FLOOD RISK MANAGEMENT (SCOTLAND) ACT 2009

THE HIGHLAND COUNCIL

SMITHTON AND CULLODEN FLOOD PROTECTION SCHEME 2016

Revision History

Revision Ref / Date Issued	Amendments	Issued to
Final P1.0 / April 2016	For comment	Alan Fraser
Final P2.0 / April 2016	For comment	Alan Fraser
Final P3.0 / April 2016	Minor corrections	Alan Fraser
Final P4.0 / April 2016	Minor corrections	Alan Fraser

1. General

1.1 In exercise of the powers conferred upon them by the Flood Risk Management (Scotland) Act 2009 (hereinafter referred to as "the Act") The Highland Council, established under the Local Government etc. (Scotland) Act 1994 (hereinafter referred to as "the Council") have prepared the following flood protection scheme (hereinafter referred to as "the Scheme") the purpose of which is to manage the risk of flooding of residential, non-residential commercial and agricultural land in the towns of Smithton and Culloden from the Smithton Burn and the Culloden Burn (West).

1.2 The National Flood Risk Management Strategy published by the Scottish Environment Protection Agency in December 2015 and the draft Local Flood Risk Management Plan due to be published by the Council in June 2016 both identify the need for the Scheme as a recommended measure to alleviate flooding in the Smithton and Culloden Potentially Vulnerable Area (PVA) in the first Flood Risk Management Cycle from 2016 – 2022, and the implementation of the Scheme will address that need.

2. Terms of the Scheme

2.1 The terms of the Scheme are as detailed in Sections 3 to 5 hereunder.

3. Description of the Operations

3.1 The flood protection operations (hereinafter referred to as "the Operations") are as detailed in Section 3 hereunder.

3.2 The Operations to be carried out in terms of the Scheme are as shown on the plans marked, annexed and executed as relative hereto, and are as follows:

Drawing Number	Title	Revision
SC-JBA-00-00-DR-C-0100	Flood Protection Scheme Drawings, Location Plan For All Zones	P 4.0
Zone 2 Murray Terrace		
SC-JBA-02-04-DR-C-0100	Flood Protection Scheme Drawings, Zone 2 Murray Terrace Plan. Sheet 1 of 3	P 4.0
SC-JBA-02-04-DR-C-0101	Flood Protection Scheme Drawings, Zone 2 Murray Terrace Plan. Sheet 2 of 3	P 4.0
SC-JBA-02-04-DR-C-0102	Flood Protection Scheme Drawings, Zone 2 Murray Terrace Plan. Sheet 3 of 3	P 4.0
SC-JBA-02-04-DR-C-0103	Flood Protection Scheme Drawings, Zone 2 Murray Terrace Sections. Sheet 1 of 2	P 4.0
SC-JBA-02-04-DR-C-0104	Flood Protection Scheme Drawings, Zone 2 Murray Terrace Sections. Sheet 2 of 2	P 4.0
Zone 2 Smithton Park		
SC-JBA-02-06-DR-C-0100	Flood Protection Scheme Drawings, Zone 2 Smithton Park Plan. Sheet 1 of 1	P 4.0
SC-JBA-02-06-DR-C-0101	Flood Protection Scheme Drawings, Zone 2 Smithton Park Sections. Sheet 1 of 4	P 4.0

SC-JBA-02-06-DR-C-0102	Flood Protection Scheme Drawings, Zone 2 Smithton Park Sections. Sheet 2 of 4	P 4.0
SC-JBA-02-06-DR-C-0103	Flood Protection Scheme Drawings, Zone 2 Smithton Park Sections. Sheet 3 of 4	P 4.0
SC-JBA-02-06-DR-C-0104	Flood Protection Scheme Drawings, Zone 2 Smithton Park Sections. Sheet 4 of 4	P 4.0
Zone 3 Redburn Avenue		
SC-JBA-03-02-DR-C-0100	Flood Protection Scheme Drawings, Zone 3 Redburn Avenue Plan. Sheet 1 of 1	P 4.0
SC-JBA-03-02-DR-C-0101	Flood Protection Scheme Drawings, Zone 3 Redburn Avenue Sections. Sheet 1 of 2	P 4.0
SC-JBA-03-02-DR-C-0102	Flood Protection Scheme Drawings, Zone 3 Redburn Avenue Sections. Sheet 2 of 2	P 4.0
Zone 3 Culloden Park		
SC-JBA-03-07-DR-C-0100	Flood Protection Scheme Drawings, Zone 3 Culloden Park Plan. Sheet 1 of 2	P 4.0
SC-JBA-03-07-DR-C-0101	Flood Protection Scheme Drawings, Zone 3 Culloden Park Sections. Sheet 2 of 2	P 4.0
SC-JBA-03-07-DR-C-0102	Flood Protection Scheme Drawings, Zone 3 Culloden Park Sections. Sheet 1of 3	P 4.0
SC-JBA-03-07-DR-C-0103	Flood Protection Scheme Drawings, Zone 3 Culloden Park Sections. Sheet 2 of 3	P 4.0
SC-JBA-03-07-DR-C-0103	Flood Protection Scheme Drawings, Zone 3 Culloden Park Sections. Sheet 3 of 3	P 4.0

3.3 Smithton Burn – Zone 02-04; Murray Terrace (MT)

3.3.1 The following Operations will work together to convey flows from downstream of the railway bridge and towards Murray Road via a new open channel. The channel will commence with about 12m of rectangular concrete open channel which will then discharge to a new open natural channel. The new open natural channel will be 144m in length, or thereby, and convey flows through the reach towards Murray Road. The channel passes through steep terrain and will require a cascade arrangement and bed reinforcement.

3.3.2 The new natural channel will replace an existing culvert pipe which has a history of blockage and is a flood risk to nearby housing from overland flow. Maintaining flows in channel in this reach will assist the proper functioning of the Smithton park flood storage area further downstream by reducing the risk of bypass by overland flows. The works have the potential to provide amenity value to the community by having an open watercourse and by reducing an existing soil bund.

3.3.3 **MT-01.** Construction of 12m, or thereby, of reinforced open concrete channel, 2m wide and 1.5m high or thereby, to form a transition structure between the existing railway bridge / embankment and the new open channel watercourse. The structure will retain the existing railway embankment and protect the bridge from scour. An existing concrete wall enclosing a foul sewer extends through the railway bridge eye and continues approximately 6m downstream. This wall, which is shown in Section 1-1 on drawing SC-JBA-02-04-DR-C-0103, will be incorporated into the new structure. The location of the new structure shown in plan may vary by ±0.5m in any direction. Structure invert and top of wall levels may vary from the level shown in section by ±0.25m. The channel will have a layer of river gravel to the invert.

3.3.4 **MT-02.** Construction of 144m, or thereby, of restored open watercourse to protect Murray Terrace and other areas from a design flood event. The channel will replace the existing concrete culvert, which will be removed or made

inoperable. The new channel will ensure design flows are conveyed towards the Smithton Park flood storage area through a reach with a steep gradient. The channel will include a cascade of steps in the steeper lengths and erosion protection to resist scouring in high flows. Along with reducing flood risk the open channel will remove portion of an existing soil bund and improve the potential for amenity and public access in the area. Section 3-3 on drawing SC-JBA-02-04-DR-C-0104 presents a typical view of the channel. The position of the channel on plan may vary by ±5m in any direction and the invert of the channel may vary from the level shown in section by ±1m.

3.4 Smithton Burn – Zone 02-06; Smithton Park (SP)

3.4.1 The following Operations will work together to convey flows under Murray Road into Smithton Park (SP-04 and SP-05) then through the park in a new open natural channel and out of the park through a flow control structure (SP-03) then into a new larger capacity culvert (SP-06) which will finally discharge into the existing open channel. The new natural channel in the park will replace a 100m, or thereby, portion of the existing culvert which will be removed. During flood events the flow control structure will limit outflows to the downstream channel and water will collect in a newly constructed flood storage basin (SP-01). The flood storage basin will have a capacity of not less than 12,000 m^3. In the event this capacity is exceeded a spillway is provided to allow the flood storage basin to safely overflow into the downstream channel (SP-02). When inflows return to normal the stored water will be gradually released to the downstream channel allowing the basin to revert to normal amenity use.

3.4.2 **SP-01.** Works will be undertaken to construct raised embankments on the northwest side and northeast sides of the park to enclose an online flood storage basin with a capacity of not less than 15,000 m^3 as measured to the spillway crest. The remainder of the basin will be formed by excavation in the existing park surface. The earth embankments will be keyed into existing ground and be provided with a suitable cut-off. The flood storage basin will be accessed for maintenance purposes by a permanent access track on the crests

of the raised embankments with access to Murray Road and to Smithton Park and a track leading to the screen inlet at basin floor level. The location of the embankment and extents of the toe from the position shown in plan may vary by ±5m in any direction. The crest of the flood embankment is typically 46.0m AOD and that of the spillway is 45.3m AOD but may vary from the level shown in section by ±0.25m. See Sections on SC-JBA-02-06-DR-C-0104 for details of embankments. The basin floor level is typically 43.9m AOD but may vary from the level shown in section by ±0.25m. The basin provides potential for two 7-a-side football pitches with suitable drainage to be constructed.

3.4.3 Approximately 110m of the existing culvert pipe through Smithton Park will be removed and replaced with a new open channel which will follow a new alignment to the eastern side of the flood storage basin. The new channel will have a gradient of 1:100, or thereby, and have a relatively wide and shallow cross section. The combination of the wide cross section and the shallow gradient will promote a shallow water depth with low velocities during normal flows. The location of the channel from the position shown in plan may vary by ±5m in any direction and the level of the invert may vary by ±0.5m from that shown on the section.

3.4.4 **SP-02.** An emergency spillway will be constructed along 65m, or thereby, of the northeast embankment crest. The location of the structure from the position shown in plan may vary by ±5m in any direction. The crest of the structure may vary from the level shown in section by ±0.25m. Flows will discharge to a stilling swale running along the toe of the embankment. See Section 6-6 on SC-JBA-02-06-DR-C-0104 for details of the spillway.

3.4.5 **SP-03.** A new outflow control structure will be constructed to convey outflows from the storage basin. The structure will permit a regulated flow through the embankment culvert pipe to the manhole OM 1. The outflow structure will consist of a flow control hydrobrake, an outfall culvert pipe, an overflow arrangement and a trash screen on the upstream side. The location of the

structure from the position shown in plan may vary by ±5m in any direction. The crest of the structure may vary from the level shown in section by ±0.25m. See Section 3-3 on SC-JBA-02-06-DR-C-0102 for details of the outflow structure.

3.4.6 **SP-04.** A new culvert will be constructed to convey flows from south to north under Murray Road and into the flood storage basin. The structure will consist of an upstream concrete inlet with a headwall, a culvert pipe of 40m in length or thereby and section area of 2.1m wide and 1.5m high or thereby with its downstream end discharging into the Smithton Park basin via a cascade or step pool structure. The location and invert levels of the culvert may vary as with variations in the connected structures. See Section 1-1 on SC-JBA-02-06-DR-C-0101 for details of the culvert structure.

3.4.7 **SP-05.** The new Murray Road culvert (SP-04) will deliver flows into the park about 4.5m higher level than the open channel invert. A suitable ramped cascade structure will convey flows from the downstream end of the new Murray Road culvert, through a stilling pond and into the open channel in the flood storage basin. The cascade will have a plan length of 25m or thereby and the stilling pond 10m or thereby. Both will use a combination of concrete weirs and rock to prevent excessive velocity in the flow and erosion to the embankment. The location of the structure from the position shown in plan may vary by ±5m in any direction. The crest levels within the structure may vary from the levels shown in section by ±0.25m. See Section 2-2 on SC-JBA-02-06-DR-C-0102 for details of the cascade structure.

3.4.8 **SP-06.** Flows will be conveyed from the manhole OM 1 via a covered channel of 55m in length, or thereby, with removable covers over some or all of its length to facilitate maintenance. The channel will be rectangular of about 2.8m wide and 1m in depth and is likely to be constructed of concrete. The covered channel will discharge through a stilling basin into the existing open channel at a point within the property of Number 27, Murray Place. This channel will replace the existing 0.9m diameter culvert pipe which is prone to blockage. The

location of the structure from the position shown in plan may vary by ±5m in any direction. The invert level of the structure may vary from the level shown in section by ±0.25m. See Section 4-4 on SC-JBA-02-06-DR-C-0103 for details of the structure.

3.5 Culloden Burn (West) – Zone 03-02; Redburn Avenue (RB)

3.5.1 There is currently a blockage risk from a culvert pipe underneath the garden of properties 18 and 20 of Redburn Avenue which has led to flooding at Redburn Avenue and Loch Lann Court and overland flows towards Culloden.

3.5.2 The works described in the operation below are to replace the pipe and will reduce this risk and the risk of overland flows bypassing the flood storage area in Culloden Park.

3.5.3 **RB-01.** Removal of the existing 1.05m diameter culvert pipe and its replacement on line with a larger capacity box culvert pipe, of 26m in length, 2.5m in width and 1.5m in height or thereby.

3.5.4 Construction of new headwalls to the new culvert pipe with reinforced concrete side walls and stepped aprons to improve inlet and outlet geometry and also to form a suitable tie-in to the existing erosion protection at the upstream and downstream channel ends; see Section 1-1 on drawing SC-JBA-03-02-DR-C-0101. The sidewalls and aprons will be about 5m in length or thereby. The location of the structure from the position shown in plan may vary by ±2m in any direction. The crest of the structure may vary from the level shown in section by ±0.3m.

3.6 Culloden Burn (West) – Zone 03-07; Culloden Park (CP)

3.6.1 The following Operations will work together by initially conveying flows into Culloden Park thus preventing flow onto Keppoch Road (CP-01 and CP-07),

then conveying flow through the park in a new open natural channel with potential for amenity and wetland. Flows will leave the park through a flow control structure (CP-04) and into the existing open channel via a short length of new open channel (CP-06). During flood events the flow control structure (CP-04) will limit outflows to downstream and water will collect in the flood storage basin (CP-03). When inflows return to normal the stored water will be gradually released to the downstream channel allowing the basin to revert to normal amenity use. During design exceedance events a spillway is provided to allow the basin to safely overflow (CP-05). The overflow will be collected in a stilling swale and directed towards the downstream channel. Maintenance works to the structures will be facilitated by provision of an access track and bridge (CP-02) on the embankment crests and a track leading to the screen inlet at basin floor level.

3.6.2 The works will protect the houses in the vicinity from flooding and provide potential for amenity in the storage basin. Additional works will improve the surface quality and drainage of two football pitches. The existing playground, buildings and car parking on the bottom tier will be retained.

3.6.3 **CP-01.** A new wall about 60m in length, or thereby, will be constructed parallel to Keppoch Road to impound Culloden Burn West flood flows reducing the risk of flooding on Keppoch Road. The location of this portion of the structure from the position shown in plan may vary by ±5m in any direction. The crest of the structure may vary from the level shown in section by ±0.4m. The arrangement is shown on Section 1-1 of SC-JBA-03-07-DR-C-0102. The remaining 25m of flood wall diverts flows into the park area and forms part of the spillway, CP-05.

3.6.4 **CP-02.** Construction of a new pedestrian and vehicular bridge of 14m span, or thereby, and at least 3.5m width to cross the diverted watercourse to allow access for maintenance vehicles to and from the outlet structure. The location of the structure may vary by ±5m in any direction from the position shown in plan. The crest of the structure may vary from the level shown in section by

±0.25m. The arrangement is shown in Section 2-2 of SC-JBA-03-07-DR-C-0102.

3.6.5 **CP-03.** Works will be undertaken to construct an online flood storage basin with realigned channel on the bottom tier and extending in to the middle tier with a capacity of not less than 17,000 m^3. The flood storage basin will be located principally on the existing bottom tier in the park and extending into the middle tier. The basin will be formed by excavating about 1m into the existing park surface and constructing embankments to the north-west and north-east sides of the park. The basin will consist of earth embankments keyed into existing ground and with a suitable cut-off to prevent seepage. A permanent access track on the crests of the raised embankments and a track leading to the screen inlet at basin floor level will be provided for maintenance access. Embankment crest level will be typically at 25.52m AOD, the spillway crest level will be 25.02m AOD but may vary from the level shown in section by ±0.4m. The location of the embankment and extents of the toe from the position shown in plan may vary by ±5m in any direction. The basin floor will typically be at 23.5m AOD. A new channel will be constructed through the basin area to convey flows towards the outlet structure CP-04. The general arrangement is shown on the plan SC-JBA-03-07-DR-C-0101.

3.6.6 **CP-04.** A new outflow control structure will be constructed to convey outflows from the storage basin. The structure will regulate flows back into a new outlet channel (CP-06) and then onwards into the existing channel at a point south of the Keppoch Road culvert. The control structure will include flow control hydrobrakes, an outfall culvert pipe, an overflow arrangement and a trash screen on the upstream side and a security screen on the downstream end of the outfall pipe through the embankment. The location of the structure may vary by ±5m in any direction from the position shown in plan. The crest levels of the structure may vary from the levels shown in section by ±0.25m. The arrangement is shown in Section 3-3 of SC-JBA-03-07-DR-C-0103

3.6.7 **CP-05.** A spillway will be constructed to include the 25m downstream portion of the floodwall and 55m, or thereby, of adjacent embankment as shown on the plan SC-JBA-03-07-DR-C-0101 and Section 7-7 of SC-JBA-03-07-DR-C-0104. The location of the structure may vary by ±5m in any direction from the position shown in plan. The crest of the structure may vary from the level shown in section by ±0.25m. The existing abandoned channel will be reinstated as a shallow swale with erosion protection as required to convey spillway flows towards the existing channel.

3.6.8 **CP-06.** Construction of a new outfall channel, 28m in length or thereby, with tie-in to the existing channel to the downstream of the storage area. The location of the channel may vary by ±5m in any direction from the position shown in plan. The channel invert may vary from the level shown in section by ±0.4m. A typical Section 4-4 is shown on SC-JBA-03-07-DR-C-0103.

3.6.9 **CP-07.** A new wall about 80m in length, or thereby, will be constructed parallel to Keppoch Road to prevent the existing Culloden Burn West flood flows from escaping onto Keppoch Road. The arrangement is shown on Sections 9-9 to 11-11 of SC-JBA-03-07-DR-C-0104. The location of the structure from the position shown in plan may vary by ±1m in any direction for the portion alongside Keppoch Road. The crest of the structure may vary from the level shown in section by ±0.25m. The existing pedestrian bridge deck will be raised by 0.25m or thereby and / or lengthened by 2m or thereby. Existing footpaths will be realigned as required to tie-in to the new structure.

4. Land

4.1 The land which will be affected by the Operations and the land upon which entry is required for the purpose of carrying out the Operations and of executing temporary works is as shown on the said plans and marked respectively: SC-JBA-00-00-DR-C-0100.

5. Cost

5.1 The current estimated cost of the said Operations is eleven million, four hundred thousand pounds sterling (£11.4M November 2015).

Made by The Highland Council on the day of 2016

……Proper Officer of the Council