Appendix 12-6. Baseline Report - Aquatic Ecology Surveys

AECOM

Dublin Airport (Passenger Capacity) Act 2026

EIAR Appendix 12-6

Baseline Report - Aquatic Ecology Surveys

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Delivering a better world

Prepared for:

daa

Prepared by:

AECOM Limited
12 Regan Way
Chetwynd Business Park
Nottingham NG9 6RZ
United Kingdom

T: +44 (115) 827 8000
aecom.com

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1. Introduction

AECOM was commissioned by daa to prepare an Environmental Impact Assessment Report (EIAR) which presents the Principal Assessment of the likely significant effects of the Proposed Order on biodiversity. The assessment compares the 2029 Permitted Operation and 2029 Proposed Operation scenarios in accordance with the project-wide assessment framework described in Chapter 5: Methodology (EIAR Volume 2).

This report documents the results of aquatic macroinvertebrate surveys and aquatic macrophyte surveys conducted by AECOM ecologists to assess the quality of aquatic habitats in local watercourses within and in the vicinity of the Dublin Airport Site.

The surveys undertaken follow a walkover survey of the same watercourses undertaken in September 2019 and reported in 'Planning Application for Infrastructure to Facilitate Passenger Growth at Dublin Airport: Baseline Report - Aquatic Ecology Walkover Survey Technical Appendix 11F'.

The walkover survey in 2019 found "little, if any suitable habitat for salmonid fish present in the watercourses within, or adjacent to the Dublin Airport Site" and that "the riverine and riparian habitats were heavily modified and of generally poor quality with little conservation value for fish".

Recommendations made within the aquatic ecology walkover survey report included surveys for:

- Aquatic macroinvertebrates – descriptions of the macroinvertebrate communities and corresponding diversity index scores (if available) to facilitate the characterisation of local watercourses and provide information on biological water quality;
- Aquatic macrophytes – descriptions of macrophyte communities and key indicator species to provide information on watercourse type and water quality;
- Invasive Non-Native Species (INNS) – data to inform managers of potential constraints to construction and operational activities in order that their spread into new areas is not facilitated; and
- Other species of conservation interest – protected or notable species.

These recommendations resulted in the aquatic macroinvertebrate surveys and aquatic macrophyte surveys undertaken by AECOM ecologists in 2024 and reported herein.

2. Methods

2.1 Survey Locations

Five survey locations (two airside and three landside) were identified from previous walkover surveys that were undertaken in September 2019. In line with previous reports, grid references for each survey location are displayed using the geographic coordinate system for Ireland, the Irish Transverse Mercator (ITM).

Macroinvertebrate surveys were undertaken at five sites and macrophyte surveys were undertaken at three sites over two days between June 10th and 11th 2024 by two suitably qualified and experienced ecologists, as detailed in Table 2-1:.

Table 2-1: Aquatic macroinvertebrate and macrophyte survey locations

Site	Macroinvertebrates	Macrophytes		Survey completed
		Upstream	Downstream	
Cuckoo Stream d/s	ITM 717547 742566	-	-	11.06.2024
Cuckoo Stream u/s	ITM 716937 742671	ITM 716929 742674	ITM 717028 742690	11.06.2024
Mayne 09	ITM 715352 742296	ITM 715258 742306	ITM 715339 742300	11.06.2024
Santry	ITM 713738 742350	ITM 713648 742357	ITM 713738 742350	10.06.2024
St. Margaret's Dunbro	ITM 713571 744138	-	-	11.06.2024

2.2 Aquatic Macroinvertebrate Survey Methodology

The aquatic macroinvertebrate survey followed survey procedures standardised by the Environmental Protection Agency (EPA) of Ireland[1]. These methods allow characterisation of aquatic macroinvertebrate communities and can be used to determine whether rare or notable species or communities are present. Samples were collected using a standard FBA pattern pond net (mesh size: 1 mm). The habitats present were sampled through a combination of kick sampling and sweep sampling for two minutes followed by a one-minute hand search of larger substrates in accordance with the standard methods. The samples collected were subsequently preserved in Industrial Methylated Spirit (IMS) for detailed laboratory processing.

Each of the samples collected was sorted and analysed in a laboratory setting by suitably trained and experienced aquatic ecologists. Lists of the aquatic macroinvertebrate taxa present were produced in line with Environment Agency (EA) of England guidance (EA, 2014)[2]. The aquatic macroinvertebrate samples were identified to 'mixed-taxon level' using a stereo-microscope. Most groups were identified to species level (where practicable), except for the following:

- Worms (Oligochaeta), which were identified to sub-class;
- Marsh beetles (Scirtidae), which were identified to family;
- True-fly larvae, which were identified to the maximum resolution possible; and
- Immature or damaged specimens, which were identified to the maximum resolution possible on a case-by-case basis.

The survey data was then used to calculate metrics that can be used to inform an assessment of relative nature conservation value, habitat condition and general degradation as detailed below.

[1] Feeley, H.B., Bradley, C., Free, G., Kennedy, B., Little, R., McDonnell, N., Plant, C., Trodd, W., Wynne, C. & O'Boyle, S. (2020) A national macroinvertebrate dataset collected for the biomonitoring of Ireland's river network, 2007–2018. Sci Data 7: 280. https://doi.org/10.1038/s41597-020-00618-8.
[2] Environment Agency (2014). Freshwater macro-invertebrate analysis of riverine samples Operational Instruction 024_08. Environment Agency, Bristol, UK.

Q value

The EPA uses the Q value to assess macroinvertebrate communities based on the relative abundances of pollution sensitive and pollution tolerant macroinvertebrate taxa present in the sample. The Q value method description is available in Appendix 1 of Toner *et al*. (2005)[3][4].

Lotic-invertebrate Index for Flow Evaluation (LIFE)

Lotic-invertebrate Index for Flow Evaluation (LIFE) scores were calculated (Extence *et al*., 1999)[5]. This is an index that links benthic macroinvertebrate data to flow regimes prevailing in UK waters. Flow scores have been allocated to various macroinvertebrates based on species/family abundance and ecological association with different flows, as detailed in Appendix A. The overall LIFE score for a site is calculated as the sum of the individual scores divided by the number of scoring species/families. LIFE scores increase with current velocity, scores <6.00 generally indicating sluggish or still water conditions and score >7.5 indicate fast flows. LIFE allows the mean flow preference of invertebrates colonising a site to be determined so that effect of habitat changes such as sediment accumulation can be monitored.

Proportion of Sediment-sensitive Invertebrates (PSI)

Calculations were undertaken to determine the proportion of sediment sensitive macroinvertebrates present using the Proportion of Sediment-sensitive Invertebrates (PSI) index[6]. Using this approach, individual taxa of aquatic macroinvertebrate are assigned a Fine Sediment Sensitivity Rating (FSSR) ranging from A to D, as detailed in Appendix B. The PSI score for each aquatic macroinvertebrate sample was derived from individual species scores and abundances. The derived PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, where low scores correspond to watercourses with high fine sediment cover. The PSI score therefore provides an indication of the extent to which watercourses are influenced by fine sediments, and therefore by inference the potential sensitivity of the associated aquatic macroinvertebrate community to changes in silt load and deposition.

Whalley, Hawkes, Paisley & Trigg (WHPT)

The aquatic macroinvertebrate data were analysed to generate the Whalley, Hawkes, Paisley & Trigg (WHPT) score Average Score Per Taxon (ASPT), and Number of scoring taxa (NTAXA) values, which provides an indication of the ecological quality in the watercourse (WFD-UKTAG, 2023)[7]. This assigns numerical value to taxa according to their sensitivity to organic pollution. The average of the values for each taxon in a sample, known as ASPT is a stable and reliable index of organic pollution. Therefore, these assessments can indicate to what extent an aquatic macroinvertebrate community is exposed to organic pollution (further information is provided in Appendix C). It is important to note that these indices can vary between geological regions and habitat types. Ditches for example are unable to support many of the high-scoring taxa associated with fast flowing habitats. Therefore, the resultant metrics should be reviewed with an awareness of their potential limitations, and the site-specific context, as described in this report.

The WHPT method has been primarily designed to respond to organic pollution, however it is suitable for monitoring other types of impact and is used for assessing the WFD classification parameter “General degradation” (WFD-UKTAG, 2023)[7].

[3] Toner, P., Bowman, J., Clabby, K., Lucey, J., McGarrigle, M., Concannon, C., Clenaghan, C., Cunningham, P., Delaney, J., O’Boyle, S., MacCárthaigh, M., Craig M. & Quinn, R. (2005) Water Quality in Ireland 2001-2003. Environmental Protection Agency, Johnston Castle, Ireland.
[4] https://www.epa.ie/publications/monitoring--assessment/freshwater--marine/EPA_water_quality_2001-3.pdf
[5] Extence, C.A., Balbi B.M. & Chadd, R. (1999) River flow indexing using British benthic macroinvertebrates: a framework for setting hydroecological objectives. Regulated Rivers: Research and Management 15: 543-574.
[6] Extence, C. Chadd, R., England, J., Dunbar, M., Wood, P. & Taylor, E. (2013) The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. River Research and Applications 29: 17–55.
[7] WFD-UKTAG (Water Framework Directive – United Kingdom Advisory Group) (2023) UKTAG River Assessment Method (Benthic Invertebrate Fauna Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg (WHPT) metric in River Invertebrate Classification Tool (RICT) July 2023.

2.3 Aquatic Macrophyte Survey Methodology

The aquatic macrophyte surveys followed guidance set out in the UKTAG River Assessment Method (Macrophytes and Phytobenthos) for use with LEAFPACS2 (WFD-UKTAG, 2014)[8], which conforms to BS EN 14184:2014 Water quality - Guidance for the surveying of aquatic macrophytes in running waters. The survey was carried out by walking within the channel of each watercourse along a 100m transect, where safely accessible. Any inaccessible areas were bypassed as necessary before re-entering the channel at the next available access point. A list of all macrophytes encountered was collated and their relative abundance was recorded using Taxon Cover Values (TCV), detailed below (Table 2-2).

Table 2-2: Taxon Cover Values (TCV) and their associated percentage cover

TCV	Percentage cover for the macrophyte species
C1	<0.1%
C2	0.1 to 1%
C3	1 to 2.5%
C4	2.5 to 5%
C5	5 to 10%
C6	10 to 25%
C7	25 to 50%
C8	50 to 75%
C9	>75%

Aquatic macrophyte data was processed through the River LEAFPACS2 calculator, available from the WFD UKTAG website[9]. Four metrics were calculated using macrophyte species and groups data:

- **River macrophyte nutrient index (RMNI)** – Macrophyte taxa are allocated a score based on their relative tolerance of nutrients. The overall observed RMNI score for a survey is the cover weighted average of the individual scores of the different taxa found.
- **Number of macrophyte taxa (NTAXA)** – The number of scoring taxa recorded in the field survey. Only true hydrophytes are included.
- **Number of functional groups (NFG)** – Hydrophytes are allocated to one of 24 “functional groups”. These are groups of organisms which exploit a resource in a similar way.
- **Cover of filamentous green algae (ALG)** – The percentage cover of filamentous green algae over the whole of the surveyed section.

The EPA are currently using Mean Trophic Rank (MTR) to summarise and interpret aquatic macrophyte survey data, and as such MTR scores were also calculated as detailed in Holmes *et. al.* (1999)[10]. MTR scores increase with decreasing eutrophy, such that low scores indicate eutrophic conditions, and high scores reflect oligotrophic (low-nutrient) conditions.

[8] WFD-UKTAG (Water Framework Directive – United Kingdom Advisory Group) (2014) UKTAG River Assessment Method Macrophytes and Phytobenthos: Macrophytes (River LEAFPACS2).
[9] https://www.wfduk.org/resources/rivers-macrophytes
[10] Holmes, N.T.H., Newman, J.R., Chadd, S., Rouen, K.J., Saint, L. & Dawson, F.H. (1999) Mean Trophic Rank: A user’s manual. Environment Agency, Bristol, UK.

Aquatic macrophyte and aquatic macroinvertebrate species were cross-referenced against the relevant Irish Red Lists[11] to identify any protected and/or notable species and the Catalogue of Ireland's Non-native Species[12] to identify any invasive and/or non-native species recorded during the surveys.

2.4 Survey Constraints

A number of sites had constraints to one or both survey methods. A detailed list for each relevant site is provided below.

Cuckoo Stream DS

It was not possible to undertake a macrophyte survey at this site due to an insufficient accessible length of watercourse. Additionally at this site, there was extensive shading by terrestrial vegetation, including nettles, mature brambles, sycamore, hawthorn, Buddleia, and grasses. Tree branches from the opposite bank also interfered with access.

St. Margaret's Dunbro

It was not possible to undertake a macrophyte survey at this site due to an insufficient accessible length of watercourse. It was not possible to access downstream of the macroinvertebrate sampling point due to the presence of a culvert, subsequent fencing, and channelisation. Upstream of the macroinvertebrate sampling point was dry with dense vegetation in the channel. The macroinvertebrate survey was a sweep survey as the only accessible area with water was heavily vegetated and very close to the culvert making it unsafe to enter.

3. Results

3.1 Aquatic Walkover Survey Results

Observations during the recent macroinvertebrate and macrophyte surveys are reported here with reference made to previous walkover results. The walkover results from 2019 can be found in the 2020 report 'Planning Application for Infrastructure to Facilitate Passenger Growth at Dublin Airport: Baseline Report - Aquatic Ecology Walkover Survey Technical Appendix 11F'.

Cuckoo Stream and Mayne River discharge into the Irish Sea at Baldoyle Bay and Santry River discharges into Dublin Bay. The sites surveyed are all less than 10km from these discharge points. St. Margaret's Dunbro is a tributary of Ward River that joins Broad Meadow River to discharge into the Irish Sea at Malahide Estuary which as approximately 10.5km from the survey site.

Cuckoo Stream DS

This watercourse was narrow and, in contrast to the 2019 walkover survey, it was difficult to access due to dense vegetation along the bank. The site was heavily shaded in places and the water depth was low at an average of 8 cm. The substrate was dominated by cobbles (70%), and sewage fungus was observed in trace amounts, likely due to the extensive coverage of sewage fungus present at Cuckoo Stream US.

Cuckoo Stream US

This watercourse is situated airside and has been heavily modified (two-step flood-defence structures) and realigned in order to cope with high-flow events and chemical run-off from de-icing (discussed in the previous walkover report). The orange colour reported in the stream during the 2019 survey was no longer evident, however, this reach of Cuckoo stream was grey in colour with a foam/scum apparent in places. Approximately 90% of the cobble-dominated (75%) substrate was covered with sewage fungus.

[11] https://www.npws.ie/publications/search?title=&keyword=red+list&author=&series=All&year=&x=0&y=0&items_per_page=25
[12] https://invasives.ie/about/catalogue/

Mayne 09

The Mayne is a narrow watercourse that is situated airside. An outflow pipe was observed on the right bank (ITM 715345 742297) but was not discharging. The channel was heavily vegetated and there was some shading from immature sycamore on the left bank. A culvert was present immediately downstream of the survey site and large tanks for holding de-icing chemicals are adjacent to the watercourse. The watercourse was shallow at an average depth of 5 cm, flowing over a substrate predominantly composed of sand (80%) with occasional sections of gravel and pebbles.

Santry

This landside watercourse is a narrow ditch that was heavily vegetated within the channel with little bankside shading present. The average water depth was 5 cm and the substrate was predominantly comprised fine sediment (95%).

St. Margaret's Dunbro

A large portion of this steep-sided artificial channel was fenced off and where culverted, there were isolated pools of water. Due to the inconsistent waterflow this site is considered unlikely to be suitable for salmonids, lamprey, or minor fish species. It was not possible to determine the substrate due to the depth of the pools and dense vegetation.

No fish were observed at any of the sites during surveys. It is also unlikely that any of the sites would be suitable for salmonids or lamprey due, in particular, to low water depth (on average less than 10 cm across all sites). However, these sites may be suitable for minor fish species such as stickleback Gasterosteidae.

3.2 Aquatic Macroinvertebrate Survey Results

The full aquatic macroinvertebrate taxa list can be found in Appendix D. A description of the macroinvertebrate community at each site is provided below. Cross-reference with the Irish Catalogue of Invasive Non-Native Species and the appropriate Irish Red Lists revealed that none of the macroinvertebrate species identified during the surveys were protected and/or notable. Two non-native, but non-invasive species, the New Zealand mud snail *Potamopyrgus antipodarum* and the freshwater shrimp *Gammarus pulex/fossarum*, were recorded, each being present at one of the five sites surveyed.

Cuckoo Stream DS

The community at Cuckoo DS was restricted in terms of diversity to only 10 macroinvertebrate taxa. The sample was dominated by the non-biting midge tribe Orthocladiinae (58% of individuals recorded), freshwater hoglouse *Asellus aquaticus* (19%), and oligochaete worms (12%).

Cuckoo Stream US

The community at Cuckoo US was also low on diversity, with only eight macroinvertebrate taxa identified. Oligochaete worms dominated the community, comprising 94% of individuals recorded. Seven individuals of the non-native New Zealand mud snail were also recorded.

Mayne 09

The community at Mayne 09 was mainly composed of oligochaete worms (50% of individuals recorded) and biting midges of the family Ceratopogonidae (11%). Several beetles were also recorded, including two species of Hydrophilidae water scavenger beetles (*Helophorus aequalis* and *Helophorus brevipalpis*), larvae of the crawling water beetles *Haliplus* sp., and larvae of the diving beetle family Dytiscidae.

Santry

Over half of the community at Santry comprised the freshwater hoglouse *A. aquaticus* (54% of individuals recorded). The community also included a diverse beetle assemblage, with two diving beetle Dytiscidae species (*Agabus paludosus* and *Dytiscus semisulcatus*) and two Hydrophilidae water scavenger beetle (*H. brevipalpis* and *Anacaena globulus*) species recorded. In addition to several tribes of non-biting midges (Tanypodinae,

Orthocladiinae and Tanytarsini), other true fly families recorded included crane fly Limoniidae (*Pilaria* sp.), drain fly Psychodidae and soldierfly Stratiomyidae larvae.

St. Margarets Dunbro

The community at St. Margarets Dunbro comprised the wandering snail *Ampullaceana balthica* (46% of individuals recorded) and the freshwater hoglouse *A. aquaticus* (23%). Several beetles were also recorded, including the two diving beetle Dytiscidae species *Hydroporus palustris* and *Ilybius fulginosus*, two individuals belonging to the genus *Agabus,* and the Hydrophilidae water scavenger species *H. brevipalpis*. Two individuals of the non-native freshwater shrimp aggregate *Gammarus pulex/fossarum* were also recorded.

Macroinvertebrate Index Scores

Based on the criteria outlined in the Methods, Q value, Whalley, Hawkes, Paisley & Trigg (WHPT) Average Score Per Taxon (ASPT) and Number of scoring taxa (NTAXA), LIFE and PSI values for all surveyed sites are summarised in Table 3-1.

Table 3-1: Macroinvertebrate index scores for five sites at Dublin Airport

Index	Cuckoo DS	Cuckoo US	Mayne 09	Santry	St. Margarets Dunbro
Q value	Q3	Q1	Q2	Q2	Q2
WHPT-NTAXA	6	5	18	10	10
WHPT-ASPT	3.00	3.04	3.81	4.18	4.10
WHPT-ASPT interpretation	Poor, Polluted or Impacted	Poor, Polluted or Impacted	Poor, Polluted or Impacted	Poor, Polluted or Impacted	Poor, Polluted or Impacted
LIFE score (family)*	5.75	6.00	5.93	5.83	5.88
LIFE score interpretation*	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows	Low sensitivity to reduced flows
PSI score (family)*	11.11	0.00	15.63	17.65	18.75
PSI score interpretation*	Heavily sedimented	Heavily sedimented	Heavily sedimented	Heavily sedimented	Heavily sedimented

* Lack of scoring species may result in inaccurate scores, consequently family level used for score and interpretation of results.

Q values for all sites varied between Q1 at Cuckoo US to Q3 at Cuckoo DS, reflecting macroinvertebrate communities of low to very low/little community diversity.

The WHPT-NTAXA number was low (10 or less) at all sites except Mayne 09, which achieved the highest WHPT-NTAXA score of 18. WHPT-ASPT scores ranged from 3.00 for Cuckoo DS to 4.18 for Santry, all scores indicative of Poor, Polluted or impacted conditions.

Flow and sedimentation effects restricting the macroinvertebrate community were evident at all sites. LIFE scores for all sites ranged from 5.75 for Cuckoo DS to 6.00 for Cuckoo US, all indicative of Low sensitivity to reduced flows. PSI scores ranged from 0.00 for Cuckoo US to 18.75 for St. Margarets Dunbro. These scores resulted in interpretations of Heavily sedimented for all survey sites.

3.3 Aquatic Macrophyte Survey Results

The full aquatic macrophyte taxa list can be found in Appendix E. Cross-reference with the Irish Catalogue of Invasive Non-Native Species and the appropriate Irish Red Lists revealed that none of the macrophyte taxa

identified during the surveys were protected and/or notable. One non-native, but non-invasive species, reed canary grass *Phalaris arundinacea*, was recorded at one of the three sites surveyed.

Cuckoo US

The channel at Cuckoo US was relatively shallow, measuring up to 0.25 m throughout the survey reach,. The channel substrate was primarily composed of 90% pebbles/gravel, with the addition of 5% boulder/cobble, 4% silt/clay and 1% sand. This resulted in a bed stability that was 100% stable. The in-channel habitat was categorised as 50% run and 50% slack with clear water conditions. Shading was documented for both banks, with 50% broken shading on the left bank and 10% broken shading on the right.

The macrophyte community at Cuckoo US consisted of a 10.8% channel cover from six in-channel aquatic plants: fool's water cress *Helosciadium nodiflorum*, great yellow cress *Rorippa amphibia*, water cress *Rorippa nasturtium-aquaticum*, brooklime *Vernoica beccabunga*, pink water-speedwell *Veronica catenata*, and horned pondweed *Zannichellia palustris*. Of the recorded species, watercress amounted to cover 6.7% of the channel and fool's watercress covered 3.5%, while the remaining taxa covered less than 1.5%.

Mayne 09

The channel at Mayne 09 was very shallow, not exceeding 0.25 m in depth throughout the surveyed reach. The channel substrate was primarily comprised of 80% pebbles/gravel, with the addition of 15% sand and 5% silt/clay. This resulted in a bed stability that was 100% stable. The in-channel habitat was categorised as 50% run and 50% slack with clear water conditions. Over half of the left bank was shaded, with 50% dense and 10% broken, whereas only 10% of broken shading was documented for the right bank.

The macrophyte community at Mayne 09 consisted of 53% channel cover from eight in-channel aquatic plants: fool's water cress, water star-wart *Callitriche* sp., marsh marigold *Caltha palustris*, blanketweed algae *Cladophora glomerata/Rhizoclonium hieroglyphicum*, great yellow cress, water cress, pink water-speedwell, water-speedwell *Veronica* sp., and hairy willowherb *Epilobium hirsutum.* Of the recorded species, filamentous green algae amounted to cover 35% of the channel, fool's watercress covered 7%, watercress 6%, water star-wart 4% and the remaining taxa covered less than 1.5%.

Santry

Water depth at Santry did not exceed 0.25 m. The channel substrate was primarily comprised of 98% silt/clay, with the addition of 2% pebbles/gravel. This resulted in a 100% soft/sinking base substrate to the channel due to the fine material. Very little shading was documented on either bank, with only 2% broken shading on the left bank and no shading at all on the right bank.

The macrophyte community at Santry consisted of 100% channel cover from eight in-channel aquatic plants: fool's water cress, yellow flag *Iris pseudacorus*, the non-native, but non-invasive reed canary-grass, water cress, branched bur-reed *Sparganium erectum*, hairy willowherb, common rush *Juncus effusus* and field horsetail *Equisetum arvense*. Of the recorded species, fool's water cress amounted to a cover of 30% of the channel, water cress 25%, reed canary-grass 20%, yellow flag 18%, hairy willowherb 8% and the remaining taxa covered 4%.

3.4 Aquatic Macrophyte Index Scores

Based on the criteria outlined in the Methods, Mean Trophic Rank (MTR), River Macrophyte Nutrient Index (RMNI), Number of macrophyte taxa (NTAXA), number of functional groups (NFG) and cover of filamentous green algae (ALG) scores for all sites surveyed are summarised in Table 3-2.

Table 3-2: Macrophyte index scores for three sites at Dublin Airport

Metric	Cuckoo US	Mayne 09	Santry
Mean Trophic Rank (MTR)	11.2	11.5	25.0
River Macrophyte Nutrient Index (RMNI)	8.63	8.19	7.96

Number of macrophyte taxa (NTAXA)	2.00	3.00	1.00
Number of functional groups (NFG)	2.00	3.00	1.00
Cover of filamentous green algae (ALG)	0.00	37.50	0.00

The MTR scores range from 11.2 for Cuckoo US to 25.0 for Santry. The RMNI scores ranged from 7.96 for Santry to 8.63 for Cuckoo US. Both results are indicative of eutrophic conditions at all sites. Cover by filamentous green algae was 0 at both Cuckoo US and Santry and was 37.5 at Mayne 09. NFG (3) and NTAXA (3) were also highest at Mayne 09, with Cuckoo US attaining 2 for both metrics and Santry achieving 1 for both metrics.

It should be noted that three scoring macrophyte taxa is the minimum requirement for accurate metric scores for RMNI, and as such the results for Cuckoo US and Santry should be treated with caution.

4. Discussion

4.1 Aquatic Walkover

The results from this round of surveys concur with the previous walkover surveys in that the habitat at the five sites is considered unsuitable for both salmonids and lamprey. The watercourses are heavily modified and in places (Cuckoo Stream US and DS) likely impacted by chemical runoff. The sites, may however, support minor fish species such as stickleback.

Cuckoo Stream and Mayne River discharge into the Irish Sea at Baldoyle Bay whilst Santry River discharges into Dublin Bay, with the surveyed sites surveyed all less than 10km from these discharge points. St. Margaret's Dunbro ultimately discharges into the Irish Sea at Malahide Estuary via the Ward River and Broad Meadow River.

The final receiving water bodies named above are all designated as either Special Area of Conservation (SAC) or Special Protection Area (SPA), or have both designations. North Dublin Bay is a SAC and the North Bull Island SPA is also located in the northern part of Dublin Bay, whilst Baldoyle Bay is both a SAC and SPA. Consequently, discharges affecting the surveyed watercourses also have the potential to affect internationally designated sites.

4.2 Aquatic Macroinvertebrate Community

No protected and/or notable macroinvertebrate species were identified at any of the survey sites.

Two non-native species were each recorded at one survey site; the New Zealand mud snail *Potamopyrgus antipodarum* was found at Cuckoo US and the freshwater shrimp *G. pulex/fossarum* was identified at St. Margarets Dunbro. Both species are reported as 'medium impact' in the Catalogue of Ireland's Non-native Species[12], based on the 2013 Invasive Species in Ireland risk assessment (Kelly *et. al.,* 2013)[13], however there are no statutory constraints to the spread of either species.

The WHPT-ASPT and NTAXA scores indicate that poor water/habitat quality, whilst LIFE and PSI scores demonstrate slow and homogeneous flow and a high degree of fine sedimentation are all influencing the macroinvertebrate community structure at all sites resulting in low diversity, as reflected by the suppressed Q values. As such, there is opportunity to enhance the habitat to benefit the aquatic macroinvertebrate community as well as the wider aquatic environment and the connected terrestrial environment.

[13] Kelly, J., O'Flynn, C. & Maguire, C. (2013) Risk analysis and prioritisation for invasive and non-native species in Ireland and Northern Ireland. http://invasivespeciesireland.com/wp-content/uploads/2013/03/Risk-analysis-andprioritization-29032012-FINAL.pdf

4.3 Aquatic Macrophyte Community

There were no protected and/or notable macrophyte species recorded during the surveys.

One non-native, but non-invasive species, reed canary grass *P. arundinacea*, was recorded at one of the sites, but there are no statutory constraints to the spread of this species. Furthermore, the species is not listed as either high or medium impact the Catalogue of Ireland's Non-native Species[12].

The results of the macrophyte surveys reflected eutrophic conditions at all survey sites, indicated by the recorded plant species being restricted to those capable of tolerating and/or favouring such conditions. As such, opportunities to reduce nutrient loading will benefit the macrophyte community, with subsequent knock-on benefits for dependent and related species of macroinvertebrates, fish and terrestrial ecology.

5. Conclusions

The surveys found the Cuckoo Stream, Mayne 09, Santry and St. Margarets Dunbro to all be heavily modified, subject to both habitat diversity and water quality pressures, and likely to support only minor fish species. Furthermore, at least two sites (Cuckoo Stream US and DS) appear to be impacted by chemical run-off.

No protected and/or notable species of macroinvertebrates or macrophytes were identified at any of the sites. However, three non-native species, including two medium impact species, were recorded.

Annex A Lotic-Invertebrate Index of Flow Evaluation (LIFE)

The Lotic-Invertebrate Index for Flow Evaluation (LIFE) provides an assessment of the impact of variable flows on benthic macroinvertebrate communities. Under the assessment, individual species of aquatic macroinvertebrates are assigned to a flow group varying from I to VI, as detailed on the Table D1 below. The LIFE score for a macroinvertebrate sample is then derived (mean of individual scores) from individual species scores and abundances, as detailed on the Table D3 below. LIFE scores for a macroinvertebrate sample ranges from 1 to 12, where highest scores describe communities adapted to rapid flows.

Table D1: Flow groups used to derive LIFE scores (from Extence *et al*., 1999)[5]

LIFE score Group	Description	Mean current velocity
I	Taxa primarily associated with rapid flows	Typically > 100 $cm.s^{-1}$
II	Taxa primarily associated with moderate to fast flows	Typically 20 to 100 $cm.s^{-1}$
III	Taxa primarily associated with slow or sluggish flows	Typically < 20 $cm.s^{-1}$
IV	Taxa primarily associated with (usually slow) and standing waters	
V	Taxa primarily associated with standing waters	
VI	Taxa frequently associated with drying or drought impacted sites	

Table D2: Abundance categories used to derive LIFE scores (from Extence *et al*., 1999) [5]

Abundance category	Description
A	1 to 9
B	10 to 99
C	100 to 999
D	1000 to 9999
E	> 10000

Table D3: A guide to interpreting LIFE scores (from Extence *et al*., 1999) [5]

Flow groups	Abundance categories			
	A	B	C	D/E
I	9	10	11	12
II	8	9	10	11
III	7	7	7	7
IV	6	5	4	3
V	5	4	3	2
VI	4	3	2	1

Annex B Proportion of Sediment-sensitive Invertebrates (PSI)

The Proportion of Sediment-sensitive Invertebrates (PSI) index allows an assessment of the extent to which a water body is composed of, or covered by, fine sediments. This follows the method stated in Extence *et al*. (2013)[6]. Under this system, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) as detailed in Table E1, and abundance rating based on LIFE scores as detailed in Table E2. The PSI score for the aquatic macroinvertebrate sample is then derived from the individual species scores and abundances, as detailed in Table E3. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample and ranges from 0 to 100, with low scores corresponding to waterbodies with high fine sediment cover.

Table E1: Fine Sediment Sensitivity Rating (FSSR) groups used to derive PSI scores

FSSR group	Description
A	Highly sensitive
B	Moderately insensitive
C	Moderately insensitive
D	Highly insensitive

Table E2: Abundance categories used to derive PSI scores

FSSR group	Abundance			
	1-9	10-99	100-999	>999
A	2	3	4	5
B	2	3	4	5
C	1	2	3	4
D	1	2	3	4

Table E3: Interpretation of PSI scores

PSI	Description
81-100	Minimally sedimented
61-80	Slightly sedimented
41-60	Moderately sedimented
21-40	Sedimented
0-20	Heavily sedimented

Annex C Whalley, Hawkes, Paisley & Trigg (WHPT) Metric

There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data we do not identify individual species but only the major types (taxa), mostly at the family taxonomic level. A key piece of information is the number of different taxa at a site. A fall in the number of taxa indicates ecological damage, including pollution (organic, toxic and physical pollution such as siltation, and damage to habitats or the river channel).

The WHPT scoring system (WFD-UKTAG, 2023) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Hawkes, 1997)[14] previously used in the UK.

The WHPT system assigns a numerical value to about 100 different taxa (known as the WHPT-scoring taxa) according to their sensitivity to organic pollution. In addition to the presence of macroinvertebrate taxa at a sampling Reach, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

Taxa abundances are classified in four categories (Class 1: 1 to 10 individuals, Class 2: 11 to 100 individuals, Class 3: 101 to 1,000 individuals, and Class 4: > 1,000 individuals). A score (Pressure Sensitivity Scores (PSs) is then assigned to each taxa, depending of the taxa sensitivity and abundances recorded.

The total WHPT score for a sample corresponds to the sum of PSs of scoring taxa recorded. The Average Score Per Taxon (ASPT) values are calculated as the Sum PSs divided by the number of scoring taxa (NTAXA). As such, three metrics are calculated:

- WHPT score
- NTAXA
- ASPT

Some animals are more susceptible to organic pollution than others, and the presence of sensitive species indicates good water quality. This fact is taken into account by the WHPT metrics.

The most useful way of summarising the biological data was found to be one that combined the number of taxa and the ASPT. The best quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution. Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are sensitive to pollution. Organic pollution sometimes encourages an increased abundance of the few taxa that can tolerate it. However, maximum achievable values will vary between geological regions. For example, pristine lowland streams in East Anglia will always score lower than pristine Welsh mountain streams because they are unable to support many of the high-scoring taxa associated with fast flowing habitat. WHPT scores and ASPT for different types watercourse are dependent on the quality and diversity of habitat, natural water chemistry (associated with geology, distance from source etc.), altitude, gradient, time of year the sample was taken and other factors.

[14] Hawkes, H.A. (1997). Origin and development of the Biological Monitoring Working Party score system. Water Research 32(3): 964-968.

Annex D Macroinvertebrate Taxa List

Table D1: Macroinvertebrate taxa found at five sites at Dublin Airport

Family	Taxon	Cuckoo DS	Cuckoo US	Mayne 09	Santry 10/06/24	St. Margarets Dunbro
Flatworms						
Dugesiidae	*Schmidtea lugubris/polychroa*			1		
Snails						
Lymnaeidae	*Stagnicola sp.*			3		
Lymnaeidae	*Ampullaceana balthica*			10		80
Tateidae	*Potamopyrgus antipodarum*		7			
Succineidae	*Succinea sp.*	1	2			
Planorbidae	*Bathyomphalus contortus*					13
Limpets and mussels						
Sphaeriidae	*Pisidium/Euglesa/Odhneripisidium*	1		19	15	
Worms						
Oligochaeta	Oligochaeta	40	400	160		
Leeches						
Glossiphoniidae	*Helobdella stagnalis*			3		
Erpobdellidae	*Erpobdella sp.*			3		
Crustaceans						
Ostracoda	Ostracoda			17		
Gammaridae	*Gammarus duebeni celticus*			1	7	
Gammaridae	*Gammarus pulex/fossarum agg.*					2
Asellidae	*Asellus aquaticus*	63	1	18	104	40
Mayflies						
Baetidae	*Baetis rhodani / atlanticus*			16		
True bugs						
Veliidae	*Velia sp.*	3		4		2
Corixidae	Corixidae (nymph)			1		
Corixidae	*Sigara nigrolineata*			1		
Beetles						
Haliplidae	*Haliplus sp.*			17		
Dytiscidae	Dytiscidae (larvae)			1	5	1
Dytiscidae	*Hydroporus palustris*					1
Dytiscidae	*Agabus sp.*					2
Dytiscidae	*Agabus paludosus*				3	
Dytiscidae	*Ilybius fuliginosus*					2
Dytiscidae	*Dytiscus semisulcatus*				1	

Family	Taxon	Cuckoo DS	Cuckoo US	Mayne 09	Santry 10/06/24	St. Margarets Dunbro
Hydrophilidae	*Helophorus aequalis*			4		
Hydrophilidae	*Helophorus brevipalpis*			7	2	1
Hydrophilidae	*Anacaena globulus*				4	
Caddisflies						
Polycentropodidae	*Plectrocnemia conspersa*				8	
Limnephilidae	*Limnephilus lunatus*					8
True flies						
Chironomidae	Chironomidae (pupae)	3	1			1
Chironomidae	Tanypodinae	22			11	
Chironomidae	Orthocladiinae	196		1	20	16
Chironomidae	Chironomini	5	7			
Chironomidae	Tanytarsini				5	
Chironomidae	Prodiamesinae		1			
Tipulidae	*Tipula sp.*	1		3		
Limoniidae	*Pilaria sp.*				2	
Dixidae	*Dixella sp.*					2
Psychodidae			7		4	
Ceratopogonidae				36		
Stratiomyidae	Stratiomyidae				1	
Culicidae	*Coquilletidia richardii*			1		
Other Taxa						
Collembola						2

Annex E Macrophyte Taxa List

Table E1: Macrophyte taxa found at three sites at Dublin Airport

Scientific name	Common name	Taxon Cover Values (TCV)		
		Cuckoo US	Mayne 09	Santry
Helosciadium nodiflorum	Fool's watercress	4	5	7
Callitriche spp.	Starwort		4	
Caltha palustris	Marsh marigold		1	
Cladophora glomerata/Rhizoclonium hieroglyphicum	Blanketweed		7	
Epilobium hirsutum	Hairy willowherb		2	5
Equisetum arvense	Field horsetail			3
Iris pseudacorus	Yellow flag			6
Juncus effusus	Soft rush			3
Phalaris arundinacea	Reed canary grass			6
Rorippa amphibia	Great yellow cress	1	1	
Rorippa nasturtium-acquaticum agg.	Watercress	5	5	6
Sparganium erectum	Branched bur-reed			4
Veronica sp.	Speedwell		1	
Veronica beccabunga	Brooklime	1		
Veronica catenata	Pink speedwell	2	2	
Zannichellia palustris	Horned pondweed	1		