Compensatory Earthworks Planning Scheme Policy

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1 Introduction

This Planning Scheme Policy explains Brisbane City Council's requirements when reshaping of land is proposed within a Waterway Corridor. Earthworks within the Waterway Corridor will only be considered when they do not conflict with the **Waterways Code** or the **Filling and Excavation Code**.

2 Objectives

The objective of this policy is to ensure that earthworks reduce neither the flood–storage capacity nor flood–carrying capacity of the area within a Waterway Corridor.

3 Balanced vs Compensatory Earthworks

For earthworks to be acceptable within a Waterway Corridor they must not adversely impact the hydraulic characteristics of the watercourse. Adverse impacts may be direct, indirect or cumulative and include:

- reducing the flood–carrying capacity of a watercourse; and/or
- reducing flood storage; and/or
- altering the hydraulic control of the stream and thus causing scour and sedimentation.

It is too simplistic to assume that earthworks will have a negligible impact on the hydraulics of a waterway if the works are *balanced*. That is the total volume of 'fill' (material added within a Waterway Corridor) equals or is less than the total volume of 'cut' (material excavated from within a Waterway Corridor). Hydraulic processes are complex, a simple 'total fill ≤ total cut' equation will not guarantee that the flood–storage capacity and flood–carrying capacity of a Waterway Corridor are maintained. These requirements ensure that that the hydraulic characteristics of the waterway are maintained.

To preserve the hydraulic characteristics within a Waterway Corridor, the volume of 'cut' and 'fill' must be *compensatory* between incremental flood levels. In Example 2, the volume of 'fill' is equal to or less than the volume of 'cut' between each incremental level. If more 'fill' than 'cut' were added between levels (see Example 1, 5.2 – 5.4m AHD) then the flood–storage capacity and flood–carrying capacity within a Waterway Corridor would be reduced for certain flood events with adverse consequences to flooding.

Example 1: Balanced Earthworks

Level (m AHD)	Cut (m^3)	Fill (m^3)
5 – 5.2	600	200
5.2 – 5.4	300	500
5.4 – 5.6	400	600
Total	*1,300*	*1,300*

Example 2: Compensatory Earthworks

Level (m AHD)	Cut (m^3)	Fill (m^3)
5 – 5.2	600	≤600
5.2 – 5.4	300	≤300
5.4 – 5.6	400	≤400
Total	*1,300*	*1,300*

Balanced earthworks can reduce the hydraulic capacity of a watercourse for large floods. The increase arising from a single development may be small; however, once allowed on one property, history has shown that neighbouring properties seek the same relaxation on the basis of the precedent set. The cumulative effect leads to unacceptable rises in flood levels. For this reason applications to develop within a floodplain must be based on compensatory earthworks rather than balanced earthworks.

4 Prelodgement Guidance

Compensatory earthworks are not to be carried out below the 1 in 20 year Average Recurrence Interval (ARI) flood inundation level based upon ultimate catchment development. Excavation below this limit is known to lead to erosion problems on the floodplain and watercourse banks that can be difficult to repair or stabilise. This has occurred on previous developments.

Compensatory earthworks will not be approved in areas close to the watercourse within the waterway that is subject to high velocity water currents. This is because altering the geometry of the watercourse in these areas is likely to raise upstream flood levels. Scour problems can also occur to the newly exposed surfaces (whether they be cut or fill surfaces). Scour problems can also occur to undisturbed areas nearby caused by swirling eddies as a result of the ground surface changes.

Areas subject to backwater flooding are more amenable to have compensatory earthworks approved as impacts are likely to have less impact on storage and conveyance.

If the proposed compensatory earthworks involve excavation outside the Waterway Corridor, then the Waterway Corridor mapping will be amended in order to encompass the excavated area. This requirement protects the excavated area from being refilled at a later date and thus worsening flooding.

5 Application Requirements

Investigation to justify compensatory earthworks involves:

- **detailed survey** of the area to be affected by the earthwork operations so that existing land features are reflected in the data
- calculation of **earthwork volumes** in accordance with the methods outlined below
- **hydraulic modelling** to determine pre– and post–development flood levels for a range of floods up to and including the defined flood to test the development proposal on its own and in combination with other development.

5.1 Item (a) Detailed Survey

Detailed survey of the area to be affected by the earthwork operations is required so that earthwork volumes (Item b) can be calculated with confidence.

5.2 Item (b) Compensatory Earthwork Volumes

Applicants must provide a table of earthwork volumes to demonstrate that the hydraulic characteristics within a Waterway Corridor are not adversely affected by the proposed development. The method to determine whether 'cut and fill' volumes are compensatory between specific flood levels is described below and illustrated in *Table 1* and *Figure a*.

1. Determine the lowest limit of the proposed earthworks (either 'cut' or 'fill' level) remembering that compensatory earthworks are not to be carried out below the anticipated 1 in 20–year ARI flood level.
2. Acquire from Council the pre–development flood levels for the 1 in 100–year ARI design event based upon ultimate catchment development. If unavailable, the developer needs to determine this.
3. Determine the increment *y*, where *y* is either 200mm or approximately one quarter of the difference between the anticipated 1 in 100 year ARI flood level and the Low Earthwork Limit, whichever is smaller.
4. The first increment between which to calculate cut and fill volumes is the Low Earthwork Limit plus *y* (refer to *Table 1*).
5. Determine cut and fill volumes for each increment up to a level equal to the anticipated 1 in 100 year ARI flood level, based on ultimate catchment development.
6. In order to be compensatory, fill volumes must be equal to or less than the cut volumes at the corresponding increments.

Table 1 Calculating Compensatory Cut and Fill Volumes

Incremental Level (m AHD)	Proposed	
	Cut (m^3)	Fill (m^3)
Start at Low Earthwork Limit – always > the 1 in 20 year ARI flood level		
Lowest Earthworks to EL 1 *(EL 1 = Lowest Earthworks Limit + y)*	a	A (≤a)
EL 1 to EL 2 *(EL 2 = EL 1 + y)*	b	B (≤b)
EL 2 to EL 3 *(EL 3 = EL 2 + y)*	c	C (≤c)
Continue with increments as appropriate upto the 1 in 100 year ARI flood level		
EL… to 1 in 100 year ARI level	z	Z (≤z)

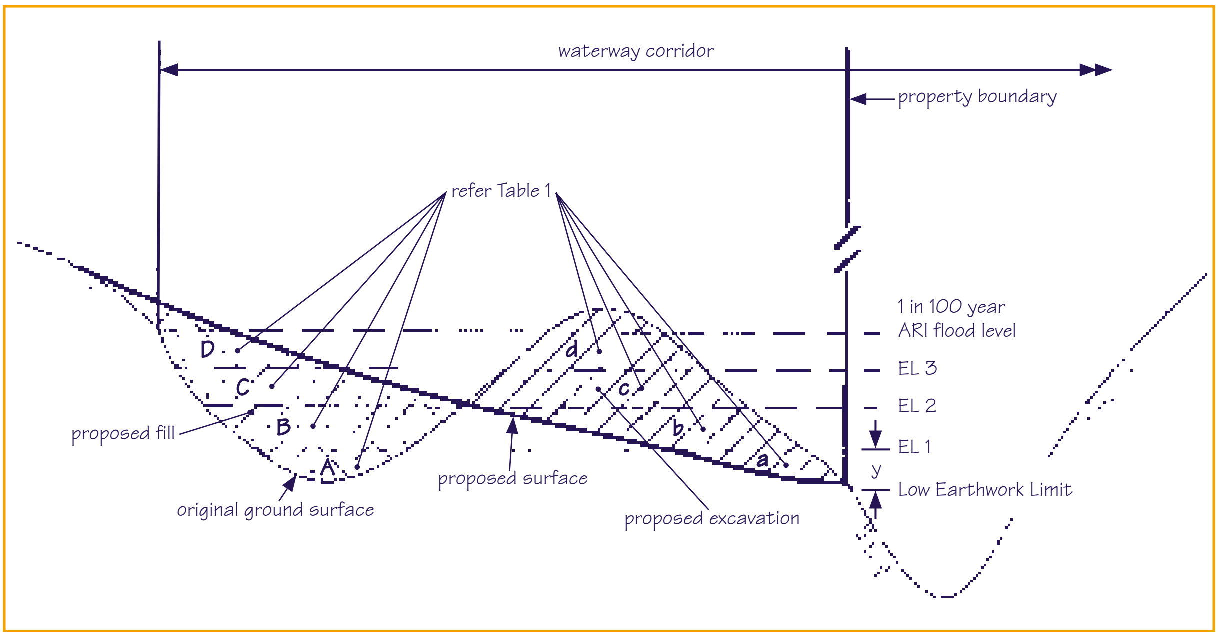

Figure a Calculating Compensatory Cut and Fill Volumes – Cross Section

Typical Compensatory Earthworks

Typical layouts for compensatory earthworks are shown in *Figure b* and *Figure c*.

Figure b shows excavation of a 'high area' within a Waterway Corridor. (For cross–section of 'high area' refer to *Figure a*). No adjustment of a Waterway Corridor is required because all 'cut and fill' occurs within the Waterway Corridor.

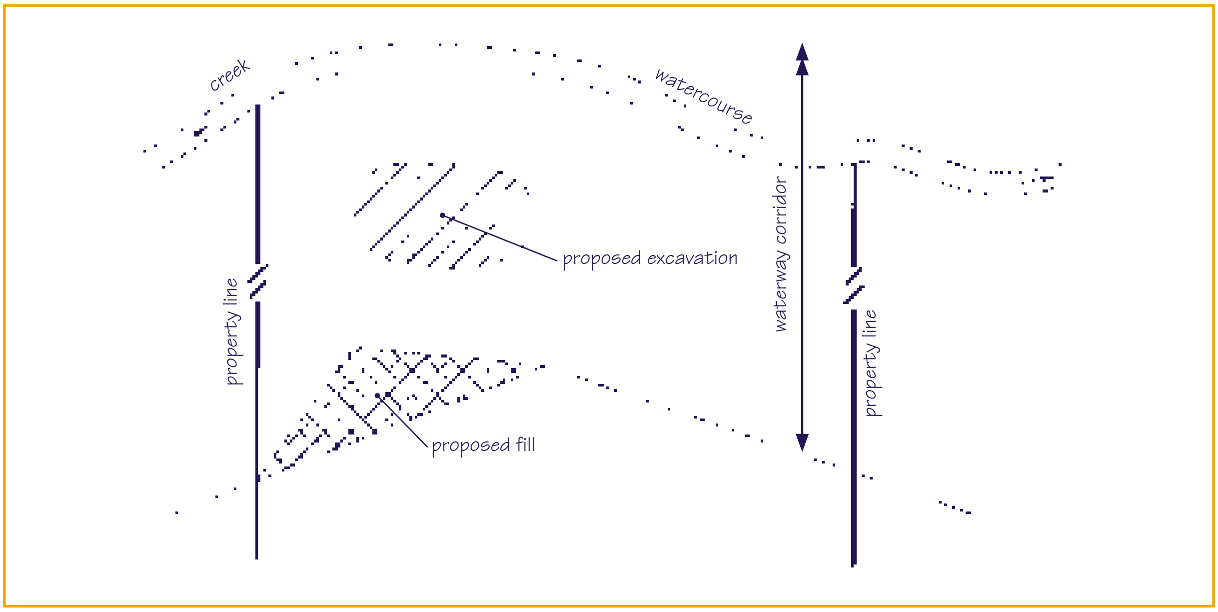

Figure b Compensatory Earthworks layout, no change to Waterway Corridor required – Plan View

In contrast, *Figure c* shows where excavation outside the existing Waterway Corridor is required to meet the compensatory earthworks standard. In this latter case, the Waterway Corridor must be extended to encompass the excavation. This requirement helps to protect the excavated area from being refilled at a later date and thus worsening flooding.

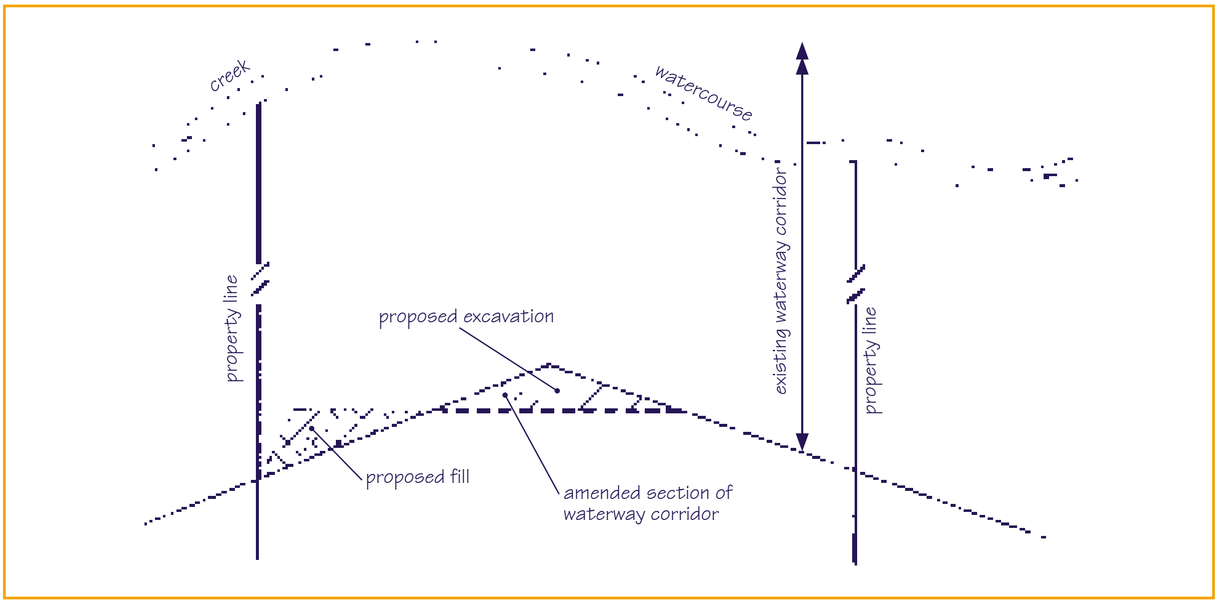

Figure c Compensatory Earthworks layout, change to Waterway Corridor required – Plan View

Compensatory Earthworks Planning Scheme Policy
Appendix 2: Planning Scheme Policies

Typical Example of 'Balanced Earthworks' that is Unacceptable

Figure d shows a 'cut and fill' operation within a Waterway Corridor that would be unacceptable. Even though the total volume of 'cut' equals the total volume of 'fill', these earthworks are unacceptable because at some *incremental levels* the volume of 'fill' exceeds the volume of 'cut'. The earthworks therefore will change the storage characteristics of the watercourse, increasing flood levels downstream for some flood events. The increase arising from a single development may be small; however, once allowed on one property, it is a natural and equitable process for the neighbouring properties to seek the same relaxation on the basis of the precedent set. The cumulative effect leads to unacceptable rises in flood levels.

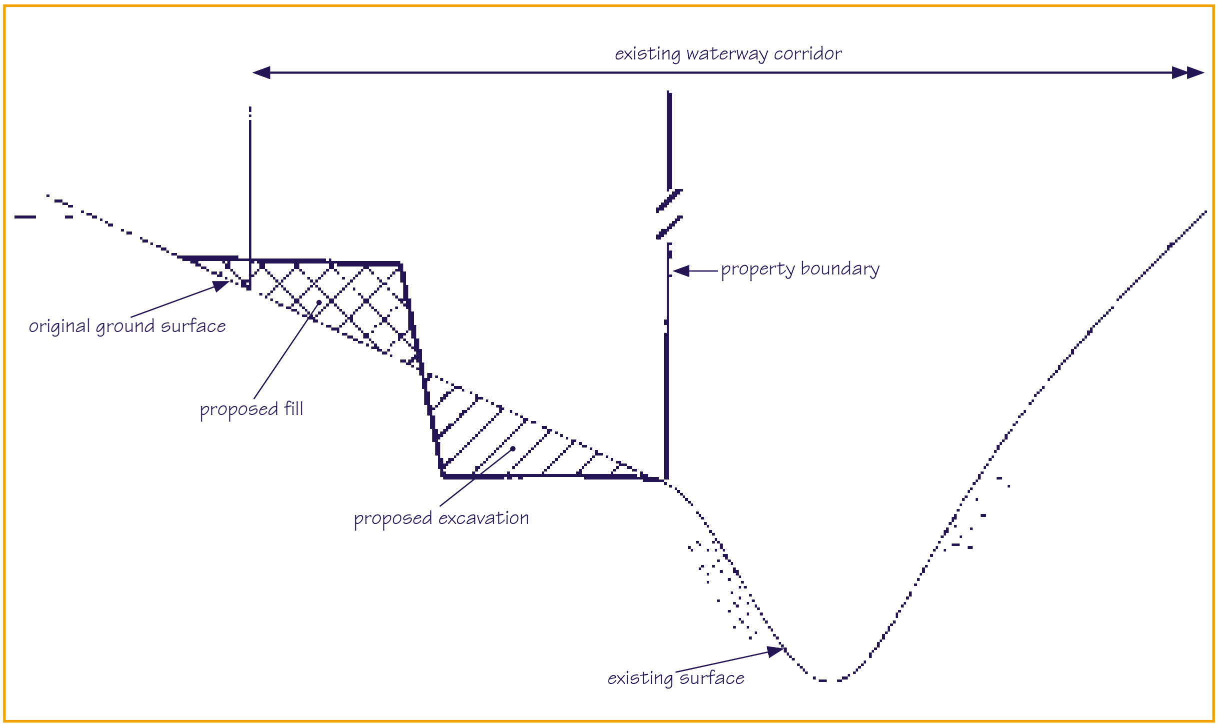

Figure d Unacceptable Balanced Earthworks – Cross Section

5.3 Item (c) Hydraulic Modelling

Calculating compensatory 'cut and fill' volumes at incremental levels (5.2 Item b) helps to identify the impact of earthworks on the storage capacity of a watercourse. The method does not, however, clearly show the likely impacts of the earthworks on a watercourse's conveyance capacity.

Therefore, development applicants are required to model pre– and post–development flood levels for a range of flood events up to and including the defined flood event to test that the development proposal causes no increase or decrease in flood level immediately upstream of the proposed compensatory earthworks.

Earthworks that increase or decrease the conveyance capacity of a watercourse are likely to be unacceptable. This is because increasing the conveyance capacity of the watercourse at the site of the earthworks reduces the effectiveness of flood storage and is likely to increase flooding downstream. Conversely, reducing the conveyance capacity of the watercourse at the site of the earthworks is likely to increase flooding upstream.