

for Steve Morgan

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Transportation and Environment Department

St. David's Landfill Site Restoration Plan



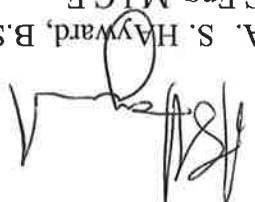
Construction Commissioning Division
March 2003

Signed
(copy)



CYNGOR SIR PENFRO-PEMBROKESHIRE COUNTY COUNCIL

**St. David's Landfill Site
Restoration Plan**

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March 2003

Page	Contents
4	Executive Summary
5	Introduction
6	Background
6	Tip Contents
7	Underlying Geology and Site Containment
8	Monitoring
8	Future Uses
9	License Requirements
9	Engineering Surveys
9	Surface Preparation
9	Leachate Management and Monitoring Systems
10	Landfill Gas Management and Monitoring Systems
10	Engineered Surface Water Management System
11	Restoration Plan
13	Site Completion – Final Landform
13	Site Security
13	Control of Mud and Debris
14	Potentially Polluting Leaks and Spillages of Waste
14	Plan
14	Fires on Site
14	Waste Acceptance and Control Procedure
14	Waste Quantity Measurement System
14	Waste Discharge and Emplacement
15	Removal of Residual Wastes from Site
15	Groundwater Monitoring and Reporting Systems
15	Surface Water Monitoring and Reporting Systems
15	Surface Water Quality Monitoring and Reporting System
15	Control, Monitoring and Reporting of Dusts, Fibres and Particulates
16	Control of Odours
16	Control of Noise
16	Control of Pest Infestation
16	Control of Litter
16	Records of Waste Movement
17	Site Diary
17	Periodic Reporting of Environmental Performance
17	Site Restoration Annual Plans
17	Year 1
17	Year 2
17	Year 3
18	Year 4 Onwards
19	Appendix 1 Borehole Logs
23	Appendix 2 Water Sampling Results
24	Appendix 3 Ecological Survey
	Appendix 4 Borehole Gas Monitoring Results

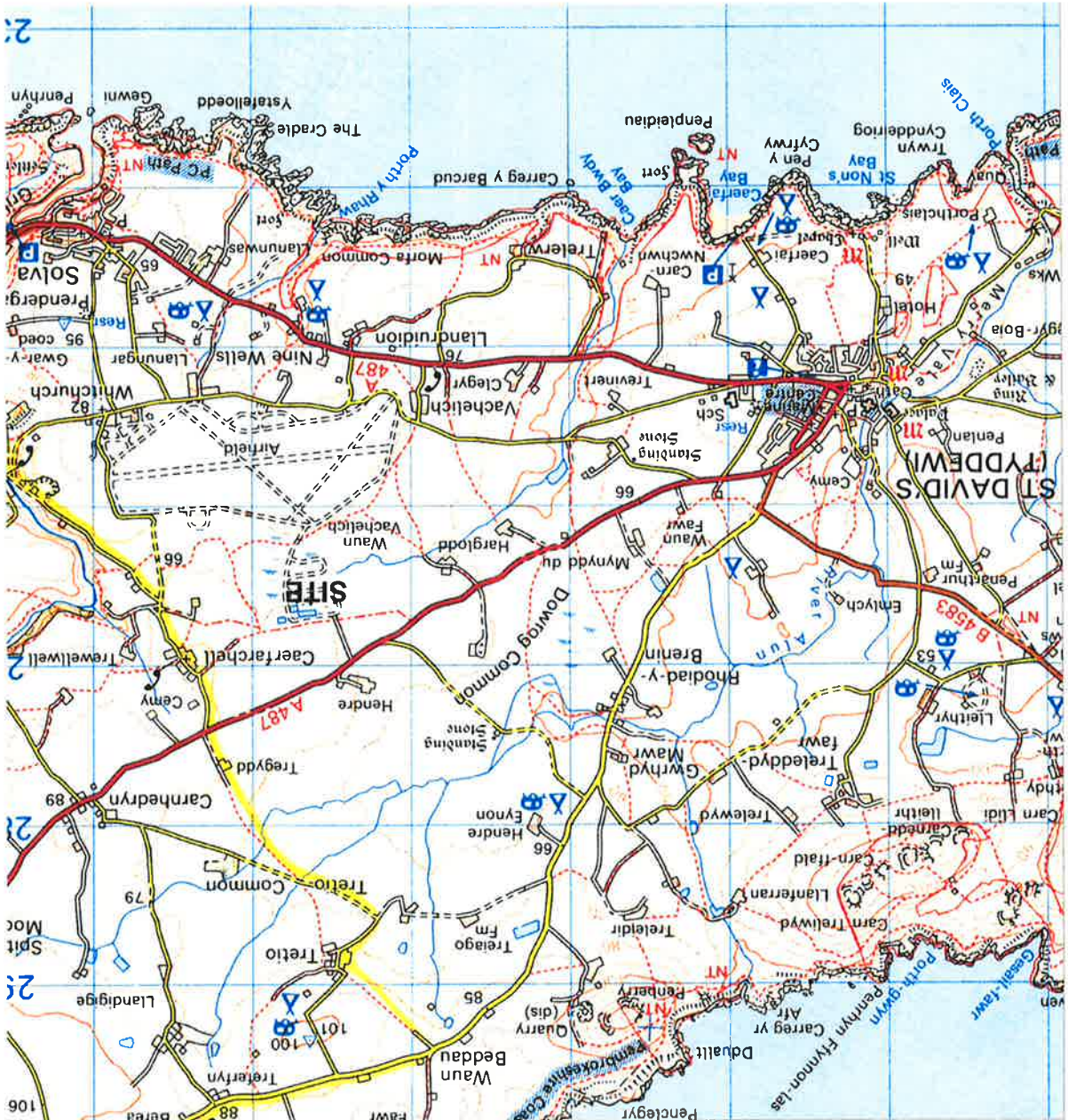
Executive Summary

This tip was established by Haverfordwest RDC following a planning consent issued in 1961.

It contains mostly domestic refuse with small quantities of material arising from works at a local refinery which has been contaminated with oil, sulphur and vanadium, some asbestos in bags and cesspit contents in lagoons. Domestic refuse was last tipped on the site in 1985 since when it has been used for disposal of inert waste.

A new Waste Management License was issued by the Environment Agency in October 2000 which imposed conditions on the operation and restoration of the site. This Report deals with issues arising from that License and suggests that the future use of the land is as open land that complements the adjacent Sites of Special Scientific Interest.

This report has been commissioned by the Infrastructure Management Division of the Transportation and Environment Department of Pembrokeshire County Council represented by Mr. David Harries, Environment Manager, as part of the process of surrendering the Waste Disposal License. It is based upon a desk study, site investigation, including boreholes and written responses from planning, environmental health and technical offices of Pembrokeshire County Council, the National Park Authority and the Countryside Council for Wales, together with copies of the Environment Agency records of the site.



1.0 Background

This tip was established by Haverfordwest Rural District Council following a planning consent issued by the former Pembrokeshire County Council in February 1961. A Location Plan is shown as Fig. 1. It was to be operated in accordance with rules laid down by the Ministry of Health in 1922 and the access road hardened out to the Public Highway. Fig. 2 illustrates the site and the adjacent S.S.S.I. on the southern boundary.



Fig. 2 St. David's Landfill Site

A council resolution laid down the basic rules for the operation of the tip based upon recommendations contained in "The Sanitary Inspection Handbook" by Henry H Clay 1947. Special provision was made for the disposal of "category 12" waste which was notifiable waste or waste contaminated with hazardous qualities or concentration of notifiable waste and also includes certain categories of waste which may not be notifiable but which would cause difficulties in certain circumstances. The tipping of domestic refuse ceased in 1985 on the opening of the Withyhedg facility at Rudbaxton.

1.1 Tip Contents

There are very limited records of the materials tipped onto this site. Facilities were provided for the disposal of domestic refuse, contaminated waste, cesspit contents, liquid trade effluent, inert waste and street sweepings.

The domestic refuse was tipped in layers and covered with inert material such as subsoil. Liquid waste from cesspits and trade effluent was placed in lagoons. The street sweepings were presumably treated as inert material and tipped as part of the capping.

Preseli District Council internal correspondence lists the following materials as having been tipped on the site but there does not appear to be any record of the precise location.

Material	Total Quantities (approximate)
-----------------	---------------------------------------

Asbestos (Undifferentiated)	20 tonnes
Vanadium and Sulphur Contaminated rubble	40-50 tonnes
Activated Alumina Desiccant	2 tonnes
Sludge Scale	3-4 tonnes
Ion Exchange Resin	8 tonnes
Oily Sawdust	50 sacks
Oily Sand	30 sacks

the analysis of the sludge scale indicated

Rust scale	90%
Sludge	8%
Organic Lead	6 ppm
Inorganic Lead	800 ppm

There are no records of analysis of the cesspit contents but they can be presumed to be septic domestic sewage. The liquid trade effluent was from a local cheese factory, again no analysis has been found but it can be presumed to be of no greater environmental hazard than the cesspit contents. Correspondence has also been seen indicating that Welsh Water wished to tip sewage sludge (3% solids) and sludge cake (35% solids). It is not known whether this occurred. There may be some heavy metal contamination of the sludge if any trade effluent was accepted into the source sewage works.

At least one incident of illegal fly tipping is noted, in this case of rockwool. Whilst this material may not be hazardous clearly the possibility exists for other deposits to have been made of waste of unknown composition.

1.2 Underlying Geology and Site Containment

The British Geological Survey map of the area indicates that the northern part of the tip is underlain by the Pebidian Series of the Pre-Cambrian, a series of tuffs (lava flows), the southern part being on sandstone of the St. David's Series of the Cambrian. These rocks are in turn covered by boulder clays (glacial tills) of the Pleistocene. It is the impermeability of these clays that has led to the development of the wet heath of such interest to ecologists.

Whilst the tuffs can normally be considered impermeable and the sandstone permeable, in this instance other factors have intervened. The sandstone is indurated and therefore would normally also be impermeable. However both the Tuffs and sandstone are possibly fractured so providing a route for ground water and the depth of clay overburden is therefore an important factor in ensuring that leachate from the refuse is contained within the site. The

This is an old tip site which does not conform to modern construction details. It was formed by tipping waste onto the existing surface forming a mound. Any rain infiltrating the capping, tipped liquid or leachate flows from the tip along the natural gradient of the surface into surrounding watercourses and the marsh. This process would have proceeded since the tipping was commenced with every fall of rain diluting and flushing out leachate. The unnecessary due to the lack of leachate detected in the watercourses and ponds surrounding the site. Samples from the surrounding watercourses and boreholes will continue to be monitored for the presence of contaminants and any that are identified will receive appropriate treatment following consultation with the Environment Agency. The results of the monitoring to date are included in Appendix 2

of leachate.

It is required to produce a Leachate Management Plan to obviate any risk of pollution of the environment, harm to human health or detriment to the amenity of the locality by discharge

2.3 Leachate Management and Monitoring Systems

No further tipping is envisaged and items 1-3 are no longer applicable. An ecological survey has been undertaken and the results forwarded to the Agency. This is included as Appendix 3 and has been used to guide the development of the Restoration Plan.

- This condition stipulated that no waste be deposited on the site until:-
1. All surface vegetation or other putrescible matter had been removed.
 2. 5 working days notice was given to the Environment Agency
 3. No waste was to be deposited on new area until a badger survey had been undertaken.
 4. An ecological Survey was required within 12 months of the date of the License.

2.2 Surface Preparation

Topographic survey of the site is required annually at a scale of at least 1:1250 referenced to Ordnance Survey grid and to Ordnance Datum (Newlyn). The required information has been supplied to the Environment Agency. Since the tip has now closed to the reception of new deposits, regular re-survey is no longer appropriate and will not be undertaken unless changes are made to surface levels as a result of restoration works. The current survey which also shows the location of the boreholes installed to monitor the site is bound with this document

2.1 Engineering Surveys.

Several requirements have been imposed by the Terms and Conditions of the site Waste Management Licence. Whilst many of these are specifically for operating tips, the issues need to be addressed in this Report. They will therefore be discussed under the headings that occur in the Licence document. However items requiring management plans and monitoring plans are included together.

2.0 License Requirements

correct fauna and flora to complement and enhance the environmentally important adjacent areas. This is therefore taken as the goal of the restoration.

2.4 Landfill Gas Management and Monitoring Systems

The licence conditions require the production of a Landfill Gas Management System for the site. This is to be based on a risk assessment that considers pollution of the environment and harm to human health from the emission of landfill gas.

This is an old site and was not equipped with any gas monitoring systems. It has therefore been necessary to install monitoring boreholes which serve the dual purpose of water and gas sampling points. A risk assessment is required to determine the need for formal gas management systems.

The site is underlain by clay with ground water standing some 3m below ground level in the boreholes with inflows starting near their base and rising up the tube indicating that it is under artesian pressure of approximately 1.5m. Any migration of gas from the site would only be possible in the clay above the saturated zone and would need a positive pressure to force it down into the clay and along any cracks. However the site is also surrounded on three sides by watercourses and the fourth side has a series of ponds which will prevent the drying out and shrinkage of the clay thereby ensuring its continued impermeability. Gas produced by the tip will therefore only vent upwards into the atmosphere through the capping material.

The tip is located some 450m from the nearest building (other than the Civic amenity site) and is within the area considered to be at risk of Radon. Any new construction would therefore require the installation of a gas impermeable membrane which would provide additional security.

Production of landfill gas is expected to reduce to values less than the natural background levels produced by marsh. This reduction in the concentrations of methane and CO₂ is already underway as can be seen in the data from sampling Borehole 4 where O₂ levels are starting to increase indicating the end of anaerobic decomposition. The sampling of gas from the three boreholes on the perimeter of the site included in Appendix 4 indicate that no methane is present, only which is combined with reduced O₂ levels. It would seem probable that this is due to decomposition of organic matter in the clay.

No risk to any existing or future property is identified and so no precautions against methane are considered to be required.

2.5 Engineered Surface Water Management System

The objective of the Surface Water Management System is to:-

- Segregate surface water runoff which is uncontaminated from that which is potentially contaminated by contact with waste.
- Prevent uncontrolled egress of surface water from the site.
- To prevent uncontrolled ingress of surface water into the site
- Prevent surface water pooling on the site
- To prevent surface water compromising the integrity of capping layers or other engineered pollution control works on site.

The tip has naturally re-vegetated presumably with wind blown or bird borne seeds from the adjacent areas. This flora should be undisturbed as far as possible with the exception of Japanese Knotweed which should be eradicated, and areas of dense bramble which should be flail mown (or similar treatment) to encourage a more diverse range of plants. However this should be done selectively, leaving some clumps to provide nest sites for birds such as Robins and warblers, on a rotation to

a) Existing Vegetation

The restoration of this site will need several stages:-

The Ecological Survey included as Appendix 3 indicates a wide range of plants that have self seeded from the surrounding heath. This is a process which will continue over time leading to the formation of a spinney of Willow, Black Thorn and Hawthorn. The area that is currently unvegetated should be undisturbed as it is anticipated to form an open glade when the site has reverted to natural scrub. The survey did identify some infestations of Japanese Knotweed which will be eradicated. The existing slabs of concrete form basing areas for reptiles and should be kept available.

2.6 Restoration Plan

The existing capping material does not show any signs of erosion and will be further protected by vegetation growth as the tip is seeded naturally. It is not considered necessary to undertake any additional works to stabilise the surface as rainfall will not compromise the integrity of the capping layers.

Given that the monitoring of the surface waters surrounding the tip have consistently indicated that there is no contamination at an unacceptable level, no engineered surface water control system is considered necessary. Monitoring of both the surrounding water and samples from the boreholes will continue until the Site License is surrendered. Any contamination detected will be treated appropriately.

Rainfall is the only source of water which needs to be considered. Since there is no containment system for surface water there can be no build up of water within the mass of tipped material which could lead to an uncontrolled egress of water in excess of the normal flows which will fluctuate with rainfall intensity. The water will flow along the plane formed by the clay and discharge into the surrounding watercourses or wet heath. Any contaminants will be diluted both by the base flows in the watercourses and the volume of water in the heath and ponds.

It is not possible to separate the surface water from the tip which might be contaminated from that which is not as the only water is rainfall soaked into the mass of the tipped material.

This site was formed by tipping of waste material on the existing surface of the marsh surrounding land across the site from north to south of approximately 5m. It is surrounded by water courses on the eastern and western boundaries with ponds and a ditch and hedgbank to the north and bog to the south. It is physically impossible therefore for surface water run-off to enter the site in an uncontrolled manner.

prevent any one area becoming too dense and rank. This would be required over a number of years if significant benefit in terms of biodiversity is to be obtained.

b) Clean Up.

There is a considerable amount of concrete and brick rubble over the surface of the tip which ought to be moved from its prominent position but left available as a basking area for reptiles. The stockpiles of street sweepings should be dispersed which would improve drainage and impoverish the soil thereby encouraging desirable species. Bituminous materials will need to be buried along with surface deposits of refuse and litter. However any clear up should take care to limit the amount of damage caused to the existing vegetation.

c) Screen Planting

The Civic Amenity site is visible from a considerable distance and should be screened both to reduce the visual intrusion into the landscape as viewed from the former airfield but also to reduce the effects of the site lighting on the insects on the moor and former tip. This can best be achieved by planting barriers of native species such as Hawthorn (*Crataegus* sp.), Blackthorn (*Prunus* sp.) and Osier, Goat, White and Grey Willow (*Salix* sp.) using locally sourced plants.

The planting season for these species is between November and March. It is intended to undertake this work in the 2003-4 season which will allow for the collection and rooting of cuttings. Whilst the southern boundary can be planted with bare rootstock plants since the conditions are favourable, any planting along the boundary of the Civic Amenity site will require the planting to be into pits since the soil is very impoverished. The planting should be in clumps of differing species to prevent a linear hedge effect. The obtaining of cuttings from the S.S.S.I. is subject to consent from the Countryside Council for Wales. This will be obtained at the appropriate time.

d) Surrender of Licence

The Environment Agency will need to be satisfied that the tip poses no current or future threat to the environment before permitting the surrender of the waste disposal licence. However the steps planned will provide sufficient evidence to enable this to occur.

e) Encouragement of biodiversity.

The advice of specialist ecologists will be sought to produce a long term management plan for this land to enable it to become part of the local landscape and enhance the S.S.S.I. along its perimeter. This will be undertaken as a partnership between the County Council, Countryside Council for Wales and the National Trust. The undisturbed area is included in the current Pembrokeshire Living Heathlands Project which, by controlled grazing, seeks to maintain and enhance the biodiversity of the heath. The Tip area is to be encouraged to develop in such a way as to blend into the S.S.S.I. providing habitats to complement those available on the Heath.

2.7 Site Completion – Final Landform

The current landform is to be retained since any extensive reforming would cause excessive disturbance of an established ecosystem. However minor adjustments may be made to bury any surface refuse or rubble. Concrete slabs will be moved to reduce their visibility but are considered important basking areas for reptiles whilst providing shelter beneath and so will be deposited flat on the surface. Shallow depressions on the existing surface provide temporary puddles acting to keep small areas clear of vegetation and so providing habitats for insects.

The general topography of the surrounding landscape is of a gently sloping plane with no significant rises until the extremities of the area where the northern coastline is fringed with hills such as Carn Llidi, Carnedd Lleithir and Penbry, the general high point is towards Croes Goch. It would therefore be desirable to provide some screen planting around the southern perimeter of the tip and of the Civic Amenity Site. Appropriate species are Willow, Hawthorn and Blackthorn which form substantial shrubs quickly. This would tend to disguise the tip mound as a clump of trees of which there are several in the general area. It may also be appropriate to plant a few specimen trees of Oak to provide future visual interest. These will provide new habitat further encouraging wildlife to colonise the tip.

2.8 Site Security

Site security is required to prevent access by humans and livestock which are not authorised. The site has three access points, two via the Civic Amenity site and one from the old airfield. The Civic Amenity site is locked when unattended and no unauthorised access is considered possible via these routes. The remainder of the northern boundary and the western boundary are formed by a barbed wire fence, ditch and hedgerow and are considered secure.

Access to the old airfield is via a locked gate, the key being held by the National Park Authority, the Countryside Council for Wales and the National Trust. A grazing program as part of the Pembrokeshire Living Heathlands Project is being undertaken by the National Trust who own the Common Land which forms the S.S.S.I. surrounding the tip and a license has been granted by Pembrokeshire County Council to them to graze the area of the tip which has not had any refuse deposited upon it. The tipped area has been secured by a stockproof fence of three strands of barbed wire on wooden posts. This extends along the southern and eastern boundaries of the tipped area and so the site is secure against unauthorised entry by livestock.

2.9 Control of Mud and Debris

The site is now closed for tipping and the only vehicular access is by contractors engaged upon restoration works. All vehicle leaving the site do so via the Civic Amenity site where a hose is available to clean any mud off vehicles before they proceed off site. Any mud or debris spilt on the Civic Amenity Site will be cleaned up in accordance with the Working Plan for the Civic Amenity Site paragraph 2.3.1 Should any mud be deposited upon the highway as a result of works on the Tip, one of the road sweepers held by the County Council will be directed to remove it.

2.10 Potentially Polluting Leaks and Spillages of Waste Action Plan.

The Tip has now closed for tipping and so the risk of leaks and spillages from newly tipped material causing any pollution are considered negligible and no plan is therefore necessary. Any discharges from the refuse such as corroding containers rupturing will be detected by the leachate monitoring and dealt with appropriately following discussions with the Environment Agency who will be notified immediately of any such discharge. Fuel, hydraulic fluid and oils from plant and vehicles engaged upon restoration works are a very minor risk since there are few of them on few occasions. The Civic Amenity Site has a Working Plan which specifies the procedures in the event of any spillage together with an appropriate kit to contain and clean up any spillage. Section 2.2 of the Working Plan will be utilised for any incident on the former Tip.

2.11 Fires on Site

Tipping on the site has now ceased and no precautions are required for any residual risk of fire arising from the tipped material.

No fires will be permitted on the site for any reason. Any accidental fires caused by, for instance vehicle exhaust sparks, or as a result of arson or vandalism will be extinguished as soon as possible using the services of the Fire Brigade. Particular attention must be paid to the possibility of fire during drought conditions if any restoration works are undertaken. Where a risk of fire is perceived to be significant, water type fire extinguishers shall be provided and be immediately available for use by a person appointed to act as a fire watch.

2.11 Waste Acceptance and Control Procedure.

No waste shall be permitted on the site which has now closed. An Acceptance and Recording Procedure is therefore not required.

2.12 Waste Quantity Measurement Systems

No waste shall be accepted at or dispatched from this closed site. No system for measuring the weight of waste is required.

2.13 Waste Discharge and Emplacement

No imported waste will be discharged or emplaced on the Tip which has now closed. Minor surface deposits will be collected and buried as part of the tip restoration. Any burial of material shall be undertaken in such a manner as not to cause any risk of pollution of the surrounding land or to any surface or ground water.

The site for burial of any collected surface deposits shall have any capping layer removed and set aside for reuse. The collected material shall be deposited in the resultant hole and covered with the capping material. If insufficient capping material is available clay subsoil shall be imported and spread over the deposit.

2.14 Removal of Residual Wastes from Site.

There are no deposits of waste on the site which have been disposed of on the site other than in accordance with the conditions of the licence or prior to the issue of the license.

2.15 Groundwater Monitoring and Reporting Systems.

The purpose of the Monitoring and Reporting System shall, for each monitoring point when required, be to:-

- a) Permit the accurate determination of groundwater level.
- b) Enable groundwater flow rates to be measured.
- c) Enable representative samples of groundwater to be taken for analysis.
- d) Withstand physical damage and chemical attack in the sub-ground environment
- e) Be secure to prevent unauthorised access and entry of foreign matter.

This tip was commenced without the provision of monitoring systems for groundwater and so four boreholes with gas and water monitoring wells in each have been installed to monitor groundwater and landfill gasses. Three are on the perimeter of the tipped area and the fourth is in the approximate centre of the tip mound. Each borehole has been capped with a metal enclosure to prevent any material falling down them.

2.16 Surface Water Quality Monitoring and Reporting System

A Risk Assessment of the site's potential impact on surface water and a specific program of surface water monitoring are required.

This site has no surface water control systems or any restrictions on the flow of surface water offsite. The tip is a gentle mound allowing water to flow freely over the surface. No trace of any contaminants have been detected in the samples taken of surface waters around the site and, since no further tipping will occur, none are anticipated in future. The site is not considered to have any potential for impact on surface water. No surface water management system will be installed.

Surface water sampling will be undertaken on a three monthly cycle. This will collect water from representative bodies of surface water surrounding the tip including those which are uphill of the site so that any airborne contamination can be identified and accounted for in the reporting of the analysis results.

These measures are consistent with the potential risks of pollution from the site.

2.17 Control, Monitoring and Reporting of Dusts, Fibres and Particulates.

This site is now closed and so no further tipping will take place. There is no source of fibres which can be blown off site. The site is becoming vegetated and so no emissions of dusts or particulates are anticipated from those areas. Those areas which remain bare earth are

compacted and so emissions from them greater than would arise from ploughed land are not anticipated. There are no surface deposits of materials which will give rise to deleterious dusts or particulates.

Should restoration works be undertaken in dry weather precautions will be taken to prevent the production of dusts by plant or machinery. A water bowser will be available to damp down.

2.17 Control of Odours.

The site is now closed and no putrescible matter has been deposited since 1985. This material will have decayed significantly in the intervening period and no odour is anticipated from the site. No control methods will be installed.

Care will need to be taken to ensure that any complaints of odour received are not emanating from the Civic Amenity site. Any complaints shall be investigated immediately and if arising from the Tip shall be dealt with in accordance with the Control of Odour plan in the Site Working Plan for the Civic Amenity site. Should the source of odour be insufficiently buried waste material, a further capping layer shall be placed over it.

2.18 Control of Noise

This site is now closed and no noise source exists upon it. Any tip restoration works will be undertaken in such a manner as to minimise any noise produced.

2.19 Control of Pest Infestation.

It is inevitable that rodents will inhabit the site, indeed they are to be encouraged to do so. They will form a food source for raptors and the population is therefore anticipated to be self limiting. Should there be an identified problem with rodents a specific plan will be prepared to control the problem using appropriate methods to ensure that other wildlife is not adversely affected.

Other pests, for example wasps, are not anticipated to cause a nuisance given the remote location of the tip from any human habitation.

2.20 Control of Litter.

The site is now closed and no further tipping allowed. All litter has been buried and so cannot be windblown. Should litter be blown in to the site or deposited by trespassers it shall be removed by the Civic Amenity site attendant and disposed of in the Civic Amenity Compactor container.

2.21 Records of Waste Movements

This site is now closed. No waste movements will occur into or from the site and so no records will be kept.

2.22 Site Diary

The Site diary shall be kept in the offices of Pembrokeshire County Council, County Hall, Freeman's Way, Haverfordwest and be available for inspection during normal office hours.

The contents shall be appropriate to a closed landfill site and include:-

- a) Details of any emergencies such as fires or pollution incidents and the actions taken.
- b) Details of water sampling, gas monitoring or other such surveying works.
- c) Details of any restoration works undertaken.
- d) Complaints received about the landfill site and any subsequent actions.
- e) Details of any reports from external sources relating to the landfill site.

2.23 Periodic Reporting of Environmental Performance.

The results of all sampling and monitoring works undertaken shall be forwarded to the Environment Agency as and when received together with any reports or other information relating to the landfill site.

3.0 Site Restoration Annual Plans

The restoration of this will take a number of years with reducing intervention as a diverse ecology develops.

3.1 Year 1

- a) The tip surface will be cleaned of any deposits of unburied rubbish.
- b) Concrete slabs are to be placed flat to reduce their visual intrusion.
- c) The large area of bramble will be flail mown into individual clumps to allow a greater diversity of plants to develop whilst still providing suitable nest sites for Warblers etc..
- d) The infestation of Japanese Knotweed will be eradicated.
- e) The surrounding untipped portion of the site will be grazed as part of the Pembrokeshire Living Heathlands Project.
- f) Suitable, locally sourced, trees will be planted along the southern boundary and the Civic Amenity Site fence.
- g) Water sampling and gas monitoring will be undertaken in a regular basis.
- h) Submit License Surrender Application using accumulated water and gas data to base a risk assessment on.

3.2 Year 2

- a) Water sampling and gas monitoring will continue on a regular basis.
- b) Alternative clumps of Bramble will be flail mown.
- c) Any surviving Japanese Knotweed will be treated.

3.3 Year 3

- a) Continue water sampling and gas monitoring.
- b) Flail mow clumps of Bramble as required
- c) Treat any recurrence of Japanese Knotweed infestation.
- d) Undertake an ecological survey.

3.4 Year 4 onwards

Monitor the site ecologically and allow to develop naturally. No works are to be undertaken unless identified by the ecological monitoring.

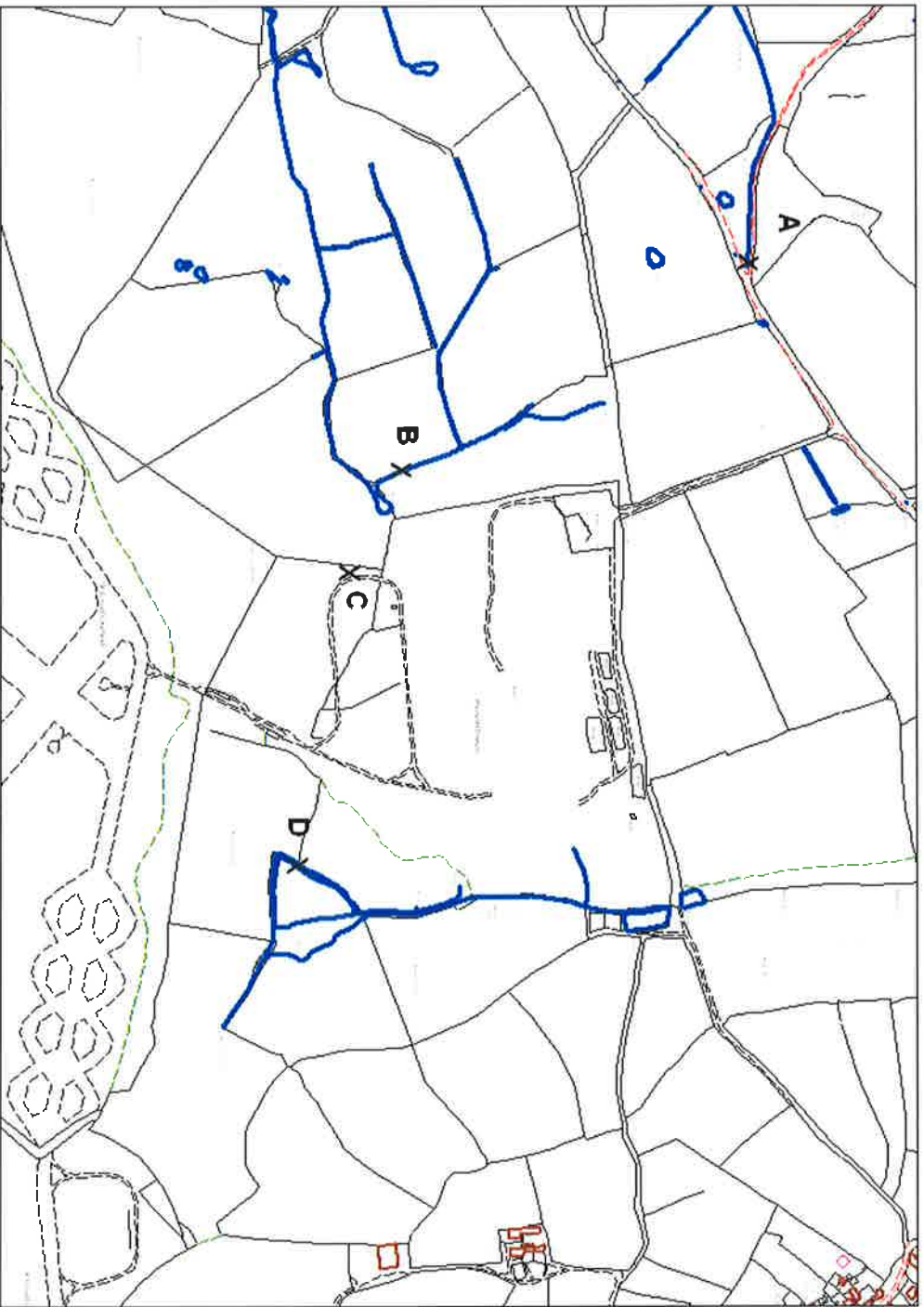
Appendix I

Borehole Logs and Permeability Test Results

Contract : St Davids		Client : Pembrokeshire County Council																																																			
Dates : 07/05/02 - 08/05/02 Job Number : X22395 Engineer : Construction Commissioning Division		Ground Level : m A.O.D. Coordinates: E N																																																			
Borehole No. BH 3																																																					
Tests		STRATA																																																			
<table border="1"> <tr> <th>Depth (Thick-ness)</th> <th>DESCRIPTION</th> </tr> <tr> <td>0.50 - 1.00</td> <td>Grey sandy (fine to coarse) line to coarse subangular to angular GRAVEL of mudstone with some cobbles and occasional boulders.</td> </tr> <tr> <td>1.00 - 1.80</td> <td>Brown silty sandy to very sandy (fine to medium) gravelly to very gravelly (fine to coarse rounded to angular) CLAY.</td> </tr> <tr> <td>1.80 - 2.70</td> <td>Below 3.50m depth... slightly gravelly.</td> </tr> <tr> <td>2.70 - 4.50</td> <td>Brown very clayey very silty fine to coarse subangular to angular gravel or silt.</td> </tr> <tr> <td>4.50 - 5.30</td> <td>Moderately strong to strong green grey mottled white and brown slightly weathered iron stained silt.</td> </tr> <tr> <td>5.30 - 6.00</td> <td>End of Borehole</td> </tr> </table>		Depth (Thick-ness)	DESCRIPTION	0.50 - 1.00	Grey sandy (fine to coarse) line to coarse subangular to angular GRAVEL of mudstone with some cobbles and occasional boulders.	1.00 - 1.80	Brown silty sandy to very sandy (fine to medium) gravelly to very gravelly (fine to coarse rounded to angular) CLAY.	1.80 - 2.70	Below 3.50m depth... slightly gravelly.	2.70 - 4.50	Brown very clayey very silty fine to coarse subangular to angular gravel or silt.	4.50 - 5.30	Moderately strong to strong green grey mottled white and brown slightly weathered iron stained silt.	5.30 - 6.00	End of Borehole	<table border="1"> <tr> <th>Legend</th> <th>Depth (Thick-ness)</th> <th>Water</th> <th>Backfill</th> </tr> <tr> <td></td> <td>0.50 - 1.80</td> <td></td> <td></td> </tr> <tr> <td></td> <td>1.80 - 2.70</td> <td></td> <td></td> </tr> <tr> <td></td> <td>2.70 - 4.50</td> <td></td> <td></td> </tr> <tr> <td></td> <td>4.50 - 5.30</td> <td></td> <td></td> </tr> <tr> <td></td> <td>5.30 - 6.00</td> <td></td> <td></td> </tr> </table>		Legend	Depth (Thick-ness)	Water	Backfill		0.50 - 1.80				1.80 - 2.70				2.70 - 4.50				4.50 - 5.30				5.30 - 6.00														
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Remarks: Dando 150 cable percussion drilling with 150mm casing and tools																																																					
THYSSEN Thysen House, Blyndor Llanelli, Carmarthenshire, SA14 9SU Tel: 01554 772244 Fax: 01554 776150 email: geotechnical@thysen.co.uk W.P. Osborn Operator: Logged By: A. Cassidy Sheet No. 1 Of 1 Scale: 1:60.98 All measurements in metres unless otherwise stated AGS																																																					

Appendix 2

Water Sampling Results



Water Sampling Point Location Plan



MINTON, TREHARNE & DAVIES LIMITED

Consulting Scientists, Mariners & Engineers
Analytical & Testing Laboratories
Public Analysts

Attn: T.E. Johnson
Client: Herbert J. Evans Division
Unit 5
Llwyn-yr-Fos
Parc Menter
Crosshands
Carmarthenshire
SA14 3RB

Test Report

Report No R2394/A/02

Client Reference St. David's Amenity Site
Client Order Number W502/2188-2191
Sample Source As supplied by client
Number of Samples 4
Date Received 29/11/02
Report Date 13/12/02

Determinand	Method	Result	Unit
-------------	--------	--------	------

R2394/A/02 : 01	Sample A	AES 1017	<0.05	mg/l	Arsenic
		AES 1017	<0.06	mg/l	Boron
		AES 1017	<0.005	mg/l	Cadmium
		AES 1017	<0.02	mg/l	Chromium
		AES 1017	<0.01	mg/l	Copper
		AES 1018	<0.025	mg/l	Cyanide
		AES 1017	0.04	mg/l	Lead
		AES 1017	<0.13	mg/l	Mercury
		AES 1027	<0.05	mg/l	Monohydric Phenols
		AES 1017	<0.01	mg/l	Nickel
		AES 1017	<0.10	mg/l	Selenium
		Ion Chromatography	13.47	mg/l	Sulphate (as SO ₄)
		AES 1026	0.08	mg/l	Sulphide
		AES 1017	13	mg/l	Sulphur
		In house Method	<0.5	mg/l	Thiocyanate
		GCMS	<1	mg/l	Total PAHs
		AES 1017	0.01	mg/l	Zinc
		AES 1035	7.17	pH value	pH



0077

Authorised Signatories:

~~Steve White~~ Environmental Manager
Jayne Were Environmental Laboratory Manager

* Indicates determinand not covered by UKAS Accreditation
† Indicates determinand subcontracted

MINTON, TREHARNE & DAVIES LIMITED

Consulting Scientists, Mariners & Engineers
Analytical & Testing Laboratories
Public Analysts

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Unit 5
Llwyn-yr-Eos
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Carmarthenshire
SA14 3RB

Test Report

Report No R2394/A/02

Client Reference St. David's Amenity Site
Client Order Number W502/2188-2191
Sample Source As supplied by client
Number of Samples 4
Date Received 29/11/02
Report Date 13/12/02

Determinand	Method	Result	Unit
-------------	--------	--------	------

R2394/A/02 : 02	Sample B	AES 1017	<0.05	mg/l	Arsenic
		AES 1017	<0.06	mg/l	Boron
		AES 1017	<0.005	mg/l	Cadmium
		AES 1017	<0.02	mg/l	Chromium
		AES 1017	0.14	mg/l	Copper
		AES 1018	<0.025	mg/l	Cyanide
		AES 1017	<0.03	mg/l	Lead
		AES 1017	<0.13	mg/l	Mercury
		AES 1027	0.09	mg/l	Monohydric Phenols
		AES 1017	<0.01	mg/l	Nickel
		AES 1017	<0.10	mg/l	Selenium
		AES 1026	6.22	mg/l	Sulphate (as SO4)
		AES 1017	0.11	mg/l	Sulphide
		AES 1017	6	mg/l	Sulphur
		In house Method	<0.5	mg/l	Thiocyanate
		GCMS	<1	mg/l	Total PAHs
		AES 1017	0.01	mg/l	Zinc
		AES 1035	6.58	mg/l	pH value



Authorised Signatories: Steve White Environmental Manager
Jayne Were Environmental Laboratory Manager

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Client Order Number W502/2188-2191
Sample Source As supplied by client
Number of Samples 4
Date Received 29/11/02
Report Date 13/12/02

Determinand	Method	Result	Unit
-------------	--------	--------	------

R2394/A/02 : 03	Sample C	AES 1017	<0.05	mg/l	Arsenic
		AES 1017	<0.06	mg/l	Boron
		AES 1017	<0.005	mg/l	Cadmium
		AES 1017	<0.02	mg/l	Chromium
		AES 1017	<0.01	mg/l	Copper
		AES 1018	<0.025	mg/l	Cyanide
		AES 1017	0.06	mg/l	Lead
		AES 1017	<0.13	mg/l	Mercury
		AES 1027	0.11	mg/l	Monohydric Phenols
		AES 1017	<0.01	mg/l	Nickel
		AES 1017	<0.10	mg/l	Selenium
		AES 1026	<0.05	mg/l	Sulphide
		AES 1017	10	mg/l	Sulphur
		In house Method	<0.5	mg/l	Thiocyanate
		GCMS	<1	mg/l	Total PAHs
		AES 1017	<0.01	mg/l	Zinc
		AES 1035	7.25	pH value	pH



0077

Authorised Signatories:

Steve White Environmental Manager
Jayne Were Environmental Laboratory Manager

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MINTON, TREHARNE & DAVIES LIMITED

Consulting Scientists, Mariners & Engineers
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Carmarthenshire
SA14 3RB

Test Report

Report No R2394/A/02

Client Reference St. David's Amenity Site
Client Order Number W502/2188-2191
Sample Source As supplied by client
Number of Samples 4
Date Received 29/11/02
Report Date 13/12/02

Determinand	Method	Result	Unit
-------------	--------	--------	------

R2394/A/02 : 04	Sample D	AES 1017	<0.05	mg/l	Arsenic
		AES 1017	<0.06	mg/l	Boron
		AES 1017	<0.005	mg/l	Cadmium
		AES 1017	<0.02	mg/l	Chromium
		AES 1017	<0.01	mg/l	Copper
		AES 1018	<0.025	mg/l	Cyanide
		AES 1017	0.04	mg/l	Lead
		AES 1017	<0.13	mg/l	Mercury
		AES 1027	<0.05	mg/l	Monohydric Phenols
		AES 1017	<0.01	mg/l	Nickel
		AES 1017	<0.10	mg/l	Selenium
		Ion Chromatography	15.32	mg/l	Sulphate (as SO ₄)
		AES 1026	0.06	mg/l	Sulphide
		AES 1017	36	mg/l	Sulphur
		In house Method	3.5	mg/l	Thiocyanate
		GCMS	<1	mg/l	Total PAHs
		AES 1017	<0.01	mg/l	Zinc



Authorised Signatories: Steve White Environmental Manager
Jayne Were Environmental Laboratory Manager

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 Carmarthenshire
 SA14 3RB

Test Report

Report No R2394/A/02

Client Reference St. David's Amenity Site
 Client Order Number W502/2188-2191
 Sample Source As supplied by client
 Number of Samples 4
 Date Received 29/11/02
 Report Date 13/12/02

Determinand	Method	Result	Unit
R2394/A/02 : 04 pH	Sample D AES 1035	7.42	pH value



Authorised Signatories:

John
~~Steve White~~ Environmental Manager
 Jayne Were Environmental Laboratory Manager

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 † Indicates determinand subcontracted

laboratory Ref : E131547 Sampling Point : 190201

Date/Time Taken : 25-MAR-2002 00:01 Date/Time Received : 26-MAR-2002 07:26
 Address : POLLUTION INVESTIGATIONS, PEMBROKESHIRE AREA :

Sampler's Comments :
 SAMPLE A NGR=SM782269

Item No.	Description	Result	Unit
L* 50	Lead - As Pb	< 2.0	MICROGRAM PER LITRE ug/l
61	Ph - As Ph Units	7.0	PH UNITS
L* 76	Temperature Water	No Result	PHUNITS
* 85	Bod Atm As O2	1.0	MILLIGRAM PER LITRE mg/l
L* 92	Cod - As O2	< 12.0	MILLIGRAM PER LITRE mg/l
* 105	Mercury - As Hg	< 0.008	MICROGRAM PER LITRE mg/l
* 108	Cadmium - As Cd	< 0.1	MICROGRAM PER LITRE ug/l
L* 111	Ammonia - As N	< 0.01	MILLIGRAM PER LITRE mg/l
* 135	Solids Suspended @105c	2.0	MILLIGRAM PER LITRE mg/l
L* 167	Sulphide - As S	Not yet in	MILLIGRAM PER LITRE mg/l
* 172	Chloride Ion - As Cl	50.0	MILLIGRAM PER LITRE mg/l
L* 175	Cyanide - As Cn	< 0.002	MILLIGRAM PER LITRE mg/l
* 215	Copper - As Cu	< 0.001	MILLIGRAM PER LITRE mg/l
L* 245	Zinc - As Zn	0.032	MILLIGRAM PER LITRE mg/l
* 53	Cadmium - As Cd	No Result	MILLIGRAM PER LITRE mg/l
L* 287	Aluminium - As Al	0.037	MILLIGRAM PER LITRE mg/l
328	Lead - As Pb	No Result	MILLIGRAM PER LITRE mg/l
L* 375	Chromium - As Cr	0.0012	MILLIGRAM PER LITRE mg/l
* 403	Manganese - As Mn	0.021	MILLIGRAM PER LITRE mg/l
L* 421	Iron - As Fe	0.08	MILLIGRAM PER LITRE mg/l
* 429	Nickel - As Ni	< 0.003	MILLIGRAM PER LITRE mg/l
L* 1042	Ethanoic Acid {Acetic Acid}	Not yet in	MILLIGRAM PER LITRE mg/l
1065	Hexanoic Acid	Not yet in	MILLIGRAM PER LITRE mg/l
L* 1068	2-Methylpropanoic Acid {Isobutyric Acid}	Not yet in	MILLIGRAM PER LITRE mg/l
1069	3-Methylbutanoic Acid {Isovaleric Acid}	Not yet in	MILLIGRAM PER LITRE mg/l
1075	Butanoic Acid {Butyric Acid}	Not yet in	MILLIGRAM PER LITRE mg/l
L* 1076	Pentanoic Acid {Valeric Acid}	Not yet in	MILLIGRAM PER LITRE mg/l
L* 1088	Propanoic Acid {Propionic Acid}	Not yet in	MILLIGRAM PER LITRE mg/l
L* 3164	Chromium - As Cr	No Result	MILLIGRAM PER LITRE mg/l
L*6046	Arsenic - As As	< 1.0	MICROGRAM PER LITRE mg/l

Sample Analysis Report

laboratory Ref : E131547 Sampling Point : 190201

Date/Time Taken : 25-MAR-2002 00:01 Date/Time Received : 26-MAR-2002 07:26

Dtd. Code	Description	Result
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continued...

L*6061 Vanadium - As V	LITRE ug/l	MICROGRAM PER LITRE ug/l	< 2.0
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6452 Copper - As Cu	No Result
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6455 Zinc - As Zn	No Result
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6462 Nickel - As Ni	No Result
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7240 Cyanide - As Cn	No Result
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7274 Identity Of Hand Held Meter	No Result
----------------------------------	-----------

7277 Iso Hexanoic (Caproic) Acid { Iso	No Result
--	-----------

Caproic Acid}	Not yet in
---------------	------------

9559 Phenol	< 0.04	MILLIGRAM PER LITRE mg/l
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'X' Indicates analysis at non-Agency laboratory.
 'L' Indicates analysis at other Agency laboratory.
 '*' Indicates that Laboratory Determination Method is UKAS Accredited.

Laboratory Ref : E131546 Sampling Point : 190201
 Date/Time Taken : 25-MAR-2002 00:01 Date/Time Received : 26-MAR-2002 07:26
 Address : POLLUTION INVESTIGATIONS, PEMBROKESHIRE AREA :
 Sample's Comments : SAMPLE B NGR=SM784264

Detd. Code	Description	Result
L* 50 Lead - As Pb		1470.0 MICROGRAM PER LITRE ug/l
61 Ph - As Ph Units		7.0 PH UNITS
76 Temperature Water		No Result PHUNITS
* 85 Bod Atu As O2		10.6 MILLIGRAM PER LITRE mg/l
92 Cod - As O2		2800.0 MILLIGRAM PER LITRE mg/l
* 105 Mercury - As Hg		0.092 MICROGRAM PER LITRE mg/l
* 108 Cadmium - As Cd		15.4 MICROGRAM PER LITRE ug/l
L* 111 Ammonia - As N		0.03 MILLIGRAM PER LITRE ug/l
* 135 Solids Suspended @105c		10024.0 MILLIGRAM PER LITRE mg/l
L 167 Sulphide - As S		Not yet in
* 172 Chloride Ion - As Cl		67.8 MILLIGRAM PER LITRE mg/l
L* 175 Cyanide - As Cn		0.002 MILLIGRAM PER LITRE mg/l
* 215 Copper - As Cu		0.588 MILLIGRAM PER LITRE mg/l
* 245 Zinc - As Zn		6.05 MILLIGRAM PER LITRE mg/l
* 53 Cadmium - As Cd		No Result
L* 287 Aluminium - As Al		9.74 MILLIGRAM PER LITRE mg/l
328 Lead - As Pb		No Result
L* 375 Chromium - As Cr		1.56 MILLIGRAM PER LITRE mg/l
* 403 Manganese - As Mn		2.91 MILLIGRAM PER LITRE mg/l
L* 421 Iron - As Fe		163.0 MILLIGRAM PER LITRE mg/l
* 429 Nickel - As Ni		0.738 MILLIGRAM PER LITRE mg/l
1042 Ethanoic Acid {Acetic Acid}		Not yet in
1065 Hexanoic Acid		Not yet in
L 1068 2-Methylpropanoic Acid {Isobutyric Acid}		Not yet in
1069 3-Methylbutanoic Acid {Isovaleric Acid}		Not yet in
L 1075 Butanoic Acid {Butyric Acid}		Not yet in
L 1076 Pentanoic Acid {Valeric Acid}		Not yet in
1088 Propanoic Acid {Propionic Acid}		Not yet in
3164 Chromium - As Cr		No Result
L*6046 Arsenic - As As		36.6 MICROGRAM PER

Sample Analysis Report

Laboratory Ref : E131546
Sampling Point : 190201

Date/Time Taken : 25-MAR-2002 00:01
Date/Time Received : 26-MAR-2002 07:26

Detd. Code	Description	Result
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continued...

*6061 Vanadium - As V		
L 6452 Copper - As Cu	No Result	
L 6455 Zinc - As Zn	No Result	
L 6462 Nickel - As Ni	No Result	
L 7240 Cyanide - As Cn	No Result	
L 7274 Identity Of Hand Held Meter	No Result	
L 7277 Iso Hexanioc (Caproic) Acid { Iso	Not yet in	
Caproic Acid}		
L 9559 Phenol	0.91	MILLIGRAM PER LITRE mg/l

* Indicates analysis at non-Agency Laboratory.
* Indicates analysis at other Agency Laboratory.
* Indicates that Laboratory Determination Method is UKAS Accredited.

Sample Analysis Report

Laboratory Ref : E131550 Sampling Point : 190201
 Date/Time Taken : 25-MAR-2002 00:01 Date/Time Received : 26-MAR-2002 07:26
 Address : POLLUTION INVESTIGATIONS, PEMBROKESHIRE AREA

Sample Comments : AMPLER CNGR=SM785263

std. Code	Description	Result
-----------	-------------	--------

L* 50 Lead - As Pb < 2.0 MICROGRAM PER LITRE ug/l

61 Ph - As Ph Units 7.0 PH UNITS

76 Temperature Water No Result

* 85 Bod Atu As O2 12.7 MILLIGRAM PER LITRE mg/l

92 Cod - As O2 58.0 MILLIGRAM PER LITRE mg/l

L* 105 Mercury - As Hg < 0.008 MICROGRAM PER LITRE mg/l

* 108 Cadmium - As Cd < 0.1 MICROGRAM PER LITRE ug/l

L* 111 Ammonia - As N < 0.01 MILLIGRAM PER LITRE ug/l

* 135 Solids Suspended @105c 173.0 MILLIGRAM PER LITRE mg/l

L* 167 Sulphide - As S 0.0095 MILLIGRAM PER LITRE mg/l

* 172 Chloride Ion - As Cl 46.0 MILLIGRAM PER LITRE mg/l

* 175 Cyanide - As Cn < 0.002 MILLIGRAM PER LITRE mg/l

L* 215 Copper - As Cu 0.0021 MILLIGRAM PER LITRE mg/l

* 245 Zinc - As Zn 0.038 MILLIGRAM PER LITRE mg/l

L* 253 Cadmium - As Cd No Result

* 287 Aluminium - As Al 0.098 MILLIGRAM PER LITRE mg/l

L* 328 Lead - As Pb No Result

* 375 Chromium - As Cr 0.0025 MILLIGRAM PER LITRE mg/l

L* 403 Manganese - As Mn 0.564 MILLIGRAM PER LITRE mg/l

* 421 Iron - As Fe 0.87 MILLIGRAM PER LITRE mg/l

L* 429 Nickel - As Ni < 0.003 MILLIGRAM PER LITRE mg/l

1042 Ethanoic Acid {Acetic Acid} Not yet in

L 1065 Hexanoic Acid Not yet in

- 1068 2-Methylpropanoic Acid {Isobutyric Acid} Not yet in

L 1069 3-Methylbutanoic Acid {Isovaleric Acid} Not yet in

L 1075 Butanoic Acid {Butyric Acid} Not yet in

L 1076 Pentanoic Acid {Valeric Acid} Not yet in

L 1088 Propanoic Acid {Propionic Acid} Not yet in

L 3164 Chromium - As Cr No Result

ENVIRONMENT AGENCY WATES REGION
Sample Analysis Report

Laboratory Ref : E131550 Sampling Point : 190201
Date/Time Taken : 25-MAR-2002 00:01 Date/Time Received : 26-MAR-2002 07:26

Detd. Code	Description	Result
L*6046 Arsenic - As As		< 1.0
*6061 Vanadium - As V		< 2.0
L 6452 Copper - As Cu		No Result
6455 Zinc - As Zn		No Result
6462 Nickel - As Ni		No Result
L 7240 Cyanide - As Cn		No Result
L 7274 Identity Of Hand Held Meter		Not yet in
7277 Iso Hexanioc (Caproic) Acid { Iso		No Result
Caproic Acid}		Not yet in
L 159 Phenol		< 0.04
	MILLIGRAM PER LITRE mg/l	
	MICROGRAM PER LITRE ug/l	
	MICROGRAM PER LITRE ug/l	

X' Indicates analysis at non-Agency Laboratory.
L' Indicates analysis at other Agency Laboratory.
* Indicates that Laboratory Determination Method is UKAS Accredited.

continued...

Laboratory Ref : E131545
Sampling Point : 190201
Date/Time Taken : 25-MAR-2002 00:01
Date/Time Received : 26-MAR-2002 07:26
POLLUTION INVESTIGATIONS, PEMBROKESHIRE AREA :

Address :
Samples Comments :
AMPLIF D NGR=SM788264

Code	Description	Result
50 Lead - As Pb		< 2.0 MICROGRAM PER LITRE ug/l
61 Ph - As Ph Units		No Result
76 Temperature Water		No Result
85 Bod Atu As O2		2.7 MILLIGRAM PER LITRE mg/l
92 Cod - As O2		32.0 MILLIGRAM PER LITRE mg/l
105 Mercury - As Hg		0.016 MICROGRAM PER LITRE ug/l
108 Cadmium - As Cd		< 0.1 MICROGRAM PER LITRE ug/l
111 Ammonia - As N		0.08 MILLIGRAM PER LITRE mg/l
135 Solids Suspended @105c		5.0 MILLIGRAM PER LITRE mg/l
167 Sulphide - As S		Not yet in
172 Chloride Ion - As Cl		49.5 MILLIGRAM PER LITRE mg/l
175 Cyanide - As Cn		< 0.002 MILLIGRAM PER LITRE mg/l
215 Copper - As Cu		0.0059 MILLIGRAM PER LITRE mg/l
245 Zinc - As Zn		0.045 MILLIGRAM PER LITRE mg/l
253 Cadmium - As Cd		No Result
287 Aluminium - As Al		0.202 MILLIGRAM PER LITRE mg/l
328 Lead - As Pb		No Result
375 Chromium - As Cr		0.0011 MILLIGRAM PER LITRE mg/l
403 Manganese - As Mn		0.088 MILLIGRAM PER LITRE mg/l
421 Iron - As Fe		1.14 MILLIGRAM PER LITRE mg/l
429 Nickel - As Ni		< 0.003 MILLIGRAM PER LITRE mg/l
1042 Ethanoic Acid {Acetic Acid}		Not yet in
1065 Hexanoic Acid		Not yet in
1068 2-Methylpropanoic Acid {Isobutyric Acid}		Not yet in
1069 3-Methylbutanoic Acid {Isovaleric Acid}		Not yet in
1075 Butanoic Acid {Butyric Acid}		Not yet in
1076 Pentanoic Acid {Valeric Acid}		Not yet in
1088 Propanoic Acid {Propionic Acid}		Not yet in
3164 Chromium - As Cr		No Result
6046 Arsenic - As As		< 1.0 MICROGRAM PER LITRE ug/l

Laboratory Ref : E131545 Sampling Point : 190201

Date/Time Taken : 25-MAR-2002 00:01 Date/Time Received : 26-MAR-2002 07:26

Detd. Code	Description	Result
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Continued...
L*6061 Vanadium - As V < 2.0

MICROGRAM PER LITRE ug/l

6452 Copper - As Cu No Result

6455 Zinc - As Zn No Result

L 6462 Nickel - As Ni No Result

7240 Cyanide - As Cn Not yet in

7274 Identity Of Hand Held Meter No Result

L 7277 Iso Hexanioc (Caproic) Acid { Iso Not yet in

Caproic Acid}

9559 Phenol

MILLIGRAM PER LITRE mg/l

0.05

'X' Indicates analysis at non-Agency laboratory.
'L' Indicates analysis at other Agency laboratory.
'*' Indicates that Laboratory Determination Method is UKAS Accredited.

Appendix 3

Ecological Survey

Site visit undertaken at the Request of Mr Emyr Williams PCC.

The site comprises of a wide range of tipped material, which has mostly become vegetated to produce a matrix of ruderal and scrub habitats with open bare ground and piles of inert hardcore material.

The nature of this mix of habitats creates a high biodiversity value, which if this is to be retained will need some form of management to avoid the whole site reverting to willow/gorse/bramble/ scrub. Whilst this type of habitat has value for some invertebrates and nesting birds such as the warblers, it would be in the interest of biodiversity to encourage some form of grazing regime to limit the spread of these species.

The day of the visit yielded over 70 species of higher plants, (see also the CCW note from Mat Sutton).

Invasive species such as Japanese knotweed/ragwort should be managed with the intention of eradication, but at least to avoid contamination of neighbouring land.

Fauna recorded included bullfinch, linnet, stonechat, reed bunting – these species have been identified as priority species in the Pembrokeshire Local Biodiversity Action Plan. A bird list relating to species recorded on or around the St Davids Aifield, surrounding moors and the landfill site, has been supplied to the local RSPB Warden.

Evidence of rabbit, fox and badger.
Badger has protection under the Protection of Badgers Act 1992 and Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), the later legislation also gives protection to common lizard, slow worm, adder and grass snake, species that almost certainly occur at the site. Any management that might affect those protected species that occur on the site must receive the appropriate license(s) before works are carried out.

The adjacent SSSI management proposal to include an area of common land through the Pembrokeshire Heathland Partnership grazing regime, could be extended to include part of the scrub/grassland over the reclaimed land to increase the biodiversity interest.

In summary, the conservation value is enhanced by the diversity of habitats. The open bare ground and piles of inert material being particularly valuable for reptiles and some invertebrates.
The willow/bramble/gorse scrub is of value for breeding birds and some invertebrates.
The neutral grassland would benefit from controlled grazing, to reduce the impact of scrub encroachment.

Trevor Theobald
Ecologist – Pembrokeshire County Council



SITE VISIT FRIDAY 6 SEPTEMBER 2002
Trevor Theobald

— Route taken

ST DAVIDS TIP WETLANDS BRIEF DESCRIPTIONS OF IMPORTANT HABITATS

MARSHY GRASSLAND

Areas of marshy grassland are found on seasonally wet ground around the edges of the tip. The 'M25c' here has Purple Moor-grass (scientific name 'Molinia') as the main species, forming a tussocky sward with a mixture of tall herbs like Wild Angelica and Meadowsweet over-topping the tussocks in late summer.

Purple Moor-grass is unusual among grasses in being deciduous. This leaf drop if left unchecked quickly leads to a build-up of litter, which smothers the ground around the tussocks. The old technique of winter burning was effective in removing this build up and stimulating the shoots to produce an early bite for grazing stock. A downside of this management technique is that many of the insects inhabiting the tussocks are also burnt off, and this management technique is only favoured by conservationists when tackling years of neglect. Moderate cattle or pony grazing generally prevents an excessive build up of litter, and also stops the tussocks from growing too high and shading out the smaller wetland plants. For a majority of plant and insect species, moor-grass vegetation somewhere just above ankle height is best. A few areas should always be left taller for creatures like spiders, harvest mice and grasshopper warblers.

Some of the wetter, more nutrient-rich or heavily managed areas have rushes ('reeds') as the dominant plant. Both Sharp-flowered Rush (areas mapped as 'M23a') and Soft Rush (areas mapped as 'M23b') occur here. A variety of herbs such as Water Mint, Marsh Bedstraw and Greater Bird's-foot Trefoil trail up into the rush canopy. Other nutrient rich areas have an abundance of meadowsweet with few other plants (areas mapped as 'M27').

SWAMP

The wettest areas have an abundance of Water Horsetail emerging from the water in the summer (areas mapped as 'S10a'). Truly aquatic plants here include Lesser Bladderwort - one of Britain's few carnivorous plants, using miniature 'bottle-traps' on the leaves to catch small water fleas to supplement their diet.

FEN

As the water gets shallower, Marsh Cinquefoil and stiff tufts of Bottle Sedge get a footing and the Water Horsetail starts dropping out (areas mapped as 'S27a' and 'other Equisetum fen'). This habitat is known as fen, or 'quaking bog'. Cushions of moss (*Calliergon cuspidatum*) appear among the stems, and wetland herbs like Water Speedwell and Marsh Pennywort grow on these cushions. The richest areas have the uncommon Lesser Tussock Sedge.

Matt Sutton, CCW, November 2002

In the wetland areas, **Southern Marsh Orchid** is found in the rush areas, alongside the paler pink **Heath Spotted Orchid**. The uncommon **Lesser Bladderwort** and the **Lesser Tussock Sedge** are found in the wetter parts of the south-east corner.

As well as the native plants above, a number of non-native plants have become naturalised here. Some of these, such as **Japanese Knotweed** have the potential to increase rapidly and out-compete smaller native plants. Others are of some interest in their own right, including the large ***Dracunculus vulgaris*** (not recorded in the wild anywhere else in Wales) and **Rosy Garlic**.

The tip itself has a variety of interesting plants. The scarce clover **Fenugreek** is abundant over the bare ground near the centre of the tip. This would need the more open conditions associated with earth movements to survive in the long term. Other plants in this area include the **Sea Pearlwort**, in a very unusual inland site, a rare hybrid **St. John's Wort** (*Hypericum linariifolium* x *humifusum*), and commoner plants like **Bristly Ox-Tongue**, **Hairy Tare** and **Perforated St John's Wort**.

The adjoining SSSI is a rich site for both rare and common plants.

PLANTS

These include small areas of flush, neutral grassland, scrub, bracken and patches of **Great Willowherb** (areas mapped as 'OV26') and stinging nettle - creeping thistle vegetation (areas mapped as 'OV25'). These all add to the diversity of the site, and have their own mix of plants and insects. A certain amount of scrub is important to the site, as bushes of species such as willow carry large numbers of bugs and caterpillars. Many insects will use the scrub for breeding and shelter, and the nectar rich wetland flowers for feeding.

OTHER HABITATS

Both fen and swamp are being invaded by **Great Reedmace** in places. This forms dense stands in places (mapped as 'S12'). A rapid growth of **Reedmace** is often a signal that the water supply is being enriched. Grazing animals that are happy to get wet will keep it at bay, but the spread should be monitored along with the hydrology.

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Matt Sutton, CCW, November 2002

Borehole Gas Monitoring Results

Appendix 4

BOREHOLE 1

Date	CH4	CO2	O2	Barometric Pressure (mb)
24.07.02	0	5	14.2	1008
06.11.02	0	5.6	13	1004
19.12.02	0	4.3	17.3	1013
13.03.03	0	4.4	19.2	1029

BOREHOLE 2

Date	CH4	CO2	O2	Barometric Pressure (mb)
24.07.02	0	1.6	16.7	1009
06.11.02	0	0.3	18	1005
19.12.02	0	0.6	17.9	1013
13.03.03	0	0	20.6	1029

BOREHOLE 3

Date	CH4	CO2	O2	Barometric Pressure (mb)
24.07.02	0	0	18.4	1010
06.11.02	0	0	18.1	1005
19.12.02	0	0	18.3	1013
13.03.03	0	0	20.5	1028

BOREHOLE 4

Date	CH4	CO2	O2	Barometric Pressure (mb)
24.07.02	44.5	19	0	1009
06.11.02	47	16.4	0	1005
13.03.03	44.1	13.7	1.6	1027

Gas Concentration Trends Borehole 4

