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SILENT VALLEY LANDFILL SITE

2016 Biological Monitoring of Nant Merddog Stream

Submitted to:

Blaenau Gwent County Borough Council
Silent Valley Landfill Site
Cwm
Ebbw Vale
NP23 6PZ

REPORT



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1.0 INTRODUCTION

Golder Associates (UK) Ltd (Golder) was commissioned by Blaenau Gwent County Borough Council (hereafter BGCBC) to undertake biological monitoring of the Nant Merddog Stream at the Silent Valley Landfill Site near the village of Waun-lwyd within the County Borough of Blaenau Gwent. The Silent Valley landfill is centred at National Grid Reference SO 185 071 (Drawing 1).

1.1 Background

The 2010 and 2011 initial biological surveys on the Nant Merddog were undertaken by Golder as a result of Compliance Assessment Reports issued by Environment Agency Wales (EAW) in spring 2010 (reference: RDR/100428/UP3335SN) and in winter 2011 (reference: RDR/110117/UP3335SN), respectively. Due to a reported leachate outbreak in 2011, BGCBC was required to propose further biological surveys of the Nant Merddog Stream. In line with Golder's recommendations and EAW guidance, biological surveys of the Nant Merddog have been undertaken ever since.

The objective of the invertebrate sampling surveys is to meet the requirements of the EAW Compliance Assessment Reports.

1.2 Scope of Works

The work comprises biological (aquatic macro-invertebrate) monitoring of the Nant Merddog Stream, both upstream and downstream of the Silent Valley Landfill Site. The results are analysed and compared with previous results for the same stretches of the stream.

The work outlined within this report is a continuation of monitoring that began in 2010. The scope of works remains fundamentally unaltered from 2010, with the continuation of spring and autumn monitoring events and reporting.

1.3 Biological Monitoring

The Biological Monitoring Working Party (BMWP) index is a common method for the assessment of water quality. This gives a score to freshwater habitat based upon the number of families of macro-invertebrates found in a sample. It works on the basic principle that freshwater pollution levels affect macro-invertebrate families differently. Thus, certain families that are most susceptible to pollution are scored maximum points. These include many families belonging to the mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddis (Trichoptera). Conversely, those families that are tolerant of polluted waters are scored the least points, and include families such as the leeches (Hirudinea), worms (Oligochaeta), chironomid midges (Diptera) and the freshwater hog-louse (Isopoda). Accordingly, high scoring watercourses are the cleanest with the highest water quality, whilst polluted watercourses score the lowest.

In the mid-1990s, Walley and Hawkes carried out a computer-based revision of the BMWP Scoring System, using data from the 1990 River Quality Survey of England and Wales (Walley and Hawkes, 1996 and 1997). This is thought to be a more objective approach to allocating BMWP scores, which would lead to a more accurate reflection of the impacts of pollution on macro-invertebrate fauna. For the purposes of this report, scores will be calculated using the original and revised techniques.

An alternative way of expressing the BMWP score is by measuring the Average Score per Taxon (ASPT) score. This is obtained by dividing the BMWP score by the number of scoring families. This score is sometimes preferred to the BMWP score, since it eliminates any discrepancies associated with 'recorder effort'. As with the BMWP score, a higher ASPT score per sample indicates a cleaner watercourse. The cleanest waters might therefore have an ASPT score close to '10', whilst the most polluted waters lie closer to '1'. In general terms, an ASPT score that is greater than the 'benchline' score of '5' is indicative of a watercourse in reasonable condition (from a biological perspective).



2.0 SITE OVERVIEW

Silent Valley Landfill Site is a former operational landfill situated in Blaenau Gwent, South Wales. Whilst the landfilling operation has now ceased and re-contouring/restoration is underway, the Site continues to operate as a waste transfer station.

The Nant Merddog Stream rises at the head of the valley on Mynydd Carn-y-cefn and flows in a southerly direction. It is culverted beneath the landfill and toward the Silent Valley Reserve, part of which is designated as a Site of Special Scientific Interest (SSSI). The Nant Merddog joins the Ebbw Fawr Stream near the village of Cwm. The collection sump overflow (shown on Drawing 1 as the Silent Valley Lagoon) is located close to the southern limit of the landfill, at the point where the Nant Merddog Stream culvert emerges from beneath the landfill.

3.0 METHODOLOGY

3.1 General

The surveys applied the methodology which has been used since 2011, providing continuity in the biological baseline dataset. This provides consistent data, gathered using a standardised approach, which is directly comparable with the previous years' surveys.

Biological sampling of the Nant Merddog Stream was undertaken on 29 April and 16 September 2016. This involved the sampling of aquatic invertebrates using the standardised 4-minute sampling method as summarised in the following paragraphs.

3.1.1 Site Selection

Biological sampling should ideally use sampling sub-sites (reaches) with a range of mesohabitats that are most likely to yield a diverse invertebrate community sensitive enough to detect changes in biological water quality. Riffles, where these are characteristic of the watercourse, are the first choice of mesohabitat to be sampled. In line with this, all the sample sites were located along riffles.

Samples were taken from four sites during the spring and autumn monitoring events, at the same locations used since 2010. Two were taken from upstream of the culvert, and another two from downstream of the discharge point (Drawing 1). This approach is consistent with that used by the EAW for their surveillance of 'main rivers'.

3.1.2 Biological Sampling Protocol (The "4-Minute" Sampling Technique)

The survey was undertaken in accordance with best practice guidelines for sampling (BS-EN 27828:1994). Pond nets were used for sampling which conformed to EA standards (1 mm mesh and 0.5 m deep). A standard methodology for obtaining BMWP scores was adopted, involving one minute of hand searching (of rocks, leaf packs, and other submerged debris), followed by three minutes of kick-sampling across each 10 - 20 m long sampling site. The sample was then placed into a sorting tray and all coarse debris was carefully checked and then removed prior to placing the remaining contents into a collection jar for subsequent identification using field guides.

3.1.3 Analysis

Aquatic macro-invertebrate groups covered by the BMWP system were identified to family level (except for segmented worms, Oligochaeta).

BMWP (original and revised) and ASPT scores were assigned to each sample site to give an indication of water quality. The numbers of scoring taxa were also determined, since this provides an indication of macro-invertebrate taxon richness associated with each sample site. However, it is important to note that taxon richness is not necessarily indicative of water quality.



4.0 RESULTS

4.1 Spring Data

Water levels within the Nant Merddog Stream were indicative of what could be considered 'normal' flow conditions from the surveyor's experience. Water clarity was good throughout the survey sites and no appreciable odour was noted.



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Table 1: Spring 2016 Biological Monitoring Results of the Nant Merddog Stream

BMWP Score		Taxa	Downstream		Upstream	
Original	Revised		Golder Site 1	Golder Site 2	Golder Site 3	Golder Site 4
10	12.4	Chloroperlidae	-	*	*	*
10	9.8	Heptageniidae	*	*	*	*
10	10.7	Perlodidae	*	*	*	*
10	9.2	Sericostomatidae	-	*	*	*
10	10.8	Taeniopterygidae	*	-	-	-
8	8.6	Cordulegastridae	*	-	*	-
8	10.6	Philopotamidae	*	*	*	*
7	6.9	Limnephilidae	*	*	*	*
7	9.1	Nemouridae	*	*	*	*
7	8.6	Polycentropidae	-	*	*	-
7	8.3	Rhyacophilidae	*	*	*	-
6	4.5	Gammaridae	*	*	*	*
5	6.4	Elmidae	*	*	-	*
5	6.6	Hydropsychidae	*	*	*	*
5	5.8	Simuliidae	-	-	-	-
5	5.5	Tipulidae	-	-	*	-
4	5.3	Baetidae	*	*	*	*
3	3.1	Glossiphoniidae	-	-	-	-
3	3.9	Hydrobiidae	*	-	-	-
3	3.6	Sphaeriidae	-	-	-	-
3	2.8	Valvatidae	-	-	*	-
2	3.7	Chironomidae	*	*	*	*
1	3.5	Oligochaeta	*	*	-	-
Scoring Taxa			15	15	16	12



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BMWP Score		Taxa	Downstream		Upstream	
Original	Revised		Golder Site 1	Golder Site 2	Golder Site 3	Golder Site 4
BMWP (Original)			93	89	109	99
BMWP (Revised)			100.4	115.6	122.6	95.2
ASPT (Based on original scores)			6.2	5.9	6.8	8.2
ASPT (Based on revised scores)			6.6	7.7	7.6	7.9



4.2 Autumn Data

Water levels within the Nant Merddog during the late summer were moderate, neither in spate or indeed particularly low. The lower reaches (Sites 1 and 2) contained frequent leaf packs and detritus under stones, symptomatic of the presence of riparian woodland. Water clarity was good throughout the survey sites and no appreciable odour was noted.

The results from the autumn monitoring surveys are provided in Table 2.



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Table 2: Autumn 2016 Biological Monitoring Results of the Nant Merddog Stream

BMWP Score		Taxa	Downstream		Upstream	
Original	Revised		Golder Site 1	Golder Site 2	Golder Site 3	Golder Site 4
10	10.7	Perlodidae	-	-	-	-
10	9.9	Goeridae	-	*	*	*
10	9.9	Leuctridae	*	*	-	*
10	9.8	Heptageniidae	*	*	*	-
10	7.8	Leptoceridae	-	-	*	-
8	8.6	Cordulegastridae	*	-	-	-
7	9.1	Nemouridae	-	*	*	*
7	8.3	Rhyacophilidae	*	*	-	*
7	6.9	Limnephilidae	-	-	*	*
6	4.5	Gammaridae	*	-	*	*
5	6.6	Hydropsychidae	-	*	*	-
5	6.4	Elmidae	*	*	*	*
5	5.8	Simulidae	*	*	-	*
5	5.5	Tipulidae	-	*	-	-
4	5.3	Baetidae	*	*	*	*
3	3.6	Sphaeriidae	-	-	-	*
3	3.1	Glossiphoniidae	-	-	*	*
2	3.7	Chironomidae	*	*	*	-
1	3.5	Oligochaeta	*	-	-	-
Scoring Taxa			10	11	11	11
BMWP (Original)			58	70	69	57



SILENT VALLEY LANDFILL SITE - 2016 BIOLOGICAL MONITORING

BMWP Score		Taxa	Downstream		Upstream	
Original	Revised		Golder Site 1	Golder Site 2	Golder Site 3	Golder Site 4
BMWP (Revised)			65.8	80.3	73.1	61.8
ASPT (Based on original scores)			5.8	6.3	6.2	5.1
ASPT (Based on revised scores)			6.5	7.3	6.6	5.6



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5.0 EVALUATION OF RESULTS

The results of the biological monitoring can be evaluated in context with Table 3, which assigns indicative water quality designations to BMWP scores.

Table 3: Indicative Water Quality Designation of BMWP Scores

Designation	Very Clean	Clean	Fairly Clean	Moderate	Poor
BMWP score	>150	100 - 150	50 - 99	26 - 49	<25

5.1 Spring Data

The results of the 2016 spring sampling are presented alongside those for 2010 to 2015 to enable comparison (Table 4; Golder 2010, 2011, 2012, 2013, 2014, 2015 and 2016).

Table 4: Site-specific Results – Spring Sampling (2010 to 2016)

Reach	BMWP (Revised)							ASPT (From Revised BMWP Scores)						
	2010	2011	2012	2013	2014	2015	2016	2010	2011	2012	2013	2014	2015	2016
1	94.6	74.3	145.3	115.2	118.6	112	100.4	7.3	7.4	7.6	7.2	7.4	7	6.6
2	91.9	79.2	124.1	136.8	125.5	133	115.6	6.6	7.2	7.3	7.6	7.8	7.4	7.7
3	135.3	70.7	95.1	137.5	139.0	123	122.6	7.5	7.8	7.9	7.2	7.7	7.3	7.6
4	62.8	55.4	107.0	142.9	111.6	126	95.2	6.3	6.9	7.1	7.5	8	7.4	7.9

The spring BMWP results indicate that the water quality was again considered 'clean' with the exception of Reach 4 which was ranked 'fairly clean'. All ASPT figures are closely comparable to previous years and, without exception, scored above 5. This indicates that there has been no appreciable adverse impact to the aquatic habitat.

5.2 Autumn Data

The results of the 2016 autumn sampling are presented alongside those for 2010 to 2015 to enable comparison (Table 5; Golder 2010, 2011, 2012, 2013, 2014, 2015 and 2016).

Table 5: Site-specific Results - Autumn Sampling (2010 to 2016)

Reach	BMWP (Revised)							ASPT (From Revised BMWP Scores)						
	2010	2011	2012	2013	2014	2015	2016	2010	2011	2012	2013	2014	2015	2016
1	88.5	71.9	159.6	145.0	76.5	93.6	65.8	7.4	7.2	6.9	6.6	6.9	7.2	6.5
2	115.9	104.6	149.1	148.1	91.0	136.5	80.3	7.2	7.5	6.8	6.2	7.6	7.1	7.3
3	84.8	56.8	132.5	65.3	83.8	113.3	73.1	6.5	6.3	6.6	6.5	7.0	7.5	6.6
4	62.2	57.2	94.9	118.3	72.5	108.3	61.8	6.9	6.4	7.3	7.0	6.6	7.2	5.6

The autumn BMWP results indicated that the water quality can be considered 'fairly clean'. The ASPT scores are largely comparable with previous survey results and all sites scored above 5. This indicates that the watercourse is in reasonable condition from a biological context.

Since surveys began in 2010, ASPT scores for all sample sites have remained between 5 and 8 indicating that the stream remains in good condition with respect to water quality both upstream and downstream of the landfill.



6.0 CONCLUSIONS AND RECOMMENDATIONS

The BMWP and ASPT scores and the continued presence of pollution-sensitive invertebrate families indicate that the Nant Merddog is in good health, which suggests that the stream is presently not negatively affected by operations at the Site.

The BMWP scores recorded during the autumn 2016 sampling were lower than in previous years and lower than the Spring 2016 sampling event. However, the results still remain within the 'fairly clean' designation.

The comparatively low BMWP scores in autumn 2016 may have been the result of a lower number of scoring taxa recorded in autumn 2016 than in spring 2016 and both sampling episodes in 2014. This could be attributed to a number of factors, including natural variation within the watercourse, surveyor effort, or the timing of the survey. In this case, the ASPT score (which averages the score by the number of taxa recorded) may give a better indication of stream health and remains at a level comparable with previous years' scores. Despite the lower number of taxa recorded, those recorded included high scoring families such as Leuctridae and Chloroperlidae, which has maintained the ASPT score relatively high during 2016.

The standardised survey methodology provides a robust strategy to monitor the aquatic ecology of the stream. The continued monitoring of the Nant Merddog will enable any impacts associated with historical landfilling operations to be identified should they occur. As such, it is recommended the existing survey strategy is continued during 2017 to build on the existing data.

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APPENDIX A

Drawings

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

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