3. SECTION B. CATCHMENT CONDITION AND LAND-USE (reassessed on each visit to site)

3.1 PHOTOGRAPHIC RECORD

Photographs of the upstream and downstream views need to be taken when the site is first assessed. Bank to bank or specific features (e.g. riffle) may also be photographed. Photographs of subsequent site visits may be included if desired. These photographs will be available for viewing in the Rivers Database.

3.2 CONDITION OF LOCAL CATCHMENT, LAND-USE AND WATER QUALITY CONDITION

Rate extent of or impact of each factor using the following guidelines. Note: the focus is on the area upstream (approximately 5 km) and adjacent to the site, not merely the site.

0 - none: none in vicinity of site, no discernible impact.

1 - limited: limited to a few localities, impact minimal.

2 - moderate: land-use generally present, impact noticeable.

3 - extensive: land-use widespread, impact significant, small areas unaffected.

4 - entire: land-use 100% in area, impact significant.

Indicate using the rating scale the land-use(s) present within and beyond 5 m of the river, the potential impact of each on receiving water quality and/or observed impact(s), whether the impact is a point or non-point source and any comments pertaining to the distance etc.

Note: 1) agriculture has been split to account for crops, livestock and irrigation return-flows

2) Afforestation refers to exotic forests.

3) Impoundment refers to dams but also includes diversion weirs, farm dams, etc.

4) Wilderness area refers to a area with no anthropogenic modification(s) but which is not officially a nature conservation area. No rating for water quality impact is required for this land-use option.

3.3 CHANNEL CONDITION

In-channel and bank modifications

Using the same rating scale as for Section B2, indicate the extent of in-channel and bank modifications affecting the site and estimate the distance upstream or downstream.

Geomorphological indicators: (modified from Rowntree and Ziervogel, in prep.). Using the

rating scale below, rate the extent of each of the factors listed below.

0 - none: none in vicinity of site.

1 - limited: limited to a few localities.

2 - moderate: generally present.

3 - extensive: widespread, small areas unaffected.

4 - entire: 100% of area affected.

Erosion: Due to river action

- *Fluvial bank erosion:* erosion due the effect of streamflow, such as undercutting.
- *Sub-aerial erosion:* erosion due to surface processes such as removal of vegetation, livestock, wildlife, surface wash etc.
- *Macro-channel shifting:* channel changing course leaving an abandoned channel (rare).
- *Active-channel shifting:* occurs in alluvial (sand/gravel) meandering rivers where erosion occurs on one side and deposition on the other.

Deposition: Due to river action

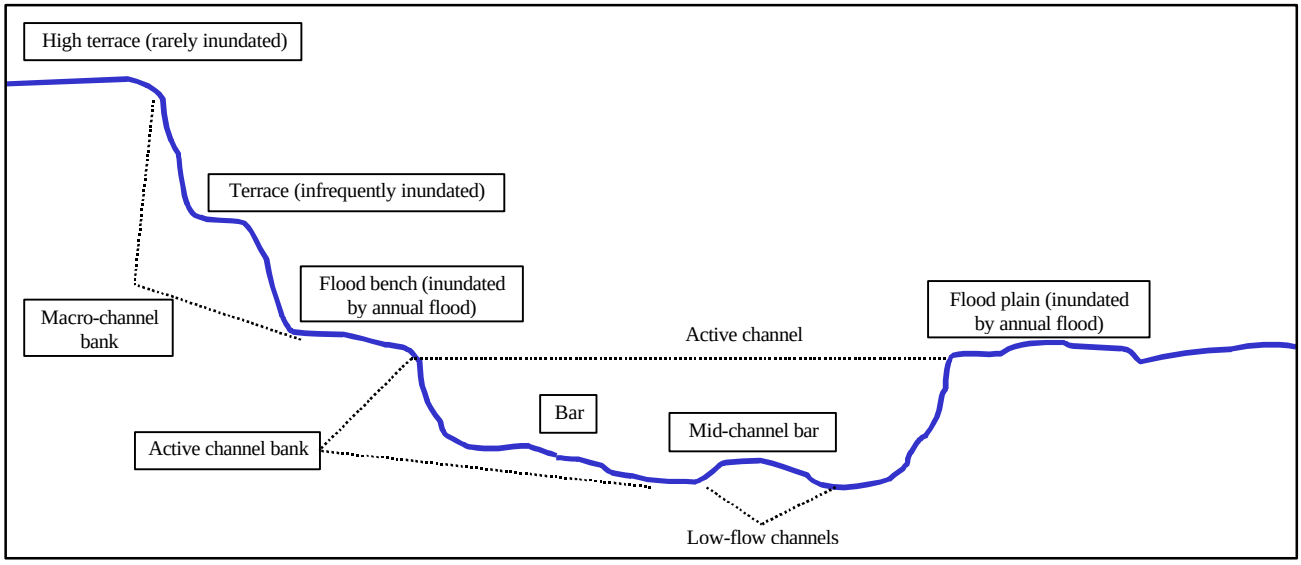
- *Sand or gravel deposits:* deposits of sand or gravel on the riverbed.
- *Silt drapes:* deposits of silt covering bedrock, boulders and cobbles.
- *Silt in pools:* deposits of silt in slower-flowing areas such as pools.
- *Encroaching vegetation:* vegetation stabilising in-channel sediment deposits, e.g. reeds on mid-channel sand bar.

3.4 CHANNEL MORPHOLOGY

The presence of each cross-sectional feature on the left and right-hand banks of the site are indicated. Features are illustrated in the diagram and listed below. Please note some of these features are also recorded in the geomorphology section in Section A, but are repeated here in diagrammatic form to provide additional information.

- *High Terrace (rarely inundated):* relict floodplains which have been raise above the level regularly inundated by flooding due to lowering of the river channel.
- *Macro Channel Bank* : the outer bank of a compound channel. Flood bench between active and macro-channel banks is usually vegetated.
- *Terrace (infrequently inundated):* area raised above the level regularly inundated by flooding.

- *Flood Bench (inundated by annual flood):* area between active and macro-channel, usually vegetated.
- *Active Channel Bank:* the bank of the channel(s) that has been inundated at sufficiently regular intervals to maintain channel form and to keep the channel free of established terrestrial vegetation.
- *Bar:* accumulations of sediment associated with the channel margins or bars forming in meandering rivers where erosion is occurring on the opposite bank to the bar.
- *Mid-Channel Bar:* single bar(s) formed within the middle of the channel; flow on both sides.
- *Flood Plain (inundated by annual flood):* a relatively level alluvial (sand or gravel) area lying adjacent to the river channel which has been constructed by the present river in its existing regime.



3.5 PRESENT STATUS

The term present status refers to the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict on the system. These disturbances include abiotic factors, such as water abstraction, weirs, dams, pollution and dumping of rubble, and biotic factors, such as the presence of alien plants and animals. The method adopted for the establishment of reference conditions is a modified version of Kemper and Kleynhans' (1998) preliminary present status which was developed as one of the procedures to be used for the determination of the preliminary ecological reserve for rivers of South Africa. The emphasis in the present assessment is, however, placed on the field-based site assessment, supplemented, where possible, with information gleaned from other sources such as catchment study reports, GIS coverages, together with local knowledge. It should be noted that any site-based assessment will lack longitudinal continuity and therefore may not adequately reflect the present status of the

river.

Aspects considered in the assessment comprise those instream and riparian zone perturbations regarded as primary causes of degradation of a river ecosystem (see section 7.1). The severity of each of these impacts is assessed, using scores as a measure of impact (Table 2).

Table 2. Summary of the scoring procedures used to determine Present Status.

Impact Class	Description	Score
None	No discernible impact, or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Limited	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability is limited.	1 - 5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability are fairly limited.	6 - 10
Extensive	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not affected.	11 - 15
Extreme	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area are affected. Only small areas are not influenced.	16 - 20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21 - 25

3.5.1 Individual criteria

It is a near impossibility to remove all subjectivity involved in making Present Status assessments such as those presented here. Descriptions of each criterion are provided to assist with the assessment.

Criterion 1: Water abstraction

Direct abstraction from within the specified river/river reach as well as upstream (including tributaries) must be considered (excludes indirect abstraction by for example exotic vegetation). The presence of any of the following can be used as an indication of abstraction: cultivated lands, water pumps, canals, pipelines, cities, towns, settlements, mines, impoundments, weirs, industries. Water abstraction has a direct impact on habitat type, abundance and size; is implicated in flow, bed, channel and water quality characteristics; and riparian vegetation may be influenced by a decrease in water quantity.

Criterion 2: Inundation

Destruction of instream habitat (e.g. riffle, rapid) and riparian zone habitat through submerging with water by, for example, construction of an on-channel impoundment such as a dam or weir.

Leads to a reduction in habitat available to aquatic fauna and may obstruct movement of aquatic fauna; influences water quality and sediment transport.

Criterion 3: Water quality

The following aspects should be considered; untreated sewage, urban and industrial runoff, agricultural runoff, mining effluent, effects of impoundments. Ranking may be based on direct measurements or indirectly via observation of agricultural activities, human settlements and industrial activities in the area. Water quality is aggravated by a decrease in the volume of water during low or no flow conditions.

Criterion 4: Flow modification

This relates to the consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow such as an increase in duration of low flow season, can have an impact on habitat attributes, resulting in low availability of certain habitat types or water at the start of the breeding, flowering or growing season. Effects of flow regulation of floods and low flows are assessed separately.

Criterion 5: Bed modifications

This is regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included.

Criterion 6: Channel modifications

This may be the result of a change in flow which alters channel characteristics causing a change in marginal instream and riparian habitat. Purposeful channel modification to improve drainage is also included.

Criterion 7: Presence of exotic aquatic fauna (e.g. fish)

The disturbance of the stream bottom during feeding may influence, for example, the water quality and lead to increased turbidity. Predation on indigenous fish is also a factor. The extent of the effect is dependant upon the species involved and their abundance.

Criterion 8: Presence of exotic macrophytes

Exotic macrophytes may alter habitat by obstruction of flow and may influence water quality. Consider the extent of infestation over instream area by exotic macrophytes, the species involved and its invasive abilities.

Criterion 9: Solid waste disposal

The amount and type of waste present in and on the banks of a river (e.g. litter, building rubble) is an obvious indicator of external influences on stream and a general indication of the misuse and mismanagement of the river.

Criterion 10: Indigenous vegetation removal

This refers to physical removal of indigenous vegetation for farming, firewood and overgrazing. Impairment of the riparian buffer zone which the vegetation forms may lead to movement of sediment and other catchment runoff products (e.g. nutrients) into the river.

Criterion 11: Exotic vegetation encroachment

This excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Encroachment of exotic vegetation leads to changes in the quality and proportion of natural allochthonous organic matter input and diversity of the riparian zone habitat is reduced.

Criterion 12: Bank erosion

A decrease in bank stability will cause sedimentation and possible collapse of the river bank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or encroachment of exotic vegetation.

3.5.2 Weightings and calculation of instream and riparian status

Once a score has been allocated to an impact, it is moderated by a weighting system, devised by Kleynhans *et al.* (1988) and modified by Kemper and Kleynhans (1998). Assignment of weights is based on the relative threat of the impact to the habitat integrity of the riverine ecosystem. The total score for each impact is equal to the assigned score multiplied by the weight of that impact (Table 3). Flow modifications (indicated with an * in Table 3) have been divided into floods and low flows as specified in Eekhout and Brown (1996).

Based on the relative weights of the criteria, the impacts of each criterion are estimated as follows:

Rating for the criterion /maximum value (25) x the weight (percent). Example: for a criterion which receives a rating of 10 in the assessment, with a weighting of 14, the impact score is calculated as follows:

$$10/25 \times 14 = 5.6$$

The estimated impacts of all criteria calculated in this way are summed, expressed as a percentage and subtracted from 100 to arrive at a present status score for the instream and riparian components, respectively. The present status scores (%) for the instream and riparian zone components are then used to place these two components into a specific preliminary present status class. These classes are indicated in Table 4.

Table 3. Criteria used to assess assessment of instream and riparian status and the weightings accorded them (Kemper and Kleynhans 1998).

Instream Criteria	Wgt	Riparian Zone Criteria	Wgt
Water abstraction (presence of pumps, irrigation, etc.)	14	Water abstraction (presence of pumps, irrigation, etc.)	13
Inundation	10	Inundation	11
Water quality (clarity, odour, presence of macrophytes)	14	Water quality (clarity, odour, presence of macrophytes)	13
Flow modification: Floods*	7	Flow modification: Floods*	6
Flow modification: Low flows*	6	Flow modification: Low flows*	6
Bed modification (bulldozing, etc. of river bed)	13		
Channel modification (e.g. bulldozing of macro-channel, floodplain)	13	Channel modification (e.g. bulldozing of macro-channel, floodplain)	12
Presence of exotic macrophytes	9		
Presence of exotic fauna (e.g. fish)	8		
Solid waste disposal	6		
		Removal of indigenous vegetation	13
		Exotic vegetation encroachment	12
		Bank erosion	14
Total	100	Total	100

Table 4. Preliminary present status classes (From Kleynhans 1996).

Class	Description	Score (% Of Total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place, but the assumption is that ecosystem functioning is essentially unchanged.	80 - 89
C	Moderately modified. A loss of change in natural habitat and biota has occurred, but basic ecosystem functioning appears predominately unchanged.	60 - 79
D	Largely modified. A loss of natural habitat and biota and a reduction in basic ecosystem functioning is assumed to have occurred.	40 - 59
E	Seriously modified. The loss of natural habitat, biota and ecosystem functioning is extensive.	20 - 39
F	Modifications have reached a critical level and there has been an almost complete loss of natural habitat and biota. In the worst cases, the basic ecosystem functioning has been destroyed.	0 - 19