2 STRUCTURE OF THE DATABASE AND VIEWING DATA

The Rivers Database is divided into two broad components as follows:

- **Editing and viewing the data** - this facilitates the entry and viewing of data via a hierarchical Tree View.
- **Querying the data** - this allows for the extraction of data already entered in the database.

A schematic diagram of the database structure and the various components is given in Figure 2.1. The different forms from each section are displayed in Appendix 2. **Note**: Neither the riparian vegetation or fish components are populated with real data and forms displayed are therefore merely fictitious examples.

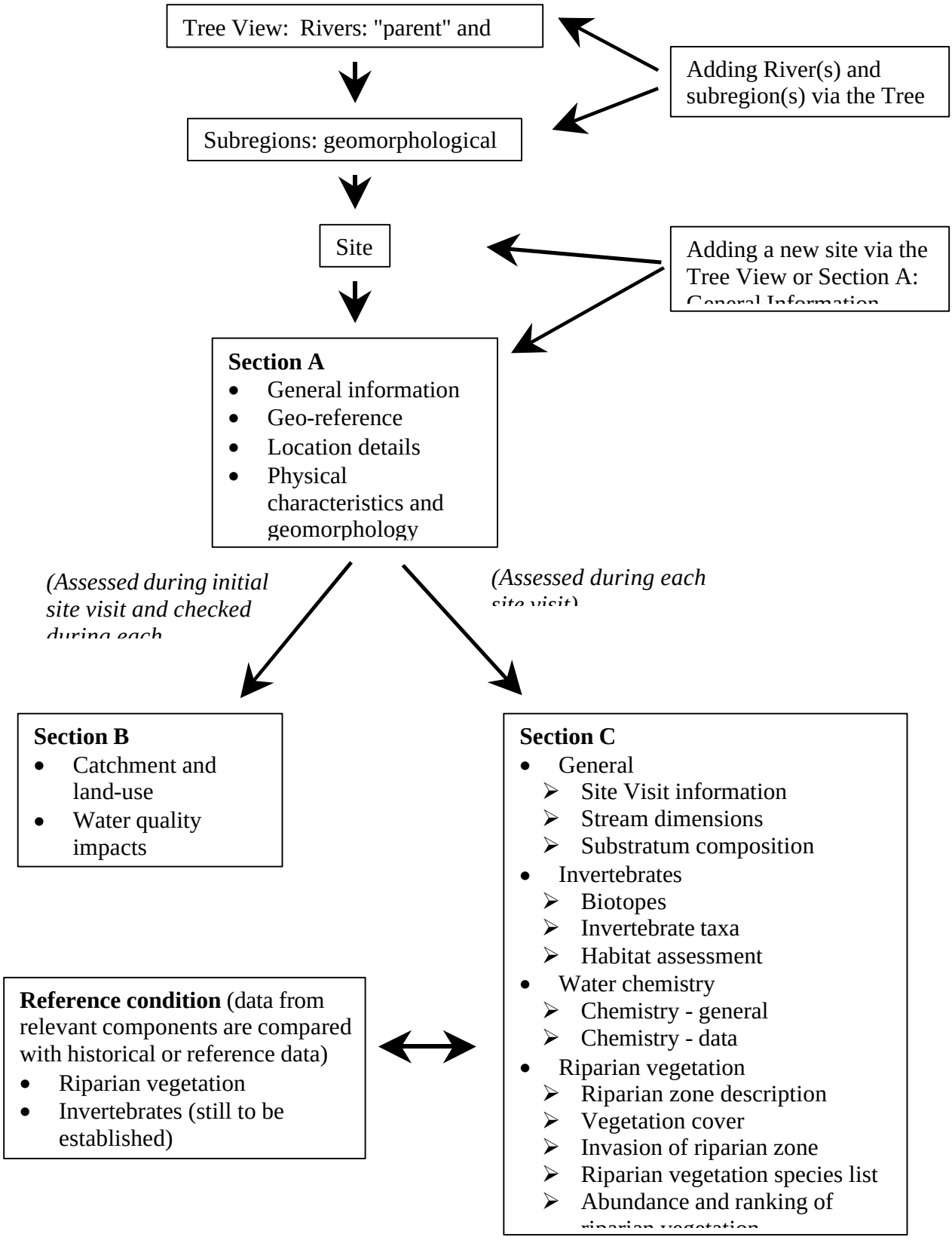
Tree View: Rivers: "parent" and
Adding River(s) and subregion(s) via the Tree
Subregions: geomorphological
Site
Adding a new site via the Tree View or Section A:
Section A
General information
Geo-reference
Location details
Physical characteristics and geomorphology
(Assessed during initial site visit and checked
(Assessed during each
Section B
Catchment and land-use
Water quality impacts
Section C
General
Site Visit information
Stream dimensions
Substratum composition
Invertebrates
Biotopes
Invertebrate taxa
Habitat assessment
Water chemistry
Chemistry - general
Chemistry - data
Riparian vegetation
Riparian zone description
Vegetation cover
Invasion of riparian zone
Riparian vegetation species list
Abundance and ranking of
Reference condition (data from relevant components are compared with historical or reference data)
Riparian vegetation
Invertebrates (still to be established)

Figure 2.1 Schematic diagram showing the various components included in the Rivers Database

2.1 Viewing information in Tree View

The purpose of the Tree View is to allow one to efficiently navigate to rivers, their tributaries and subregions or segments either to view sites on rivers already entered into the database or to add new sites or new site visits to existing sites (see section 2.2.3).

The Tree View is divided into two sections as follows:

- all existing “parent” rivers and their tributaries are viewed in the left hand block.
- subregions and site codes are viewed in the right hand block.

2.1.1 Filtering the Tree View

A searching function has been added to the Tree View to enable the user to navigate and locate sites within a specific region (political, bioregion, ecoregion), catchment (secondary or quaternary), subregion, hydrological type, rainfall region, or by river, site code, map reference or DWAF gauging station code.

Once a selection has been made using the drop-down lists in the fields "Filter trees for" and "=", all parent rivers and associated tributaries in which the selected criteria are met and returned. Matching sites are returned and may be viewed in the drop-down list "Matching sites". The navigational sequence to the selected site is displayed and includes: the name(s) of all rivers above it in the hierarchy together with the subregion in which the site occurs.

To clear the selection criteria, click the "Clear" button and refresh screen to view all rivers.

2.1.2 Navigating to sites

1) Click the cross to the left of the river name of a given “parent” river to expand the tributaries of that river. (To reverse the operation and contract the tributaries click on the minus sign next to the appropriate river).
2) Select the desired sort order of rivers and their tributaries by selecting either the “alphabetical” order or “sequential” order which sorts the rivers and their tributaries either

alphabetically or in the order of occurrence from "source to sea" along a parent river respectively.

3) Continue clicking the cross to the left of each river in the hierarchy until the desired river has been found.
4) Highlight the desired river by clicking on the river name.
5) Select the desired “navigational” sequence by selecting either “subregions” or “segments” at the bottom left hand side of the tree view. All subregions (or segments, depending on the desired sequence selected) of the highlighted river will automatically appear in the block on the right of the Tree View in order of their occurrence from source to its confluence with the parent river.
6) Click the cross to the left of the subregion (or segment) to view the site codes (see section 2.2. for an explanation of the site codes) of all existing sites in that subregion (or segment).
7) Double click the site code or click “go” to view detailed site information. This action opens “Section A”, “Section B” and “Section C” which houses all site and site visit information.
8) Click "Refresh" to return the screen to the original form of the Tree View.
9) Click "Rebuild Tree" to incorporate changes made to the Tree View.
10) Click "River/Subregion" to add, edit or delete rivers or subregions (see Section 2.1.3)
11) "Picklist Options" is an administrative function whereby drop-down lists etc. are edited. Access to this is strictly controlled.
12) Click "Exit" to close the database.

2.1.3 Adding a new river, subregion or segment

With the exception of the Mpumalanga region, users will need to enter information at the river, subregion and segment (if appropriate) level before entering information for specific sites. The process of adding a new river and subregions or segments to the Tree View is explained in this section.

To add a new river:

1) Click "River/Subregion"
2) Type in the name of the new river to be added. If it is a tributary of a river which already exists in the database then select the relevant river from a drop-down list which appears when the down arrow to the right is selected. If the new river is a parent river then the “is a tributary of” box is left blank but the “parent river” box is ticked by clicking in the relevant box.

3) Select the secondary catchment code into which that river falls from the existing dropdown list.
4) Type in the order of occurrence of a river if it is a tributary of another river in the "Sort Order" box. E.g. if the Klip River is the 23rd tributary of the Blyde River by counting tributaries from the source of the Blyde River to its confluence with the Olifants River, then type 23 in this box. If the sort order is unknown, then the rivers and their tributaries are automatically sorted alphabetically in the tree view.
5) Click the "Add Record" button.

To add a new subregion:

1) Choose the river to which a new subregion will be added from the drop-down list at the top of the form.
2) Once the details of that river appear on the form select the "subregions" tab.
3) Select a subregion from the drop-down list and enter its sequence from the source of the river. The same subregion may be added more than once with a different number indicating the sequence each time.
4) If the subregion is unknown, select the "unspecified" option from the drop-down list.
5) Click the "Add Record" button.

To add a new segment:

Repeat the steps outlined above for adding a new subregion to the tree view but select the "segment" tab. Once all new details have been added, return to the Tree View by clicking the "Close Form" button.

2.2 Site and Site Visit information

Sections A, B and C of the Rivers Database form the main body of the database for the inclusion of information which both characterises a site and provides information for the assessment of the condition of a river at a particular site at a given time. The field datasheets for the collection of biomonitoring data form the basis for the design of this component of the Rivers Database and a full description of some of the information included in the database has been taken from the associated field manual (Dallas 2000). Each section varies with regard to the nature of information entered and the frequency of assessment as follows:

	TYPE OF INFORMATION	FREQUENCY OF ASSESSMENT
SECTION A	Site specific information	Entered during or after the first site visit
SECTION B	Site visit information	Entered during the first site visit and is checked and reassessed on each site visit
SECTION C	Site visit information	Assessed during each site visit

The basic layout for all 3 sections is as follows:

- The active bar with separate buttons for “Section A”, “Section B”, “Section C” and the Reference Condition and Admin sections. Click these buttons to list the forms which are included within each section.
- A header with information about the current user, the organisation to which the user is affiliated and the "owner" of the data. The site code selected in the Tree View is displayed, and the user is able to switch to another site within the same river and subregion by selecting the appropriate site from the drop-down list. To show all sites, regardless of river or subregion, click the "Show All Sites" button. In the case of Sections B and C, the date of the site visit is displayed. In Section C, a drop-down list enables Section C to be divided into subcategories, namely general, invertebrates, water chemistry, riparian vegetation and fish. Details of each section are given in sections 2.2. to 2.2.4 respectively.

2.2.1 Adding a new site

A new site can be added by clicking the "Add Site" button which appears in both the Tree View form and the General Site Information form of Section A. To add a site on the Tree View form:

1) Navigate to the river and subregion into which a site needs to be added (see section 2.1.3).
2) Click the "Add Site" button. This opens the general site information form.
3) Type in the new site code.
4) Click the "Add Site" button on the form. This will update the site code in the header and populate the drop-down list with the new site code. Note: If the "Add Site" button is clicked again at this point, the site code box will be cleared and a new site may be added to the same river and subregion.
5) The river name is confirmed by checking the drop-down list of river name, together with the secondary catchment code, tributary of, subregion and tributary sequence. All additional site information is added into the appropriate text or numeric fields directly or using the drop-down lists.

6) To add a site to a different river or subregion, return to the Tree View form, navigate to the appropriate river and subregion and repeat this process.

2.2.2 Viewing data in Section A

Section A contains five forms which display general information about a site and a sixth form which summarises any changes made to this information. The following procedure outlines the steps taken when viewing data for a specified site code selected in the Tree View.

1) Click “Section A” to view all forms which apply to this section.
2) Double click “General” to open the general site information.
3) Repeat step 2 to view each separate form in the section.

Details pertaining to each form are given below. The process by which a new site is added is described in section 2.2.1.

(a) General Site information

General site information spans two forms, and includes information which characterises the site. Each field is described briefly below and the reader is referred to the glossary or Dallas (2000) if additional clarification is required. In all cases data are either added directly as text or by selecting from the appropriate drop-down list. **Note:** The red asterisks indicate those components which must be entered as a minimum requirement.

Site Code: A standardised unique site code is allocated to each site. A duplicate site code will not be accepted and will require the user to modify the site code by changing the location component of the code when adding a new site. (The date on which the site code was entered automatically appears below the site code once it has been entered for the first time).

River name: name of river assessed. This will appear automatically in the correct box based on the navigation sequence followed in the tree view. By clicking the drop-down list to the right, the river name, together with the secondary catchment code, tributary of, subregion and tributary sequence will appear. This allows one to check whether the correct river has been entered in this box. **Note:** This is particularly important in cases where river names are common and rivers of the same name may occur in different catchments. Once the river name has been entered, the information described above automatically appears on the right hand side of the form.

Subregion: This appears automatically since the user has to specify the subregion within which the site falls. An "unspecified" option is given if the subregion is not known.

Segment: Based on the subdivision of rivers into homogenous stretches in terms of fish habitat as defined by Kleynhans (1999).

Description: details of site location, e.g. farm name, road, bridge, village, etc.

Map Reference: either 1: 250 000 or 1: 50 000 .

Site Length: length of river being assessed.

Political Region: one of seven regions.

BioRegion: one of 18 bioregions as identified in Brown *et al.* (1996).

Ecoregion: one of 18 as identified in Kleynhans *et al.* (1998).

WQ Region: one of seven water quality regions as identified in Day *et al.* (1998).

Secondary Catchment Code: DWAF secondary drainage region.

Catchment Area: area (km^2) of the secondary catchment.

Quaternary Catchment Code: DWAF Quaternary drainage region.

Comment: Any additional information which may be pertinent to the site which has not been included in the forms.

Source Distance: distance from source of river estimated from 1: 50 000 map.

Contour Range: altitude range within which site falls estimated off 1:50 000 map (50 m intervals).

Stream Order: order estimated of 1: 50 000 map using the Strahler method.

Slope/gradient: calculated as the vertical difference between contours (m) divided by horizontal distance between contours, estimated from 1: 50 000 map.

Geological Type: based on Vegter's (1995) simplified lithostratigraphic units.

Vegetation Type: based on Low and Rebelo's (1996) potential natural vegetation of South Africa, Lesotho and Swaziland.

Hydrological Type: based on the following types: perennial, seasonal or ephemeral.

Rainfall Region: season in which the majority of rain falls.

DWAF Gauging Station: the presence of a DWAF gauging station is indicated. If present, the greyed boxes becomes active and the DWAF Code and estimated distance upstream or downstream of the site is recorded.

Associated System: important systems associated with the site or river (e.g. wetlands or estuaries), together with distance from the site, are shown.

(b) Geo-reference

Three different formats for longitude and latitude co-ordinates are available in the database. i.e. conventional format (degree/minutes/seconds), GPS format (degrees and minutes+seconds) and GIS format (decimal degrees). Data may be entered via any format by selecting the desired format after which the other formats are calculated automatically. Records are stored by clicking the "Save" button.

(c) Location Detail

This form provides a text box for entering a relatively detailed description of how to find the site and whose land must be traversed to access the site. Provision is made to indicate whether or not a permit is required, where to obtain the permit, whether or not a key is needed and where to obtain the key. This is a descriptive form to facilitate future access to the site for monitors who may not have visited the site previously.

(d) Physical Characteristics and Geomorphology

Five components, namely "Valley Form", "Lateral Mobility", "Channel Form", "Channel Pattern" and "Channel Type" are included. Selection and descriptions of these geomorphological components are taken from Rowntree and Wadeson (1998) and are summarised in the field manual for the collection of biomonitoring data (Dallas 2000). One or more "Valley Form" features may be present, but only one type is selected for "Lateral Mobility", "Channel Form", "Channel Pattern" and "Channel Type". When the "Channel Type" selected is alluvial, the "Dominant Type"(s) of substratum are recorded.

(e) Site Transaction

The "site transaction" form is an inventory of all changes that are made to the information entered in Section A. When a user changes information that was entered on a previous occasion in Section A, the user is asked to confirm whether the change should be made. If the user confirms these changes then the database automatically updates the Site Transaction form with these changes. The following information is recorded on this form: the field which has been changed, the information that was initially recorded for that field, the new information added to that field, the date that the changes were made, the user who is responsible for making the changes and the organisation to which the user is affiliated. In this way, a complete record is kept of any changes that may be made to the site information. Although the information included in Section A is site specific and therefore should not change over time, it is important to allow changes to be made

for e.g. if land ownership changes or improved GPS technology allows more accurate geo-referencing of a site.

(f) Photographs

Photographs of the upstream, downstream or bankside views or specific features at the site are stored on a website which is linked to the database. Each photograph has a unique "Photographic ID Code" which consists of basic site code plus the letter "u" for upstream, "d" for downstream, "b" for bankside or "s" for a specific feature and then the site visit date. The date is specified using the convention "ddmmyyyy" to indicate the day, month and year.

2.2.3 Adding site data to Section A

Most information is added directly into the text boxes or using the drop-down lists. Specifics are as follows:

Adding general site information data: Populate each field from the drop-down lists or by typing in the free text boxes.

Adding geo-reference data: Select the format of the co-ordinates to be entered (i.e. conventional, GPS or GIS) and enter the values in the appropriate fields.

Adding location details: Add text directly to the appropriate fields. Certain free text boxes only become active when the appropriate tick boxes are ticked, including the "Permit Required", "Permit Acquired" and "Key Needed" fields.

Adding physical characteristics and geomorphology data: Add "Valley Form Detail" using the "Add Valley Form" drop-down list. Several valley forms may be added for each site. Use drop-down lists to add other information. If "Alluvial with Dominant Types" is selected as the "Channel Type", then "Dominant Types" becomes active and is populated using the drop-down lists in the "Add Dominant Types". Several types may be added for each site.

Site transaction: This form is automatically updated and cannot be edited.

Adding photographs: The area or feature photographed is selected from a drop-down list and the "spool number" and "photo number" are entered to a keep a record of user-specific photographs. A unique "Photographic ID Code" is allocated to each photograph. This ID Code consists of the Site Code combined with the first letter of area photographed combined with the date of the site visit (e.g. X2SABI-HOXAN-U-28111999).

2.2.4 Viewing Site Visit data in Section B

Section B consists of five forms which include fields that relate to catchment condition and channel features. Components of this section are checked and reassessed if necessary and

therefore the information is site visit specific, i.e. the information is related to a specific sampling date. The following procedure outlines the steps taken when viewing data for a specified site code and date.

1) Click “Section B” in the active bar to view all forms which apply to this section.
2) To view site visit data, select a "Site Visit" from the drop-down list on the right hand side of the form.
3) Click “Catchment and Land Use” in the active bar to view details for the first form in this section.
4) Repeat step 3 to view details for each separate form within Section B. The details of each form in Section B are summarised below.

(a) Catchment and Land Use

This form includes features regarding the condition of the local catchment and land-use within the catchment. The presence and extent of each land-use "within" and "beyond 5m" is given with specific details included if relevant.

(b) Water Quality Impacts

Water quality impacts are linked to the land-uses specified in the previous form. Each impact present at a site is listed and rated according to the extent of the impact on the receiving water body. If the impact originates from a point source it is ticked in the associated box.

(c) Channel Condition

In-channel and bank modifications are listed, the extent of their impact both upstream and downstream of the site is rated, and the distance of each modification upstream or downstream specified. Four erosional and four depositional features are listed and rated according to the extent of each at the site. This is modified from a report of Rowntree and Ziervogel (1999) and is detailed in Dallas (2000).

(d) Channel Morphology

Additional information related to channel morphology may be added in this form. It is based on a diagram from Kemper (1999) and is particularly relevant for interpretation of the riparian index. The presence of each cross-section feature is noted for both the left and right banks by clicking the appropriate box.

(e) Present Status

Scores allocated to each instream and riparian component are displayed and "Instream Status",

"Riparian Status", "Overall Status" are automatically calculated and displayed together with the associated "Present Status Class". Details of the methodology are given in Dallas (2000).

2.2.5 Adding Site Visit data to Section B

To add a new site visit, click the "Add New Site Visit" button and enter the date in the following format "dd/mm/yy". You are prompted to confirm the new site visit date, which when confirmed enables one to add additional site visit data for that date. Additional data are added as follows:

Adding catchment and land-use data: One or several land-uses are selected from the drop-down list and the extent of each “within 5 m” and “beyond 5 m” rated depending on the level of the impact. Any specific information about each entry can be included in the free text box titled “detail” on the form.

Adding water quality impact data: The impact of each land-use is automatically added to this form from the previous section. It may be altered if necessary via the drop-down list. The extent of impact is rated and whether or not the impact is from a point source is indicated by clicking the appropriate box. Any specific comments about the impacts can be included in the free text box.

Adding channel condition data: In-channel and bank modifications are selected from the drop-down list, the extent of each upstream and/or downstream of the site rated and the distance upstream or downstream specified. Comments about the impact can be included in the free text box next to each modification. The extent of each erosion and deposition feature is rated from the drop-down list.

Adding channel morphology data: The presence of each cross-sectional feature is noted for both the left and right banks by clicking the appropriate box.

Adding present status data: Scores for each factor used in the calculation of present status are added directly in the numeric field (use "tab" to move down the column). The Instream Status, Riparian Status, Overall Status and Present Status Class are calculated automatically.

Note: When adding a second site visit, the user is notified that all fields in section B for the new site visit are automatically updated using the previous site visit's data. If certain aspects have changed since the last site visit, for example land-use, the user must go to the appropriate form and field and update the record.

2.2.6 Viewing Site Visit data in Section C

(a) General

- **General Site Visit Information**

This form provides information pertaining to each site visit or sampling occasion. All users may view the data but only the Owner may edit the data linked to the particular site visit. Each field is described briefly below and the reader is referred to the glossary or Dallas (2000) if additional clarification is required. Details of each field are given below.

Note: If data in this section is collected on different dates but which is still considered to be part of the same site visit, then the earliest date should be used. For example, if SASS data was collected on 06/06/1999 and fish data on 07/06/1999 both should be entered as 06/06/1999. This is necessary to enable subsequent queries to be linked to common site visits.

Date Visited: date (dd mmm yyyy) of site visit

Time: time (hh.mm) of assessment

Assessor: name of assessor

Organisation: organisation to which assessor is affiliated

Water Level: water level at time of sampling (dry, isolated pools, low flow, moderate flow, high flow, flood)

Rainfall in the last 4 days? Indicates the presence and extent of any rainfall event preceding the site visit

Water Turbidity: the colour and degree of visibility is indicated (clear, discoloured, opaque or silty)

Vegetation Sampling Instructions: details of the exact position at which the riparian vegetation assessment was conducted

Canopy Cover: extent of canopy cover (open, closed, partially open)

Impact on channel flow: rate of the impact on channel flow of coarse woody debris or any other obstruction. Specify if the source is local or upstream and add additional comments in the text box.

- **Stream Dimensions**

Macro-channel, active channel and water surface widths, left and right bank heights, and minimum, maximum and average depths of the available deep- and shallow-water biotopes are given. The type of deep- or shallow-water biotope can also be detailed if necessary. Details of the methodology are given in Dallas (2000).

- **Substratum Composition**

The relative percentage contribution of each substratum type (bedrock, boulder, cobble, pebble, gravel, sand and silt/mud) is given for the bed and bank. These substratum types, together with an additional substratum type, soil, is assessed for the riparian zone (Kemper 1999). The degree of embeddedness is also provided. Details of the methodology are given in Dallas (2000).

(b) Invertebrates

- **Biotopes**

Biotopes have been included at two levels, namely SASS biotopes (e.g. SIC, SOOC, marginal vegetation, aquatic vegetation, gravel, sand, mud/silt) and specific biotopes (e.g. cobble riffle, bedrock rapid, backwater, Palmiet, etc.). The presence of each is recorded and relative percentage estimated for each level. Details of the methodology are given in Dallas (2000).

- **Invertebrate Taxa**

SASS data for invertebrates is given at either the site visit level or the biotope level depending on whether biotopes were sampled separately or not. To view taxa from each biotope, the appropriate biotope is selected from the drop-down list. A "<Site Visit>" option is included to view all SASS data at the level of site visit. SASS4 Score, Number of Taxa and ASPT are calculated automatically for all taxa, as are the scores for air-breathing taxa.

- **Habitat Assessment**

Three habitat assessments are included, namely Habitat Assessment Matrix (HAM), Habitat Quality Index (HQI) and Invertebrate Habitat Assessment System (IHAS). Only one of these per site visit is given and scores for each are calculated below the entry data. Sub-components of the IHAS score are given in the various tabs at the bottom of the form. Details of the methodology are given in Dallas (2000).

(c) Water Chemistry

The water chemistry information is divided into two sections, namely chemistry-general and chemistry-data. "General" includes sampling process details and information related to water condition, whilst "data" tabulates actual chemistry data collected in the field or analysed in the laboratory.

- **Chemistry-general**

Fastest flow? Were the meters positioned in the fastest flowing section of the stream.

Samples collected? Details of the filtering, freezing, preservation and analysis method.

Macrophytes and algae: The presence and percentage cover of each is estimated and additional details such as species is recorded in the comment text field.

- **Chemistry data**

All chemistry data for the site visit is given together with the standard units of measurement and values.

(d) Riparian Vegetation

The riparian vegetation component has been developed by Kemper (1999) and details pertaining to the method are described in Kemper (1999). Six forms constitute the riparian vegetation component of the database. Details for viewing information within each form are as follows:

- **Riparian Zone Description**

Vegetation cover and width of the riparian zone on the left and right bank of the active channel and islands are recorded together with disturbances to the riparian zone rated in terms of severity. Extent of Vegetation Cover (EVC) scores 1 and 2 are calculated automatically.

- **Vegetation cover**

Percentage contribution of grasses, sedges, reeds, shrubs and trees, as well as bare ground, is given, together with the relevant distribution pattern of each, i.e. clumped, continuous, scattered, sparse. The reason for the current distribution pattern, relative to the natural condition at the site (i.e. land-use) and the "problem" score or rate (low, medium, high and very high), is also recorded. A Structural Intactness (SI) score is automatically calculated according to a comparison matrix between the present day and reference state (see Section 2.2.8 for a description of the reference condition component).

- **Vegetation invasion**

The extent of the invasion of the riparian zone (bank, bed, island and bars) by exotic, reeds and terrestrial vegetation is recorded. An exotic Percentage Cover of Indigenous Species (PCDI) and a terrestrial (PCDI) score are calculated.

- **Vegetation Species List**

A list of species present is given together with the type (tree, reed, shrub, forb or sedge) and status (exotic, introduced or native). For each species both the number of individuals in each height class and the abundance measured (low, medium, high and very high) for each height class is recorded.

- **Vegetation Abundance**

The dominant vegetation types are ranked on the basis of either recruitment, biomass or abundance. The Recruitment of Desirable Indigenous species (RDI) is rated.

- **Vegetation Index**

All scores calculated for the vegetation section are displayed, including EVC, PCDI, SI and RDI. From these sub-scores the Riparian Vegetation Index (RVI) is calculated.

(e) Fish

The fish component has been developed by Kleynhans (1999) and details pertaining to the method are described in Kleynhans (1999). Currently one form is available for this component.

- **Fish samples**

Data are given for different combinations of depth and flow, including deep slow, shallow slow, deep fast and shallow fast. Fish species collected (using established fish codes) via each of three sampling methods (cast net, seine net or shock apparatus) are recorded, together with sampling effort. The extent of aquatic vegetation, overhanging vegetation, stream substratum and undercut bank and roots is rated.

2.2.7 Adding Site Visit data in Section C

(a) General

- **General Site Visit Information**

Data is added directly in the text boxes or using the drop-down lists. Date and time formats are specified (see section 2.2.6) and tick boxes are used for some fields.

- **Stream Dimensions**

Values for each of the fields may be added directly within each field and additional comments may be added. The type of deep- or shallow-water habitat may also be detailed.

- **Substratum Composition**

An estimate of the relative percentage contribution of each substratum type (bedrock, boulder, cobble, pebble, gravel, sand and silt/mud) is entered for bed and bank cover. An additional substratum type is available for the riparian zone cover, namely soil. The degree of embeddedness is selected from the drop-down list.

(b) Invertebrates

- **Biotopes: To enter data:**

1) Click the boxes of the SASS biotopes present.
2) Add a percentage for each. Note the total should be 100%.
3) Position the mouse on the SASS biotope for which specific biotope data need to be added.
4) Select specific biotopes from the drop-down list and enter the percentage of each.

- **Invertebrate Taxa: To enter data:**

1) Select a biotope or "Site Visit" from the drop-down list.
2) Click on the first field in the taxon column.
3) Type the first letter of the invertebrate taxon and then select the appropriate taxon from the drop-down list.
4) Press tab to move the cursor to the abundance column and enter abundance (A, B, C or D).
5) Repeat until all taxa have been entered.
6) Repeat step 1 to 5 for the next biotope if appropriate.
7) Click "Site Visit Taxa" if site visit scores are desired.

- **Habitat Assessment: To enter data:**

1) Select habitat assessment method (HAM, HQI or IHAS) from the drop-down list.
2) Click "Add Habitat Assessment".
3) Position mouse in the first field under the "Score" column and enter value.
4) Tab down and click "Calculate" to return score(s).
5) To remove an assessment, select the appropriate habitat assessment from the drop-down list and click "Remove Habitat Assessment".

(c) Water Chemistry

- **Chemistry-general**

To add data click the appropriate boxes and enter data into the associated text boxes. Note that some fields only become active once the preceding box has been clicked.

- **Chemistry data: To enter data:**

1) Position the cursor in first field of the chemistry column.
2) Type the first letter of the chemistry code and scroll down until the correct variable is highlighted.
3) Press tab to move the cursor to the value column and enter value.
4) Tab to comment field and add text if necessary.
5) Tab to chemistry and repeat process until all chemistry variables have been added.

(d) Riparian Vegetation

Data are entered using the appropriate drop-down lists, text boxes and tick boxes.

(f) Fish

Data are entered using the appropriate drop-down lists, text boxes and tick boxes.

2.2.8 Reference Condition

Reference or historical conditions are in the process of being developed for each of the major components, namely invertebrates, riparian vegetation and fish. They are all in different stages of development but all aim to facilitate comparisons between monitoring sites and a baseline or benchmark data set derived in a component-specific way. Thus far, a historical fish database has been developed for the Mpumalanga region (Kleynhans 1999) and a riparian component has been included (Kemper 1999).