surrounding habitat.	Authority area	Medium Negative	Temporary	Moderate
	Direct mortality due to pre-construction habitat clearance.	Regional	Low negative	Temporary	Minor
Wintering birds	Habitat loss resulting in loss of foraging/roosting habitat during construction and operation.	Regional	Medium negative	Temporary	Moderate
	No habitat fragmentation and isolation impacts are predicted.	Regional	Neutral	N/A	Neutral

Receptor	Impacts	Receptor Value	Nature of effect	Timescale of effect	Significance of impact
	Disturbance to birds located in adjacent habitats will occur during habitat clearance, construction and operation.	Regional	Medium Negative	Temporary	Moderate
	Pollution from machinery and particulate matter and the water treatment areas may have an indirect impact upon birds due to a diminishing quality of the surrounding habitat.	Regional	Medium Negative	Temporary	Moderate
	Mortality due to construction activities	International	Low negative	Temporary	Moderate
Otter	Direct disturbance due to construction and increased traffic.	International	Low negative	Temporary	Moderate
	Potential for otter to investigate the water treatment area which if polluted could impact upon the receptor.	International	Low negative	Temporary	Moderate
Bats	Disturbance due to night working by light pollution.	Local	Low negative	Temporary	Minor
	No impact on existing conditions	Authority area	Neutral	N/A	Neutral
Freshwater invertebrates	New water treatment swale could potentially provide a new habitat for freshwater invertebrates	Authority Area	Beneficial	Temporary, but potentially permanent	Minor Positive
	Loss of approximately 10ha habitat including potential national BAP eyebright species due to construction. This is practically all of this habitat within the development area.	Authority area	Medium negative	Small permanent (access roads) Temporary	Moderate
Semi-improved neutral grassland (species rich)	Potential pollution from construction and operation e.g. from oil from machinery, sediments. There also may be indirect impacts due to damage caused by machinery.	Authority area	Medium negative	Temporary	Moderate

Receptor	Impacts	Receptor Value	Nature of effect	Timescale of effect	Significance of impact
Coastal heath	Loss of 16 ha coastal heath habitat where Scottish primrose is known to be present. This is over 70% of this habitat within the development area	National	High negative	Temporary	Major
	The heath that remains will be severely fragmented and damaged due to construction activity	National	High negative	Temporary	Major
	Potential pollution from construction and operation from oil from machinery and particulates from the grouting plant.	National	Medium negative	Temporary	Major
	Water treatment area may cause nutrient enrichment and/or dewater to the surrounding habitat There also may be indirect impacts due to damage caused by machinery.	National	Medium negative	Temporary	Major
Coniferous woodland	No Impact	Low	Neutral	N/A	Neutral

Summary of Ecological Mitigation Measures and Residual impacts

Receptor	Significance of Impact	Mitigation	Significance of residual impact
Breeding Birds	Moderate negative	Mortality will be prevented by all habitat clearance being performed prior to the main bird breeding season (March - August). These areas will be maintained in such a condition as to ensure that they will not be used for breeding purposes (i.e. all cleared material must be either be chipped or moved and stored off-site to ensure that birds do not use the cleared material for nesting during the breeding season). Work must stop in the vicinity should birds be found nesting in the clearance area or it is likely that a legal infringement will occur.	Minor
	Moderate negative	Habitat loss will be mitigated for by the production of a post-closure site restoration plan and will include the creation of species rich grassland suitable habitat for the described baseline species..	Minor
	Moderate negative	Disturbance will be minimised to adjacent areas by best practice working methods and SEPA guidelines and by fencing off areas that are not to be impacted upon. Pollution from machinery and during operation of the grouting plant will be minimised by following SEPA guidelines and implementing settlement tanks. The quality of the water from the water treatment area will be monitored accordingly.	Minor
Wintering birds	Minor negative	Direct mortality will be prevented by ensuring that bird scaring activities are employed prior to and during all habitat clearance through the main winter season (October - March).	Negligible
	Moderate negative	Habitat loss will be mitigated for by the production of a post-closure site restoration plan and will include the creation of species rich grassland suitable habitat for the described baseline species. Increasing the arable and pasture field margins and relaxation of the mowing regimes during the operation of the scheme will partially offset the loss of wintering bird habitat.	Minor negative
	Moderate Negative	Disturbance will be minimised to adjacent areas by best practice working methods and SEPA guidelines and by fencing off areas that are not to be impacted upon. Pollution from machinery and during operation of the grouting plant will be minimised by following SEPA guidelines and implementing settlement tanks. The quality of the water from the water treatment area will be monitored accordingly.	Minor negative

Receptor	Significance of Impact	Mitigation	Significance of residual impact
Otters	Moderate negative	<p>Covering of small excavations (e.g. sumps, manholes, footings) at night or fencing off large excavations and vigilance from the contractors when operating machinery.</p> <p>Monitoring of the water treatment area to maintain water quality.</p>	Minor negative
Bats	Minor negative	Refrain from directing lights for night time working in the direction of the Dounreay buildings where pipistrelle were discovered roosting.	Negligible
Grasslands	Moderate negative	<p>Pre-construction surveys will assess the presence of any national priority eyebrights. These plants will be avoided or translocated if found in sufficient numbers. Remnants of species rich grassland will be undisturbed to provide refuge for species that will re-colonise the site following site regeneration.</p> <p>Areas not to be impacted upon will be delineated to prevent incidental damage during construction and operation.</p> <p>Habitat loss will be further mitigated for by the production of a post-closure site restoration plan including the creation of species rich grassland</p>	Minor negative
	Major negative	Areas with high densities of Scottish primrose will be delineated through pre-construction surveys and avoided where practicable. The excavated material will be placed in such a way to allow coastal heath remnants to be used for site regeneration. In areas where significant numbers of Scottish primrose will be unavoidably impacted, options for translocation of the plants will be discussed and agreed with SNH.	Moderate negative
Coastal heath	Major negative	<p>Settlement tanks will be created following SEPA principles to capture particulates preventing dispersal into the wider area.</p> <p>The water treatment area is designed to SUDS principles and in accordance with SEPA guidelines. It will provide a net negative flow therefore preventing pollution of the surrounding area.</p> <p>Best practice will be followed during all construction to minimise air borne particulates and potential pollution from machinery including SEPA guidelines PPG 1,2, 5 and 6 to prevent pollution and damage to the surrounding area</p>	Moderate negative

Appendix 13A Landscape and Visual Assessment Sensitivity and Magnitude Criteria

Table A13.1 Landscape Sensitivity Criteria

Sensitivity	Criteria
High	Important elements of the landscape or a landscape of particularly distinctive character susceptible to relatively small changes of the type proposed
Medium	A landscape or elements of moderately valued characteristics reasonably tolerant to change of the type proposed
Low	A relatively unimportant landscape or elements potentially tolerant to substantial change of the type proposed

Table A13.2 Landscape Magnitude of Change Criteria

Magnitude	Criteria
High	Notable change in landscape characteristics over an extensive area ranging to very intensive change over a more limited area
Medium	Minor changes in landscape characteristics over a wide area ranging to notable changes in a more limited area
Low	Minor or virtually imperceptible change in any area or landscape components

Table A13.3 Visual Sensitivity Criteria

Sensitivity	Criteria
High	Receptors where the changed view is of high value and importance and/or where the receptor will notice any change to visual amenity by reason of the nature of use and their expectations
Medium	Receptors where the changed view is incidental but not critical to amenity and/or the nature of the view is not a primary consideration of the users
Low	Receptors where the changed view is unimportant/irrelevant and/or users are not sensitive to

	change
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Table A13.4 Visual Magnitude of Change Criteria

Magnitude	Criteria
High	Where the proposed scheme or elements of the scheme will dominate the view and fundamentally change its character and components.
Medium	Where the proposed scheme or elements of the scheme will be noticeable in the view, affecting its character and altering some of its components and features.
Low	Where the proposed scheme or elements of the scheme will be only a minor element of the overall view that are likely to be missed by the casual observer and/or scarcely appreciated.

Appendix 13B Extracts from Dounreay Landscape and Visual Baseline Study

Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 05 Coastal Plain
Field Survey Date:	3 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	Sedimentary Middle Old Red Sandstone of the Upper Caithness Flagstone Group, Latheron subgroup, have given rise to soils which consist of noncalcareous gleys, some peaty gleys, brown forest soils and brown rankers.
Topography and Drainage	This area consists of a raised beach terrace, which slopes very gradually up to the A836. It is relatively free draining.
Settlement and Infrastructure	The settlement consists of isolated farms which are reached via minor roads from the A836.
Landuse and Landcover	The agriculture here consists of large rectangular fields of arable and permanent pasture, with traditional slate and wire or dry stone boundaries.
Historic and Cultural Influences	The site of a chambered cairn is situated immediately east of the Dounreay site and brochs are located in the northeast and southwest extremities of this area. The relative fertility of this area has enabled it to become one of the most fertile and prosperous agricultural areas within the environs of Dounreay.
Ecological Value	Flora of ecological value is present in the habitats of maritime grasslands and cliffs on the coastline of this area.
Character/Visual/Perceptual Factors	This area is exposed and large in scale, with open views across the north Atlantic. It partially surrounds the Dounreay site, yet retains the character of rural and coastal agricultural land within its boundary. The presence of Dounreay is visually unavoidable, but despite the juxtaposition, the character of this area remains tranquil, ordered and harmonious.
Landscape Condition	The landscape condition of this area is good, due to its productivity and maintenance.
Forces for Change	The current lack of disturbance to this area is dependent on the status quo of Dounreay. Any changes at Dounreay, in terms of new development or changes to the extent of the safety exclusion zone, could have a significant impact on this area.
Designations	None.

Relationship to Dounreay site

Visibility	The majority of the Dounreay site is visible from the heart of this area, with limited views towards the north east and south west elevations.
Distance	This area ranges from 0 km to 3km from Dounreay.
Perception	Dounreay is perceived as a visible, neighbouring development, which does not otherwise affect this area.

Evaluation

Landscape Value	This area is of medium landscape value, since it is fertile and productive, and has a visually dramatic coastal location, but also serves as the threshold to Dounreay site.
Landscape Sensitivity (to changes at Dounreay)	High



Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 06 Loch of Skiall Basin
Field Survey Date:	3 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	Sedimentary Middle Old Red Sandstone of the Upper Caithness Flagstone Group, Latheron subgroup, have given rise to soils which consist of noncalcareous gleys, some peaty gleys, brown forest soils and brown rankers.
Topography and Drainage	This area is a flat, poorly drained basin, situated between the raised beach adjacent the coast and the north slope of the Hill of Shebster.
Settlement and Infrastructure	A minor road, which bisects the area, provides access to Achreamie School House and an assortment of other isolated houses and outbuildings.
Landuse and Landcover	This area is essentially moorland, merging into croft-sized paddocks of rough grazing, edged by improved pasture immediately adjacent the A836. Land either side of the road to Achreamie House has become developed for an assortment of housing.
Historic and Cultural Influences	Two chambered cairns and stone rows remain at the foot of the Hill of Shebster and Achreamie School House had status as the local school in the last century. The new housing reflects the presence of, and proximity to, Dounreay as a recent source of employment.
Ecological Value	This area is not currently acknowledged as supporting flora or fauna of notable ecological value.
Character/Visual/Perceptual Factors	This area is open and bleak. Degraded land is interrupted by a selection of private housing. It has views over Dounreay to the sea and the cliffs of the Sutherland coast beyond. Dounreay is perceived as a source of much needed employment in this impoverished area.
Landscape Condition	The landscape condition of this area is poor, based on the need for maintenance to some of the housing and improvement to impoverished land.
Forces for Change	The withdrawal of employment by Dounreay would cause decline in this area.
Designations	None.

Relationship to Dounreay site

Visibility	The whole Dounreay site, except the car park and airstrip is visible, sprawled across the middle distance. However, all the structures, except the stack at the east end, are below the horizon of the sea.
Distance	This area ranges from 0.5 km to 2 km from Dounreay.
Perception	Dounreay features visibly from this area and is an important source of employment.

Evaluation

Landscape Value	This area is of low value, since it has no remarkable features, and has had its rural qualities degraded by ribbon development and its scenic quality reduced by Dounreay.
Landscape Sensitivity (to changes at Dounreay)	Low



Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 07 Upper Dounreay Basin
Field Survey Date:	3 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	Sedimentary Middle Old Red Sandstone of the Upper Caithness Flagstone Group, Latheron subgroup, have given rise to soils which consist of noncalcareous gleys, some peaty gleys, brown forest soils and brown rankers.
Topography and Drainage	This undulating lowland, adjacent to the north west slope of the Shebster Hill, has shallow slopes and is poorly drained.
Settlement and Infrastructure	Isolated farms are reached by a grid of minor roads which join the A836.
Landuse and Landcover	Arable farmland, rough grazing and disturbed, derelict ground in the immediate vicinity of the farm buildings feature in this area. The areas of rough grazing consist of acid-bent fescue grassland and Dry Atlantic Heather moor.
Historic and Cultural Influences	This area is a foothill to the Hill of Shebster and contains standing stones and chambered cairns. Historical evidence of the struggle for agricultural survival is evident from ruined bothies and abandoned small-holdings.
Ecological Value	This area is not currently acknowledged as supporting flora or fauna of notable ecological value.
Character/Visual/Perceptual Factors	This area is bleak, exposed and degraded. The agriculture is marginalized and impoverished. There is a potentially attractive open aspect to the sea, which is dominated by middle distance views of Dounreay.
Landscape Condition	The landscape condition of this area is poor, due to the derelict properties and lack of maintenance throughout.
Forces for Change	Farming in this area is so impoverished that only a minor deterioration of prevailing conditions could cause further decline.
Designations	None.

Relationship to Dounreay site

Visibility	The whole Dounreay site is visible and dominates the middle distance.
Distance	This area ranges from 0.5 km to 3 km from Dounreay.
Perception	Dounreay is a dominant visual presence for this area.

Evaluation

Landscape Value	This area has low landscape value because it has limited agricultural use and no designations.
Landscape Sensitivity (to changes at Dounreay)	Medium



Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 08 Dounreay site
Field Survey Date:	3 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	The Dounreay Nuclear Power Development Establishment is built on Dounreay Shore formation, a member of the Upper Caithness Flagstone Group of sedimentary rocks, of Middle Old Red Sandstone Age.
Topography and Drainage	The site is flat, with hard surfaces and a drainage system.
Settlement and Infrastructure	The site development consists of a cluster of industrial buildings, ranging from the landmark 38m diameter steel dome, 37m high chimney stacks and the Vulcan buildings to the sprawl of two storey administration buildings. The site has its own internal road and circulation system.
Landuse and Landcover	The Dounreay site is used for research and industry, producing nuclear power from the DFR until 1977 and the PFR until 1994. Since then, the decommissioning process and Dounreay Site Restoration Plan are being implemented.
Historic and Cultural Influences	The site was originally part of Lower Dounreay Farm, which was occupied by the state during the Second World War for use as an aerodrome and was selected as a suitable site for the Dounreay plant because of its physical and geological properties.
Ecological Value	None.
Character/Visual/Perceptual Factors	Dounreay is an extensive industrial complex of very large scale and impact.
Landscape Condition	The landscape condition of this area is high because it is well maintained.
Forces for Change	Implementation of the Dounreay Site Restoration Plan in terms of additional construction, demolition and remediation will constitute a significant force for change
Designations	The Dome has been designated as a listed building.

Relationship to Dounreay site

Visibility	Site staff experience the full visual impact of Dounreay site at close proximity.
Distance	None.
Perception	Dounreay site is perceived as a vital source of employment.

Evaluation

Landscape Value	This area is of medium value, since it serves as a vital source of employment to the local residents.
Landscape Sensitivity (to changes at Dounreay)	Low



Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 10 Achvarasdal
Field Survey Date:	3 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	The solid geology here are bands of Middle Old Red Sandstone Barren Group sandstones of the upper Caithness Flagstone Group, Metamorphic rocks from the Moine era and Pre-Caledonian Igneous Intrusive Rocks, which, collectively underlay humus-iron podzols and brown forest soils.
Topography and Drainage	This undulating area surrounds a shallow valley, which is generally free draining.
Settlement and Infrastructure	Several houses are scattered around the foot of the valley and adjacent the B874.
Landuse and Landcover	This area incorporates a range of landuse in the form of moorland, rough grass, large stretches of gorse, small patches of scrub, a mixed woodland plantation, one arable field and scattered housing.
Historic and Cultural Influences	The remains of several brochs are present within the valley of Archvarasdal.
Ecological Value	This area is not currently acknowledged as supporting flora or fauna of notable ecological value.
Character/Visual/Perceptual Factors	This is an area of transition, from Milton Moss moorland to the raised beach around Dounreay. It is visually variable, with no recognisable identity. It is generally degraded and impoverished.
Landscape Condition	The landscape condition of this area is medium, given that it is reasonably maintained.
Forces for Change	Withdrawal of employment at Dounreay would impact on the long term viability of the new housing in this area.
Designations	None.

Relationship to Dounreay site

Visibility	The dome, stacks and Vulcan buildings are clearly visible from this area.
Distance	This area ranges from 1 km to 3.5 km from Dounreay.
Perception	Dounreay features as a dominant, middle distance view and is a source of employment and housing development in the area.

Evaluation

Landscape Value	This area is of medium value, since it provides a variety of landuse within a relatively compact area and is visually stimulating.
Landscape Sensitivity (to changes at Dounreay)	Medium



Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 16 Sandside Headland
Field Survey Date:	2 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	Sedimentary Middle Old Red Sandstone of the Upper Caithness Flagstone Group, Latheron subgroup, have given rise to soils which consist of noncalcareous gleys, some peaty gleys, brown forest soils and brown rankers.
Topography and Drainage	This area is undulating, with poorly drained hollows, and rocky outcrops nearer the coast.
Settlement and Infrastructure	Sandside House is situated in the centre of this area, and fishermen's cottages are built beside the harbour. They are accessed by minor and private roads, which also provide public access to Sandside Bay.
Landuse and Landcover	The farmland is used for arable and grazing, and the estate nearest to Sandside House contains a mixed woodland plantation and shelterbelt of predominantly sycamore. A stone quarry on the estate remains active and provided the stone for the new Scrabster Harbour. The grazing consists of acid-bent fescue grassland. Sandside Harbour, which is still used by local fishermen, is surrounded by original stone walls, and encloses a sandy shore. Elsewhere, the coastline is rocky.
Historic and Cultural Influences	A monument, south of Sandside House, marks the site where battles between clans took place and Sandside House itself is still an active and influential estate. The once thriving fishing community at Sandside Harbour has been almost eliminated by the use of trawlers, and is now reduced to catching a small amount of salmon and lobster.
Ecological Value	This area has coastal and marine ecological significance.
Character/Visual/Perceptual Factors	The area is essentially rolling farmland, which is well-tended and relatively productive for this location. The unusual presence of woodland planting creates a degree of shelter and enclosure, creating a more comfortable scale. Sandside House and the fishermen's cottages at Sandside Harbour are vernacular in style, and sensitively located in the landscape. The harbour itself is intimate, timeless and charming, with scenic views out to sea and inland to Sandside Bay. Dounreay is perceived as an unobtrusive visual feature across Sandside Bay, against the skyline, but absorbed by the scale of its surroundings.
Landscape Condition	The landscape condition of this area is good, because the majority of elements are well maintained.
Forces for Change	The demise of Sandside Estate or further decline in the local fishing industry are potentially forces for change to this area.

Designations	This area occurs in a natural heritage zone of ‘medium sensitivity’ and Sandside Bay is designated as an ‘Area of Great Landscape Value’.
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Relationship to Dounreay site

Visibility	A clear view of Dounreay features in the distance, but it is absorbed by the scale of its surroundings.
Distance	This area is between 2 and 3.5 km from Dounreay.
Perception	Dounreay is perceived as a distant industrial development which does not impact significantly on this area.

Evaluation

Landscape Value	This area is of high value due to the diversity of cultural and scenic elements present and its designation status, including a deciduous shelterbelt, which is a rare feature in this locality.
Landscape Sensitivity (to changes at Dounreay)	High



Landscape Character Baseline Description and Evaluation

Landscape Character Area Reference and Name:	LCA 17 East Shebster
Field Survey Date:	2 October 2002
Surveyor :	D Cook, M Paterson.

Landscape Description

Geology and Soils	Sedimentary Middle Old Red Sandstone of the Upper Caithness Flagstone Group, Latheron subgroup, have given rise to soils which consist of noncalcareous gleys, some peaty gleys, brown forest soils and brown rankers.
Topography and Drainage	This area is a broad valley with gently sloping sides, which is poorly drained.
Settlement and Infrastructure	Isolated farms occur on either side of the B874, which originates in Thurso.
Landuse and Landcover	The land is used for grazing, with improved, permanent pastures and acid-bent fescue grassland, with small sections of roadside trees.
Historic and Cultural Influences	The name 'Shebster' originates from the Viking and Norse occupation of the North of Scotland and cairns remain in the areas of East and West Shebster, on the southern slope of this valley.
Ecological Value	This area is not currently acknowledged as supporting flora or fauna of notable ecological value.
Character/Visual/Perceptual Factors	This straight valley slopes gradually down towards Thurso, and features regular field pattern of exposed farmland. There are fragments of shelterbelts and hedgerow trees beside the road and farm. It is peaceful and pleasant, with no views of Dounreay.
Landscape Condition	The landscape condition of this area is medium, since it is in a reasonable state of repair and maintenance.
Forces for Change	A decline in farming would be a force for change to the detriment of this area.
Designations	None.

Relationship to Dounreay site

Visibility	Dounreay is not visible from this area.
Distance	This area is between 3.5 and 7.5 km from Dounreay.
Perception	There is no apparent perception of Dounreay in this area.

Evaluation

Landscape Value	This area is of medium value due to its relatively productive farmland and tranquillity.
Landscape Sensitivity (to changes at Dounreay)	Low



Appendix 13C Indirect landscape Impacts upon LCAs

Table C13.1 Indirect Landscape Impacts upon LCAs (with mitigation measures in place)

LCA	Sensitivity	Element of Scheme	Timescale (Phase)	Impact Description	Magnitude	Impact
Loch of Skiall Basin (LCA 06)	Medium	Construction LLW Facilities	2008-2011 (Phase 1)	i. Noise and visual impacts of construction operations. ii. Minor reduction perceived tranquillity/remoteness.	Low to Medium	Slight to Moderate adverse
	Medium		2020-2023 (Phase 2)		Low	Slight adverse
	Medium to High		2023-2026 (Phase 3)		Low	Slight to Moderate adverse
	Medium	Operation LLW Facilities	2011-2020 (Phase 1)	i. Visual impacts of LLW Facilities buildings, access road, administration building and grouting plant. ii. Minor reduction perceived tranquillity/remoteness.	Low	Slight adverse
	Medium		2020-2023 (Phases 1&2)		Low	Slight adverse
	Medium to High		2023-2036 (Phases 1-3)		Low	Slight to Moderate adverse
	Medium to High	Closure All phases	2036 (All phases)	i. Noise and visual impacts of closure operations. ii. Minor reduction perceived	Medium	Moderate adverse

LCA	Sensitivity	Element of Scheme	Timescale (Phase)	Impact Description	Magnitude	Impact
Upper Dounreay Basin (LCA 07)				tranquillity/remoteness. iii.		
	Medium	Construction LLW Facilities	2008-2011 (Phase 1)	i. Noise and visual impacts of construction operations. ii. Minor reduction perceived tranquillity/remoteness.	Low to Medium	Slight to Moderate adverse
	Medium		2020-2023 (Phase 2)		Low to Medium	Slight to Moderate adverse
	Medium to High		2023-2026 (Phase 3)		Low to Medium	Moderate adverse
	Medium	Operation LLW Facilities	2011-2020 (Phase 1)	i. Visual impacts of LLW Facilities buildings, access road, administration building and grouting plant.	Low	Slight adverse
	Medium		2020-2023 (Phases 1&2)	ii. Minor reduction perceived tranquillity/remoteness.	Low to Medium	Slight to Moderate adverse
	Medium to High		2023-2036 (Phases 1-3)		Medium	Moderate adverse
	Medium to High	Closure All phases	2036 (All phases)	i. Noise and visual impacts of closure operations. ii. Minor reduction perceived tranquillity/remoteness.	Medium	Moderate adverse
	Medium to High	Post Closure	2036 (All phases)	i. Minor visual impact of altered landform/ vegetation cover.	Low	Negligible

LCA	Sensitivity	Element of Scheme	Timescale (Phase)	Impact Description	Magnitude	Impact
Achvarsdal (LCA 10)	Medium	Construction LLW Facilities	1 – 2008-2011	i Visual impacts of construction operations. ii Minor reduction perceived tranquillity/remoteness.	Low	Slight adverse
	Medium		2 – 2020-2023		Low	Slight adverse
	Medium to High		3 – 2023-2026		Low	Slight to Moderate adverse
	Medium	Operation LLW Facilities	2011-2020 (Phase 1)	i Visual impacts of LLW Facilities buildings, access road, administration building and grouting plant. ii Minor reduction perceived tranquillity/remoteness.	Low	Slight adverse
	Medium		2020-2023 (Phases 1&2)		Low	Slight adverse
	Medium to High		2023-2036 (Phases 1-3)		Low	Slight adverse
Medium to High	Closure All phases	2036 (All phases)	i. Visual impact of closure operations. ii. Minor reduction perceived tranquillity/remoteness.	Low to Medium	Slight to Moderate adverse	
Medium to High		Post Closure 2036 (All phases)		Low	Negligible	
Sandside Headland (LCA 16)	High	Construction LLW Facilities	1 – 2008-2011	i. Minor visual impact of construction operations.	Nil	Nil
	High		2 – 2020-2023		Low	Slight

LCA	Sensitivity	Element of Scheme	Timescale (Phase)	Impact Description	Magnitude	Impact
	High		3 – 2023-2026		Low to Medium	adverse Slight to Moderate adverse
	High	Operation LLW Facilities	2011-2020 (Phase 1) 2020-2023 (Phases 1&2)	i. Visual impacts of LLW Facilities buildings, access road, administration building and grouting plant.	Nil Low	Nil Negligible-Slight adverse
	High		2023-2036 (Phases 1-3)		Low	Slight adverse
	High	Closure All phases	2036 (All phases)	iii. Visual impact of closure operations. iv. Minor reduction perceived tranquillity/remoteness.	Low to Medium	Slight to Moderate adverse
	High	Post Closure	2036 (All phases)	i. Minor visual impact of altered landform/ vegetation cover	Low	Negligible
East Shebster (LCA 17)	Low	Construction LLW Facilities	2008-2011 (Phase 1)	i. Noise and visual impacts of construction operations (from Hill of Shebster).	Low to Medium	Slight adverse
	Low		2020-2023 (Phase 2)	ii. Minor reduction perceived tranquillity/remoteness (for Hill of Shebster).	Low to Medium	Slight adverse
	Medium to High		2023-2026 (Phase 3)		Medium	Slight to Moderate adverse

LCA	Sensitivity	Element of Scheme	Timescale (Phase)	Impact Description	Magnitude	Impact
	Low	Operation LLW Facilities	2011-2020 (Phase 1)	i. Visual impacts of LLW Facilities buildings, access road, administration building and grouting plant – will appear separate from main Dounreay facility in views from Hill of Shebster.	Low to Medium	Slight
	Low		2020-2023 (Phases 1&2)		Low to Medium	Slight to Moderate adverse
	Medium to High		2023-2036 (Phases 1-3)	ii. Minor reduction perceived tranquillity/remoteness.	Medium	Slight to Moderate adverse
	Medium to High	Closure All phases	2036 (All phases)	i. Noise and visual impacts of closure operations. ii. Minor reduction perceived tranquillity/remoteness.	Medium	Moderate adverse
	Medium to High	Post Closure	2036 (All phases)	i. Minor visual impact of altered landform/ vegetation cover.	Very Low	Negligible

Receptor No. and type	Sensitivity	Significance of Impact – Phase 1 Operation	Significance of Impact – Phases 1 & 2 Operation	Significance of Impact – Phases 1, 2 & 3 Operation	Significance of Impact – Phase 1 Construction	Significance of Impact – Phase 2 Construction	Significance of Impact – Phase 3 Construction	Significance of Impact – Closure	Significance of Impact – Post-closure
View Point A836			Slight adverse						
11 dwelling	Medium	Slight/ Moderate adverse	Slight to Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate to Substantial adverse	Negligible to slight adverse
12 dwelling	Medium	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Moderate adverse	Negligible
13 dwellings	Medium	No view	No view	No view	Negligible to Slight adverse	Negligible to Slight adverse	Negligible to Slight adverse	Slight adverse	Negligible
14 dwellings	Low-Medium	No view	No view	No view	Slight adverse	Slight adverse	Slight to Negligible adverse	Slight adverse	Negligible
15 dwellings	Medium	Slight to Moderate adverse	Slight to Moderate adverse	Slight to Moderate adverse	Moderate adverse	Moderate adverse	Moderate adverse	Moderate to substantial adverse	Negligible
16 dwelling	Medium	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight to Moderate adverse	Moderate adverse	Negligible
17 A836 SW of site	Low	Slight adverse	Slight adverse	Slight to Moderate adverse	Slight to Moderate adverse	Slight to Moderate adverse	Slight to Moderate adverse	Moderate adverse	Negligible
18 A836 NE of site	Low	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight to Moderate adverse	Slight/ Moderate adverse	Negligible
19 dwelling/farm	Medium	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Negligible to Slight adverse	Slight/ Moderate adverse	Negligible
20 dwellings/farm	Medium	Slight to Moderate adverse	Slight to Moderate adverse	Slight to Moderate adverse	Moderate adverse	Slight to Moderate adverse	Slight to Moderate adverse	Moderate adverse	Negligible
21	Medium	Slight adverse	Moderate	Moderate/ adverse	Moderate	Moderate	Moderate to	Substantial	Negligible

Receptor No. and type	Sensitivity	Significance of Impact – Phase 1 Operation	Significance of Impact – Phases 1 & 2 Operation	Significance of Impact – Phases 1, 2 & 3 Operation	Significance of Impact – Phase 1 Construction	Significance of Impact – Phase 2 Construction	Significance of Impact – Phase 3 Construction	Significance of Impact – Closure	Significance of Impact – Post-closure
Cnoc Freiceadain Cairn									
22 dwelling	Medium	No view	No view	No view	Slight adverse	Negligible to Slight adverse	Negligible to Slight adverse	Slight adverse	Negligible
23 dwellings	No View								
24 dwelling	Medium	Slight adverse	Slight adverse	Slight adverse	Slight to Moderate adverse	Slight adverse	Slight adverse	Slight adverse	Negligible
25 dwelling	Low	Negligible to Slight adverse	Negligible to Slight adverse	Negligible to Slight adverse	Slight adverse	Negligible	Negligible	Slight adverse	Negligible
26 dwellings	Low	No view	No view	No view	Negligible to Slight adverse	Negligible to Slight adverse	Negligible to Slight adverse	Negligible to Slight adverse	Negligible
27 dwelling	Medium	Negligible to Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Negligible
28 dwelling/ dwelling/ farm	Low to Medium	Negligible to Slight adverse	Negligible to Slight adverse	Negligible to Slight adverse	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Negligible
29 Portskerra village	Medium	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
30 Sandside House dwelling	Medium	Slight adverse	Slight adverse	Slight adverse	Slight to Moderate adverse	Negligible to Slight adverse	Slight adverse	Slight to Moderate adverse	Negligible
31 dwellings at Sandside Harbour	Medium	Slight adverse	Slight adverse	Slight adverse	Moderate adverse	Slight adverse	Slight to moderate adverse	Moderate adverse	Negligible
32 Sandside	Medium	Slight adverse	Slight adverse	Slight to Moderate	Moderate adverse	Slight adverse	Slight to moderate	Moderate adverse	Negligible

Appendix 14A

Other Documentary sources

Ordnance Survey (1870) Name Book

Ordnance Survey (1873) Name Book

Cartographic Sources

1642 Gordon, R. *Cathensia*.

1654 Blaeu, J. *Cathenesia*.

1654 Blaeu, J. *Extima Scotiae*.

1750 (circa) General Roy.

1661 Lucini, A F. *Carta particolare della costa di Scozia che cominicia con il C: de Cromar e finisce con l'Isole do Orcades*.

1750 Dorrett, J. *A General Map of Scotland and Islands...*

1774 Bryce, A. *A Map of the North Coast of Great Britain from Row Stoir of Assynt to Wick in Caithness*.

1807 Arrowsmith, A. *A Map of Scotland*.

1822 Thomson, J. *Caithness Shire*.

1823 Thomson, J. *Sutherlandshire*.

1853 Burnett, G & Scott, W. *Map of the County of Sutherland made on the basis of the trigonometry survey of Scotland in the year 1831*.

1876 Ordnance Survey, Caithness Sheet IV (First Edition, surveyed 1872), scale 1:10,560.

1905 Ordnance Survey, Caithness Sheet IV (revision of 1876 map), scale 1:10,560.

1905 Ordnance Survey, Caithness Sheet X (revision of 1871-2 map), scale 1:10,560.

1909 Ordnance Survey, Caithness (Second Edition, surveyed 1873, published 1874, revised 1905, published 1909), scale 1:10,560.

1964 Ordnance Survey, NC 96 NW, scale 1:10,000.

1969 Ordnance Survey, ND 06 NE, scale 1:10,000.

1969 Ordnance Survey, ND 06 NW, scale 1:10,000.

1989 Ordnance Survey, NC 96 NE, scale 1:10,000.

1980 Ordnance Survey, NC 96 SE, scale 1:10,000.

Aerial Photographs

<i>Sortie</i>	<i>Frames</i>	<i>Date</i>	<i>Scale</i>	<i>Lib</i>
541/A/467	4339-4334	26.4.19 49	1:10,000	B265
541/A/467	3341-3335	26.4.19 49	1:10,000	B 265
541/A/467	3393-3388	26.4.19 49	1:10,000	B265
58/RAF/1 714	F21 0129-0134	14.4.19 55	1:10,000	B410
58/RAF/1 714	F22 0129-0134	14.4.19 55	1:10,000	B410
58/RAF/1 714	F22 0383-0386	14.4.19 55	1:10,000	B410
OS/75/134	177-170 184-191	21.5.19 75	1:8,000	-
OS/75/135	252-246 261-265	21.5.75	1:8,000	-
51588	191-189	10.6.88	1:24000	C275

Table B14.1: Archaeological Sites Within the Site Boundary

Site	Name	Description	SMR & NGR No.	Legal status	Importance
1	Cnoc-Na H Uiseig	A chambered cairn now comprising a grassy mound that has been mutilated by large-scale construction work and is now slightly rectangular in shape, measuring 22.0m E-W and 17.5m transversely, by about 2.5m high. The horns are barely distinguishable on the E side. The soil-tip to the S formerly overlay the S segment, but the cairn has been 'cleaned-up' and a high mesh-fence now encloses it.	NC 96 NE 6 NC 99690 67720	SAM	National
2	Dounreay Airfield	Although construction began early in 1942 this airfield was not completed until 1944. When more or less complete in April 1944, the station was occupied by a Care and Maintenance party and the runways obstructed. The site was selected for the development of a nuclear power station (NC96NE 78), construction being started in 1954. One runway was retained, the research station having been built on the northern half of the airfield. The wartime control tower has now been modernised with a modern glasshouse on top.	NC 96 NE 87.02 NC 9971 6720	None	Local
5	Dounreay Airfield	A small modern aircraft hangar for light aircraft has been built to the N of the surviving runway.	NC96NE 87.03 NC 9951 6739	None	Negligible
8	Lower Dounreay	A sub-rectangular, grass-covered cairn, 6m N-S by 2.5m and 0.5m high, was noted during field survey, the centre of which had been robbed, presumably in antiquity.	NC96NE 40 NC 9987 6744	N/A	Local
13	Dounreay	A structure, 11m NW-SE by 5.5m and 0.5m high, damaged on the N.	NC96NE 76 NC 9990 6740	N/A	Local
21	Balmore, Cairn	A structure, 4m N-S by 2.5m by 0.25m high, comprising a sub-circular, grass covered bank with a depression, 0.5m deep, around a central cairn.	ND06NW 48 ND 0014 6774	N/A	Local
36	Dounreay, Mound	A small, grass-covered mound. Previously unrecorded site, identified during scoping walkover survey, 2000 (Site 3). Recorded by AOC Archaeology during previous walkover of site.	NC 9930 6790	N/A	Local
44	Dounreay, Rubble patch	A Rectangular patch of rubble, 10 m long, possible structure. Previously unrecorded site, identified during AOC scoping walkover survey, 2000.	NC 9950 6820	N/A	Unknown

Table B14.2: Identified Archaeological Sites Beyond the Site Boundary

Site	Name	Description	SMR & NGR No.	Legal status	Importance
3	Peas Cairn (site of)	A very large mound, described as a 'Pict's House', removed about 1832 when small sea shells and round stones resembling small cannon balls 'were found in abundance lying on the floor of the building'. The name 'Peas Cairn' came from the wild peas which grew on the mound. This site was destroyed during the construction of the Dounreay Research Centre.	NC96NE 5 NC 9887 6694	N/A	Local
4	Dounreay Airfield Military Camp	Post-war RAF vertical air photographs (106G/Scot/UK 133, 3171-3172, flown 30 June 1946) show that there were at least 27 Nissen huts of varying sizes plus about eleven other huts in this group. Spread amongst the group on the N side of the road were five emergency air-raid shelters. A vertical air photograph taken in 1977 (OS/77/122, 168, 1977) show that all huts in this area had been removed apart from the gym/cinema building and one other structure.	NC96NE 87.01 NC 99460 66591	N/A	Local
6	Dounreay Airfield	Area shown as 'Camp site' (disused) on OS 1:10000 scale map (1989) and 1:10560 scale map (1969). A post-war RAF vertical air photograph (106G/Scot/UK133, 3171, flown 30 June 1946) shows that this area was probably utilised for general mess, showers and stores. Seven large Nissen huts and several other smaller versions along with other types are visible on the air photograph. The depiction on the current OS digital 1:2500 scale map would suggest that at least six buildings survive in this area.	NC96NE 87.04 NC 9995 6720	N/A	Local
7	North Cairn Possible cairn/Broch	The NMRS records this site as a possible cairn while the Highland Sites and Monuments Record describes this site as a Broch. Although there is confusion over the interpretation, this site is clearly Prehistoric.	NC96NE 4 NC 9874 6716	N/A	Local
9	Dounreay Lime Kiln	The flue of a large lime kiln was uncovered by bulldozer excavation. The kiln was about 12ft in diameter with clay-filled walls, 5ft thick. The flue was of dry-stone construction. Extensive burning was indicated by reddish earth and charred straw in the interior. No evidence for dating was found and the site has now been destroyed by a road.	NC96NE 52 NC 98909 67006	N/A	Local
10	Dounreay Airfield Military camp	An L-shaped area of huts centred NC 99813 66385 is visible on a post-war air photograph (106G/Scot/UK133, 3171-3172, flown 30 June 1946) situated about 300m SE of NC96NE 87.01. About 35 huts along with five flat roofed buildings have been noted on the photographs. A vertical air photograph taken in 1977 (OS/77/122, 168, 1977) show that all huts in this area had been removed and only hut bases remain.	NC96NE 7.05 NC 9981 6638	N/A	Local
11	Dounreay Small Cairn	A circular, grass-covered cairn, 2m in diameter and 0.1m in height	NC96NE 74 NC 9931 6714	N/A	Local
12	Dounreay	A discontinuous, grass-covered wall, 200m long, NE-SW, 1m thick and 0.1m high, with only a few stones visible.	NC96NE 75 NC 9970 6710	N/A	Negligible
14	Gling Glang	A grass-covered wall, 2m wide and 1m high, following the cliff-edge.	NC96NE 77 NC 9975 6855	N/A	Local
15	Choc Urray	This turf-covered mound, 2.7m high, is generally as described by the RCHAMS, but no surrounding ditch is visible.	NC96NE 16	SAM	National

Site	Name	Description	SMR & NGR No.	Legal status	Importance
		To the SE there is a quantity of rubble stones, which is either debris from the mound or a result of stone clearance. The hillock is conical, and situated on a flat plateau, a position which suggests it is more likely to be a cairn than a broch. No traces of walling could be found. Choc Urray survives as a turf-covered mound as described by the previous authorities. The 'mound on mound' effect and the former existence of a ditch (RCHAMS refers) suggest the remains of a broch, but no wall faces are exposed, and there is no central depression. Erosion on the NE side reveals a content of earth and small pieces of sandstone. Commonly, when the turf has been removed or eroded from Caithness 'hullochs', a mixture of earth and stones is exposed, at least in the upper layers, but this does not preclude their classification as brochs. According to Mr Gourlay (Highland Region Archaeologist) such a content was noticeable in the excavated broch at Cross Kirk (ND07SW 4). He noted (i) that the core material between wall faces seemed to be of earth and small stones and (ii) that the large slabs of sandstone readily crumbled to fine chips. Probably for these reasons the sandstone brochs of Caithness tend to be reduced to slumped, ill-defined mounds attracting a turf cover, which contrasts strongly with the brochs further to the W which are constructed of harder rock and are more likely to retain their form.	NC 9838 6630		
16	Upper Dounreay Standing Stone	The NMRS and OS records the presence of a standing stone at this location (ND 0062 6607) The RCHAMS recorded in 1911 that "This upright slab of sandstone, facing ESE and WNW, slightly pointed at the upper end, is 6ft 6ins high above ground, 4ft 2ins broad and 1ft thick"	ND06NW 2 ND 0062 6607	N/A	Regional
17	Upper Dounreay Stone Rows	The NMRS records that No standing stones remain at the points indicated on the OS map and there is no local knowledge of such features, other than standing stone ND06NW 2.	ND06NW 3 ND 007 660	N/A	Regional
18	Upper Dounreay, Cairns	At ND 003 660 the NMRS records the presence on a low ridge within modern fields of a group of three turf-covered cairns (A - C), now severely reduced and disturbed. The farmer (G Begg, Upper Dounreay Farm) does not plough these cairns, but has attempted to do so in the past, when he has found high concentrations of stone but no cists. Cairn A, the best preserved, is 17.0m in diameter and 0.6m high; B survives as a low swelling, about 9.0m in diameter and 0.2m high, and C is 9.0m in diameter and 0.3m high.	ND06NW 30 ND 003 660	N/A	Regional
19	Upper Dounreay, Hut Circle	The NMRS records the presence at ND 0055 6607, on flat ground at the edge of a pasture field, of a denuded, turf-covered hut circle, 8.0m in diameter within a wall spread to 2.0m and 0.2m high. A slight lowering in the wall in the S arc may be the entrance, but the hut is disfigured by a tractor track crossing it.	ND06NW 32 ND 0055 6607	N/A	Local
20	Upper Dounreay, Quarries	Two early quarries are known at this location	ND06NW 43 ND 008 660	N/A	Local
22	Balmore Small cairn	A sub-circular, grass-covered cairn, 2m in diameter and 0.5m high, of small stones	ND 06NW 49 ND 0040 6759	N/A	Unknown
23	Upper Dounreay, Chambered	The NMRS records the presence of a chambered cairn at this location first identified in the early 20th century. The short, horned, chambered cairn of the Orkney-Cromarty group at Upper Dounreay measures about 55ft across and has horns projecting towards the cardinal points, giving a diameter from tip to tip across the cairn of	ND06NW 5 ND 0079 6604	N/A	Regional

Site	Name	Description	SMR & NGR No.	Legal status	Importance
	Cairn	about 90ft. The top of the cairn has been removed, leaving a present height of 4 to 5ft, and four stones of the chamber are visible. Two sides of a short cist can be seen on the S horn. RCHAMS 1911; A S Henshall 1963. This turf-covered chamber cairn, 1.5m maximum height, is generally as described above. The W horn although shapeless is larger than the others. Stone slabs set on edge, forming part of the burial chamber, are visible in the mutilated top of the cairn. In the S horn, one end and one side slab of a cist, 1.0m by 0.6m, can be seen protruding 0.1m through the surface of the cairn.			
24	Baltimore, Small Mound	A mound and structure 2m in diameter and 0.5m high. The mound, circular and grass covered, is associated with a possible rectangular stone structure.	ND06NW 50 ND 0017 6884	N/A	Unknown
25	Craigton, Chapel Site	The remains of a pre-Reformation chapel were destroyed during the construction of the Dounreay complex. The site formerly consisted of only an angle of walling a foot or two high. It is not known when the chapel fell out of use nor to which saint it was dedicated, but it is well known in the district. About 40 yards from the chapel, in a small crevice at the foot of the cliff, there issues a tiny stream of water which falls into an artificial basin 18ins in diameter and about 6ins deep. It is roughly cut and is certainly not natural, since the fall of the water is not sufficiently strong to have created it. This is supposed to be the holy well of the chapel! In 1840 it was known only as a mineral spring.	NC96NE 1 NC 9812 6690	N/A	Unknown
26	Upper Dounreay Farm Steading	Circa 1840-50. Large open square steading range; rubble with tooled rubble dressings. Main NW symmetrical 2-storey, 5 arched bay front with centre gabled bay with hoist loft entrance and outer single storey wings. Long 2-storey barn projects from rear of main front, dividing inner court in two and linked to back enclosing ranged of threshing mill and flanking stables and byres. Entrances to rear courts right and left of main front block, which has basket arched centre entrance and similar flanking cart bays (blocked at extreme left) all masked by modern sliding doors. Lean-to wheel house to rear against NE elevation of threshing barn, served by (blocked) lade. Graded Caithness roofs of varying heights. LB Number 14989.	NC96NE 98	B Listed Building	Regional
27	Dounreay Airfield Military Camp	The NMRS records the former presence of a military camp at this location. NC96NE 87.06 99991 66128, 99725 66018 and 99987 65808. Three areas of huts at Upper Dounreay Smallholdings all visible on a post-war RAF vertical air photograph (106G/Scot/UK133, 3171, flown 30 June 1946). The huts are mainly of the Nissen type apart from one or two larger flat roofed buildings which are possibly Mess huts. One area of huts centred at NC 99923 66045 had already been removed in 1946 as their location is only visible as hut bases. A vertical air photograph taken in 1977 (OS/77/122, 168, 1977) shows that all huts in these three areas had been removed and only hut bases survived.	NC96NE 87.06 NC 9965 6606	N/A	Local
28	Dounreay Airfield Military Camp	The NMRS records that a vertical air photograph taken in 1977 (OS/77/122, 168, 1977) shows that all huts in this area had been removed by this date, and only the generator house is left upstanding is confirmed by a visit to the site in 2000.	NC96NE 87.07 NC 9952 6606	N/A	Local
29	Upper Dounreay Field Survey	ND 008 660 (centred) A desk-based assessment and walkover survey were conducted for a proposed windfarm. A few unrecorded sites were noted in the area of military buildings.	ND06NW 147 ND 008 660	N/A	Unknown

Site	Name	Description	SMR & NGR No.	Legal status	Importance
			(centred)		
30	Upper Dounreay, Mound (site of)	The NMRS records "The Pict's house was removed about 1866 during cultivation, leaving a mound one or two feet high. Nothing of any importance was found in it, but sea shells and burnt bones and wood can still be picked up on it (Name Book 1873). No surface trace of this mound in a field now under pasture survives.	NC96NE 18 NC 9990 6626	N/A	Regional
31	Oigin's Geo, Sheep Shelter	The Highland Council SMR records the presence of a shaped sheep shelter marked on 1st edition OS map and modern map base. A M.Fox, Highland Council, 31.01.02.	NC96NE0099 NC 9969 68228	N/A	Unknown
32	Creag Bhreac Mhor	What may be an unroofed long building is depicted on the 1st edition of the OS 6-inch map (Caithness 1876, sheet x), and it is shown on the current edition of the OS 1:10,560 map (1969).	ND06NW 124 ND 0099 6621	N/A	Local
33	Upper Dounreay Standing Stone (Site of)	The NMRS records that "According to Mr Begg (G Begg, Upper Dounreay, Reay), this stone was removed in 1940 during the construction of military installations. No trace remains. Visited by OS (N K B) 13 November 1964.	ND06NW 1 ND 00130 65960	N/A	Local
34	Dounreay, Cross Slab (site of)	A fragment of a Pictish slab, 200mm long, from the foot of the cliffs at Dounreay (NC 98 67), was presented to the NMAS by Stevenage Museum. During the construction of the Power Station at Dounreay, a Class 3 decorated slab was found at the foot of the cliffs. It measures 0.2m x 0.15m x 0.01m and is 'slatey-grey' stone. It bears a key pattern in low relief on one face and could be part of the cross-shaft found at Reay parish church (NC 967 648, NC96SE 1) (now in NMAS IB 267). It was presented to the Royal Museum of Scotland (RMS, formerly the National Museum of Antiquities of Scotland [NMAS]) by Stevenage Museum, Hertfordshire in 1974 (NMAS: IB 303).	NC96NE 31 NC 98 67	N/A	Local
35	Druim Na Ceud, Cemetery?	Druim na Ceud - 'Ridge of the Hundred' - is a long low ridge on which traditionally a hundred men were killed and buried during the 15th century battle of the Ruaig Haunsaid (ND06NW 4), the graves being marked by small stones a foot or so in height, set on end. The stones are no longer visible as the ground has been cultivated for some time. (See also ND06NW 3 & 8 for similar stone settings and tradition.) Name Book 1873.	ND06NW 6 ND 00200 66100	N/A	Local
37	Craigton, Limekiln	About 300 yards E (sic) of the skeleton (NC96NE 3) an underground passage was uncovered. This was constructed of dry-stone walling, and was the flue of a large lime kiln, about 12' in diameter. Extensive burning was indicated by reddish earth and charred straw in the interior. The construction had clay-filled walls of 5' thickness. No evidence for dating was found and the site has now been destroyed by a road. In 1981 the OS surveyor reported that the skeleton had been found adjacent to the NE side of the now demolished farm at Craigton at NC 9815 6690. Photographs taken in 1966 by Mr J Saxon of Thurso, show that the old lime kiln was uncovered hereabouts. (The skeleton was probably found 300 yards to the W where a cemetery has been uncovered over the years - NC96NE 3).	NC96NE 50 NC 9815 6690	N/A	Local
38	Lower Dounreay, Find Spot	Half a small cylinder of bone, possibly a knife handle, was found during clearance of a site at Lower Dounreay, and was donated to the National Museum of Antiquities of Scotland (NMAS) by the Atomic Energy Authority, Dounreay (PSAS 1968).	NC96NE 30 NC 981 670	N/A	Local
39	Dounreay Castle	The remains of Dounreay Castle are located here and the original castle built in the later 16th century on the 'L'-	NC96NE 2	SAM	National

Site	Name	Description	SMR & NGR No.	Legal status	Importance
		plan, featured a barmkin enclosure wall, part of which still stands on the SW side of the site, and which is keyed into the SW wall of the tower itself. Elements of the barmkin wall also survive on the seaward side of the courtyard, incorporated into a later cottage wall. The courtyard area so defined was paved in Caithness slabs, laid in some places almost directly over bedrock. Soon thereafter a kitchen range was added to the SE wing, built directly against the barmkin, and blocking an original gun loop at the corner of the tower wing. During the 19th century the site became a large farm, with additional accommodation being provided by the still-standing cottages adjoining the castle to the NE. The courtyard now saw use as a farmyard, and a rich organic horizon was identified in excavations carried out from October 1997 to January 1998 (Ewart & Dunn 1998) above the flagged surface level. The farm is depicted on an aerial photograph of the mid-20th century. Finally, the site was levelled, with the exception of the castle and NE cottage block, and the site was occupied by the nuclear research establishment.	NC 9830 6693		
40	Lower Dounreay, Bridge	A bridge, 6m long, NE-SW, by 2m wide comprising a grass-covered structure with a maximum of ten courses visible in the piers on either side of the stream. This bridge crosses an unnamed burn within the area of the Dounreay Nuclear Power Development Establishment (NC96NE 78). Demolished, although traces of the stone abutments may survive.	NC96NE 72 NC 9831 6691	N/A	Local
41	Lower Dounreay, Wall	A grass-covered drystone wall, 18m long, 1m wide and 0.2m, two courses, high, running SE-NW along the S bank of the stream. Possibly destroyed.	NC96NE 73 NC 9832 6688	N/A	Unknown
42	Lower Dounreay, Cist Cemetery	The existence of an extensive cemetery may be indicated by the finding of interments in the vicinity of Lower Dounreay Farm. The first group of 'several coffins' was discovered while part of the stackyard was being levelled about 1865, which was said to be the graveyard of the adjacent chapel (NC96NE 1) (Name Book 1870). Another group of at least seven pre-Christian interments were found about 8 - 9ft below present ground level during deep trenching, and later partial excavation in October 1956. Three skeletons were found extended and one was crouched. Some were in cists which were destroyed before observation and measurement; and others were in pits. Unspecified animal remains were also found. Two hut floors, one with a clay hearth, were revealed in cross-section and may be contemporary with, or later than, the interments (S Cruden 1956). The sites of both groups of burials are now within the Dounreay Atomic Establishment. The first is discovered by a small playing field; the second was indicated by Mr Carmichael, but the excavation has been back-filled (information from D Carmichael, General Secretary, Dounreay Atomic Establishment) Another interment was exposed by bull-dozer excavation at NC 985 670 in 1966. It may have been in a cist but damage was extensive and the position of the bones was uncertain. The remains are in the National Museum of Antiquities of Scotland (NMAS, J E Burns 1966).	NC96NE 3 NC 985 670	N/A	Regional
43	Smyrna: Shipwreck Pentland Firth	Location of wreck cited as Dounreay. It was noted that there was a cargo of iron and tallow.	NC96NE 8002 NC 98 67	N/A	Local

Site	Name	Description	SMR & NGR No.	Legal status	Importance
45	Downreay, Structure	A structure, 11m NW-SE by 5.5m and 0.5m high, damaged on the N.	NC96NE 76 NC 9990 6740	N/A	Unknown
46	Downreay Outfall	Downreay effluent outfall is located at NGR eastings 298104, northings 967586 (+/- 5mtrs).	NC96NE 8001 NC 9810 6759	N/A	Unknown
47	Achbuiligan Tulloch, Mound	The NMRS records the presence of a probable cairn previously erroneously interpreted as the ruins of a broch. Achbuiligan Tulloch is a turf-covered, elongated mound measuring 45.0m NNE-SSW by 26.0m transversely, and rising gently from the N to a summit, 4.5m high, towards the S end. The summit area is disturbed, probably by surface quarrying. Soil erosion at the base reveals a content predominantly of earth suggesting that the mound may be in part natural, its profile having been sharpened by ploughing around the edge. In the SE side at the base is an arc of walling; this has not the heavy build of a broch wall, but is possibly a revetment of an outwork or it may be relatively recent. Apart from this possible revetment there is no evidence to classify this mound as the remains of a broch.	NC96NE 17 NC 9894 6570	N/A	Regional

Appendix 16A – The Nature and Measurement of Noise and Vibration

1. The sound wave travelling through the air is a regular disturbance in atmospheric pressure. These pressure fluctuations, when within the audible range, are detected by human ear, producing the sensation of hearing. Noise is often defined as sound which is undesired by the recipient.
2. It is impossible to measure nuisance caused by noise directly but it is possible to measure the “loudness” of that noise. “Loudness” is related to both sound pressure and frequency, both of which can be measured. The human ear is sensitive to a wide range of sound levels. The sound pressure level of the threshold of pain is over a million times that of the quietest audible sound. In order to reduce the relative magnitude of the numbers involved. A logarithmic scale of decibels (dB) based on a reference level of the lowest audible sound is normally used.
3. The response of the human ear is not constant over all frequencies. It is therefore usual to weight the measured frequency to approximate the human response. This is achieved by using an “A”-weighted decibel reading dB (A) and has been shown to correlate closely to the non-linear and subjective human response.
4. When measuring traffic noise the instantaneous noise level is constantly changing due to variation in the traffic flow and composition. To obtain a single representative figure for traffic noise it is normal to adopt the level that is exceeded for 10% of the time. This is known as the L_{10} noise level. To depict the noise levels experienced throughout the day the hourly L_{10} noise levels are averaged over the 18 hour period from 06.00 to 24.00 on a normal working day.
5. When related to perceived changes in noise a change of 10 decibels from say 60dB(A) to 70dB(A) would represent a doubling in “loudness”. It is also useful to note that traffic noise level changes of less than 3dB(A) cannot normally be perceived by the human ear.
6. **Equivalent Continuous Sound Level (L_{Aeq})** is the level of a Notional Steady Sound which at the same position and over a defined period of time, would have the same “A” Weighted acoustic energy as the fluctuating noise.
7. L_{A90} is the level, which is exceeded for 90% of the time, often referred to as the background noise level.
8. L_{A10} is the level, which is exceeded for 10% of the time and is used to evaluate road traffic noise.
9. **Free Field** is where the sound is measured or calculated in the open, without any reflection from nearby surfaces.
10. **Facade level** is the effect of reflection, which produces a higher level. In the case of a building, the sound level close to it, say one metre from the walls, is slightly higher (2.5dB(A)) than it would be if the building were not there.

11. **Peak Particle Velocity (PPV)** is used to determine satisfactory vibration magnitudes with regard to human response.
12. **Vibration Dose Value (VDV)** is an alternative measure of vibration and is also used when establishing human response to vibration.
13. **Sound Power Level (PWL)** is the energy output of a source and is a property of the source itself. The sound power level is a ratio of the power of a source and a reference and is quoted in dB.

The sound power level is defined as:

$$PWL = 10 \log_{10} (W/W_0)$$

where: W is the sound power of the source (watts)
and W₀ is the reference sound power (10-12 watts)

UKAEA

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Thurso/Dounreay Network Analysis

March 2006

Halcrow Group Limited

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Thurso/Dounreay Network Analysis

Contents Amendment Record

This report has been issued and amended as follows:

Issue	Revision	Description	Date	Signed
1	a	Draft	01/03/2006	ARB
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In addition to the two on-site developments, THC asked that a cumulative analysis be carried out on all of the sites planned activities over the next five years to 2010.

The Scottish Executive was consulted as to the extent of the junctions to be analysed and responded favourably to what was proposed.

1.2

Comparison Years

The work undertaken within this report allows a comparison of junction/network operation in the year 2010 with that in 2005. In addition to the Dounreay (UKAEA) development impact, the following models have also been reported on separately:

- € 2005
- € 2010
- € 2010 plus Committed (Tulloch Homes)
- € 2010 plus Committed (Tulloch Homes) minus Dounreay Staff Decline

As the Tulloch Homes development has been included as a committed development, we will use this as our point of comparison, however, the level of analysis contained within this report allows the cross referencing of all modelled years

1.3

The Report

The analysis and data has been structures in the report as follows:

- € Chapter 2: Base Data
- € Chapter 3: Vehicle Generation, Distribution and Assignment
- € Chapter 4: Method of Analysis
- € Chapter 5: LLW Facilities Phase 1 Results
- € Chapter 6: DCP2 Cementation Plant Results
- € Chapter 7: Cumulative Site Activity Results

2 Base Data

2.1 *Introduction*

The data used within this report has been supplied by UKAEA and the analysis undertaken in accordance with methodology agreed with THC during the scoping meeting on 7th December 2005. The following information explains how the base data was analysed.

2.2 *Construction Phase Data*

The analysis of the predicted traffic volumes were undertaken by UKAEA and extracted from their extensive information database. This data provided predicted annual LGV and HGV traffic movements for each planned project up to, and including, 2010. The methodology centred on looking at the quantity of exports and imports of construction material to and from the site, and predicting vehicle numbers on an assumed worst-case load capacity. As the data was supplied in yearly figures, it was agreed with The Highland Council that the data be broken down into an hourly flow, based on a flat arrival and departure profile throughout the working day. This would be based on a 5 day working week and an 11 hour working day (7am – 6pm).

2.3 *Traffic Data*

The traffic data utilised within the report, and previously agreed with THC, was the same data used to support the previous Breeder Fuel Removal Project (BFRP) EIA. The counts for the BFRP were undertaken in 2003 and 2004. The National Road Traffic Forecast statistics (NRTF) were used to growth the 2003 and 2004 figures to the years 2005 and 2010. The central figure was used, as this was consistent with the BFRP EIA.

2.4 *Employment Data*

As the Dounreay site is currently undergoing decommissioning, there is natural wastage of permanent staff, which is reported in the document 'Lifecycle Baseline, Annex 3: Dounreay Site'. The document summarises the detailed Lifecycle Baseline plan for Dounreay, which was submitted to the Nuclear Decommissioning Authority on 30 September, 2004, and details the natural staff decline to the end of the facilities lifespan. Figure 2.1 illustrates the decline graphically with Table 2.1 providing the actual figures over the 5 year analysis period.

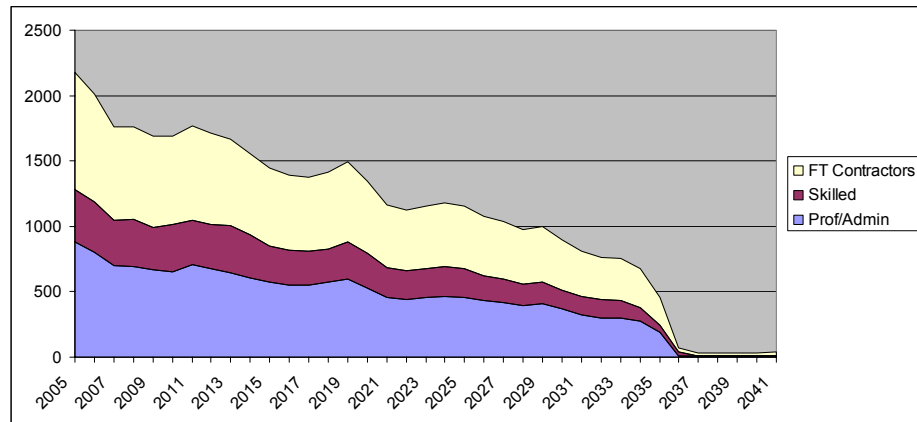


Figure 2.1: Staffing Changes from 2005 to 2041

Year	Total Staff Numbers	Decrease in Staff
2005	2179	n/a
2006	2010	-169
2007	1764	-246
2008	1761	-3
2009	1687	-74
2010	1692	5

Table 2.1: Staffing Changes from 2005 to 2010

2.5

Committed Development

THC's directed that the Tulloch housing development be included within the analysis. Details of these proposals were extracted from the Thurso Western Expansion Area Transport Assessment (TWEATA). As it was agreed that the housing development should be accessed via a priority junction on the A836, and that our analysis period covers only the next 5 years, and not 15 as analysed within the aforementioned report, it was thought more realistic to include a priority junction within the Paramics model. In addition, the TWEATA supported only the planning application for residential housing areas 1A-5B, and did not support any business land use.

3 Vehicle Generation, Distribution and Assignment

3.1 *Introduction*

The vehicle generation for the site was discussed with THC during the scoping meeting. Distribution and assignment was developed using industry approved software and local knowledge. Each of these areas are now examined in turn.

3.2 *Contractor Staff Vehicle Trip Generation*

It was UKAEA's view that most of the contractor staff members would commute to the site from their place of residence by mini-bus. As temporary contractors are usually specialists imported from outlying areas, this assumption was considered reasonable as a good proportion of these workers would stay in the same temporary residences. However, to provide a robust analysis, it was assumed that the same proportion of vehicle usage calculated for the permanent staff member should be applied to each temporary contractor.

3.3 *Permanent Staff Vehicle Trip Reduction*

To ascertain the associated reduction of staff vehicles in the AM and PM peak, a ratio of vehicles to staff member was calculated. This was achieved by taking the number of full time staff in 2003 and dividing it by the number of cars entering the site in the peak AM period. The vehicle numbers were extracted from the traffic count data obtained on September 2nd 2003. The staff employment figure of 2719, assumed as the staff employment figure of 2003 in the absence of historic data, divided by the 701 vehicles entering the site, produced a ratio of 1 vehicle per 3 members of staff. After consultation with UKAEA management, and in light of the excellent bus services to the site in the AM and PM peak periods (13 buses in total), and the high level of car sharing undertaken by the staff members, this figure was considered to be acceptable.

The resultant vehicle reductions applied were as follows:

- € AM Peak: 136 Vehicles
- € PM Peak: 92 Vehicles

The differential between the AM and PM peaks is the result of less traffic leaving the site in the PM compared to that arriving in the AM. This is consistent with

conditions of employment which include working extended hours and overtime, thus leaving out with the 1600-1700hrs peak period, and has been applied within this analysis to, again, help provide a robust assessment.

3.4

Vehicle Distribution

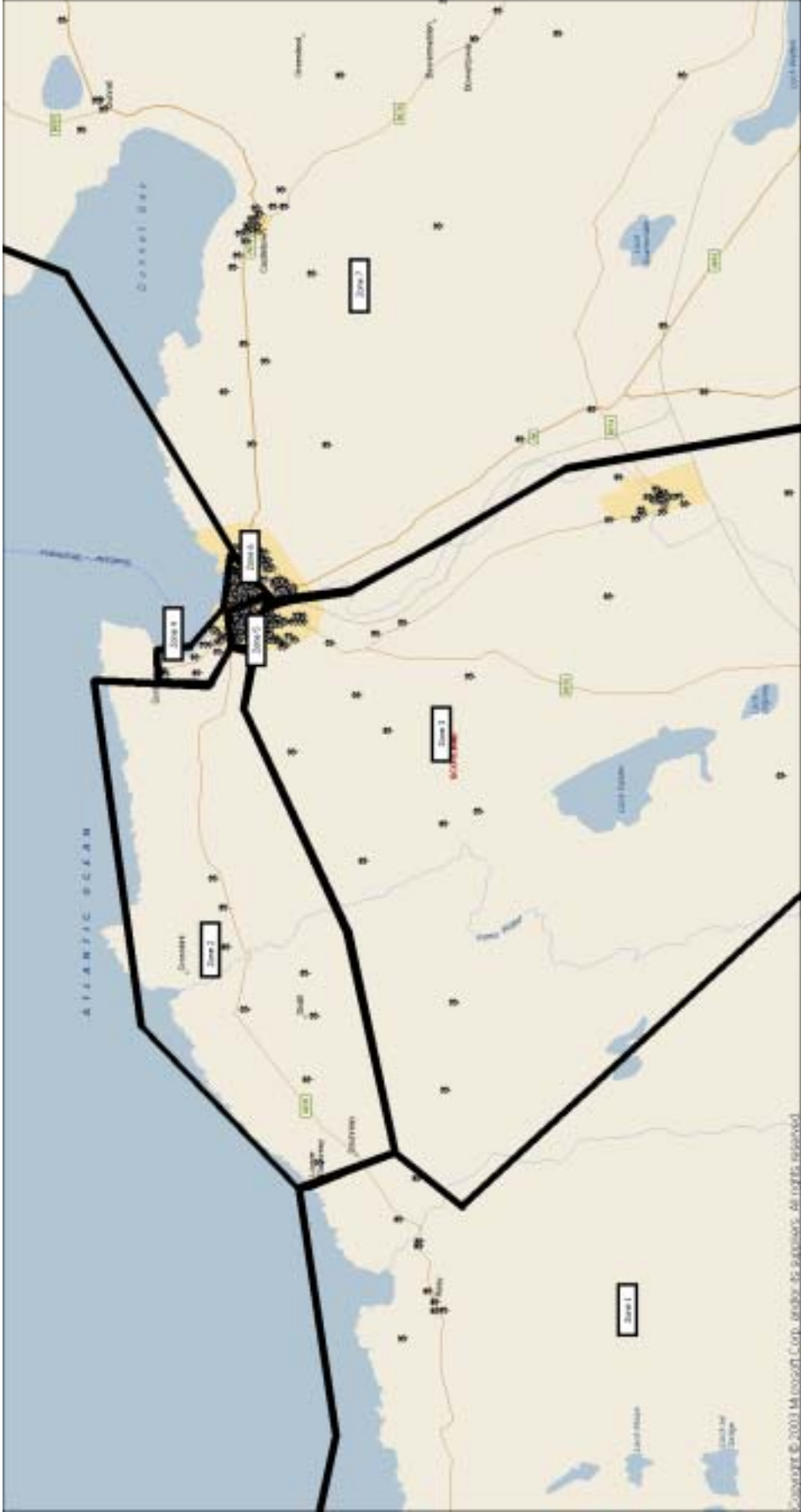
UKAEA supplied staff postcodes to facilitate the vehicle distribution calculations. The resultant distribution was then applied to the staff vehicle reduction, and contractor vehicle generation figures.

The method employed in deriving the distribution was based on the industry approved GIS software programme MapPoint. The Thurso area was zoned into six areas, each having one loading point onto the network. The postcodes were then plotted using this software and a percentage distribution derived from the number of postcodes within each segment. Although the postcode data was not complete, it was assumed to provide a representative sample. Table 3.1 below details the resultant percentage distribution to be applied. Each percentage distribution figure is associated with a MapPoint and Paramics Zone.

MapPoint Zone	Paramics Zone	Staff	Percentage Distribution
1	1	42	4%
2	4	33	3%
3	2	210	21%
4	5	33	3%
5	6	125	13%
6	7	71	7%
7	7	478	48%

Table 3.1: Staff Vehicle Distribution

Figures 3.1 and 3.2 detail the MapPoint distribution zones.



Copyright © 2003 MapSource Corp. and/or its suppliers. All rights reserved.
Figure 3.2: Detailed MapPoint Distribution Zones

3.5

LGV/HGV Traffic Distribution

Additional data supplied by UKAEA detailed the distribution of import and export of construction vehicles entering the site. The distribution of imports was assumed to have a 50:50 west/east split. All exports, however, were assumed to travel via Thurso in the east. All figures calculated within the hourly flows have been rounded up to provide a robust analysis. Where HGV figures were low, the assumption was that traffic should be routed east through Thurso to produce a robust assessment.

3.6

Vehicle Assignment

Due to no route choice within the Paramics model, the assignment is purely based upon the distribution percentage detailed in Table 3.1.

3.7

Vehicle Reassignment

The Thurso Western Expansion Area Transport Assessment undertaken by HGA (UK) Ltd detailed traffic reassignment due to the building of a link road. This reassignment was included within our analysis from the year 2010 with committed onwards.

3.8

LLW Facilities Phase 1 Vehicle Trip Generation

From the data supplied by UKAEA, the total work force for the LLW Facilities Phase 1 was calculated. The yearly figure is detailed in Table 3.2.

Staff Employed By Phase	2005 BASE	2006	2007	2008	2009	2010
LLW Facilities Phase 1	0	0	0	30	30	30

Table 3.2: Staff Employed

The ratio of car to staff member detailed in Chapter 2 was then applied to the total number of staff employed on the LLW Facilities Phase 1. The peak hour vehicle movements are detailed in Table 3.3.

Contractor Travel to Work Vehicles	2005 BASE	2006	2007	2008	2009	2010
LLW Facilities Phase 1	0	0	0	10	10	10

Table 3.3: Generated Vehicles

The data in Tables 3.2 and 3.3 were then combined with the total hourly traffic associated with this phase of on-site works. The hourly figures are based on the yearly data supplied by UKAEA and reduced to an hourly rate based on the methodology described earlier in Chapter 2 and agreed with THC. Table 3.4 details

the hourly two-way movements generated and accumulates all movement into a total vehicle trip generation figure.

Total Traffic Impact	2005 BASE	2006	2007	2008	2009	2010
UKAEA Staff Numbers	2179	2010	1764	1761	1687	1692
Reduction in Staff Vehicles	Base	-47	-116	-117	-137	-136
Contractor Staff Vehicle Generation	0	0	0	10	10	10
LLW Facilities Phase 1						
LGV's Inbound	0	0	0	2	5	4
HGV's Inbound	0	0	0	1	1	1
LGV's Outbound	0	0	0	2	5	4
HGV's Outbound	0	0	0	1	1	1
Total Vehicle Generation	0	-47	-116	-101	-116	-116

Table 3.4: Total Vehicle Trip Generation

3.9

DCP2 Cementation Plant + Solids Encapsulation Plant D3900 Vehicle Trip Generation

From the data supplied from UKAEA, the total workforce for the DCP2 Cementation Plant + Solids Encapsulation Plant D3900 was calculated. The yearly figures are detailed in Table 3.5.

Total Staff Employed	2005 BASE	2006	2007	2008	2009	2010
Build DCP2 Cementation Plant	0	0	120	120	120	120

Table 3.5: Staff Employed by Year

The ratio of car to staff member detailed in Chapter 2 was then applied to the total number of staff employed on the DCP2 Cementation Plant + Solids Encapsulation Plant D3900. The peak hour vehicle movements are detailed in Table 3.6.

Contractor Travel to Work Vehicles	2005 BASE	2006	2007	2008	2009	2010
Build DCP2 Cementation Plant	0	0	36	36	36	36

Table 3.6: Generated Vehicles in Peak Hour

The data in Tables 3.5 and 3.6 were then combined with the total hourly traffic associated with this phase of on-site works. The hourly figures are based on the yearly data supplied by UKAEA and reduced to an hourly rate based on the methodology described earlier in Chapter 2 and agreed with THC. Table 3.7 details the hourly two-way movements generated and accumulates all movements into a total vehicle generation figure.

Total Traffic Impact	2005 BASE	2006	2007	2008	2009	2010
UKAEA Staff Numbers	2179	2010	1764	1761	1687	1692
Reduction in Staff Vehicles	Base	-47	-116	-117	-137	-136
Contractor Staff Vehicle Generation	0	0	36	36	36	36
Build DCP2 Cementation Plant						
LGV's Inbound	0	0	4	4	4	4
HGV's Inbound	0	0	0	1	1	1
LGV's Outbound	0	0	4	4	4	4
HGV's Outbound	0	0	0	1	1	1
Total Staff Vehicle Generation	653	-47	-72	-71	-91	-90

Table 3.7: Total Vehicle Trip Generation – DCP2 Cementation Plant

3.10

Cumulative Site Activity Vehicle Trip Generation

From the data supplied from UKAEA, the total workforce for the all site activities was calculated. The yearly figure is detailed in Table 3.8.

Total Staff Employed	2005 BASE	2006	2007	2008	2009	2010
Cumulative Assessment	-	130	240	205	150	150

Table 3.8: Staff Employed

The ratio of car to staff member detailed in Chapter 2 was then applied to the total number of staff employed on all site activities. The peak hour vehicle movements are detailed in Table 3.9.

Contractor Travel to Work Vehicles	2005 BASE	2006	2007	2008	2009	2010
Cumulative Assessment	0	42	77	66	48	48

Table 3.9: Generated Vehicles

The data in Tables 3.8 and 3.9 were then combined with the total hourly traffic associated with this phase of on-site works. The hourly figures are based on the yearly data supplied by UKAEA and reduced to an hourly rate based on the methodology described earlier in Chapter 2 and agreed with THC. Table 3.10 details the hourly two-way movements generated, and accumulates all movements into a total vehicle generation figure. To provide a worst case scenario, year 2007 data was used in the 2010 analysis.

Total Traffic Impact	2005 BASE	2006	2007	2008	2009	2010
UKAEA Staff Numbers	2179	2010	1764	1761	1687	1692
UKAEA Staff Vehicle Generation	Base	-47	-116	-117	-137	-136
Contractor Staff Vehicle Generation	0	42	77	66	48	48
Cumulative Assessment						
LGV's Inbound		7	10	10	11	9
HGV's Inbound		1	2	3	4	4
LGV's Outbound		7	10	10	11	9
HGV's Outbound		1	2	3	4	4
Total Vehicles Generation	0	9	-17	-26	-59	-62

Table 3.10: Total Vehicle Trip Generation

4 Method of Analysis

4.1 *Paramics Model*

The model study area comprises of the four junctions described in Chapter 1 including the interconnecting links.

Three different types of vehicles, each associated with differing operational characteristics, were included in the model. They were car, light goods vehicles and heavy goods vehicles.

The model was calibrated using the turning counts data supplied by UKAEA. The modelled turning counts were compared against the observed counts using a standard measure called the GEH statistic. Modelling standards as set out in the Design Manual for Roads and Bridges (DMRB) recommend that 85% of compared flows should exhibit a GEH statistic of less than 5. In both AM and PM cases, over 95% of these counts were within this criteria.

To validate the model, journey times were undertaken in the peak AM and PM periods and assessed against the DMRB criteria that states that the simulated times should be within 15%/or 1 minute of observed times. The model was run three times with different seed values in the AM and PM peak hours and in both cases, the journey times fell within the degree of tolerance detailed in the DMRB. Further details can be provided on request

4.2 *PICADY Models*

The client also requested that junction capacities be clearly demonstrated. This was an additional method of analysis not requested by THC during the scoping discussion. In response, the four specified junctions were analysed using the industry approved PICADY software.

PICADY is an industry approved software package produced by the Transport Research Laboratory (TRL) for assessing priority junctions. The Ratio to Flow to Capacity (RFC) that it produces provides a measure of the performance of each arms of a junction where there are conflicts of movements. An RFC equal to 0.85 indicates that the junction has reached its practical capacity. PICADY input and output files can be supplied on request.

5

LLW Facilities Phase 1 Results

5.1

LLW Facilities Phase 1

The Paramics model was used to assess and compare the global impact of LLW Facilities Phase against four other model scenarios. These were:

- € 2005 Base
- € 2010
- € 2010 + Committed
- € 2010 + Committed – Staff Reduction

Total network delay was used for analysis purposes. Table 5.1 and Figure 5.1 detail the results. The 2010 total delay figure is higher than 2005 due to the random seeds applied within the Paramics model. As the Dounreay traffic represents a large percentage of the total network traffic, and as this was not subject to growth, the difference between traffic volumes in the 2005 and 2010 models was low.

Model Year	2005	2010	2010 + Com	2010 + Com -Staff	2010 LLW EIA
	414957	398226	538543	433054	429130
	396804	398226	517812	418743	434770
	409838	408340	536264	425533	443821
Total Delay (Avg)	407200	401597	530873	425777	435907

Table 5.1: Total Average Network Delay (Secs) AM

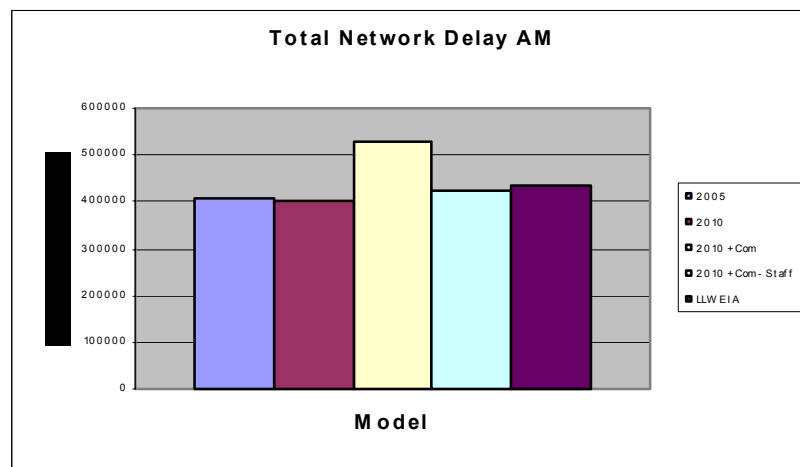


Figure 5.1: Total Average Network Delay (Secs) AM

Model Year	2005	2010 + Growth	2010 + Com	2010 + Com -Staff	2010 LLW EIA
	379762	400807	447936	383201	416942
	375464	381939	447936	394186	406383
	375923	378990	447936	386095	426383
Total Delay (Avg)	377050	387245	447936	387827	416569

Table 5.2: Total Average Network Delay (Secs) PM

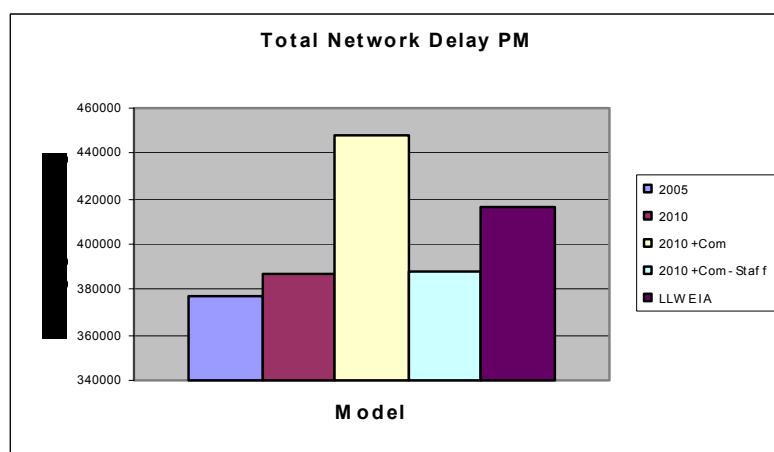


Figure 5.2: Total Average Network Delay (Secs) PM

From the tables and figures above it can be seen that both the AM and PM total network delay are less than those associated with the 2010 with committed development.

The PICADY analysis focused on the AM and PM peak periods. The following four tables detail the capacities at all 4 junctions.

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.401	0.446	0.347	0.301	0.304
B-A	0.054	0.062	0.06	0.056	0.056
C-AB	0.074	0.081	0.05	0.048	0.048

Table 5.3: Castle Road/Smith Terrace RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.06	0.07	0.073	0.072	0.072
B-A	0.075	0.082	0.093	0.081	0.084
C-B	0.124	0.133	0.136	0.136	0.137

Table 5.4: Scrabster/A836 RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.036	0.036	0.036	0.036	0.042
B-A	0.034	0.035	0.038	0.033	0.04
C-AB	0.739	0.743	0.813	0.622	0.644

Table 5.5: Site Access/A836 RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.012	0.015	0.016	0.015	0.015
B-A	0.308	0.335	0.362	0.231	0.299
C-AB	0.038	0.042	0.045	0.035	0.045

Table 5.6: Shebster/A836 RFC (AM)

In the AM, peak period, it can be seen that the busiest arm is movement C-AB at the site access but at 0.644 RFC, it has not exceeded its practical capacity of 0.85 RFC. All other other movements are well within the design capacity. It should be noted that in the AM peak period, all junctions are working more effectively than model year 2010 + committed development.

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.184	0.204	0.163	0.162	0.162
B-A	0.24	0.274	0.253	0.244	0.247
C-AB	0.5	0.572	0.337	0.3	0.307

Table 5.7: Castle Road/Smith Terrace RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.262	0.29	0.285	0.277	0.279
B-A	0.023	0.027	0.062	0.06	0.06
C-B	0.249	0.277	0.271	0.263	0.264

Table 5.8: Scrabster/A836 RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.593	0.595	0.622	0.394	0.519
B-A	0.263	0.264	0.282	0.184	0.242
C-AB	0.015	0.015	0.016	0.016	0.023

Table 5.9: Site Access/A836 RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	LLW EIA
B-C	0.054	0.073	0.074	0.074	0.074
B-A	0.012	0.016	0.016	0.016	0.016
C-AB	0.052	0.076	0.077	0.077	0.077

Table 5.10: Shebster/A836 RFC (PM)

It can be seen in the PM peak period that the busiest arm is movement B-C at the site access but at 0.519 RFC, it has not exceeded its practical capacity of 0.85 RFC. All other movements are well within their design capacity. It should be noted that in the PM peak period, all junctions are working more, or as, effectively than model year 2010 + committed development.

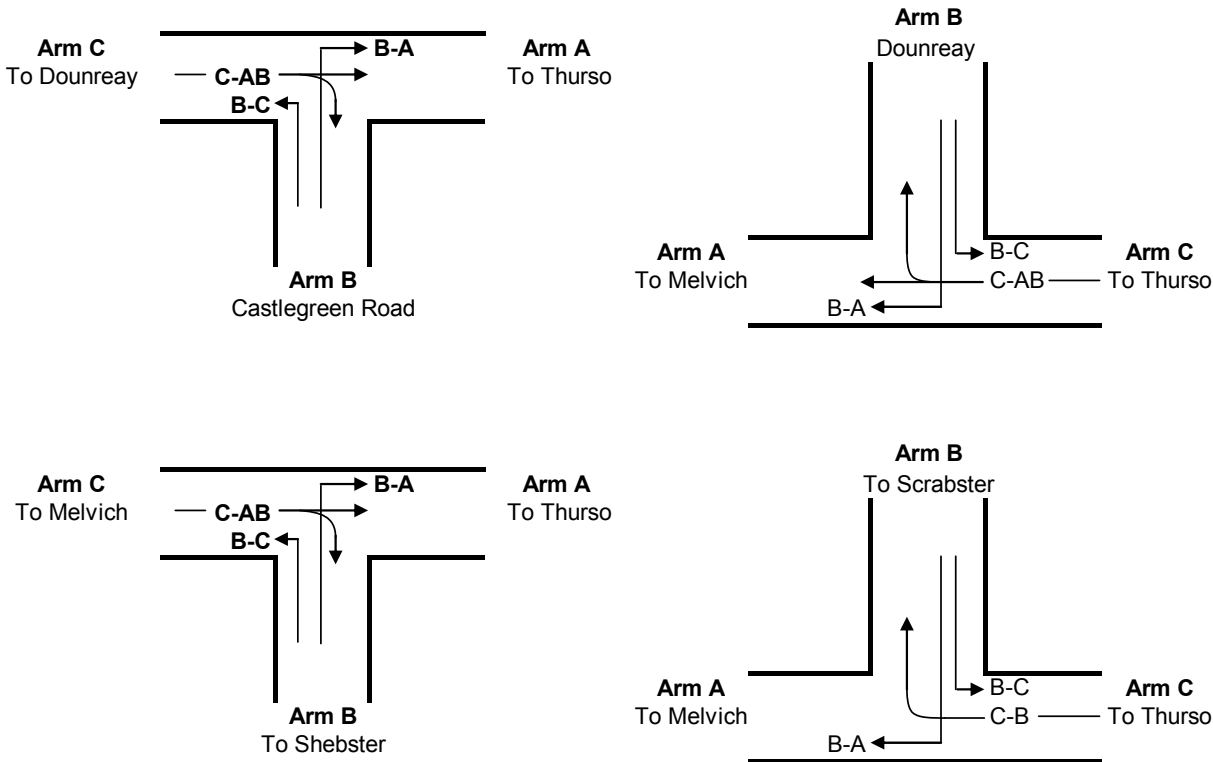


Table 5.11: PICADY Movements

6

DCP2 Cementation Plant Results

6.1

DCP2 Cementation Plant + Solids Encapsulation Plant D3900

The Paramics model was used to assess and compare the global impact of the DCP2 Cementation Plant + Solids Encapsulation Plant D3900 against four other model scenarios. These were:

- € 2005 Base
- € 2010
- € 2010 + Committed
- € 2010 + Committed – Staff Reduction

Total network delay was used for analysis purposes. Table 6.1 and Figure 6.1 detail the results.

Model Year	2005	2010	2010 + Com	2010 + Com -Staff	DCP2 EIA
	414957	398226	538543	433054	451998
	396804	398226	517812	418743	469218
	409838	408340	536264	425533	457956
Total Delay (Avg)	407200	401597	530873	425777	459724

Table 6.1: Total Average Network Delay (Secs) AM

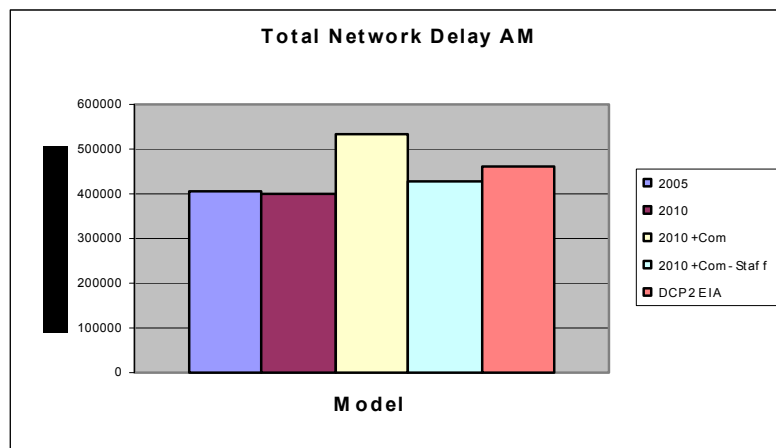


Figure 6.1: Total Average Network Delay (Secs) AM

Model Year	2005	2010 + Growth	2010 + Com	2010 + Com -Staff	DCP2 EIA
	379762	400807	447936	383201	424927
	375464	381939	447936	394186	425971
	375923	378990	447936	386095	434211
Total Delay (Avg)	377050	387245	447936	387827	428370

Table 6.2: Total Average Network Delay (Secs) PM

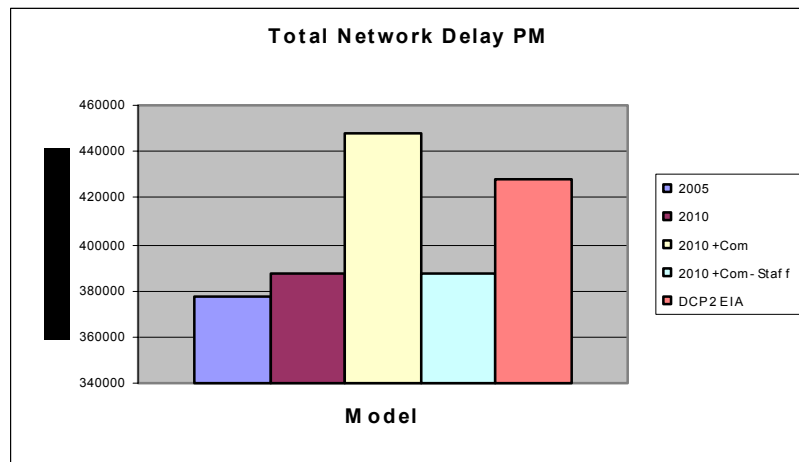


Figure 6.2: Total Average Network Delay (Secs) PM

From the tables and figures above it can be seen that both AM and PM total network delay totals are less than those associated with the 2010 + committed development.

The PICADY analysis focused on the AM and PM peak periods. The following four tables detail the capacities at all 4 junctions.

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.401	0.446	0.347	0.301	0.314
B-A	0.054	0.062	0.06	0.056	0.057
C-AB	0.074	0.081	0.05	0.048	0.049

Table 6.3: Castle Road/Smith Terrace RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.06	0.07	0.073	0.072	0.072
B-A	0.075	0.082	0.093	0.081	0.084
C-B	0.124	0.133	0.136	0.136	0.136

Table 6.4: Scrabster/A836 RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.036	0.036	0.036	0.036	0.041
B-A	0.034	0.035	0.038	0.033	0.038
C-AB	0.739	0.743	0.813	0.622	0.685

Table 6.5: Site Access/A836 RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.012	0.015	0.016	0.015	0.015
B-A	0.308	0.335	0.362	0.231	0.311
C-AB	0.038	0.042	0.045	0.035	0.045

Table 6.6: Shebster/A836 RFC (AM)

In the AM peak period it can be seen that the busiest arm is movement C-AB at the site access but at 0.685 RFC, it has not exceeded its practical capacity of 0.85 RFC. All other movements are well within the design capacity. It should be noted that in the AM peak period, all junctions are working more effectively than model year 2010 + committed development.

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.184	0.204	0.163	0.162	0.163
B-A	0.24	0.274	0.253	0.244	0.251
C-AB	0.5	0.572	0.337	0.3	0.322

Table 6.7: Castle Road/Smith Terrace RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.262	0.29	0.285	0.277	0.282
B-A	0.023	0.027	0.062	0.06	0.061
C-B	0.249	0.277	0.271	0.263	0.267

Table 6.8: Scrabster/A836 RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.593	0.595	0.622	0.394	0.588
B-A	0.263	0.264	0.282	0.184	0.255
C-AB	0.015	0.015	0.016	0.016	0.021

Table 6.9: Site Access/A836 RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	DCP2 EIA
B-C	0.054	0.073	0.074	0.074	0.074
B-A	0.012	0.016	0.016	0.016	0.016
C-AB	0.052	0.076	0.077	0.078	0.078

Table 6.10: Shebster/A836 RFC (PM)

In the PM peak period, it can be seen that the busiest arm is movement B-C at the site access but at 0.588 RFC, it has not exceeded its practical capacity of 0.85 RFC. All other movements are well within their design capacity. It should be noted that in the PM peak period, all junctions are working more, or as, effectively than model year 2010 + committed development.

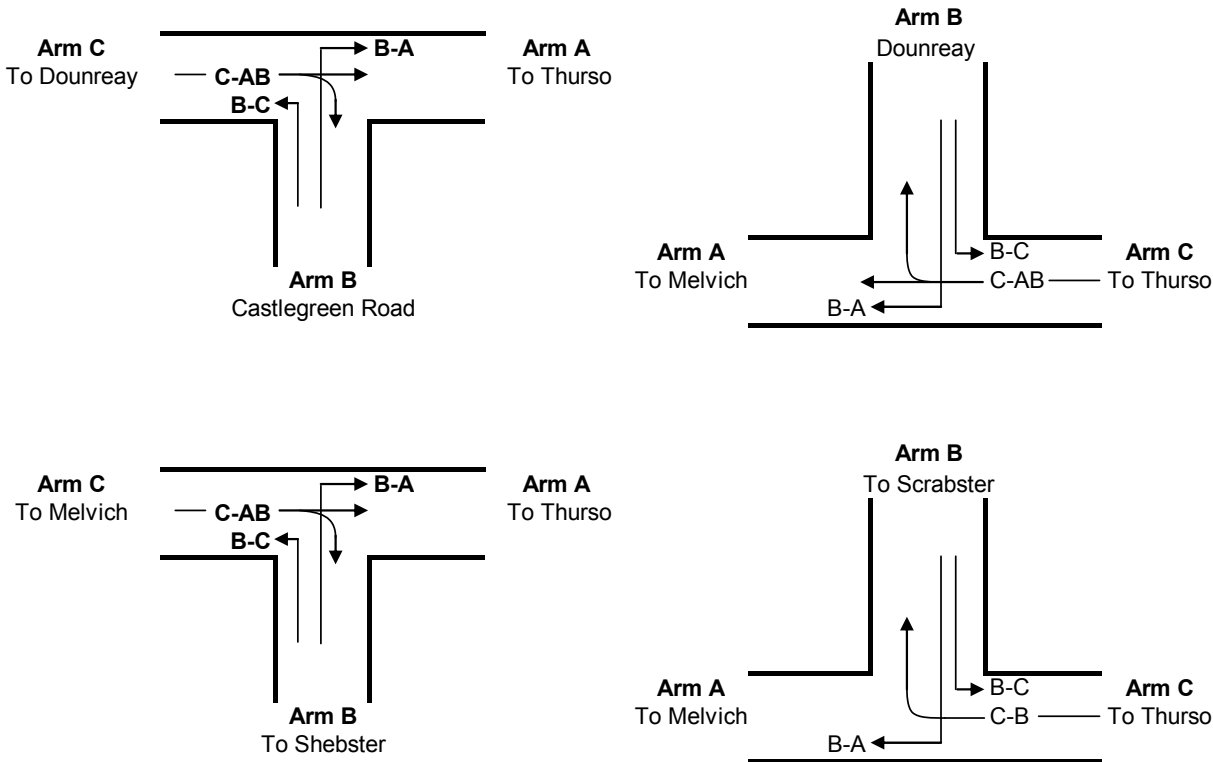


Table 6.11: PICADY Movements

7

Cumulative Site Activity Results

7.1

Cumulative Site Activity

The Paramics model was used to assess and compare the global impact of the sites activities over the entire network. All site activities were compared against four other model scenarios. These were:

- € 2005 Base
- € 2010
- € 2010 + Committed
- € 2010 + Committed – Staff Reduction

Total network delay was used for analysis purposes. Table 7.1 and Figure 7.1 detail the results.

Model Year	2005	2010	2010 + Com	2010 + Com -Staff	Cumulative Analysis
	414957	398226	538543	433054	485258
	396804	398226	517812	418743	487841
	409838	408340	536264	425533	488045
Total Delay (Avg)	407200	401597	530873	425777	487048

Table 7.1: Total Average Network Delay (AM)

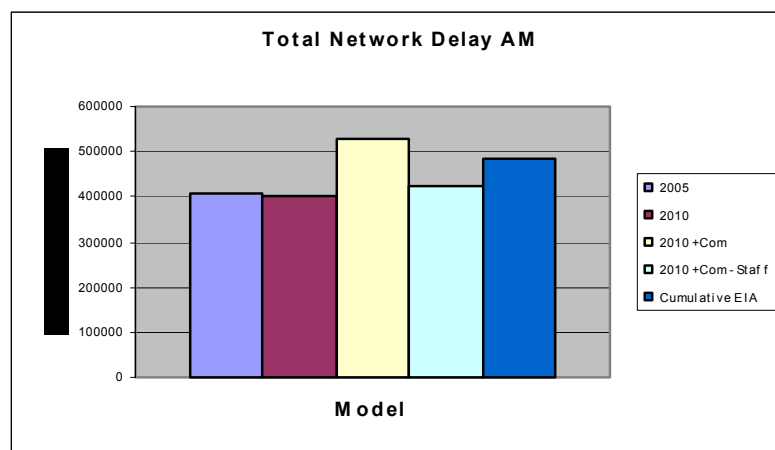


Figure 7.1: Total Average Network Delay (AM)

Model Year	2005	2010 + Growth	2010 + Com	2010 + Com -Staff	Cumulative Analysis
	379762	400807	447936	383201	461872
	375464	381939	447936	394186	460951
	375923	378990	447936	386095	455614
Total Delay (Avg)	377050	387245	447936	387827	459479

Table 7.2: Total Average Network Delay RFC (PM)

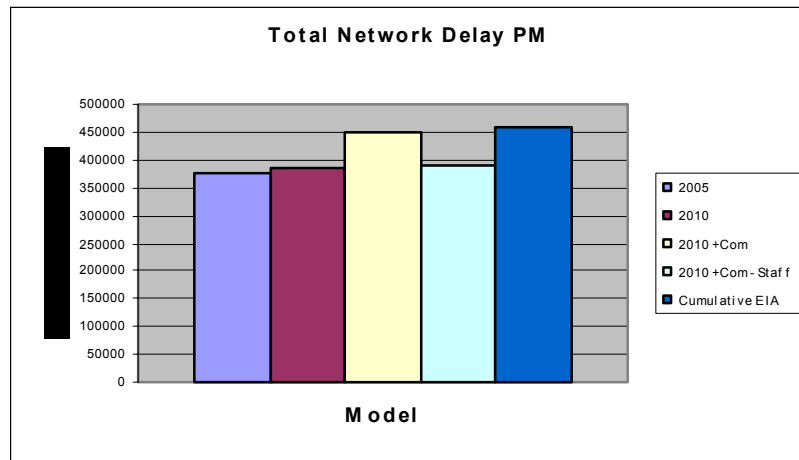


Figure 7.2: Total Average Network Delay RFC (PM)

From the above it can be seen that the AM peak period total network delay is less than 2010 + committed development. The PM results are slightly above that recorded on the PM 2010 model with committed development rising from 447,936 seconds to 459,479, equating to a 2.5% increase. This is partly due to the fact that the exiting traffic in the PM peak was lower than that which arrived in the AM peak, and in response a lower amount of vehicles was removed from the full time vehicle numbers to take into account the aforementioned staff wastage. No vehicle reduction was applied to the total contractors vehicles leaving in the PM peak so as to produce a robust analysis.

The PICADY analysis focused on the AM and PM peak period. The following four tables detail the capacities at all 4 junctions.

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.401	0.446	0.347	0.301	0.326
B-A	0.054	0.062	0.06	0.056	0.051
C-AB	0.074	0.081	0.05	0.048	0.05

Table 7.3: Castle Road/Smith Terrace RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.06	0.07	0.073	0.072	0.072
B-A	0.075	0.082	0.093	0.081	0.088
C-B	0.124	0.133	0.136	0.136	0.137

Table 7.4: Scrabster/A836 RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.036	0.036	0.036	0.036	0.049
B-A	0.034	0.035	0.038	0.033	0.059
C-AB	0.739	0.743	0.813	0.622	0.75

Table 7.5: Site Access/A836 RFC (AM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.012	0.015	0.016	0.015	0.016
B-A	0.308	0.335	0.362	0.231	0.335
C-AB	0.038	0.042	0.045	0.035	0.045

Table 7.6: Shebster/A836 RFC (AM)

In the AM peak it can be seen that the busiest arm is movement C-AB at the site access but, at 0.75 RFC, it has not exceeded its practical capacity of 0.85 RFC. All other movements are well within the junctions design capacity at 0.85 RFC. It should be noted that, in most cases within the AM peak period, all junctions are working on a par with model year 2010 + committed development.

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.184	0.204	0.163	0.162	0.164
B-A	0.24	0.274	0.253	0.244	0.257
C-AB	0.5	0.572	0.337	0.3	0.343

Table 7.7: Castle Road/Smith Terrace RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.262	0.29	0.285	0.277	0.286
B-A	0.023	0.027	0.062	0.06	0.063
C-B	0.249	0.277	0.271	0.263	0.271

Table 7.8: Scrabster/A836 RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.593	0.595	0.622	0.394	0.619
B-A	0.263	0.264	0.282	0.184	0.291
C-AB	0.015	0.015	0.016	0.016	0.03

Table 7.9: Site Access/A836 RFC (PM)

Movement	2005	2010	2010+Com	2010 + Com - Staff	Cumulative EIA
B-C	0.054	0.073	0.074	0.074	0.075
B-A	0.012	0.016	0.016	0.016	0.016
C-AB	0.052	0.076	0.077	0.078	0.079

Table 7.10: Shebster/A836 RFC (PM)

In the PM peak period, it can be seen that the busiest arm is movement B-C at the site access but at 0.619 RFC, it has not exceeded its practical capacity of 0.85 RFC. All other movements are well within the design capacity. It should be noted that, in most cases within the PM peak period, all junctions are working on a par with the model year 2010 + committed development.

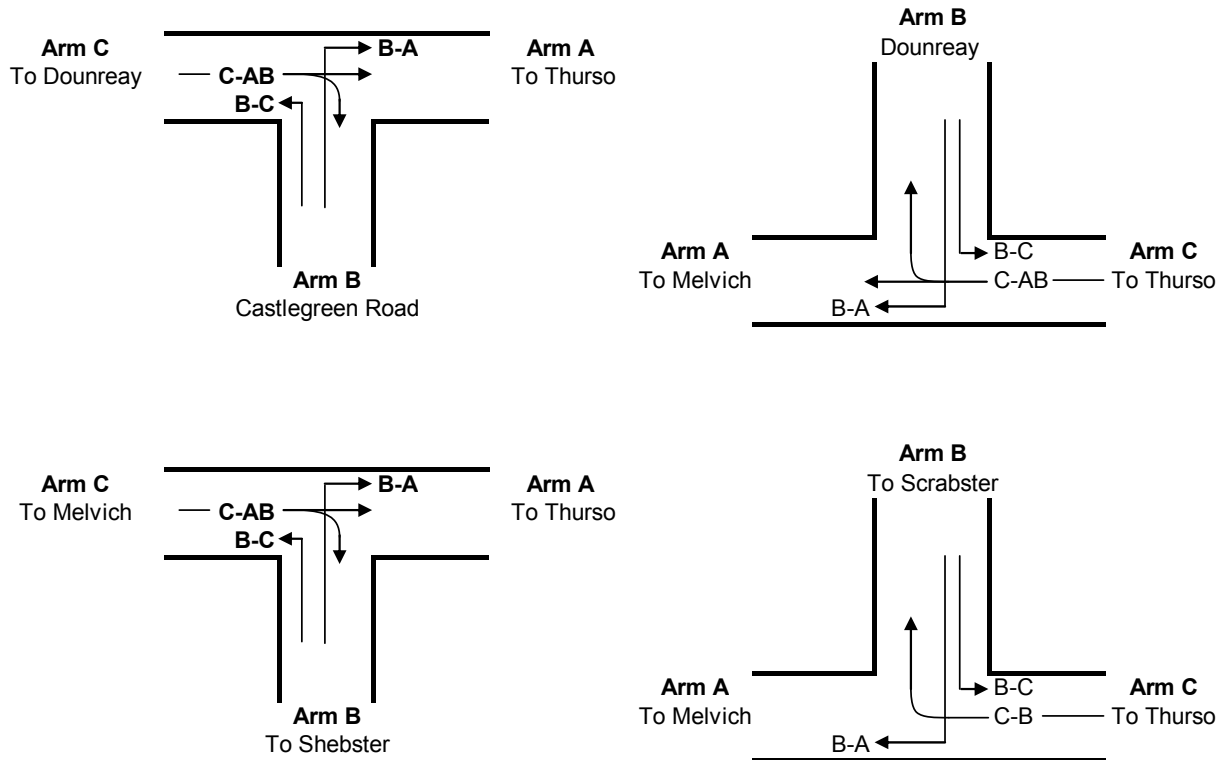


Table 7.11: PICADY Movements

8 Conclusion

8.1 *Robust Testing*

Throughout the report we have used figures and applied methodology that would provide a robust, or 'worst case', analysis. This includes:

- € Using the year with the highest vehicle generation in the 2010 analysis, where the figures in 2010 were found to be less.
- € Acknowledging that the percentage of full time staff vehicles leaving the site in the PM was lower than that entering in the AM. In response, the number of vehicles removed from the network in the PM peak was reduced from 136 to 92.
- € Not applying the methodology detailed above to the contractors 'journey to work vehicles', albeit the same methodology should have applied.
- € Assuming that these contractors arrive by means of private vehicle in proportions similar to that of full time staff members, and not by company minibus.
- € Routing traffic eastwards through Thurso where low numbers made percentage distribution difficult.
- € Applying the inbound and outbound site traffic equally over the peak hour where, in reality, there would be a time lag between vehicles entering and exiting in the AM peak. This would have resulted in lower flows than modelled.
- € Using the peak 30 minutes within the peak hour to assess the junction capacity figures, rather than an average over the hour.

8.2 *Model Output*

The Paramics output illustrates that in the AM peak period there is less total network delay, and only slightly more in the PM peak, as compared to the 2010 + committed development model.

In addition, the individual junction analyses undertaken in PICADY all operate under their practical capacity in both the AM and PM. As detailed within the

tables, most junctions are operating very comfortably with only the site access producing an RFC figure of over 0.60.