West Lothian Local Development Plan 2 (LDP2) Evidence Report	
Schedule	**3. The Water Environment and Flood Risk including water supply**
Information required by the Act and NPF4 regarding the issue addressed in this section	**Town and Country Planning (Scotland) (Act) 1997, as amended:** • section 15(5)(a) 'the principal physical, cultural, economic, social, built heritage and environmental characteristics of the district' • Section 15(5)(d) 'how that infrastructure is used' **Town and Country Planning (Development Planning) (Scotland) Regulations 2023:** • Regulation 9 requires the LDP to have regard to: o any river basin management plan; o any flood risk management plan; o any local flood risk management plan; o the national marine plan; and, o any regional marine plan. **National Planning Policy 4 (adopted 13 February 2023)** • **Policy 22 Flood Risk and Water Management** – LDP's should strengthen community resilience to the current and future impacts of climate change, by avoiding development in areas at flood risk as a first principle. Resilience should also be supported by managing the need to bring previously used sites in built up areas into positive use; planning for adaptation measures; and identifying opportunities to implement improvements to the water environment through natural flood risk management and blue green infrastructure. Plans should take into account the probability of flooding from all sources and make use of relevant flood risk and river basin management plans for the area. A precautionary approach should be taken, regarding the calculated probability of flooding as a best estimate, not a precise forecast. For areas where climate change is likely to result in increased flood exposure that becomes unmanageable, consideration should be given to alternative sustainable land use. • **Policy 10 Coastal Development -** LDP spatial strategies should consider how to adapt coastlines to the impacts of climate change. This should recognise that rising sea levels and more extreme weather events resulting from climate change will potentially have a significant impact on coastal and islands areas, and take a precautionary approach to flood risk including by inundation. Spatial strategies should reflect the diversity of coastal areas and opportunities to use nature based solutions to improve the resilience of coastal communities and assets. LDP spatial strategies should identify areas of developed and

	undeveloped coast and should align with national, sectoral and regional marine plans. • **Policy 32 Aquaculture -** LDPs should guide new aquaculture development in line with National and Regional Marine Planning, and will minimise adverse environmental impacts, including cumulative impacts, that arise from other existing and planned aquaculture developments in the area while also reflecting industry needs Other schedules which should be read alongside this schedule on the Water Environment and Flooding: • 1 - Climate Change • 4 - Blue and green infrastructure • 5 - Natural places and soils • 6 - Forestry, woodland and trees • 7 - Greenbelt
Links to Evidence referred to in this schedule	• SEPA, National Flood Maps / flood hazard and risk maps • SEPA, Forth Estuary District Flood Risk Management Plan 2021 (FRMP) • Forth Estuary Local Flood Risk Management plan (cycle 1 2016-2022) and Cycle 2(LFRMP) • SEPA, River Basin Management Plan Scotland 2021-2027 • West Lothian Council, Surface Water Management Plan (SWMP) • Coastal erosion (SEPA Flood Maps and Our Dynamic Coast) • Mine workings (Coal Authority) • West Lothian Council statutory planning guidance, Flooding and Drainage 2018 • Scottish Government, Scottish National Marine Plan • Scottish Government, Climate change Sea level assessment • West Lothian Council, Linlithgow Loch Catchment Management Plan (2012) and Nutrient Loading Study (copy to be sourced) • Scottish Government, The Reservoir (Scotland) Act 2011 • SEPA, 'water bodies data sheets' and RBMP3 (sepa.org.uk) • West Lothian Council, Climate Change Strategy 2021-2028 • West Lothian Council, Adaptation Action Plan (2022-2028) • Environmental data | Scottish Environment Protection Agency (SEPA) • Scottish Water, Strategic Plan - A Sustainable Future Together and the accompanying Delivery Plan (2021/2022 to 2022/2023) • Scottish Water, Climate Change Adaption Plan 2024 • SEPA, National Water Scarcity Plan • SEPA, River Almond Catchment Profile • Scottish Water, Improving Urban Waters project • Scottish Water, Winchburgh waste water treatment works • British Geological Survey, hydrogeological maps of Scotland This schedule aims not to repeat the content of other topics covered by the LDP2 Evidence Report. Other schedules which should be read alongside this schedule on the Water Environment and Flooding include:

	• 1 - Climate Change • 2 - Biodiversity • 4 - Blue and Green Infrastructure and OP

Summary of Evidence

Purpose, scope and structure of this schedule

This schedule focuses on the water environment and flood risk in West Lothian. This schedule and its evidence are set out in the following sections:

- Part 1 - The Water Environment in West Lothian
- Part 2 - West Lothian Strategic Flood Risk Assessment
- Part 3 - Flooding and Flood Risk in West Lothian
- Part 4 - Water supply, waste water, water supply capacity and Investment

Part 1 - The Water Environment in West Lothian

1.1 West Lothian's waterbodies provide many important benefits, or ecosystem services, to the area. They contribute to sustainable flood management, storing large amounts of water and reducing peak flows, supply fresh drinking water to communities, businesses and agriculture, support recreation and tourism by offering attractive places to play, visit and enjoy the area's natural and built heritage, and, are home to an array of habitats and wildlife including birds, fish, invertebrates and mammals.

1.2 West Lothian has a diversity of waterbodies, rivers, tributary burns, reservoirs, lochs, ponds, wetlands, the Union Canal and includes a small section of the Firth of Forth estuary. The main watercourses in West Lothian include:

- River Almond (Breich Water, Killandean Burn, Linhouse Water, Murieston Water, White Burn)
- River Avon (Brunton Burn, Cauld Burn, Logie Water, Mains Burn)
- The Water of Leith
- The Union Canal
- The Firth of Forth

1.3 Water bodies in West Lothian are:

River Avon (Source to Jawhills) River Avon (Logie Water Confluence to Estuary) River Avon (Jawhills to Logie Water Confluence) Union Canal (Falkirk Wheel to Greenbank) River Carron (Avon Burn to Bonny Water Confluences)	Upper Forth Estuary Water of Leith (Harperrig Reservoir to Poets Burn Confluence) Boghead Burn/Bog Burn/Couston Water Breich Water / Darmead Linn Brox Burn (by Wester Tartraven to Ryal Burn Confluence)	Harperrig Reservoir Linhouse Water / Camilty Water / Green Burn Linlithgow Sand and Gravel Lower Forth Estuary Middle Forth Estuary Pardovan Burn (Bridgend to Estuary)

Union Canal (Craigton to Murray Burn) Union Canal (Greenbank to Kirk Bridge) Union Canal (Kirk Bridge to Park Farm) Union Canal (Park Farm to Craigton)	Brox Burn (Ryal Burn Confluence to River Almond) Cobbinshaw Reservoir Drainage ditch upstream to Cobbinshaw Drumtassie Burn Foulshiels & Bickerton Burns. Foulshiels Burn & Bickerton Burns Foulshiels Burn to Breich Water	Pardovan Burn / Haugh Burn / Riccarton Burn / Source to d/s Bridgend) River Almond (Source to Foulshiels Burn Confluences) River Carron (Carron Valley Reservoir to Avon Burn Confluences) River Carron (Source to Carron Valley Reservoir)

Water Environment Evidence

1.4 The inclusion of evidence relating to the water environment is needed to deliver the policy intent and outcomes for Biodiversity and Nature Networks (Policy 4), Blue and Green Infrastructure (Policy 20) and Flooding and Water Management (Policy 22) of NPF4.

1.5 The council is currently mapping on GIS the available water environment data sets (as set out below) in order to:

- identify pressures (such as flood risk, water quality) which the Local Development Plan could help address through the identification of opportunities to reduce flood risk and to improve the water environment,
- assist in the development and delivery of West Lothian's Nature Network and policies to support biodiversity as covered in Schedule 2. Most of the main watercourses throughout West Lothian are protected Local Biodiversity therefore will form the backbone of West Lothian's Nature Network.
- assist in the auditing of existing Blue and Green infrastructure assets and networks in West Lothian as covered in Schedule 4, and,
- for use in the assessment of proposed development sites as part of the Site Appraisal Methodology as set out in Schedule 28.

Water Environment Data Sets

1.6 The available water environment data sets are as follows:

- The national **SEPA River Basin Management Plan for Scotland for 2021 to 2027** sets out a plan for Scotland's water environment. Cycle 4 of RBMP covering the period 2027 – 2033 is due to be published in 2027. RBMPs set out how SEPA, the Scottish Government and local authorities and public bodies can enhance the environmental quality of rivers, lochs, estuaries, coastal waters and groundwater, delivering greater benefits for the environment, and safeguarding them for future generations. Data on key pressures is available from SEPA's Water Environment Hub RBMP3 (sepa.org.uk) which includes data on current state of the water environment in West Lothian.

- The Water Classification Hub (sepa.org.uk) provides detail on the current classification of waterbodies including surface waters and ground waters. Water body data sheets are

available for areas of significant water bodies in West Lothian. In terms of surface water, most of West Lothian's rivers are rated poor or moderate in terms of their pre-heavily modified water body use and physical modification and overall ecological water quality. In terms of ground water, most of West Lothian's rivers are rated poor in terms of their chemical status.

- Other data sources are available from Environmental data | Scottish Environment Protection Agency (SEPA) which can help identify pressures in the water environment which management of the water environment, or the creation of West Lothian's nature networks and policies on blue green infrastructure could help address. These are:

  - SEPA's **natural flood management maps** and **reservoir inundation maps** provide a high level of locations overview of where the implementation of the specified nature-based techniques could be most effective.
  - **Recommended riparian (river bank) corridor layer** – shows minimum riparian corridor widths scaled to the width of the watercourse, which if left undeveloped increase climate resilience by giving rivers space to adapt to changes in flood frequency and magnitude and provide a wide range of benefits. The linear nature of riparian corridors providing opportunities to create wildlife corridors and connect habitats and are therefore an important element of nature networks.
  - **Geomorphic risk layer**: identifies sections along the river network at risk of channel adjustment. Avoidance of development in these areas would be beneficial for climate adaptation and are areas where the undeveloped riparian area could be included in a nature network.
  - **Scottish Wetland Inventory layer** – identifies known wetlands
  - **Obstacles to fish migration (included in WFD classification)** – identifies natural and artificial obstacles to migratory fish, therefore potential opportunities to remove artificial barriers and restore habitats
  - **Water Environment Fund Projects current, completed and future opportunities layer** – identifies existing or potential project locations and therefore opportunities for water environment improvement relevant for nature networks
  - **Water environment classification layers** – provides current baseline information and could be used to identify opportunities to address issues and enhance nature networks
  - **Natural Flood Management maps** – identifies areas to be protected for their role in reducing flood risk and for opportunity mapping for nature-based solutions.
  - **River recovery potential -** prioritise passive river restoration actions**.**

- The British Geological Society **hydrogeological maps of Scotland**. The suite comprises two layers: groundwater vulnerability and aquifer productivity (bedrock and superficial). They have been used to help characterise groundwater bodies as required by the Water Framework Directive and are useful in policy development to prioritise water supply and site investigations, to inform planning decisions and to improve awareness of groundwater in general.

1.7 **Sustainable Urban Drainage Systems (SUDS)** are a surface water management approach designed to manage rainfall near its source, mimicking natural drainage processes and providing flood alleviation and attenuation benefits. SUDS are designed to slow the flow of surface water before it enters rivers and streams, while also providing areas for temporary storage where water can infiltrate into the ground or evaporate. Mapping of sustainable urban drainage

systems (SUDS) in West Lothian is currently being updated and will be incorporated into the proposed plan.

Part 2 – West Lothian Strategic Flood Risk Assessment

2.1 A **draft Strategic Flood Risk Assessment (2024)** has been prepared as accompanying evidence to the Evidence Report. Its primary purpose is to provide a high-level overview of existing and future flood risk across all sources. This aligns with National Planning Framework 4 (NPF4) Policy 22 on Flood Risk and Water Management and Policy 10 on Coastal Development, focusing on flood risk avoidance and reducing the vulnerability of current and future developments in West Lothian.

2.2 The main purpose of the SFRA is to provide a high-level overview of the scope and nature of all sources of existing and future flood risk by delivering the intention of National Planning Framework 4 (NPF4) Policy 22 Flood Risk and Water Management and Policy 10 Coastal Development to strengthen resilience to flood risk by promoting avoidance as a first principle and reducing the vulnerability of existing and future development to flooding within the West Lothian area.

2.3 The SFRA will inform the preparation of the local development plan; ensuring that flood risk is considered in the formulation of the Council's spatial strategy; in the identification of development allocations; and in the review of land use policies, whilst contributing towards satisfying the statutory duties West Lothian Council has under the Flood Risk Management (Scotland) Act 2009.

2.4 The SFRA is a strategic-level assessment used to inform the broad direction of the Spatial Strategy. The key objectives of the SFRA include:

- Providing a robust, up-to-date evidence base to inform the preparation and implementation of the Local Development Plan (LDP), ensuring compliance with national and regional flood risk policies.
- Serving as a reference and policy document to guide and inform the public, private sector, and developers of their responsibilities and obligations under the latest national planning guidance, including the Flood Risk Management (Scotland) Act 2009, National Planning Framework 4 (NPF4), and SEPA guidelines.
- Delivering a comprehensive strategic assessment of flood risk across West Lothian from all potential sources, including:
    - Fluvial flooding (rivers and watercourses).
    - Coastal flooding, including the designation of functional floodplains, coastal erosion, and geomorphic change.
    - Pluvial flooding (surface water).
    - Sewer flooding, groundwater flooding, and residual risks from reservoirs.
    - Accounting for climate change impacts, including updated UK Climate Projections (UKCP18), to ensure long-term resilience.
- Identifying opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance, storage of floodwater through appropriate Sustainable Urban Drainage Systems (SUDS);
- Highlighting the need for site-specific flood risk assessments (FRA) for proposed developments in areas identified as at risk of flooding, to ensure development does not exacerbate flood risk.

- Promoting natural flood management (NFM) techniques and the integration of blue / green infrastructure to enhance flood resilience, biodiversity, and community amenity spaces; and
- Documenting existing and planned flood risk management schemes, strategies, and plans**,** including their status, objectives, and how they align with the broader Spatial Strategy and Flood Risk Management Plans (FRMPs).

2.5 Gaps in information have been identified through a gap analysis and are recorded and listed. The hazard maps mentioned in this SFRA are part of the SEPA Flood Map and include an allowance for climate change for the 0.5% annual probability flood. However, SEPA have advised that there is a disparity between the latest climate change modelling (UK Climate Projections) and the SEPA pluvial future flood risk maps with climate change allowance, which the SFRA and development plan will need to consider. The SFRA identifies additional evidence gaps to be taken into account.

2.6 West Lothian Council has prepared **Supplementary Guidance: Flooding and the Water Environment** to support LDP1. This Supplementary Guidance aims to assist developers in making better planning applications to aid infrastructure delivery and help stakeholders gain a better understanding of the Council's commitment to minimising the risk of flooding across West Lothian. This guidance is currently being updated to support the SFRA and the proposed plan.

Part 3 - Flooding in West Lothian

3.1 Flooding has occurred many times in West Lothian, and will continue to happen, in the area. Significant flood events since 1998 include:

- November 2023 - Storm Ciaran have caused a number of flooding issues in West Lothian including road closures and property damage.
- August 2020 - Pyothall Court / Nicol Road Broxburn - 28 houses affected by surface water flooding following intense rainfall.
- February 2020 - Storm Ciara brought heavy rainfall and high winds, leading to localised flooding across West Lothian, including Broxburn and Linlithgow.
- 2017 - Dixon Terrace, Whitburn: Flloding at the Community Centre following sustained rainfall.
- February 2017 – Barbauchlaw Burn, Blackridge: Flooding at the Community Centre following sustained rainfall.
- December 2013 – Heavy rainfall resulted in multiple road closures due to surface water flooding.
- 2014 – White Burn, Whitburn: Several properties flooded due to river overflow after a significant event.
- July 2013 – West Calder: Intense rainfaill causes flash flooding in parts of the town.
- 2012 – Broxburn: Significant flooding incidents occurred in both 2008 and 2012, affecting residential and commercial areas along the Brox Burn
- 2012 – Eldrick Avenue / Bridge Street / Greenburn Road Fauldhouse: Flooding caused damage to properties and infrastructure.
- May 2005 – East of Linlithgow:12 homes affected by heavy rainfall and surface water flooding.
- 2005 – Near Community Centre, West Calder: Localised flooding impacted community services.

- July 2002 – West Calder: Flash flooding impacted homes and roads following a summer storm.
- July 1998 – Douglas Avenue / The Maltings Linlithgow: Approximately100 homes flooded during an extreme rainfall event

3.2 Mapping of flood locations is underway and will be available for the proposed plan.

3.3 Data on the number of people at risk from flooding in West Lothian is available through the National River Flow Archive (NFRA) and is set out below.

Table 1 - Number of people at risk of flooding identified through the NFRA.

Area	Number of homes / businesses at risk	Number of homes / businesses at risk by 2080
Linlithgow	250	
Armadale	230	320
Bathgate	150	
Broxburn	220	
Blackridge	40	70
Livingston and Mid Calder	260	
Blackburn	120	150
Whitburn	470	570
Fauldhouse	80	110
West Calder	110	120

3.4 Based on pluvial (surface water) flood hazard data provided by SEPA, it is estimated that approximately 1500 properties in West Lothian may be at risk of flooding from the 1:200-year, three-hour duration storm event.

Flood Risk Management

3.5 For the purposes of managing flood risk, Scotland has been divided into 14 Local Plan Districts (LPDs). Each LPD has a partnership and a lead local authority (LLA). SEPA has produced a Flood Risk Management Strategy for each LPD and the lead local authority produces a **Local Flood Risk Management Plan (FRMP)** in liaison with responsible authorities. They are approved by the Scottish Government and published by SEPA as Scotland's strategic flood risk management authority. The **FRMP for the Forth Estuary Local Plan District** covers the vast majority of the LDP area.

3.6 **Local flood risk management plans (LFRMPs)** complement FRMPs, providing additional local detail on how bodies will fund, coordinate and deliver actions to reduce the effects of flooding. Falkirk Council as Lead Local Authority for the Forth Estuary Local Plan District has published the local **Forth Estuary Local Flood Risk Management Plan**. The local flood risk management plan (LFRMP) provides detail on how and when the actions will be delivered locally within the target area(s) of a Potentially Vulnerable Areas.

3.7 The FRMPs and LFRMPs are in their second cycle and cover the same six-year period: 2022-28. An interim report is required 3 years into each LFRMP cycle, this is due in 2025.

3.8 **Potentially Vulnerable Areas (PVAs)** are where significant flood risk exists now or is likely to occur in the future. Identifying PVAs helps SEPA, West Lothian Council and other partners plan to protect people, properties, businesses, communities, infrastructure and the environment from flooding. Based on the 2018 National Flood Risk Assessment (NFRA), Scottish Ministers designated a total of four PVAs covering land in the Wet Lothian LDP2 area. These are:

- PVA 2/10/12 Linlithgow
- PVA 2/10/13 Livingston, Broxburn and Bathgate
- PVA 2/10/14 Whitburn
- PVA 2/10/15 West Calder and Fauldhouse

3.9 Within these PVA's the target areas (known as Objective Target Areas or OTA's) are communities at risk of flooding, which should benefit from actions to reduce flood risk. Target areas include implementation information, proposed timescales, funding mechanisms and identify who is responsible for carrying out each action. The 4 PVA's for Cycle 2 include the following 10 target areas:

Armadale	Bathgate	Blackburn	Blackridge	Broxburn
Fauldhouse	Linlithgow	Livingston & Mid Calder	West Calder	Whitburn

3.10 The SEPA "FRM Strategies Datasheet" for each of the 10 Objective Target Areas in West have been mapped on QGIS including all their opportunity areas for West Lothian.

SEPA Flood Hazard Maps

3.11 The **SEPA Flood Hazard Maps** provide a national source of data on flood hazards and include information on the different likelihoods of river (fluvial), coastal and surface (pluvial) flooding. The SFRA maps consist of all current flood risk information.

3.12 Due to licencing agreements not all maps are viewable to the public and are therefore not provided within this document.

3.13 The SEPA Flood Hazard Maps now include the **Future Flood Maps** which provide information on how the areas at risk of river or coastal flooding in a 0.5% Annual Exceedance Probability event may flood due to climate change. The Future Flood Maps are based on the UK Climate Projections' high emission scenarios assuming limited or no global action to reduce greenhouse gas emissions by the 2080s. In addition, the Future Flood Maps are used to indicate, for planning purposes, "areas at risk of flooding", or "in a flood risk area" in terms of NPF4 Policy 22. SEPA's explanatory note provides a fuller technical explanation of the Future Flood Maps.

3.14 The latest version of the SEPA Flood Hazard Maps (v2.1) was issued to West Lothian Council in late 2023 and will be by the council in developing the local development plan, ensuring that flood risk is considered in the formulation of the Council's spatial strategy; in the identification of development allocations; and in the review of land use policies.

3.15 As identified in the SFRA, the maps do not identify the river extent of small watercourses with catchments less than 3 sq. km. The extents of river, coastal and surface flooding are indicative

and do not fully take account of structures, such as culverts, bridges and flood defences which can influence flooding. The maps do not take account of river and coastal flooding happening simultaneously.

3.16 The Future Flood Maps also underestimate future river and coastal flood risk in the LDP2 area, applying smaller allowances for climate change and sea level rises than those stated for the Forth Region in SEPA's Climate Change Allowances for Flood Risk Assessment in Land Use Planning (Version 4).

3.17 Pluvial flood hazard maps for surface water management are currently under preparation by SEPA and it is likely that these will be available for the proposed plan.

3.18 A site-specific flood risk assessment (FRA) will be required for candidate sites in locations known to be at risk of flooding to account for this gap.

West Lothian Council Flood Studies

3.19 The council has prepared the following flood studies.

Bathgate • Entec (2003) Bathgate Water Catchment Study (Volume 1&2) • Entec (2008) Boghead & Bogburn Flood Alleviation Scheme Review • Scottish Water (2019) Bathgate Integrated Catchment Study (ICS) • AECOM (Feb 2021) Bathgate Cemetery Flood Risk Review Report Dec 2020 FINAL • ARUP (2022) Bathgate Flood study (Bog Burn, Boghead Burn & Bathgate Water)
Blackridge • ARUP(2019) Flood Study
Broxburn • 2007 Brox Burn Flood Protection Scheme (FPSc) constructed by 2013. • outline design stage of the Liggat Syke FPSc (Flood storage basin and flood relief culvert) • BROXBURN – Scottish Executive (2007) List of Operations – 2007 Brox Burn FPSc • BROXBURN – Halcrow 2009 - Halcrow (2009) Broxburn Post Flood Review (20 Aug 2008) • BROXBURN - HALCROW 2011 - Halcrow (2011) Review of areas previously excluded from the 2007 FPSc • CH2MHill (2014) Liggat Syke NFM Assessment (Technical Memo) FINAL • CH2MHill (2016) Broxburn Hydraulic Report_v1.1 • Jacobs (2019) Broxburn Flood Mitigation_v2 Feasibility Document with CBA • WLC (2020) Broxburn Liggat Syke Flood Report, 27 August 2020 (Final) • Jacobs (2020 12) Broxburn Liggat Syke Review of 27 August 2020 flood incident_v1.0 • Jacobs (2022) Liggat Syke FPSc Hydro morphology Technical Note_v1.2
Linlithgow • 2001 Linlithgow Mains Burn FPSc constructed by 2003. • Sir Frederick Snow (1998) Mains Burn Linlithgow Flood Study Report • Sir Frederick Snow (1999) Mains Burn FPSc Feasibility Study (Part 1 & 2) • Sir Frederick Snow (2001) Mains Burn FPSc Draft Scheme Report • Scottish Executive (2002) List of Operations - 2001 Mains Burn FPSc

• Scottish Executive (2005) 2001 Mains Burn FPSC - Condition Assessment and Database of Flood and Coastal Defences • JBA (2005) Mains Burn FPSc Inspection Report • Halcrow (2009) Mains Burn Catchment study & integrity of watercourse infrastructure (FINAL.Rev1) • SAC (2012) Soil and Drainage Investigation Linlithgow Rugby FC • Cycle 2 (C2) action to deliver a small FPSc for the Bell's Burn in Linlithgow (PFR & bund). A consultant is due to be appointed shortly. • Jarret (2006) Bell's Burn Flood Study, Linlithgow • Kaya (2021) Linlithgow Bell's Burn Flood Study FINAL • River Avon flood study at Linlithgow Bridge • Mott (2019) River Avon Flood Study at Linlithgow Bridge • Mott (2020) River Avon Structural Investigation - Revetment Assessment • Scottish Water (2019) Linlithgow ICS
West Calder • Halcrow (2006) West Calder Catchment Study
Whitburn • Entec (2008) North Reeves Place, Whitburn – Flood Review • Mott Macdonald (2018) White Burn Flood Study.
Covering move than one urban area within WLC there is also: • Mott (2015) Strategic Surface Water Management Plan (SWMP) • Reservoirs – WLC (2013) Reservoirs Act 1975 – Biennial Report

Surface Water Management

3.20 West Lothian Council's Surface Water Management Plan (SWMP) was prepared in 2015. The plan covers the four areas identified by SEPA within the Forth Estuary Characterisation Report (SEPA, 2014):

- Bathgate;
- Broxburn;
- Linlithgow; and
- Livingston.

3.21 The SWMP outlines the preferred surface water management strategy for the council area. It includes considerations of flooding from sewers, drains, runoff from land, small watercourses, and ditches that occur as a result of heavy rainfall. The SWMP has been prepared via a partnership between West Lothian Council and Scottish Water to meet the requirements of the Flood Risk Management (Scotland) Act 2009. The SWMP includes an Action Plan for the implementation of sustainable actions derived via a six-phase approach as recommended within the published guidance on the preparation of SWMPs (SEPA, Scottish Water, Scottish Government, 2013).

3.22 The SWMP presents 10 surface water management objectives which are consistent with the objectives set for the management of surface water within the Forth Local Plan District. The objectives use the Avoid-Protect-Prepare philosophy used by SEPA when setting objectives for Local Plan Districts. These are:

Area description	Objective type	Source	Objective description
Bathgate	Avoid	Surface water	Avoid an overall increase in flood risk
Broxburn	Avoid	Surface water	Avoid an overall increase in flood risk
Linlithgow	Avoid	Surface water	Avoid an overall increase in flood risk
Livingston	Avoid	Surface water	Avoid an overall increase in flood risk
Bathgate	Protect	Surface water	Reduce residential and commercial surface water flood damages
Broxburn	Protect	Surface water	Reduce residential and commercial surface water flood damages
Linlithgow	Protect	Surface water	Reduce residential and commercial surface water flood damages
Livingston	Protect	Surface water	Reduce residential and commercial surface water flood damages
West Lothian	Prepare	Surface water	Reduce the disruption caused by surface water flooding by raising awareness of the risk of flooding
West Lothian	Avoid	Surface water	Improve the provision of maintenance to surface water management assets

West Lothian's coast

3.23 The **Scottish Marine Plan** covers the management of both Scottish inshore waters (out to 12 nautical miles) and offshore waters (12 to 200 nautical miles). The plan promotes an ecosystem approach, putting the marine environment at the heart of the planning process to promote ecosystem health, resilience to human induced change and the ability to support sustainable development and use.

3.24 Eleven Scottish Marine Regions have been created which cover sea areas extending out to 12 nautical miles. Regional marine plans will be developed by Marine Planning Partnerships, allowing more local ownership and decision making about specific issues within their area. West Lothian forms part of the **Firth of Forth Scottish Marine Region** for which an assessment was carried out in 2020.

3.25 In terms of sea level rise, the long-term average mean sea level change in the Forth and Tay SMR, as estimated from a historical climate model run (UKCP18), was 4 cm (likely range between 1 and 7 cm) higher in 2018 than the 1981-2000 average. For reference, the Scottish average is estimated to be 5 cm (likely range between 3 and 8 cm). By 2100, mean sea level in the Forth and Tay SMR is anticipated to be approximately 34 cm for a medium emissions scenario (UKCP18 RCP4.5; see also and Climate change Sea level assessment).

3.26 Dynamic Coast is a set of online maps identifying land potentially vulnerable to coastal erosion which take account of past erosion rates and future sea level rise as a result of climate change. The maps also help identify areas of the coast, where if erosion occurs, coastal flooding could get worse. The possible loss of land by 2100, due to coastal erosion, could be between 50m to 70m along the current coastal boundary of West Lothian, which runs from the east of Blackness to beyond Society, Hopetoun. By 2100, coastal erosion could result in the loss of between 50m to 70m of land along the current coastal boundary of West Lothian, from the east of Blackness to beyond Society, Hopetoun, with the area of influence extending further

3.27 West Lothian Council's Flood Risk (2023 SEPA mapping) indicates that there are 2-3 properties in the small hamlet of Society that are within the Future Coastal flood risk extent, and 3-4 houses that are near the Future Coastal flood risk extent. However Coastal accretion (net accumulation of sediment) has been identified at Society since the 1890's and there is no known flood risk to properties from coastal erosion within West Lothian's shoreline.

3.28 West Lothian Council has begun preparation of a Coastal Change Adaptation Plan.

3.29 There are currently no aquaculture developments within the Firth of Forth Scottish Marine Region, although other marine industries do take place such as seaweed harvesting, fishing, water abstraction, renewables and marine tourism.

Mine workings

3.30 There is potential flood (and pollution) risk arising from mine water discharges from historic mine workings across West Lothian. SEPA and the Coal Authority hold a list of such sites and the locations of major discharges can be viewed on the Coal Authority Interactive Map. Schedule x Safety included further evidence on coal mining in West Lothian.

Linlithgow & Linlithgow Loch Catchment - Area of Water Control

3.31 There are severe drainage constraints and a significant risk of surface water and fluvial flooding in parts of Linlithgow and Linlithgow Bridge. The risk from fluvial flooding includes out of bank flows from the Bell's Burn, Mill Burn, Mains Burn and River Avon. Studies have also brought forward evidence of risk from the localised overtopping of Linlithgow Loch linked to constraints on the discharge during and in the aftermath of heavy and prolonged rainfall. Two studies are available Linlithgow Loch Catchment Management Plan (2012) and the Linlithgow Loch Nutrient Loading Study (2023) covered further below under part 3 management of the water environment. West Lothian Council will shortly be developing a design for part of the of Bell's Burn Flood Protection Scheme.

The Union Canal

3.32 Exploratory discussions have previously taken place with Scottish Canals and Scottish Water about the potential for surface water from sites adjacent to and above the canal to be directed into the Union Canal. The principle of using the managed watercourse of the canal as a conduit for managing surface water was supported by Scottish Water, alleviating pressures on conventional infrastructure. Discharging surface water to a canal could potentially form part of any strategy where there are constraints. This has already been demonstrated in Glasgow where the canal was used to unlock a large area of developable land as part of the Metropolitan Glasgow Strategic Drainage Partnership scheme.

Reservoirs

3.33 The Reservoir (Scotland) Act 2011 modernised the regulatory regime for the construction, alteration and management of controlled reservoirs in Scotland capable of holding 10,000 or more cubic metres of water. The legislation requires SEPA to establish and maintain a register including information such as the name (if any), location and maximum water capacity of the controlled reservoir. The register also assigns a risk designation (of high, medium or low) to each controlled reservoir considering the impacts of an uncontrolled release of water on features below the reservoir. These features could include residential properties, businesses, communities, transport links, agriculture, cultural heritage and the environment. It must be stressed the designation is not an indication of flood risk.

3.34 On SEPA's website, you can view the register and associated maps showing the extent of land that would be flooded in the unlikely event of a controlled reservoir failing. The table below lists the eight controlled reservoirs that pose a risk, albeit an unlikely risk, of flooding land in the West Lothian LDP area. Seven are located in the area, and the remaining one is situated in North Lanarkshire.

Table x: List of controlled reservoirs.

Name of Reservoir	**Local Authority Area**
Bangour Reservoir	West Lothian
Beecraigs	West Lothian
Cobbinshaw Reservoir	West Lothian
Crosswood Reservoir	West Lothian
Forrestburn	North Lanarkshire
Harperrig Reservoir	West Lothian
Gowanbank Reservoir	West Lothian
Loch Cote	West Lothian

Source: SEPA

Flood Defences and Schemes

3.35 There are 2 schemes in the West Lothian LDP2 area:

- Linlithgow Flood Prevention Scheme 2001 - to mitigate the flooding of up to 100 properties in the Braehead and the Maltings areas of Linlithgow from the Mains Burn.
- Brox burn Flood Prevention Scheme 2007 - to mitigate the flooding of 90 residential and business properties in the Burnside Village, West Burnside, Blyth Road and Pyothall Court areas of Broxburn.

3.36 There are 2 additional formal flood protection schemes currently in progress for Broxburn & Linlithgow:

- Liggat Syke Flood Protection Scheme, Broxburn - to mitigate the flooding of 40 residential properties in the Pyothall Court and Nicol Road area of Broxburn.
- Bell's Burn Flood Protection Scheme, Linlithgow - mitigate the flooding of approx. 30 properties from the Bell's Burn.

3.37 Sections 18 and 59 of the Flood Risk Management (Scotland) Act 2009 require local authorities to inspect and assess relevant bodies of water within their area on a plan-led, risk-based basis to determine if their condition poses a flood risk to land, property, or assets. A relevant body of water includes rivers, streams, lochs, ponds, and artificial watercourses, excluding canals and sewers. Inspections focus on higher-risk watercourses, prioritising those with a history of flooding or significant potential to impact communities. If a flood risk is identified, and the authority determines that clearance and repair works could mitigate it, a schedule of necessary works must be prepared. These works may involve removing obstructions, addressing potential blockages, and repairing artificial structures along the watercourse. The local authority must also specify the timing of the next assessment and make the schedule publicly available. Additionally, if the flood risk extends beyond the local authority's boundaries, the neighbouring authority must be notified. Authorities are obligated to carry out scheduled works if they align with measures in a Local Flood Risk Management Plan and do not conflict with other flood risk strategies.

3.38 A total of 39 watercourses are routinely inspected - 13 quarterly, 13 annually and 13 biannually, the remaining watercourses are inspected on an ad hoc basis. In addition, the council's Flood Risk Management team carry out routine, planned inspections/maintenance on trash screens and culverts where required.

Part 4 - Water supply, water supply capacity and Investment

4.1 Scotland's public drinking water and sewerage services are for the most part provided by Scottish Water (SW), The infrastructure for the supply of clean water and disposal (and treatment of waste water in Scotland) is classed as essential infrastructure and is wholly owned by SW.

4.2 Scottish Water's Strategic Plan - A Sustainable Future Together and the accompanying Delivery Plan (2021/2022 to 2022/2023) does not set out specific investment proposals for West Lothian. The SW website sets out current investment priorities including for growth at Winchburgh Core Development Area.

4.3 SW has confirmed that it has no issues in supplying water throughout the planning period. However, detailed consultation with SW to investigate the location of any restrictions to potable water supply will be undertaken as allocations of development site are considered for inclusion in the Proposed Plan. SW has committed to work closely with the council to manage the Delivery Programme in conjunction with the HLA that provides it with revised growth projections. It will use this to inform its growth model that helps to shape its investment programme. SW is currently reviewing and assessing the effects of growth and climate change on water systems in West Lothian and will put plans in place to ensure that customers continue to receive the high quality of service they have come to expect now and in the future.

4.4 Scottish Water's Climate Change Adaption Plan 2024 provides an updated assessment including the latest climate change predictions and while this indicates that in a 'do nothing' scenario Edinburgh and Lothians Water Resource Zone is predicted to go in to deficit by 2050. However,

this is not an option for Scottish Water and it is confirmed that work is well underway to plan, prepare and invest to ensure it addresses this and continues to provide water now and in the future.

4.5 SW is also committed to invest in water and wastewater infrastructure to support those developments in the current LDP by providing off-site mitigation as part of their strategic modelling exercises.

Water scarcity

4.6 In 2020, SEPA published Scotland's first National Water Scarcity Plan setting out how water resources will be managed prior to and during periods of prolonged dry weather. This is to ensure the correct balance is struck between protecting the environment and providing resource for human and economic activity. Scottish Water has advised that it is planning for the effects of climate change on our water systems and that it will invest to protect services in the future. There are however no water scarcity issues with regards to West Lothian at this moment or throughout the planning period.

Waste Water

4.7 Waste water collection and treatment within West Lothian is undertaken and managed by Scottish Water (SW). West Lothian is served by three water treatment works (WTw) – Balmore (west of Kirkintilloch), Pateshill (south West Lothian) and Marchbank (south of Balerno). Wastewater treatment works at Whitburn, Blackburn, East Calder, Fauldhouse, Livingston, Newbridge and Whitburn are all operated directly by SW, as is the sewerage network, numerous combined sewer overflows, emergency overflows, network pumping stations. Veolia AVSE, has a 30-year performance-based contract for the operation of a number of other Wastewater Treatment Works in West Lothian.

4.8 A combined sewer system (CSO) is designed to collect and convey surface runoff and sewage in a shared system. This type of legacy sewer system serves West Lothian's more established communities. However, such systems are no longer constructed and SW standards specifically state all new development must have separate foul and surface water pipes and surface water must be discharged to a suitable receiving watercourse.

4.9 Under normal conditions, combined sewers convey urban wastewater to a wastewater treatment works before discharging to a watercourse. During periods of heavy rainfall or snowmelt, however, the volume of wastewater in a combined sewer system can exceed the capacity of the system or the capacity of the wastewater treatment works. It is therefore designed to overflow and discharge excess wastewater, untreated, to nearby watercourse or other bodies of water through CSOs. In terms of discharge of sewage from Combined Sewer Overflows (CSOs), this is monitored by SEPA.

River Almond

4.10 The River Almond suffers significant seasonal flow variation. Treated wastewater represents a further pressure on the river in so far as not all substances in urban wastewater can be broken

down successfully by wastewater treatment. A comprehensive review of wastewater assets in the River Almond catchment was completed in 2019 and this work identified that several wastewater treatment works required investment to meet water quality objective. SEPA's River Almond Catchment Profile is a comprehensive source of useful data. The quality of the Almond has improved steadily over the last forty-years but remains subject to significant and growing pressures, which negatively affect its ecology and the biodiversity of the river corridor.

4.11 Scottish Water is a part of the **Lighthouse project, a** multi-agency scheme which is looking at and understanding the needs of the River Almond/East Calder catchment and investigating possible solutions to the issues it faces. It is looking holistically at rain water drainage in the area and what types of changes would deliver improvements.

4.12 There are a combination of pressures on the river from urban developments, including run-off from Whitehill and Whiteside Industrial Estates in Bathgate, septic tank outfalls and pollutants associated with historic coal mining activities in the area. These projects are part of SW's wastewater investment programme for 2021-2027 and includes upgrading Livingston WwTW to increase removal of reactive phosphorus which is currently in the development phase. The scale of improvement required may not be sustainable but SW is working to identify the best solution and intends to complete the upgrade by the end of 2027.

4.13 The Improving Urban Waters project is also looking at several CSO's, prioritising them according to needs (both aesthetic and water quality). A number of these CSO's lie within the Almond Valley, including locations in Fauldhouse and Harthill.

The River Avon

4.14 The River Avon is the other principal watercourse. From its head waters near Greengairs, North Lanarkshire, the Avon runs to enter the Firth of Forth at Grangemouth, downstream of the Carron and the Grange Burn at Grangemouth Refinery. The catchment includes the settlements of Linlithgow, Bathgate, Armadale and Blackridge. SEPA's River Avon Catchment Profile refers.

Linlithgow Loch / Catchment

4.15 Linlithgow Loch is one of only two remaining natural lowland lochs in the Lothians. In 2012 the Linlithgow Loch Catchment Management Plan was published. It provided a summary of the water quality issues at Linlithgow Loch, identified the main causes of these problems and provided advice and suggested appropriate actions to improve water quality management into the future.

4.16 In 2021 HES commissioned a Linlithgow Loch Nutrient Loading Study, the overall objective of which was to identify the major sources of phosphorus and other nutrients entering Linlithgow Loch and to suggest management options for improving water quality. The study was originally prompted by a recommendation in the 2012 Linlithgow Loch Catchment Management Plan.

4.17 Site condition monitoring as far back as 2004 concluded that the loch was in an unfavourable condition due to high level of nutrient enrichment (phosphorus, chloride and nitrogen). There are frequent extended seasonal impacts to public health and use by the public of the loch due to extensive and long-lasting seasonal toxic algal blooms. Evidence suggests that the loch is

currently eutrophic (having an elevated amount of dissolved nutrient) and may soon be hyper-eutrophic.

4.18 Among its recommendations the study advises that the sources of nitrogen to Linlithgow Loch need to be more fully established and that nutrient management strategies should be implemented to reduce nitrogen loads to the loch. Potential sources were identified as the application of inorganic fertilisers as well as soil erosion and run-off. Further monitoring of the Bell's Burn upstream and downstream of the properties with septic tanks on Edinburgh Road was also recommended in order to confirm, or otherwise, whether discharges from the septic tanks are likely to be degrading water quality in this inflow.

4.19 The Loch remains in a long-term deteriorating condition due to pollution significantly associated with surrounding land use within what is a complex catchment. Coupled with the serious risk of flooding in Linlithgow, impaired water quality in the loch represents a potential barrier to development in the catchment. Linlithgow Loch also acts to regulate flood risk to the properties within Linlithgow.

Future Waste Water Treatment Investment

4.20 SW have provided the council with shapefiles of its wastewater and water catchments and which set out where it needs to invest if further growth comes forward. SW is funded to provide growth upgrades at Waste Water Treatment Works (WwTws) when required to accommodate domestic developments. Therefore, limited capacity at a works should not necessarily be seen as a barrier to development, and should not prevent a site from being allocated for development in LDP 2.

4.21 SW has conducted a number of strategic network impact assessments. These assessments help to understand the impact of planned development on the water and wastewater networks. The assessments are projected over a 25-year period but only provide solutions up to year 10. Two assessments are undertaken. If there are no impacts, then this stage concludes and no further assessment is required. If however, there are detrimental impacts, then a Stage 2 is carried out to understand what mitigation is required to support the development. Stage 2 identifies the solutions required to reinforce the network.

Strategic Studies

Drainage Operational Area		Drainage Operational Area	
Newbridge	Stage 2	**Linburn**	Stage 2
East Calder	Study complete	**Addiewell**	No study required
Livingston	Not started	**Newton**	No study required
Winchburgh	Study complete	**Philipstoun**	No study required
Bathgate	Study complete	**Threemiletown**	No study required
Blackburn	Study complete	**Torphichen**	No study required

Linlithgow	Study complete		
Armadale	Study complete		
Whitburn	Study complete		
Fauldhouse	Study complete		
Blackridge	Not started		
Bridgend	Stage 2		

Water Operational Area		Water Operational Area	
Balmore South	Not started	**Balmore East**	Study complete
Pateshill	Study complete	**Marchbank**	Study complete

4.22 In the Almond catchment SW has installed new technology and sensors to deliver against an improved monitoring commitment. SW also have several investment projects in its delivery programme for 2021-2027. Seven waste water treatment works require investment at Blackburn, Harthill, Whitburn, Fauldhouse, East Calder, Livingston and Winchburgh. There are also 3 CSO's in Fauldhouse (one at 29 Greenburn Road and 2 at the WWTw), 1 at Harthill (Howburn Road) and 1 in Blackburn (Blackburn Storm Tanks).

4.23 One of the most recent investments by SW in West Lothian, and one of their largest during 2021/2022 has been in a waste water treatment works (WwTw) upgrade in Winchburgh. The existing WwTw had come to the end of its life and the new works have been designed to provide increased capacity to support existing and proposed development in the growing town for the next decade and beyond. Construction commence in July 2021 and handover to Scottish Water is anticipated in June 2024 once commissioning works have been completed.

Summary of Stakeholder Engagement

This will summarise the steps taken by the planning authority to seek the views of all relevant stakeholders. This will also summarise the views expressed, and explain how they have been taken account of in the Evidence Report. (hyperlinks to records of engagement may be added where appropriate)

Statements of Agreement / Dispute

This will include statements from stakeholders highlighting their agreement or the areas they dispute

Summary of Implications for the Proposed Plan

This will cover what the evidence means for the plan, e.g. the spatial strategy, the Delivery Programme or plan preparation.

Strategic Flood Risk Appraisal (SFRA)

The Strategic Flood Risk Appraisal will provide a robust, up-to-date evidence base to inform the preparation and implementation of the Local Development Plan (LDP), ensuring compliance with national and regional flood risk policies.

The SFRA will inform the preparation of the local development plan; ensuring that flood risk is considered in the formulation of the Council's spatial strategy; in appraisal and identification of

development allocations (schedule 28: site appraisal methodology); in the review of land use policies, and inform the Strategic Environmental Assessment (SEA) whilst contributing towards satisfying the statutory duties West Lothian Council has under the Flood Risk Management (Scotland) Act 2009.

Based on the evidence the proposed plan will;

- Identify opportunities to improve the water environment through flood risk management, nature networks and blue green infrastructure.
- Identify actions to improve the water environment where rivers and ground water are rated poor or moderate in terms of their pre-heavily modified water body use and physical modification, overall ecological water quality, or chemical status.
- Ensure that the public, private sector, and developers are aware of their responsibilities and obligations under the latest national planning guidance, including the Flood Risk Management (Scotland) Act 2009, National Planning Framework 4 (NPF4), and SEPA guidelines.
- Identify opportunities to reduce flood risk to existing communities and developments through better management of surface water, provision for conveyance, storage of floodwater through appropriate Sustainable Urban Drainage Systems (SUDS).
- Promote natural flood management (NFM) techniques and the integration of blue / green infrastructure to enhance flood resilience, biodiversity, and community amenity spaces. Integrate blue and green networks and open space as part of core development areas, asset transfers and major regeneration initiatives.
- Highlight the need for site-specific flood risk assessments (FRA) for proposed developments in areas identified as at risk of flooding, to ensure development does not exacerbate flood risk.
- For areas where climate change is likely to result in increased flood exposure that becomes unmanageable, consideration should be given to alternative sustainable land use.
- Design, construct and manage new buildings, assets and infrastructure to be resilient to current climate impacts and able to adapt in future.
- Implement flood protection schemes in Broxburn & Linlithgow to provide enhanced protection to homes and may deliver additional benefits such as green network creation.
- Investigate the location of any restrictions to potable water supply will be undertaken as allocations of development site are considered for inclusion in the Proposed Plan.
- Implement wastewater assets in the River Almond to meet water quality objective.
- Implement management of Linlithgow Loch for water quality and flood management.
- Implement waste water treatment works at Blackburn, Harthill, Whitburn, Fauldhouse, East Calder, Livingston and Winchburgh. There are also 3 CSO’s in Fauldhouse (one at 29 Greenburn Road and 2 at the WWTw), 1 at Harthill (Howburn Road) and 1 in Blackburn (Blackburn Storm Tanks).