River Forth catchment profile

Introduction

The River Forth catchment encompasses a large area – approximately 1029 km^2. As can be seen in Figure 1, the catchment not only contains the River Forth itself, but also major tributaries such as the River Teith.

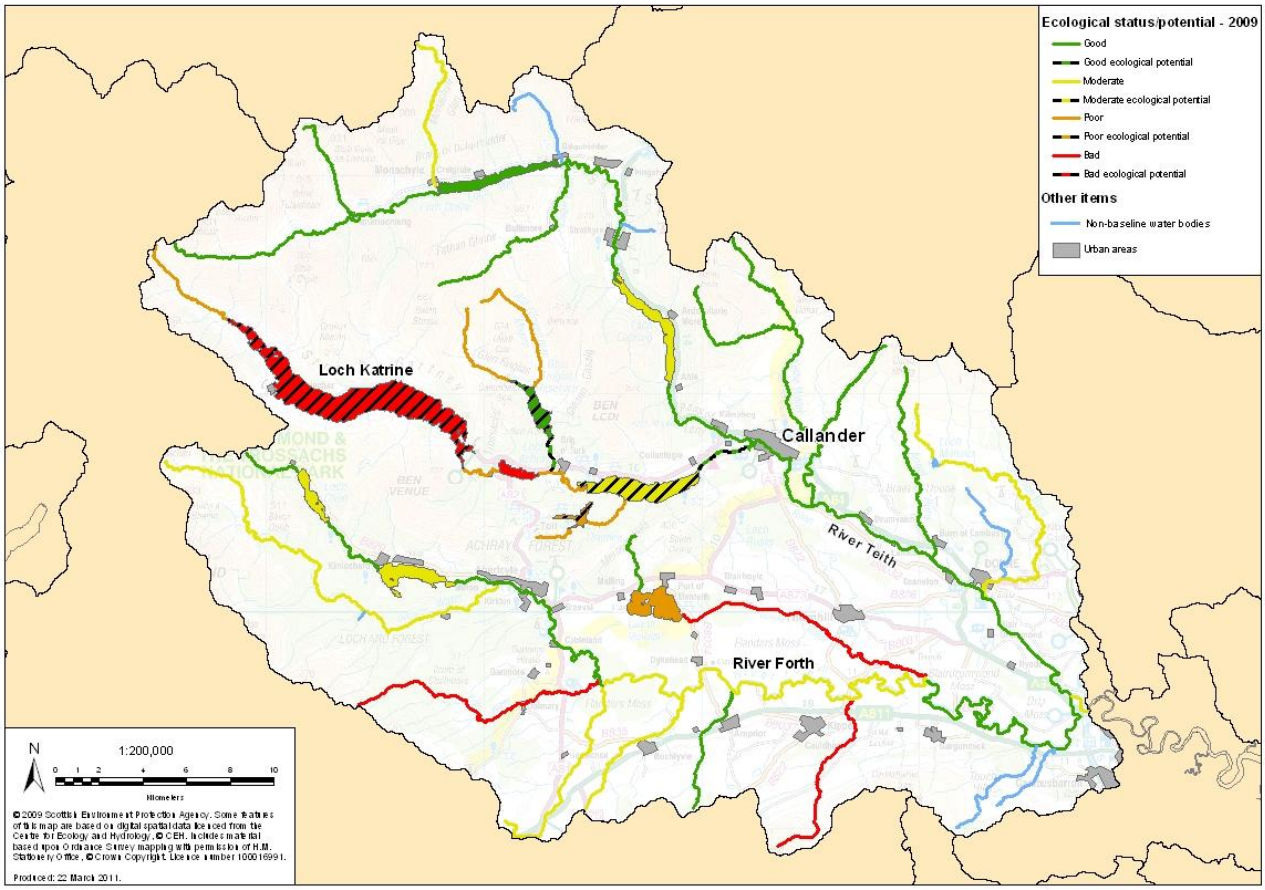

Figure 1: River Forth catchment

Land-use within the catchment is predominantly rural, comprising managed forests and farmland. The Loch Lomond and Trossachs National Park covers a significant portion of the upper reaches of the catchment. In the lower-lying reaches, a greater degree of urbanisation can be seen with the City of Stirling and surrounding villages, interspersed with agricultural holdings.

Water resources are important within this catchment with the lochs and reservoirs serving important functions in the supply of drinking water – indeed Loch Katrine plays a vital role in providing Glasgow with much of its water. In addition, the development of small-scale micro hydro generation schemes are increasing within the catchment.

The catchment contains 46 baseline[1] surface water bodies, six of which are heavily modified. These heavily modified water bodies have been designated because of the modifications necessary to enable the supply of drinking water. There are five groundwater bodies associated with the catchment.

Further information on the River Forth catchment can be found on the RBMP interactive map.

1 A baseline water body is a river which drains a catchment greater than 10km^2, lochs bigger than 0.5km^2, all coastal waters out to three nautical miles, transitional waters such as estuaries and groundwaters. A non-baseline water body is a river or loch which falls below the size threshold.

The Forth Area Management Plan and other catchment profiles within the Forth sub basin district can be found on SEPA's website.

Water-dependent protected areas
The catchment contains the following water-dependent protected areas which are all currently achieving their objectives:

- 15 drinking water protected areas
- One freshwater fish directive designation – River Forth
- One Special Area of Conservation – River Teith
- Two urban waste water treatment directive sensitive areas – Lake of Menteith and Loch Mahaick

Classification and pressures summary

Table 1: Classification status, pressures and objectives for the 46 baseline surface water bodies within the River Forth catchment in 2009; water bodies are ordered from the upstream extent of the catchment to the downstream extent

Surface water body	Water body ID	2009 classification	Pressures	Good by
River Larig	4719	Good ecological status	-	-
Monachyle Burn	4721	Moderate ecological status	Morphology – forestry	2021
Loch Voil	100254	Good ecological status	-	-
River Balvag	4737	Good ecological status	-	-
Finglas Water	4724	Poor ecological status	Morphology – impoundments	Less than good beyond 2027
Allt Gleann nam Meann	4725	Poor ecological status	Morphology – impoundments	Less than good beyond 2027
Calair Burn	4720	Good ecological status	-	-
Glen Finglas Reservoir	100262	Good ecological potential	-	-
River Turk	4723	Good ecological potential	-	-
Loch Lubnaig	100258	Moderate ecological status	Morphology - culverting	2027
Garbh Uisge/River Leny	4718	Good ecological status	-	-
River Teith	6834	Good ecological status[2]	-	-
Annet Burn	4714	Good ecological status	-	-
Ardoch Burn	4712	Moderate ecological status	Morphology – impoundment	2027
Glengyle Water	4711	Poor ecological status	Morphology – impoundment	Less than good beyond 2027
Loch Katrine	100261	Bad ecological potential[3]	Flow regulation – water collection	2015

[2] The River Teith has improved to good ecological status in 2009 on account of better quality hydrological data as opposed to measures delivery.
[3] In the 2010 classification (to be published late 2011) Loch Katrine will be at good ecological potential. This is because the flow regulation pressure has been removed as it doesn't impact on the loch itself but on the downstream water environment.

Achray Water	4710	Poor ecological status	Flow regulation – water collection	2015
Loch Achray	100264	Bad ecological status	Flow regulation	2015
Black Water	4709	Poor ecological status	Flow regulation – water collection	2027
Drunkie Burn (Reoidhte Lochan to Loch Drunkie)	4722	Poor ecological status	Morphology – forestry activities & culverting	2027
Loch Drunkie	100268	Poor ecological potential	Morphology – culverting & impoundments	2027
Drunkie Burn (Loch Drunkie sluice to Loch Venachar)	4734	Poor ecological status	Flow regulation – water collection Morphology – culverting & impoundments	2027
Loch Venachar	100266	Moderate ecological potential	Abstraction – water treatment works Morphology – forestry & impoundments	2027
Eas Gobhain	6835	Good ecological potential	-	-
Water of Chon (Source to Loch Chon)	4707	Good ecological status	-	-
Loch Chon	100265	Moderate ecological status	Morphology – forestry activities	2027
Water of Chon (Loch Chon to Loch Ard)	4706	Good ecological status	-	
Loch Ard	100270	Moderate ecological status	Morphology – forestry activities	2027
Avondhu Burn	4705	Good ecological status	-	-
Glenny Burn	4727	Good ecological status	-	-
Lake of Menteith	100271	Poor ecological status	Point source pollution – aquaculture Diffuse source pollution – mixed farming	2027
River Forth (Milton to Auchentroig Burn confluence)	4704	Good ecological status	-	-
Duchray Water	4733	Moderate ecological status	Diffuse source pollution - forestry	Less than good beyond 2027
Kelty Water	4732	Bad ecological status	To be determined[4]	-
Auchentroig Burn	4731	Moderate ecological status	Morphology	2027
Ballochneck/Mye Burn	4730	Moderate ecological status	Point source pollution – sewage disposal Diffuse source pollution – livestock farming	2027
Arnprior Burn	4729	Good ecological status	-	-

[4] The Kelty Water has gone from 'good' in 2008 to 'bad' in 2009 on account of fish ecology. Potential causes may be associated with forestry-related acidification. However, further investigations are required as a downstream natural fish barrier, previously thought to be passable, may in fact be impassable. Therefore, the classification may revert to back to 'good'.

River Forth (Auchentroig Burn to Arnprior Burn confluences)	4703	Moderate ecological status	Diffuse source pollution – mixed farming	2021
River Forth (Arnprior Burn to Goodie Water confluences)	4702	Moderate ecological status	Point source pollution – sewage disposal Diffuse source pollution – mixed farming	2021
Boquhan Burn	4728	Bad ecological status	Abstraction – water treatment works	2015
Goodie Water	4726	Bad ecological status	Morphology – forestry, mixed farming Point source pollution – sewage disposal Diffuse source pollution – mixed farming	2027
River Forth (Goodie Water to River Teith confluences)	4701	Good ecological status	-	-
River Forth (below River Teith confluence)	4700	Moderate ecological status	Point source pollution – sewage disposal	2027
Allt Ruighe an Eas	4717	Good ecological status	-	-
Keltie Water	4716	Good ecological status	-	-
Lower Keltie Water	4715	Good ecological status	-	-

NB: Pressures that have already been addressed and pressures that have been assessed as having achieved good ecological potential (GEP) are not included within this table.

Small water bodies

There are also small (non-baseline[5]) surface water bodies associated with the catchment. If there are any issues associated with these small water bodies which significantly impact a downstream baseline water body, then a pressure will be noted against the baseline water body so that it will be addressed. It should be noted however that as the Water Framework Directive applies to the whole water environment we should be harnessing opportunities to improve the condition of any small water body where possible.

[5] Under the Water Framework Directive we are only required to formally identify pressures, determine the classification status, develop and implement measures and report progress to the European Commission for baseline water bodies. However, the Water Framework Directive applies to the whole water environment and if any pressures exist on non-baseline water bodies we would seek to address these through river basin planning; especially, for example, where an activity on a non-baseline water body causes, or has the potential to cause, a downgrade in status to a downstream baseline water body or protected area.

Table 2: Classification status, pressures and objectives for the groundwater bodies associated with the River Almond catchment in 2009

Groundwater	Water body ID	2009 classification	Pressures	Good by
Upper Teith	150081	Good overall	-	-
Teith Valley Sand and Gravel	150280	Good overall	-	-
Doune bedrock and localised sand and gravel aquifers	150276	Good overall	-	-
East Campsie bedrock and localised sand and gravel aquifers	150395	Good overall	-	-
Stirling and Falkirk bedrock and localised sand and gravel aquifers	150234	Poor chemical status	Diffuse source pollution from mining and quarrying of coal	Less than good beyond 2027
		Poor hydrological status	*To be completed. New failure – awaiting further information*	-

Groundwater bodies often lie below several surface water catchment areas and therefore the reason for poor status may be associated with above ground activities in other catchments. In this case, the reason for poor status within the Stirling and Falkirk groundwater is associated with historic mining activities in the Stirling, Falkirk and West Lothian areas.

Pressures, measures and objectives summary

No deterioration objectives

No pressures exist on the 16 surface water bodies which are at good ecological status, the four groundwater bodies at good status and on the water-dependent protected areas. Under the Water Framework Directive we have a requirement to ensure that there is no deterioration in status.

For those water bodies currently less than good ecological status the objective is to ensure that no further deterioration occurs, in addition to any improvement objectives.

It will be important to consider the cumulative impact of small-scale micro hydropower schemes to ensure that no deterioration in status occurs.

In the case of Loch Lubnaig, a watching brief is required to ensure that the impacts associated with wild camping do not generate any environmental problems. There are currently issues with trees being cut down, causing bankside erosion, which could potentially generate diffuse pollution or morphological pressures. SNH have also expressed concerns over increased access by amateur fishermen, with the potential for introduction of North American signal crayfish.

Verification of good ecological potential

In the case of the three heavily modified water bodies which are at good ecological potential (GEP), there is a need for SEPA to verify the assessment that the pressures associated with the reason for the heavily modified designation are at GEP. The objective for these is to ensure that there is no deterioration.

Water resources

Abstraction

The measure to address the abstraction pressure on Loch Venachar associated with the Brig O'Turk water treatment works is expected to be incorporated into a future Scottish Water Quality and Standards Investment Programme with an aim to deliver improvements by 2024.

The measure to address the abstraction pressure on the Boquhan Burn which is caused by the Carron Valley water treatment works is expected to be incorporated into a future Scottish Water Quality and Standards Investment Programme with an aim to deliver improvements by 2024.

Flow regulation
The impoundment on Loch Katrine is creating a flow regulation pressure on three downstream water bodies, the Achray Water, Loch Achray and the Black Water. This is due to be addressed by Scottish Water by 2014 through the Quality and Standards Investment Programme.

The impoundment on Loch Drunkie is creating a flow regulation pressure on the downstream Drunkie Burn (Loch Drunkie sluice to Loch Venachar) water body. This is forecast to be addressed by Scottish Water by 2014.

Point source pollution

Sewage
On the River Forth (Arnprior Burn to Goodie Water confluences) water body, a measure will be delivered at the Kippen waste water treatment works by early 2015 to increase capacity to mitigate impacts associated with previous growth in the area. This measure is being implemented to prevent a deterioration in status.

On the River Forth (below River Teith confluence) water body, measures are required to improve the final effluent quality at the Doune and Deanston waste water treatment works. The point source sewage pressure on the Ballochneck/Mye Burn is associated with the Buchlyvie waste water treatment works combined sewer overflow. In the Goodie Water, the point source pressure is associated with the final effluent quality at the Thornhill waste water treatment works. It is proposed that measures to address all these pressures will be incorporated into a future Scottish Water Quality and Standards Investment Programme with an aim to deliver improvements by 2025.

Aquaculture
On the Lake of Menteith, there are three point source pressures associated with aquaculture operations. Measures to reduce these point source pressures are due to be delivered by 2019. However, SEPA need to initiate discussions with the operator before 2015 and undertake a review of the Controlled Activities Regulations (CAR) licence to enable these measures to be delivered by 2019.

Diffuse source pollution

The Lake of Menteith, Ballochneck/Mye Burn, River Forth (Auchentroig Burn to Arnprior Burn confluences), River Forth (Arnprior Burn to Goodie Water confluences) and Goodie Water are all impacted by diffuse pollution associated with farming activities. The catchment is a candidate priority catchment for the second river basin planning cycle. This means that focused work to tackle rural diffuse pollution within the catchment will commence in 2015 with an aim to achieve improvements by 2021. Further information on the priority catchment approach can be found on the priority catchment page on SEPA's website.

Although Forestry Commission Scotland delivered riparian planting improvements between 2005 and 2007, the Duchray Water is likely to continue to suffer from acidification associated with forestry due to ecological recovery time. However, it is likely to be beyond 2027.

On the Calair Burn there was a classification failure in 2008 due to missing year classes for salmon and low trout numbers. As the reason for this was unknown, a diffuse pollution pressure was recorded to capture this failure. In 2009, the classification improved to good ecological status. However, recent surveys (September 2010) by the River Forth Fisheries Trust have identified sediment inputs upstream of excellent spawning grounds which are associated with a farm track. This work has also identified channel dredging to create higher banks, quarrying of alluvial gravels adjacent to the channel and arable farming with inadequate riparian buffer strips near Ballimore Farm. The cumulative impact of these activities could have caused the 2008 classification failure. The 2009 monitoring may not have identified a problem on account of the cessation of potentially impacting activities at the time of monitoring. Consideration of future classification results is required to determine if an environmental problem exists.

Morphology

The morphological pressures within this catchment are primarily associated with water collection, treatment and purification activities and also forestry activities.

Impoundments
The impounding dam on Loch Drunkie is generating a morphological pressure on the loch itself and is also impacting sediment transfer into the downstream water body, the Drunkie Burn (Loch Drunkie sluice to Loch Venachar). It is expected that Scottish Water will deliver the morphological improvements and address the sediment transfer issue by 2014.

The measures to address the morphological pressures associated with Loch Venachar are expected to be incorporated into a future Scottish Water Quality and Standards Investment Programme with an aim to deliver improvements by 2024.

Barriers to fish passage
Barriers to fish passage are present throughout the catchment. It is expected that through continued engagement with fisheries experts on the ground further barriers will be identified as we move through the river basin planning cycles.

The impounding dam at Loch Drunkie is currently not recorded as presenting a barrier to fish passage. This requires to be verified through discussions with the Forth District Salmon Fisheries Board.

On a tributary of Loch Lubnaig and a tributary of the Ardoch Burn, barriers to fish passage have been identified. In order to address these pressures, the landowners need to be identified and requested to undertake remedial action by 2027.

The barrier to fish passage on the Drunkie Burn (Loch Drunkie sluice to Loch Venachar) is affecting the upstream water bodies – Loch Drunkie and the Drunkie Burn (Reoidhte Lochan to Loch Drunkie). Further information needs to be gathered on this barrier. Discussions should be initiated with the appropriate landowner in relation to delivering appropriate mitigation by 2027.

Allt Gleann nam Meann and the Finglas Water[6] will continue to be at poor ecological status beyond 2027 because of a barrier to fish passage at the downstream Glen Finglas Reservoir. The Glengyle Water[1] will also continue to be at poor ecological status beyond 2027 because of a downstream barrier to fish passage at Loch Katrine. These barriers will not be addressed because the environmental benefits of installing a fish passage are low compared with the costs involved.

Through workshops with stakeholders in March 2011, a fish barrier pressure has been added to the River Teith water body. This will be included in the 2011 classification and therefore the water body will be downgraded to poor ecological status.

Forestry
Forestry Commission Scotland measures to address intensive planting issues are to be delivered on the following water bodies: Drunkie Burn (Reoidhte Lochan to Loch Drunkie) by 2013; Monachyle Burn by 2021; Loch Venachar by 2021; Loch Chon by 2027; Goodie Water by 2025; and Loch Ard by 2027.

Agriculture
Morphological pressures on the Goodie Water as a result of farming activities are expected to be addressed as part of the priority catchment work which commences in 2015. These pressures are therefore expected to be addressed by 2021.

Other
There is a requirement for SEPA to complete the identification of the specific locations and causes of the morphological alterations on the Auchentroig Burn. This will allow the determination of the improvements required to restore it to good ecological status. SEPA would then undertake discussions

6 The water body information sheets for the Finglas Water and Glengyle Water, which can be found on the SEPA website, currently state that they will reach good status by 2015. This is an error which will be amended when the water body information sheets are updated.

with appropriate landowners to request improvements to the modified habitat so that it can achieve good ecological status by 2027.

Invasive non-native species

No water bodies are currently downgraded to less than good on account of the presence of aquatic invasive non-native species. However, the presence of North American signal crayfish in the River Forth catchment was confirmed by a SNH funded survey carried out by the River Forth Fisheries Trust in 2009. Crayfish were found in the Row Burn, a tributary of the River Teith that joins the river at Blairdrummond. This requires further investigation. In addition, Loch Lubnaig and the Lake of Menteith water bodies only attain good rather than high status due to the presence of Canadian pondweed, *Elodea canadensis*.

Riparian invasive non-native species such as Japanese knotweed, giant hogweed, Himalayan balsam and rhododendron are currently not incorporated into the morphology component of the Water Framework Directive classification scheme. However, this is expected to change before the end of the first river basin planning cycle. Efforts should be targeted to map the location of riparian invasive non-native species as this can be used by SEPA to inform future classification outputs. Please contact SEPA for a copy of the survey method. The Water Environment Restoration Fund can be used to fund eradication projects.

The River Forth Fisheries Trust have produced a biosecurity plan for the Forth district which covers a very similar area to the Forth Advisory Group area. Key objectives of the plan include preventing the introduction and spread of invasive non-native species, establishing a framework for detection and surveillance, and developing co-ordinated control and eradication programmes for invasive non-native species. This work will directly assist the achievement of RBMP objectives.

Areas for action

No.	Action	Suggested owner	Date
1	Engage with Scottish Water to promote appropriate projects into future quality and standards investment periods and ensure measures are on track to deliver	SEPA quality and standards team/Scottish Water	Ongoing - 2025
2	Continue to raise profile of RBMP and requirement to protect and improve the water environment.	All SEPA/All AAG members	Ongoing - 2027
3	Raise awareness of diffuse pollution and diffuse pollution general binding rules to support future priority catchment work – specifically around Lake of Menteith, Ballochneck/Mye Burn, River Forth (Auchentroig Burn to Arnprior Burn confluences), River Forth (Arnprior Burn to Goodie Water confluences) and Goodie Water	Forth AAG/SEPA Land Unit/RBMP coordinator/local operations team	Ongoing - 2015
4	Work through AAG INNS sub-group to ensure co-ordinated action to tackle invasive non-native species to meet RBMP objectives.	River Forth Fisheries Trust/AAG INNS sub group	Ongoing - 2027
5	Ensure agreed Forestry Commission Scotland measures to address intensive planting issues causing morphological pressures are delivered.	FCS	Ongoing-2027
6	Verify good ecological potential assessments on Glen Finglas Reservoir, River Turk and Eas Gobhain water bodies.	SEPA local operations team	Ongoing - 2014
7	Investigate fish barrier on the Drunkie Burn (Loch Drunkie sluice to Loch Venachar) water body – query weir or road culvert.	AAG/ River Forth Fisheries Trust	2011
8	Investigate fish barrier on tributary of Loch Lubnaig to confirm if road culvert	AAG/ River Forth Fisheries Trust	2011
9	Confirm that impounding dam at Loch Drunkie does not present a barrier to fish passage.	SEPA/ River Forth Fisheries Trust	2011

10	Investigate fish barrier on tributary of Ardoch Burn to identify possible mitigation options.	AAG/ River Forth Fisheries Trust	2011
11	Investigate reports of fish barrier on Calair Burn upstream from mill house near Ballimore.	AAG/ River Forth Fisheries Trust	2011
12	Continue to gather information on barriers to fish passage from the River Forth Fisheries Trust and other appropriate stakeholders.	River Forth Fisheries Trust /Stirling Council/SEPA RBMP co-ordinator	2011 - ongoing
13	Investigate anecdotal reports of North American Signal Crayfish in the River Teith	SEPA/RFFT/SNH/Stirling Council	2011
14	Maintain watching brief on Calair Burn – possible diffuse pollution pressure	SEPA local operations team/local environmental quality	Ongoing
15	Investigate Loch Venacher Management Group to see if any RBMP links	AAG	2011
16	Investigate classification failure on Kelty Water to determine pressure fully and derive appropriate measures	SEPA local environmental quality team	2011
17	Initiate discussions with aquaculture operator on Lake of Menteith before 2015 and undertake a review of the Controlled Activities Regulations (CAR) licence to enable these measures to be delivered by 2019.	SEPA local operations team	Ongoing - 2019
18	Initiate discussions with FCS in relation to forestry-related morphological pressures on the Goodie Water as the measure to address this pressure by 2024 is not currently projected or agreed.	SEPA RBMP co-ordinator/FCS	2012
19	Ensure priority catchment work progresses	SEPA land unit	2015
20	Identify morphological issues on Auchentroig Burn and identify landowners to apply for restoration funding	SEPA hydromorphology specialists/RBMP co-ordinator/local operations team	2017