Lough Mask & Lough Carra Priority Area for Action – Desk Study Summary

This is a summary of the desk study for the Lough Mask and Lough Carra Priority Area for Action (PAA), Co. Mayo. Desk studies are reports that are prepared by the catchment scientists using available information and data. To write these reports, we use information available for all waters that we plan to assess in the PAA. We get our information from:

- The Environmental Protection Agency
- Local Authorities
- Inland Fisheries Ireland
- Irish Water
- The Department of Agriculture, Food and the Marine
- Other public agencies.

The desk study also includes information learned from the public at community information meetings specific to the Lough Mask and Lough Carra PAA which were held in February 2019.

In our desk studies, we examine a number of things:

- **quality** – how the water quality has changed since 2007
- **importance** – for example, if its water is used for drinking water, and if there are any rare plants or animals in it that we need to protect.
- **impacts from human activity** – here we focus on impacts that damage water quality such as discharges from wastewater, agriculture, forestry practices, physical changes to the water etc.

We complete desk studies first before starting our field-based assessments or local catchment assessments (LCAs).

1. Background and Location

LAWPRO catchment scientists work in specific catchment areas called Priority Areas for Action (PAAs). The Lough Mask and Lough Carra PAA is an area of approximately 460km^2 located predominantly in south Co. Mayo and partly in north Co. Galway. It extends from the village of Ballyhean in Mayo to Clonbur in the south and from Ballyglass in the east to Gowlaun in the west.

The PAA is comprised of two large hydrologically connected lakes, Lough Mask and Lough Carra, and several of the lakes tributaries as well as the smaller Cloon Lough (**Figure 1**). To the east of the PAA

lies Lough Carra, a shallow (mostly less than 2 m) marl lake with three main inflowing rivers which includes the Annies, Cloondaver and Aghinish rivers and several small tributaries feeding into the lake from the east. To the west of the PAA lies Lough Mask, a large oligotrophic (low nutrient) lake hydrologically connected to Lough Carra via the Keel River. Several tributaries of Lough Mask are also included in the PAA: Claureen, Aille, Srah, Owenbrin, Srahnalong, Finny, Glensaul, Lough Nacorralea, Rathmalikeen and Robe rivers.

The PAA was selected for several reasons. Lough Mask is an important drinking water source and several of its tributaries as well as the lake itself have deteriorated in water quality. It also is a Blue Dot lake – see below for further explanation. Lough Carra is one of the best examples of a hard water marl lake in Europe. However, the lake's ecology is under threat from excess nutrients, which has been highlighted by the local community. The water quality of the lake's tributaries is also unsatisfactory.

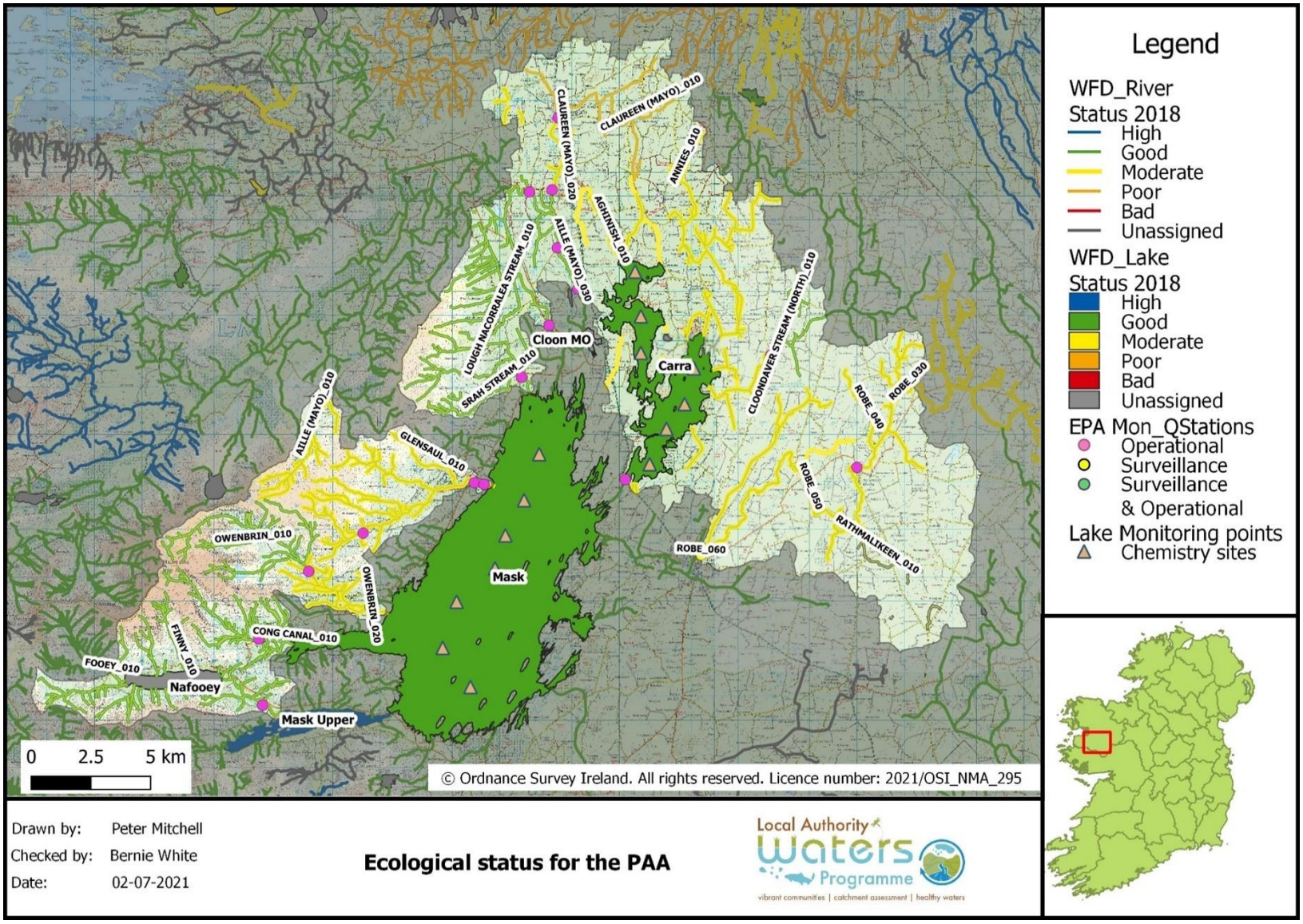


Figure 1: Lough Mask and Lough Carra PAA and ecological status

2. Catchment Description

Land cover throughout the PAA is predominantly pasture with a large area of peat bog spanning the Partry Mountains to the west of the PAA. The soil type in the PAA is predominantly well-drained (43%) with poorly drained soils accounting for 33% of the soil type and peat accounting for 17%.

Lough Mask and Lough Carra are important drinking water sources for both regional and local communities. Mask supplies the Lough Mask Regional Water Supply Scheme (RWSS) which serves a population equivalent of 46,500. Carra supplies the Lough Carra and Robeen group water schemes (GWSs) which serve a population equivalent of approximately 1508 and 687, respectively.

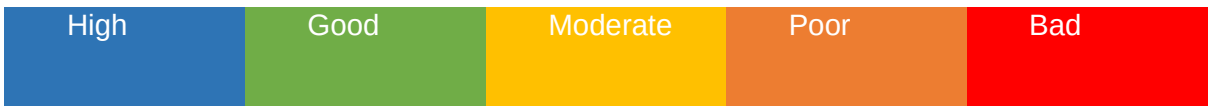
The Mask Carra PAA overlaps with 25 protected areas including Special Areas of Conservation (SACs); Special Protected Areas (SPAs); Proposed Natural Heritage Areas (pNHAs); Fresh Water Pearl Mussel (*Margaritifera)* sensitive areas; Salmonid Waters and Nutrient Sensitive Areas.

3. Blue Dot Catchments Programme

Lough Mask together with the Finny River and a section of the Aille River (030) are also part of the Blue Dot Catchments Programme which is a collaborative programme being delivered by a range of agencies as a means of focusing attention and resources towards the protection and restoration of our high status objective waters. The Environmental Protection Agency (EPA) have identified the waters in Ireland that should have a high status objective, and these are more commonly known as Blue Dot waters or Blue Dots. Ireland has seen a long-term declining trend in our high status waters. Blue Dot waters are our best quality waters. They have the highest ecological quality of all our waters and often a greater diversity of species that are sensitive to pollution. Blue Dot waters have a natural physical form that has not been changed much by human activities. Further information on this Programme can be found here - Blue Dot Programme - Local Authority Water Programme (lawaters.ie).

4. Water Quality History in the Lough Mask & Lough Carra PAA

Rivers and lakes are classified into five quality classes (status), with high status being unpolluted and bad status the most polluted.



The EPA assign status at (approximately) 3-yearly intervals based on the standards set out in the Water Framework Directive. Status is based on many different elements that altogether indicate the overall health of the river, for example the ecology recorded in river habitats, the physico-chemical condition of the river (oxygen levels, nutrient concentrations, indicators of organic and chemical pollution etc) and the physical condition of the riverbed and bank or lake shore.

We need to make sure that the waterbodies in the Lough Mask and Lough Carra PAA achieve their good or high status objectives. We have reviewed water quality data available for each of the waterbodies (**Table 1**) and we have found that:

- **Lough Mask:** Lough Mask is a high status objective water body that only achieved good status in 2013-2018. Nutrients, in particular Total Phosphorus, is thought to be the main cause of the lake's decline.
- **Aille (Mayo)_030 & Finny_010**: Both rivers have a high status objective but are only achieving good status. In Finny, physical habitat degradation caused by erosion is thought to be driving the decline. In the Aille (Mayo)_030, excess sediment is the cause of the decline.
- **Aille (Mayo)_010:** This water body is the upper stretch of the Aille River and it is currently achieving moderate status. The cause of its decline from good status is unknown.
- **Srah Stream_010:** The 2010-2015 status of this river was bad because of a toxic impact from sheep dip however, the river has since recovered to good status.
- **Glensaul_010:** The status of this river declined from good to poor in 2010-2015. Toxicity was suspected as the main cause. In 2013-2018, a slight improvement to moderate status was recorded for the waterbody.
- **Lough Nacorralea Stream_010:** The 2010-2015 status of this river was moderate. Its decline from good was caused by excess sediment and nutrients. However, in 2013-2018 its status recovered to good.
- **Srahnalong_010:** This river deteriorated to moderate status in 2010-2015 with excess sediment suspected as the cause of deterioration. The river recovered to good status again in 2013-2018.
- **Owenbrin_010 & Owenbrin_020:** Both the upper (010) and lower (020) reach of the Owenbrin River deteriorated to moderate status in 2010-2015. Excess sediment was identified as the main cause for the deterioration as it caused physical habitat degradation of the channel. In 2013-2018, the upper reach improved to good however the lower reach (020) remained at moderate status where impacts to fish are still occurring.
- **Claureen_010 & Claureen_020:** Both the upper (010) and lower reach (020) of the Claureen River are impacted as indicated by their 2013-2018 status of poor and moderate, respectively. Excess sediment is an issue in both reaches while excess nutrients are also an issue in the upper reach (010).
- **Robe_040 & Robe_050:** The 2013-2018 status in the middle reaches of the Robe River (040 and 050) was moderate. Excess orthophosphate and sediment are the cause of the moderate status of the Robe_040. Impacts to fish because of physical habitat degradation is the issue in the Robe_050.
- **Rathmalikeen_010**: This river is not monitored by the EPA and therefore its status is unknown. It is classified as unassigned.
- **Cloon MO lake**: This lake is not monitored by the EPA and therefore its status is unknown. It is classified as unassigned.
- **Lough Carra**: This lake is consistently achieving its good status objective however there is evidence to show that the lake's ecology is suffering impacts as a result of excess nutrients in particular, total phosphorus. This in turn is significantly impacting protected habitats within the lake and the marl on the lake bed in certain locations.

- **Aghinish_010**: This river has been at moderate status since 2012. The cause of the moderate status is not fully understood but altered flow and excess ammonium are considered likely causes.
- **Annies_010**: This is a newly monitored river since 2018. It is only achieving moderate status and like the Aghinish_010 further fieldwork is required to determine the cause of the moderate status.
- **Cloondaver Stream North_010:** This river returned to good status in 2018 for the first time since 1993. Altered flow and excess orthophosphate were identified as the main causes of its past moderate status.

Table 1: Ecological status, pressures and significance in the Lough Mask and Lough Carra PAA (high status objective waterbodies highlighted in blue in column 1)

Water body Name	WB Type	Risk	Ecological Status				EPA Characterisation Significant Pressure Category (Sub-category) (2013-2015)	EPA Characterisation Significant Issue (2013-2015)	Desk Study Review Potential additional pressures (2019)	Desk study Review Potential Significant Issue (2019)
			2007 - 2009	2010 - 2012	2010 - 2015	2013-2018				
Cloon Mo	Lake	*Review*	Unassigned	Unassigned	Unassigned	Unassigned	Anthropogenic Pressures (Unknown)	Unknown		
Carra	Lake	*Review*	Good	Good	Good	Good	Anthropogenic Pressures (Unknown)	Unknown	Agriculture	Nutrient pollution
									Hydromorphology (Channelisation)	Sediment
Mask	Lake	*At Risk*	High	Good	Good	Good	Agriculture (Pasture)	Nutrient pollution	No additional pressures identified at desk study stage	
							DWWT (Waste Water discharge)	Nutrient pollution		
							Invasive Species	Nutrient pollution		
Aille (Mayo)_ 010	River	*At Risk*	Moderate	Moderate	Moderate	Moderate	Anthropogenic Pressures (Unknown)	Unknown	Agriculture (Agriculture)	Nutrient pollution and sediment
Aille (Mayo)_ 030	River	*At Risk*	High	Unassigned	Good	Good	Agriculture (Agriculture)	Sediment	No additional pressures identified at desk study stage	
							Forestry (Forestry)			
Aghinish_ 010	River	*At Risk*	Good	Moderate	Moderate	Moderate	Hydromorphology (Channelisation)	Altered flow	No additional pressures identified at desk study stage	Ammonium
							Agriculture (Pasture)	Unknown		
Annies_010	River	*Review*	Unassigned	Unassigned	Unassigned	Moderate	Anthropogenic Pressures (Unknown)	Unknown	Hydromorphology (Channelisation)	Altered habitat

Water body Name	WB Type	Risk	Ecological Status				EPA Characterisation Significant Pressure Category (Sub-category) (2013-2015)	EPA Characterisation Significant Issue (2013-2015)	Desk Study Review Potential additional pressures (2019)	Desk study Review Potential Significant Issue (2019)
			2007 - 2009	2010 - 2012	2010 - 2015	2013-2018				
Cloondaver Stream (North)_ 010	River	*At Risk*	Moderate	Moderate	Moderate	Good	Hydromorphology (Channelisation)	Altered flow and enrichment	No additional pressures identified at desk study stage	
Claureen (Mayo)_ 010	River	*At Risk*	Poor	Poor	Poor	Poor	Hydromorphology (Channelisation) Extractive Industry (Quarries) Agriculture (Agriculture)	Sediment Nutrient pollution	No additional pressures identified at desk study stage	
Claureen (Mayo)_ 020	River	*At Risk*	Good	Moderate	Moderate	Moderate	Hydromorphology (Channelisation) Forestry (Forestry)	Sediment	No additional pressures identified at desk study stage	
Finny_010	River	*At Risk*	High	High	Good	Good	Hydromorphology (Channelisation)	Sediment	Hydromorphology (Erosion)	
Glensaul_ 010	River	*At Risk*	Good	Good	Poor	Moderate	Agriculture (Agriculture)	Nutrient pollution and insecticides	No additional pressures identified at desk study stage	
Lough Nacorralea Stream_ 010	River	*At Risk*	Good	Good	Moderate	Good	Hydromorphology (Channelisation) Forestry (Forestry) Agriculture (Pasture)	Sediment Nutrient pollution and sediment Nutrient enrichment	No additional pressures identified at desk study stage	
Owenbrin_ 010	River	*At Risk*	Moderate	Good	Moderate	Good	Hydromorphology (Overgrazing)	Sediment	No additional pressures	

Water body Name	WB Type	Risk	Ecological Status				EPA Characterisation Significant Pressure Category (Sub-category) (2013-2015)	EPA Characterisation Significant Issue (2013-2015)	Desk Study Review Potential additional pressures (2019)	Desk study Review Potential Significant Issue (2019)
			2007 - 2009	2010 - 2012	2010 - 2015	2013-2018				
									identified at desk study stage	
							Forestry (Clearfelling)	Sediment		
Owenbrin_020	River	*At Risk*	Good	Good	Moderate	Moderate	Forestry (Forestry)	Sediment	No additional pressures identified at desk study stage	
							Hydromorphology (Overgrazing)	Sediment		
Robe_040	River	*At Risk*	Moderate	Moderate	Moderate	Moderate	Hydromorphology (Channelisation)	Sediment	No additional pressures identified at desk study stage	
							Urban Waste Water (Hollymount Waste Water Treatment Plant)	Nutrient pollution		
Robe_050	River	*At Risk*	Good	Moderate	Moderate	Moderate	Hydromorphology (Channelisation)	Altered habitat	No additional pressures identified at desk study stage	
Rathmalikeen_010	River	*Review*	Unassigned	Unassigned	Unassigned	Unassigned	Anthropogenic pressures (Unknown)	Unknown	No additional pressures identified at desk study stage	
Srah Stream_010	River	*At Risk*	Good	Moderate	Bad	Good	Agriculture (Agriculture)	Insecticides	No additional pressures identified at desk study stage	
Srahnalong_010	River	*At Risk*	Good	Good	Moderate	Good	Agriculture (Farmyards)	Sediment	No additional pressures identified at desk study stage	

5. Sources of Pollution

Pollutants find their way to rivers by a number of paths:

- They can be piped directly to the river from large sources such as wastewater treatment plants, or small sources such as faulty septic tanks, farmyards, roadside drains etc.
- They can flow across the ground to the river when nutrients which are applied to the land as fertiliser are washed off by rainfall before the crop and soil has absorbed them. This is usually a problem where soils are wetter and poorly draining, particularly during wet weather.
- Groundwater losses occur when pollutants move down through the soil and rock into groundwater and eventually into rivers, lakes and coastal waters. This usually occurs when too much fertiliser is applied to land, or when the soil is not ready to absorb the nutrient (e.g. temperatures too cold, incorrect soil pH etc) and is common in free draining/ light soils.

A common problem throughout the Lough Mask and Lough Carra PAA is changes to river hydromorphology. Hydromorphology considers the physical character and hydrology (flow, energy etc.) of rivers and lakes and good hydromorphological conditions support healthy aquatic ecosystems. In this PAA, several activities are altering the flow and physical character of the rivers including arterial drainage and drainage for agriculture and, the overgrazing of bankside vegetation by animals particularly sheep in commonage areas. Drainage activities over-deepen and over-widen small streams and larger river channels and contribute significant amounts of sediment to the channel. Overgrazing causes bank destabilisation which can also result in the loss of bank sediment to the river channel.

Agriculture is another common source of pollution to the rivers and lakes in the PAA. Agricultural activities are the source of contaminants such as nutrients and other chemicals (e.g. sheep dip, grassland herbicides) that enter rivers and lakes during wet weather by overland flow, direct discharges or via drains connected to the waterbodies. In this PAA which is largely underlain by karst limestone bedrock, features such as swallow holes can also carry contaminants to rivers and lakes. Wet soils are most vulnerable to phosphorus, sediment and herbicide/ insecticide runoff during rainfall events. The application of slurry or chemical fertiliser, herbicides etc. on or near swallow holes or areas of exposed bedrock will result in the direct transfer of the contaminants into groundwater, which may then re-emerge in springs or in other streams and rivers.

Forestry is also a source of pollution in the PAA. Commercial (Coillte) and private forestry collectively equates to 4% (18.2km^2) of the total area in the PAA. The main species planted is *Sitka spruce*. The majority of Coillte planting occurred before 1990 i.e. before the introduction of Forest Service guidelines regarding buffer zone management along watercourses e.g. introduction of within the buffer zones, management of ground preparation and other forest operations are curtailed to protect water quality, and therefore pose a risk to water quality. In addition, drainage channels through the forest may link directly into river channels with little or no buffer zone in place. This may become an issue when carrying out forestry activities such as felling and may need to be investigated further if impacts are observed in the water bodies.

Quarries are a source of sediment pollution in one river in the PAA, the upper Claureen River (010). There are two quarries close to the river however only one is licenced to discharge small amounts of groundwater seepage on the quarry floor to the river after it has been treated on site through an oil interceptor.

Urban waste water and domestic waste water treatment systems (e.g. septic tanks) are both considered a significant source of pollution. Hollymount Certificate of Authorisation (CoA) plant discharges treated effluent and storm water overflow to the Robe River 60m downstream of Hollymount Bridge. Excess nutrients are an issue at Hollymount Bridge and although the CoA plant is downstream of the bridge, LAWPRO will confirm if the CoA is having an impact on water quality in the river. DWWTS are identified as a source of pollution in Lough Mask. Areas vulnerable to DWWTS pollution are poorly drained or well drained soils where rock is at ground surface. The main risk from domestic wastewater arises from existing systems where the site was not suitability assessed or designed correctly or from treatment systems that are not adequately maintained under a maintenance contract or regularly de-sludged. DWWTS inspections carried out by Mayo County Council in the Lough Mask and Lough Carra catchments in 2018 observed a high failure rate of approximately 86%. A total of 30 DWWTS were inspected in 2018.

The zebra mussel (Dreissena polymorpha), an invasive species in Ireland, is also an issue in Lough Mask. Zebra mussels thrive in calcium and nutrient rich conditions. They filter algae from the water reducing chlorophyll levels. This can cause water clarity to increase depending on the size of the zebra mussel population. This can lead to changes in the macrophyte community. Zebra mussels cannot be controlled or eradicated from a lake at present.

6. Next Steps

Community Engagement Meeting

Two community information meetings were held about the Mask and Carra PAA, one on the 18th of February 2019 at Tourmakeady Community Centre and the second on the 19th of February 2019 at Carnacon Community Centre. The meetings were attended by members of the public and local stakeholders. The meeting involved two presentations by LAWPRO followed by a Q&A session with the attendees. Some questions raised by attendees included: timeline of water quality deterioration for Lough Mask; decrease in the numbers of mayfly over Lough Carra; inspection of septic tanks and measures to mitigate impacts from septic tanks; potential impacts from forestry; nutrient pollution in the Carra catchment; groundwater and surface water catchment of Lough Carra; and timelines for implementing measures on the ground.

Farmers Meeting

The Agricultural Sustainability Support and Advisory Programme (ASSAP) advisors from Teagasc held two farmers meeting about the Mask and Carra PAA, the first on the 26th of February 2019 at Tourmakeady Community Centre and another on the 16th of April 2019 at the Carnacon Community Centre. The meetings were attended by farmers located within the PAA and involved presentations from the ASSAP advisors, a LAWPRO Catchment Scientist and a Teagasc Forestry Advisor (in case of the Carra meeting) which were then followed by a questions and answers session with the attendees. Some questions raised by attendees included: the quality of drinking water from Lough Mask treatment plant; flooding issue on lands bordering rivers; and the prospect of future environmental schemes such as GLAS.

7. Local Catchment Assessment

LCA work for the PAA is expected to commence during the summer of 2019 to confirm the sources of pollution affecting water quality in the deteriorated rivers and to identify any additional pollution sources. Where water quality improvements have already occurred in rivers, LAWPRO will work to identify activities that pose a risk to maintaining the current High or Good water quality within the rivers. Where agricultural activities are confirmed as impacting water quality through the introduction of sediment, nutrients and/ or pesticide, we will communicate our LCA findings to the ASSAP advisors for the area who will work closely with farmers providing them with free and confidential advice to address these activities. In the case of the lower Owenbrin and Robe rivers where fish stocks are unsatisfactory, LAWPRO will liaise with Inland Fisheries Ireland (IFI) about the issues affecting fish. LAWPRO will liaise with the OPW in relation to ongoing arterial drainage maintenance programmes in the PAA.

Figure 2: Lough Mask

Figure 3: Lough Carra