i. The three depressions (or perhaps better termed basins) shown in **Figure 3.3** do not support wetland plants and augered lowpoints showed no indications of soil wetness (no mottling, gleying or presence of impervious layers within 0.5 mbgl) (see **Figure 3.11**);

ii. In a different climate, they might well support wetland habitat – in the arid environment of the site, they do not retain sufficient moisture to support wetland habitat, with evaporation rates significantly higher than precipitation rates;

Figure 3.11
Landscape in the lowest point of the central depression mapped in SRK (2020b). The depression does not support wetland habitat in the present climate

iii. The most northerly of the depressions lies in an area clearly disturbed by a long history of farming, and includes a few excavated depressions into clay, which were probably created to store water for livestock. These depressions are likely to retain water longer than other areas, but are nevertheless considered artificial systems. They fall within the authorised mining area for the site. Assessment of PES and/or EIS is not appropriate for artificial systems, and has not therefore been carried out;

iv. The pan between the northerly and central depressions shown in **Figure 3.3** was identified as a largely terrestrial "hardpan" area by Helme (2014), who deemed the vegetation to be of High sensitivity (from an ecological perspective), and a rare feature in the landscape, which support threatened *Lachenalia barkeriana* plant species, and which could not be recreated once the underlying hardpan or calcrete is damaged or removed. The sparse vegetation in the hardpan area includes *Ruschia fugitans, Antimima* sp. and *Drosanthemum* sp. The broad area mapped by Helme (2014) was assessed in the present study. Two areas within the broader area mapped by Helme (2014) were assessed as wetland, transitioning into terrestrial areas, where the depth of soil on the hardpan was greater, and given the low rainfall in the area, did not result in the formation of saturated conditions within the top 50cm of the soil surface. The two wetland areas were identified on the basis of an impervous clay layer at between 30 and 40cm below the surface (and at the surface in the more disturbed wetland pan), and signs of recent inundation (surface crusting, saturated to moist surface soils). It is likely that the wetlands are inundated for only short periods during and shortly after wet conditions. Nevertheless, in some arid areas, such temporary pans can be important in supporting aquatic invertebrate fauna typical of temporary pans and pools, some of which have high conservation value. Prolonged drying out of the pans between wet cycles is an important part of maintenance of conditions suitable for such life, and increased salinities as the pools dry up can act as cues for diapause or egg laying (Bird et al 2010).

There was no water in the pans at the time of the assessment and they were thus not sampled.

The wetland pans were disturbed by vehicle tracks and parts looked as though they might have been excavated. They were accorded a PES Category C on this basis. Their Ecological Importance is considered High, as they are rare features in this landscape. Their Ecological Sensitivity is also considered High, as changes in water availability (particularly increases) could result in substantial changes in biodiversity (assuming that they do support temporary pool invertebrate fauna). They are also considered vulnerable to physical disturbance, particularly loss of top soil and compaction. **Figures 3.12 – 3.15** illustrate the pans in this area.

Figure 3.12
Disturbed porton of hardpan area

Figure 3.13
Ephemeral wetland pan within mapped hardpan area.

Figure 3.14
Small temporary wetland pan in the Pan area shown in Figure 3.3, as mapped by Helme (2014)

Figure 3.15
Disturbed surrounds of one of two wetland pans in the greater Pan area mapped by Helme (2014) and shown in Figure 3.3.

3.8.5 The De Kom pan

The De Kom pan lies to the south of the site. It has high biodiversity importance but would not be affected by the proposed East OFS project (SRK 2020b and SRK 2020c). It is not considered further in this report.

4 FINDINGS OF THE SPECIALIST GEOHYDROLOGICAL AND SURFACE WATER STUDIES WITH REGARD TO IMPACTS OF THE PROPOSED PROJECT

This section assesses the findings of the geohydrological and surface water EIA studies, as these are important in determining the implications of the proposed project for surface (inland) aquatic ecosystems – that is, for rivers and wetlands.

4.1 Geohydrological assessment outcomes

On the basis of modelling of a number of scenarios, which included lining versus not lining the proposed RSF, and time scales from the present (pre East OFS project implementation) to 2150 (~100 years after the predicted end of life of mining operations), SRK (2020c) reached the following conclusions, summarized from the specialist report as follows:

- Pre East OFS mining contaminant plumes (current Tronox operations until 2020) have an average concentration (primarily salinity) in the EOFS area of ± 20% of source (i.e. seawater). The Primary Aquifer has higher concentrations than the secondary, and higher concentrations (± 50% of source) are found near the Groot Goerap River in the north-east as well as the eastern edge of STF2;
- The Secondary Aquifer has concentrations of less than 10% of source throughout most of the East OFS mine footprint, with the exception of slightly higher concentrations (± 30% of source) towards the Groot Goerap in the north-east;
- End of Mine (2055) and Post-closure results showed that the contamination plume largely mimics the shape of the seepage area and remains largely within the Mining Rights Area (MRA) during mining and post-closure;
- However, the contaminant plume migrates from the EOFS mining area in a north-west direction towards the Sout River as well as north-east towards the Groot Goerap River;
- 70% of the contaminant plume footprint would be under 5% of source concentration at end of Life of Mine;
- The maximum concentrations in the Primary Aquifer would be ± 8% higher than in the Secondary Aquifer;
- The Secondary Aquifer contaminant plume would extend some ± 500 m further than the Primary Aquifer;
- Tailings (deep and shallow backfilling) would have a maximum concentration of ± 60% and ± 20% of source salinity (measured as EC) for the Primary and Secondary Aquifer respectively;
- The Overburden Facility would have a maximum concentration of ± 45% and ± 20% for the primary and Secondary Aquifer respectively;
- The contaminant plume of the RSF and Overburden facility would be similar for all lining versus non lining scenarios;
- The greatest mounding effect (up to ± 20 m) in local groundwater levels would occur below the RSF;
- The effect of groundwater level mounding would be very localised (within ± 300 m of the source – i.e. the RSF);
- The contaminant plume would migrate below the Groot Goerap River (± 10 mbgl) with a maximum concentration of ± 10% of source;

- Groundwater mounding at the Groot Goerap River, if any, would be below 5mbgl;
- The contaminant plume may reach up to 5% of the source concentration at stretch of ± 50 m along the southern banks of, and within, the Sout River;
- The contaminant plume dissipates/decreases by an average 30%, 50% and 80% for 2070, 2100 and 2150 for all scenarios respectively;
- Temporary seepage may occur in the Groot Goerap River during backfill in the north of the EOFS mine area.

Based on the above outputs of the geohydrological model, the specialist identified the following impacts, all of which could be mitigated to Low to Very Low significance levels (SRK 2020c):

- Groundwater Mounding from Seepage – this would comprise temporary, local (within 300m from source) increases in groundwater levels, with the largest increases (up to ± 20 m) in local groundwater levels occurring below the RSF – but natural local groundwater levels in this area are deep (± 60 mbgl) and thus increased water levels would not decant into surface systems. The specialist noted that:
    - Temporary seepage might however occur into the Groot Goerap River during backfill in the north of the EOFS mine area.
    - The long-term impact of groundwater mounding is insignificant as it is very localised and unlikely to seep as the groundwater levels are deep;
    - Different lining options for the RSF base made little difference to modelled water level increase (<5 m);
    - Post-mining groundwater <u>levels</u> would be expected to recover very rapidly (a few years), however, the saline contamination plume would be expected to take much longer (> 100 years) to return to the natural water quality of the area.
- Impacts associated with the Overburden facility Base Preparation Scenarios
    - The Overburden facility (volume of c.3.15 Mm3) would store overburden (previously backfilled RAS tailing, taken from previously mined and then backfilled areas) for a period of approximately 3 years once EOFS mining commences. A comparative assessment was conducted which assessed the effect with and without base preparation. The simulated results for the end of Life of the Mine (LOM) are as follows:
        - The contaminant plume does not migrate beyond 200 m from the facility in either of the modelled base preparation options;
        - Both base preparation options have fairly low groundwater concentrations underlying the overburden facility. These low concentrations are attributed to the low moisture content of the RAS tailings (5%) as well as the short (three year) duration of RAS tailings disposal;
    - It was concluded that although lining the facility might improve local concentrations, this is deemed unnecessary as the contaminant plume would not migrate further than 200 m from the facility.

4.2 Findings of the specialist surface hydrology study with regard to impacts of the proposed project on hydrology

The surface water specialist study (SRK 2020b) identified a number of potential impacts to surface hydrology as a result of the proposed project, of which the following are the most pertinent to aquatic ecosystems:

- Erosion:
  - Collection and outflow of water seeped from STFs, causing erosion and potentially transporting sediments to the river.
- Changes to Catchments and Flow Patterns:
  - A change to the catchments and watercourses is expected as the project would alter current sub-catchments and result in the formation of more non-draining areas and artificial pans.
- Damage to Water Courses:
  - This would result from driving over water courses or storage of materials or equipment within them.
- Deterioration of Water Quality as a result of the following:
  - During extreme storm events, runoff from STF 2 could reach the river, carrying sediments, particularly from the steep side slopes of the STF;
  - Storage of materials that could be washed away by surface water flows in large storm events; and
  - Backfilling with sand tailings in the STF areas with a 20% moisture content – some 12% of this water would seep out over time, and could mix with clean stormwater during a storm event and disperse.

Noting that surface water flows in the region are extremely rare, the specialist concluded that the surface water impact assessment shows that all impacts on surface water could be effectively mitigated to low or no significance. **Figure 4.1** presents the specialist's proposed stormwater mitigation plan, comprising a secondary berm built downslope of the (advancing) STF outer side slope, which would aim to direct seepage water runoff and contaminated stormwater away from the RC3 catchment area, which drains to the Groot Goeraap river, and rather divert it into a non-draining catchment. .

The above findings, and those of the geohydrological study in particular, have informed the impact identification, assessment and significance ratings provided in the following section.

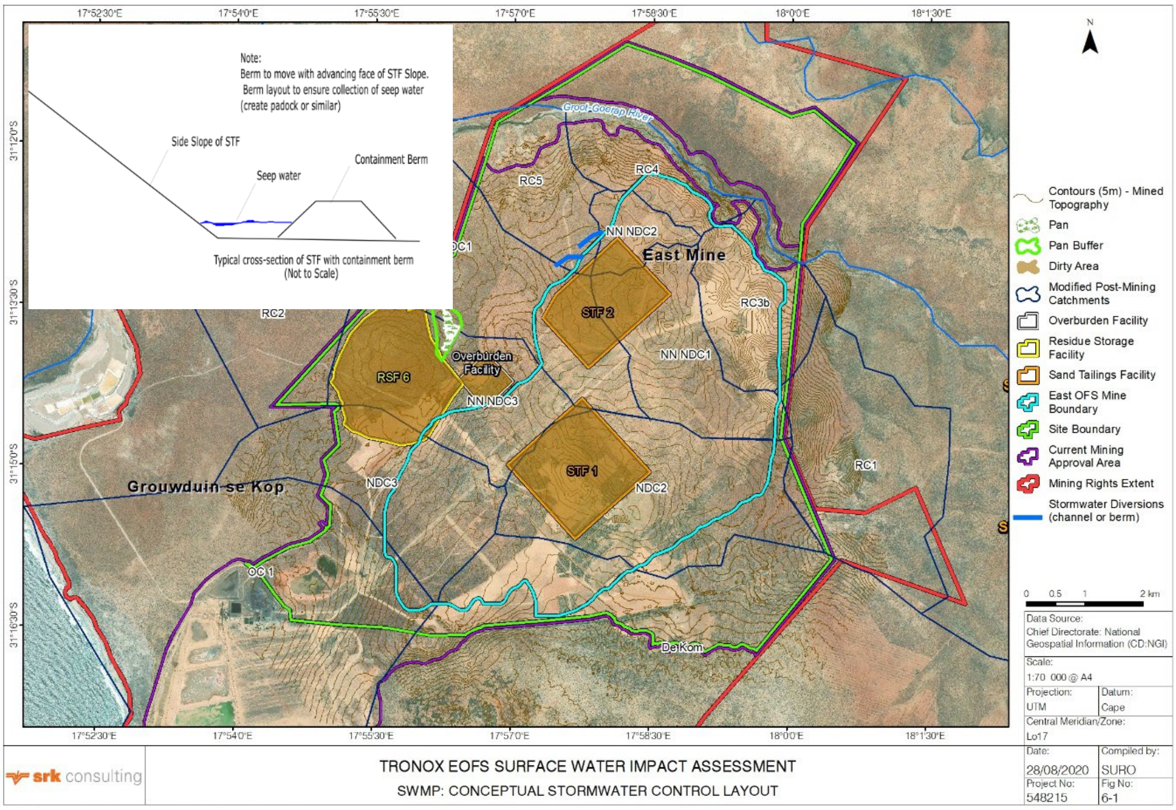

Figure 4.1
Proposed stormwater mitigation plan, after SRK (2020b)

5 ASSESSMENT OF THE IMPACTS OF THE PROPOSED WORKS TO AQUATIC ECOSYSTEMS

5.1 Overview

Surface aquatic ecosystems on the site and its surrounds are limited to the Sout and Groot Goerap Rivers, and the few natural and artificial pans that occur on clay lenses in the dunes - just north of the proposed RSF, as described in Section 3.

The biggest future impact to these systems are the large-scale landscape-level changes that will arise from the authorized mining activities in an extensive area, which have already been assessed and authorized through the EIA (Golder, 2012).

As a result, the present section is limited to assessment only of the impacts likely to be associated with the additional / amended activities / infrastructure outlined in Section 2, noting though that the existing mining authorisation is considered in the assessment of Cumulative Impacts (Section 5.5).

5.2 Impacts associated with Design and Layout

5.2.1 Degradation of natural ephemeral pans as a result of biodiversity loss

The proposed RSF boundary is shown in **Figure 3.3** as encroaching to the buffer of the pan identified by Helme (2014) as a hardpan area, with high biodiversity importance and high sensitivity. Helme recommended a minimum setback of 100m from the mapped pan, as part of the previous authorisation process. While most of the identified hardpan area in fact comprises terrestrial habitat, as described in Helme (2014), small sections do support ephemeral wetland. The biodiversity values of these pans is enhanced as a result of its linkage with terrestrial areas of high biodiversity importance, particularly in a context of landscape scale transformation. In the event that the proposed RSF, with its ± 30m high walls encroaches into or to the edge of this area, it is likely to compound the impacts already assumed as a result of largescale fragmentation of habitat from mining.

This impact is assessed in **Table 5.1**, which also recommends essential mitigation measures. Given that the wetland pans within the broader area are perched, and reliant on direct precipitation rather than runoff, they would be expected to survive despite mining in the surrounding area, provided that the hardpan area remained intact.

Table 5.1
Degradation of natural ephemeral pans

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	Local 1	Medium 2	Long-term 3 – effectively irreversible	Medium 6	Definite	Medium	- ve	Medium
Essential Mitigation Measures The 100m setback from the hardpan edge recommended by Helme (2014) must be stringently applied to this project, with the setback regarded as a minimum and with no activities associated with the development permitted in this zone. **Figure 3.3** shows the hardpan edge.								
With Mitigation	Local 1	Low 1	Long-term 3	Low	Probable	Low	- ve	Medium

5.3 Construction and Operational Phase Impacts

The construction and operational phases in this instance are somewhat complicated by the fact that "construction" would be ongoing through the lifetime of the mine, and in a sense becomes part of the operational phase of development. Construction and Operational Phase impacts are thus assessed together.

5.3.1 Physical disturbance to aquatic ecosystems

Implementation of the proposed activities and infrastructure considered in this report could potentially result in increased physical disturbance to aquatic ecosystems such as the wetland pans in the hardpan area of Helme (2014) and the Groot Goerap River , as a result of increased passage of vehicles through these areas throughout mining.

However, best practice mitigation measures are required, as listed in **Table 5.2**.

Table 5.2
Physical disturbance to aquatic ecosystems – the Groot Goerap River and natural ephemeral pans

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	Local 1	**Low** 1	Long term 3	Low 5	Probable	Low	- ve	Medium
Essential Mitigation Measures i. The setbacks from the hardpan edge and the Groot Goerap River (100m and 130m or the 1:100 year flood line +30m, respectively) required by Helme (2014) must be implemented; ii. These areas should be clearly demarcated throughout construction (i.e. during works and until adjacent areas have commenced rehabilitation) and managed as no-go areas (this measure to be included in the EMPr);								
With Mitigation	Local 1	Low 1	Medium-term 2	Very Low 4	Probable	Very Low	- ve	Medium

5.3.2 Changes in plant communities in the Sout River as a result of seepage water from the proposed RSF, overburden facility and STFs

The specialist geohydrological report noted that seepage of seawater into the primary and secondary aquifers would take place, from the proposed RSF, the overburden facility and backfilling areas.

The Overburden facility (which would be active for three years) would seep water with a maximum concentration of ± 45% of source (i.e. around 2250 mS/m), while the STFs would seep water with a salinity of ± 60% of source (4000 mS/m). While these salinities are well above natural groundwater concentrations (300 -1000 mS/m (see Section 3.4 of this report)), SRK (2020c) notes that the contaminant plume would migrate below the Groot Goerap River (± 10 mbgl) and would thus not be expected to have any effect on this system.

The report notes also however that the contaminant plume may reach up to 5% of the source concentration (i.e. 250 mS/m) within a stretch of ± 50 m along the southern banks of the Sout River. This concentration lies within the range of normal groundwater salinity, and it is thus not considered a significant impact to Sout River water quality. However, if prolonged seepage of water of this salinity entered the river (which is extremely unlikely according to SRK, 2020c), it would result in a major but localised change in hydroperiod, to a system that is naturally ephemeral. Long-term inflows of water along a ± 50 m stretch of river would potentially have the following impacts:

- Result in a change in plant communities, with a local increase in perennial species such as *Phragmites australis* (already present along the estuary margins just upstream of the salt processing works) abutting the salt processing facility – this species would be able to tolerate the salinity range of inflowing water, and would thrive in perennial seepage flows;

- If water was sufficient to result in local pooling, it could result in shallow standing water pools, likely to support *Cladophora* algae and possibly sedges such as *Bolboschoenus maritimus*, noted in the lower estuary, which receives water from the salt processing works, which process borehole water.

The above would be negative impacts to a system that is relatively unimpacted as far as the upper reaches of the estuary. However, the impacts would be localised, affecting a small area of the river only, compared to its overall length and width. *Phragmites australis* is already in the system, and is an indigenous reed species, that occurs in many slightly saline to brackish river systems, providing nesting habitat to various passerine birds.

After the end of the Life of the Mine, it is likely that these vegetated areas would slowly (over decades) revert to their more natural vegetation (or on the river bed, lack of vegetation).

Table 5.3
Changes in plant communities in the Sout River as a result of seepage water from the proposed RSF, overburden facility and STFs

<table>
<tr><th></th><th>Extent</th><th>Intensity</th><th>Duration</th><th>Consequence</th><th>Probability</th><th>Significance</th><th>Status</th><th>Confidence</th></tr>
<tr><td>Without Mitigation</td><td>Local
1</td><td>Medium
2</td><td>Long term
3
Reversible in the very long term</td><td>Medium
6</td><td>Possible</td><td>Low</td><td>- ve</td><td>Medium</td></tr>
<tr><td colspan="9"><u>Essential Mitigation Measures</u>

With regard to seepage from the RSF:
i. No mitigation measures are recommended initially, given the relatively small area likely to be affected and the low significance of the impact.
ii. Monitoring of the depth and water quality of lateral flows into the Sout River must take place, by way of strategically placed monitoring boreholes, as per SRK (2020c) mitigation measures;
iii. Inspect the banks of the Sout River on a quarterly basis for evidence of visible seepage, and should groundwater discharges be observed in the river banks or if monitoring data shows a significant variation (>2m) compared to the modelled outputs (see SRK, 2020c) then pumping from new interception boreholes to prevent the passage of additional flows (i.e. additional to the modelled inflows) into the Sout River should be undertaken, under the guidance of a geohydrologist - (this measure to be included in the EMPr).
iv. With regards to the need to line the RSF to prevent the passage of contaminated flows into sensitive systems, the geohydrological study (SRK 2020c) concluded that lining of the RSF would not contribute markedly to the extent or concentration of contamination plume, and this measure is therefore discarded as an effective mitigation measure, particularly since the modelled impacts of seepage from the RSF would have a Low significance only.
With regard to seepage from the STFs:
v. The specialist Surface Water Resources assessment (SRK 2020b) recommends the use of a migrating containment berm against the edge of the northern STF, which would collect seeped tailings water and convey it back to the processing plant for re-use. This measure would further reduce the impacts to aquatic ecosystems of seepage of (increasingly diluted) seawater from the STF.</td></tr>
<tr><td>With Mitigation</td><td>Local
1</td><td>Medium
2</td><td>Medium-term
2</td><td>Low
5</td><td>Possible</td><td>Very Low</td><td>- ve</td><td>Medium</td></tr>
</table>

5.3.3 Salinisation and changes in plant community in the Groot Goerap River

The geohydrological specialist noted that temporary vadose zone seepage might occur into the Groot Goerap River during tailings backfill in the north of the EOFS mine area. In the event that seepage reached the riverine area, it is assumed that it would be a fairly constant but low magnitude inflow, taking place over a few years – that is, during the period that backfill is being placed in the adjacent areas, and gradually ceasing thereafter. Seepage of water into the river would be saline (SRK 2020c assumes ± 60% of source for mine void tailings), which would amount to an expected EC of around 4000 mS/m, which would be well above the expected thresholds of local plant communities. Such seepage would either promote growth of the most salt-tolerant plant species at the expense of a more diverse community, or (more likely) would result in die-off in areas exposed to seepage, where crystallisation of salt on the river bed would be likely. Such effects could be anticipated along the length of abutting areas where tailings backfill would occur. Although the period of seepage would be over a few years only, the effects could be long-term, given the low frequency of natural surface flow in the region and slow growth rates of vegetation. When river flow did occur, however, it is anticipated that locally increased salt accumulation would be flushed downstream and that slow vegetation recovery would commence thereafter.

The above impacts are assessed in **Table 5.4**.

Table 5.4
Salinisation and changes in plant community in the Groot Goerap River

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	Local 1	Medium 2	Long term 3	Medium 6	Probable	Medium	- ve	Medium
Essential Mitigation Measures Mitigation against these impacts is difficult, in that the impacts are difficult to identify and non-point-source. The following measures are recommended: i. The river bed (particularly low points on the bed) must be visually checked at least monthly along its edges abutting rehabilitated areas during the period of active backfilling within the Groot Goerap river-draining catchment and for one year thereafter to identify significant moisture plumes likely to intercept the river bed or banks (this measure to be included in the EMPr); ii. Installation of temporary cut-off drainage pipes along the closest edge to the river of the planned rehabilitation area should be installed, to collect and convey seepage water from the area, or alternative practical measures introduced to address the issue, if visual evidence or monitoring data indicate that seepage of flows into the river are occurring - (this measure to be included in the EMPr).								
With Mitigation	Local 1	Low 1	Long-term 3	Low 5	Probable	Low	- ve	Medium

5.3.4 Erosion and passage of sediment into the Groot Goerap River

The surface hydrology specialist identified the passage of sediments from unrehabilitated / early phase rehabilitation backfilled slopes and the STF2 into the river during rare storm events as an impact associated with the proposed project. While erosion of slopes is likely to impact negatively on rehabilitation outcomes, in large storms when there is surface flow in the river, the volume of natural sediment is likely to be high, and the effect of additional local sediment sources is expected to be relatively low.

Nevertheless, sediment passage from roads and side slopes into the river would be poor practice, and would cumulatively contribute to riverine degradation over time. It could also be associated with point-source impacts, at the few road crossings over the river. Thus the mitigation measures outlined in **Table 5.5** should be applied.

Table 5.5

Erosion and passage of sediment into the Groot Goerap River

	Extent	Intensity	Duration	Consequence	Probability	Significance	Status	Confidence
Without Mitigation	Local 1	Low 1	Medium term 2	Very Low 4	Probable	Very Low	- ve	Medium
Essential Mitigation Measures i. Existing efforts to rehabilitate slopes following backfilling are supported; ii. The stormwater management plan of SRK (2020b) must be implemented; iii. Attention must be paid to the timeous identification of localised erosion gullies / rills (e.g. down planted slopes and access roads) and small catch dams or other appropriate measures must be included where such impacts are observed, particularly on the north facing slopes of subcatchments RC1, RC3, RC4 and RC5 of SRK (2020) (see **Figure 3.3**) (this measure to be included in the EMPr).								
With Mitigation	Local	Low	Medium term	Very Low	Probable	Very Low	- ve	Medium

5.4 Decommissioning Phase Impacts

No additional decommissioning phase impacts to aquatic ecosystems were identified in this study, as on the basis of the geohydrological assessment, the impacts in terms of water quality and water quantity on downstream aquatic ecosystems would abate, with time. Decommissioning would not result in additional impacts, but would be associated with the end of the rehabilitation phase of the mined areas.

This impact has thus not been rated here.

5.5 Cumulative Impacts

The proposed activities / infrastructure assessed in this report would contribute to the cumulative impacts to surface aquatic ecosystems, primarily from mining, but also (in the lower reaches of the Sout River and its estuary) from the salt processing works and ancillary activities. While the proposed new infrastructure (backfilling in general, including the RSF, the temporary overburden facility and the STFs) could result in a variety of impacts to aquatic ecosystem environments (as assessed in this report), these would be in the context of the existing Mine where large-scale loss of ecological connectivity between aquatic and terrestrial ecosystems, and ongoing inflows of saline seepage water. In this context, the additional (cumulative) impacts of the project have a lower significance than in the case of an environment not already largely ceded to mining.

5.6 Impacts of No Development

SRK (2020a) defines the No Development scenario as follows:

> "*Should the application for the RSF be refused, the East OFS project will not be technically feasible, and mining activities would cease in the East Mine in 2024. The financial viability of the Mine (operating out of the West Mine only) and smelter in Saldanha Bay would be threatened, and those employed directly at the East Mine would be retrenched.*
>
> *Should infrastructure upgrades and the proposed RSF be approved, but the disposal of most tailings in a STF / the required change in topography be refused, the East OFS project may still be technically and financially viable, but at a significantly reduced profitability. In other words, a second variant of the No Go alternative in effect entails disposal of fine residue to the RSF and backfilling of all tailings to the pit.*".

From an aquatic ecosystems perspective, if mining activities ceased from 2024 onwards, and assuming that the required post-mining rehabilitation measures were continued, then there would be a reduced impact on aquatic ecosystems, as a result of the following:

- Topsoils re-established in rehabilitated areas for current RAS mitigation measures would not need to be removed – it is assumed that a significant proportion of topsoil is lost in each removal operation, and the depth of topsoil removed for rehabilitation (just 5cm depth) is assumed to be but a small proportion of the depth of topsoil removed for mineral processing;
- The timelines for rehabilitation completion would be brought forward; and
- The additional (albeit of low to very low significance, with mitigation) impacts to the Groot Goerap and Sout Rivers as a result of the proposed additional infrastructure would not accrue to these systems.

With regard to the second alternative, namely that infrastructure upgrades and the proposed RSF were approved, but the change in tailings disposal strategy was refused, and disposal of fine residue to the RSF and backfilling of all tailings to the pit was sanctioned), then:

- Impacts to the Groot Goerap River ecosystems might be measurably increased, as a significantly larger volume of sediment contaminated with sea water would be stacked in mined areas abutting the river than in the case of RAS mining, resulting in longer term potential seepage of water with an elevated salinity into the river, with all of the impacts identified in Section 5.3.3 potentially being magnified in this reach; and
- The identified impacts to the Sout River would, it is assumed, remain the same.

6 RISK ASSESSMENT

6.1.1 Identification of watercourses

This section considers Section 21c and Section i water uses as defined in the NWA. That is, activities involving impeding or diverting the flow of water in a watercourse (Section 21c) and/or altering the bed, banks, course or characteristics of a watercourse (Section 21i).

In the present project, the following watercourses have been identified, as shown in **Figure 3.3**:

- The Sout River;
- The Groot Goerap River
- Natural perched wetlands in the identified hardpan area.

The artificial off-channel depressional wetlands identified in the approved mining area and described in Section 3.8.4 are not considered watercourses in terms of the NWA.

6.1.2 Identification of water uses

The following water uses have been identified as part of the proposed project:

- Section 21i water use: Changes in the bed, course and characteristics of:
  - the natural perched wetlands described in Section 3.8.4;
  - the lower reaches of the Sout River;
  - the reaches of the Groot Goerap River abutting rehabilitation zones.

6.1.3 Application of the Risk Matrix

Undertaking any of the water uses listed in Section 21 of the NWA requires, unless it is a permissible use as defined in the Act, authorisation through the DHSWS and/or registration of use.

In the case of Section 21c and i water uses, the DHSWS has developed a Risk Matrix (DWS 2016), with the intention of informing the Department as to <u>either</u> the need for authorisation of a Section 21c or i water use through a water use licence, requiring a Water Use Licence Application (WULA) and subsequent registration of use, <u>or</u> whether the use might be considered Generally Authorised in terms of the stipulations of GN509, and require only Registration of Use.

Section 21c and i water uses that are assessed as being of a Low Risk, using the Risk Assessment Matrix, are considered Generally Authorised in terms of GN509, and require only Registration of Use, prior to implementation.

Exclusions to GN509 include the passage of hazardous material including sewers through or in the vicinity of a watercourse. In the present case, although the development includes a sewerage system, these pipelines would not pass through or in the vicinity of any identified watercourses.

Table 6.1 presents the outcomes of application of the Risk Assessment Matrix to the listed Section 21c and i water uses, which have been distinguished in terms of Layout, and Construction / Operational Phase impacts. Decommissioning Impacts were not identified.

Note that the format of the Risk Matrix in its current form does not easily apply to the Layout and Construction Phase activities assessed here, and ratings of Activity and Impact frequency have been adjusted to make more sense of the kind of impacts considered. The Matrix itself requires revision as a matter of urgency.

6.2 Results of Application of the Risk Assessment Matrix

The results of the Risk Assessment are shown in **Table 6.1**. This assessment is based on the mitigation / control measures outlined in Section 5 and repeated in Table 6.1, and assuming the setbacks shown in **Figure 6.1**. These were recommended by SRK (2020b) and are endorsed in this project, as compliant with those of Helme (2014), subject to the complete buffering of the hardpan area by an area of minimum width 100m.

These results indicate that all of the identified water uses would be considered of Low Risk. Normally, they would therefore be subject to registration of use rather than to a full WULA. However, given that the mine currently has a water Use Licence (WUL), an amendment to this WUL would probably rather be applicable – DWS officials should be engaged in this regard.

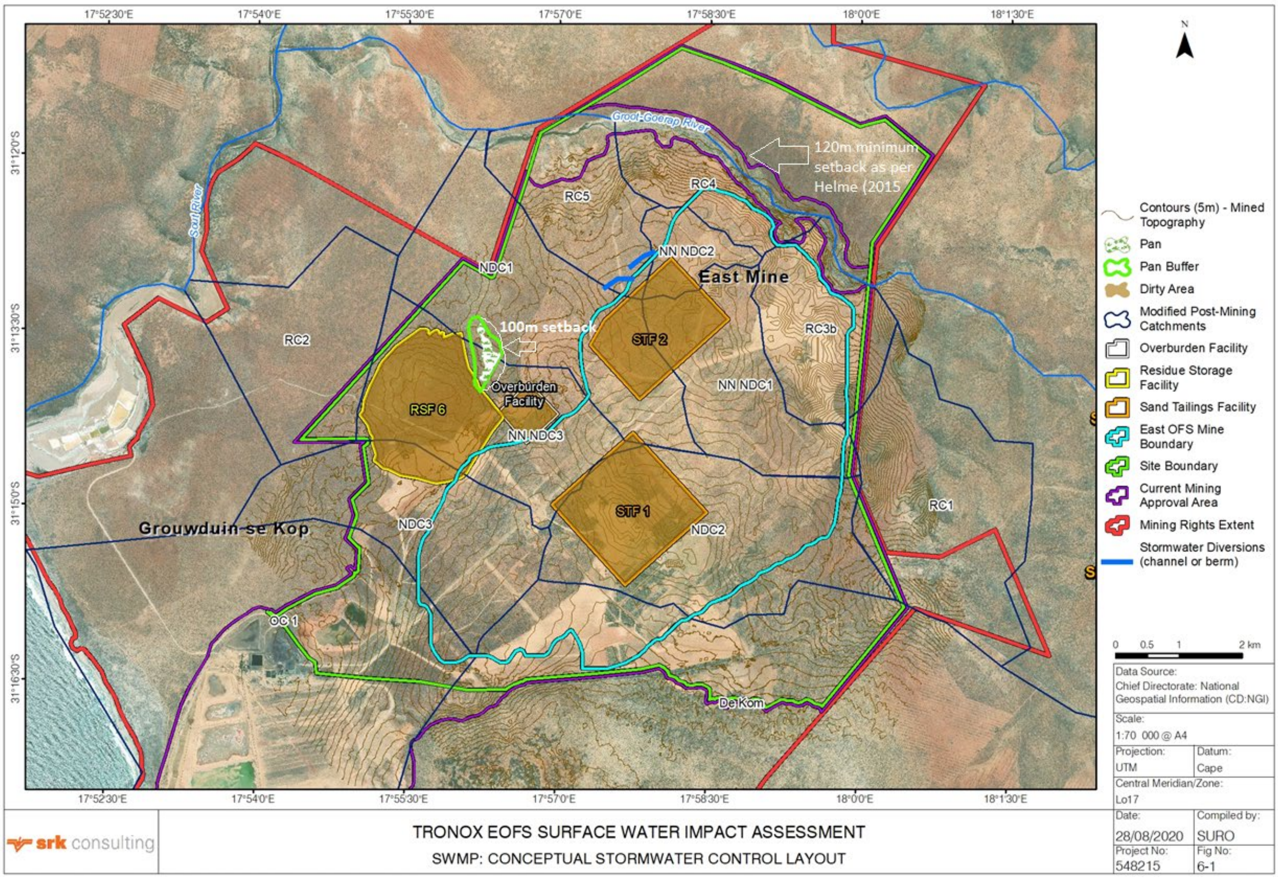

Figure 6.1
Layout of the proposed development showing Groet Goerap River and hardpan area including wetland pan. Figure adapted slightly from SRK (2020b) - the hardpan buffer area has been amended in the above figure to allow for a minimum 100m buffer all the way around (SRK 2020b does not buffer all sides). The Groot Goerap River setback of 120m minimum width and the 1:100 year floodline, as per Helme (2015) is indicated too. These buffers may not be accurately portrayed on this figure and should ideally be marked on site.

Table 6.1

Aspects and Impact Register/Risk Asssessment for NWA Section 21i activities associated with the proposed Residue Storage Facility and associated infrastructure at the Tronox Namakwa Sands Mine development.

Assessment assumes fulll implementation of control measures listed. Risk Matrix completed by Liz Day -SACNASP Reg no. 400270/08

					Severity																
Impact	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Conseq.	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Signif.	Risk Rating	Control Measures	Watercourse Type
1	**Layout**	New RSF	Proximity to perched wetland in hardpan area	Degradation of natural ephemeral pans as a result of biodiversity loss - surrounding terrestrial area would be impacted, fragmenting the pan	1	1	2	1	1.3	1	3	5.25	1	2	5	1	9	47.3	L	The 100m setback from the hardpan edge recommended by Helme (2014) must be stringently applied to this project, with the setback regarded as a minimum and with no activities associated with the development permitted in this zone.	Pan
2	**Construction and Operational Phases**	New RSF, STF, Overburden facility and commencement of approved East OFS mining	Increased passage of heavy vehilces in proximity to and across the Groot Goerap River and hardpan pan	Physical disturbance to aquatic ecosystems – the Groot Goerap River and natural ephemeral pans	1	1	2	1	1.3	1	3	5.25	2	2	5	1	10	52.5	L	i.The setbacks from the Groot Goerap River and the hardpan edge (120m and 100m respectively) required by Helme (2014) must be implemented; ii.These areas should be physically fenced off throughout construction (i.e. during works and until adjacent areas have commenced rehabilitation) to prevent accidental access	Pan
					1	1	2	1	1.3	1	4	6.25	2	3	1	2	8	50	L		Groot Goerap River (lowland river)
3			Seepage water from the proposed RSF, overburden facility and STFs	Changes in plant communities in the Sout River [Note: Frequency of activitiy rated 3 as a low impact but ongoing impact)	1	1	2	2	1.5	1	4	6.5	3	2	1	2	8	52	L	i. No mitigation measures are recommended initially, given the relatively small area likely to be affected and the low significance of the impact. ii. Monitoring of the extent and water quality of actual lateral flows into the Sout River must take place, by way of strategically placed monitoring boreholes. iii. Should the length of affected river be exceeded by more than 50% (i.e. 75m running river bank) or should salinities in throughflows / groundwater discharges into the river exceed 1000 mS/m, then pumping from boreholes to prevent the passage of additional flows (i.e. additional to the modelled inflows) into the Sout River should be undertaken, under the guidance of a geohydrologist. iv. With regards to the need to line the RSF to prevent the passage of contaminated flows into sensitive systems, the geohydrological study (SRK 2020c) concluded that lining of the RSF would not contribute markedly to the extent or concentration of contamination plume, and this measure is therefore discarded as an effective mitigation measure, particularly since the modelled impacts of seepage from the RSF would have a Low significance only. With regard to seepage from the STFs: v.The specialist Surface Water Resources assessment (SRK 2020b) recommends the use of a migrating containment berm against the edge of the STF, which would collect seeped tailings water and convey it back to the processing plant for re-use. This measure would further reduce the impacts to aquatic ecosystems of seepage of (increasingly diluted) seawater from the STF	Sout River (lowland river) and upper estuary
6			Temporary saline seepage into the Groot Goerap River during backfill in the north of the EOFS mine area	Salinisation and changes in plant community in the Groot Goerap River	1	2	2	2	1.8	1	4	6.75	1	2	5	1	9	60.8	L	Mitigation against these impacts is difficult, in that the impacts are difficult to identify and non point-source. The following measures are recommended: i. Monitoring of water quality and levels in the upper levels of the primary aquifer must take place between the river and the rehabilitated areas, to identify significant moisture plumes likely to intercept the river bed or banks; ii. Installation of temporary irrigation drainage pipes along the closest edge to the river of the planned rehabilitation area should be installed, to collect and convey seepage water from the area, if visual evidence or monitoring data indicate that seepage of flows into the river are occurring.	Groot Goerap River (lowland river)
7			Passage of sediments from unrehabilitated / early phase rehabilitation backfilled slopes and the STF2 into the river during storm events	Erosion and passage of sediment into the Groot Goerap River	1	1	1	1	1	1	1	3	1	2	1	2	6	18	L	i. Existing efforts to rehabilitate slopes following backfilling are supported; ii. The stormwater management plan of SRK (2020b) must be implemented; iii. Attention must be paid to the timeous identification of localised erosion gullies / rills (e.g. down planted slopes and access roads) and small catch dams or other appropriate measures must be included where such impacts are observed, particularly on the north facing slopes of subcatchments RC1, RC3, RC4 and RC5 of SRK (2020)	Groot Goerap River (lowland river)

7 CONCLUSIONS

This report has assessed the impacts to aquatic ecosystems associated with the proposed modification of the East Mine's approved residue disposal plan, to accommodate a single RSF to accommodate all fine reside from the project, a change in the tailings backfill strategy and a short-term overburden RAS tailings facility.

Four aquatic ecosystem types were identified in the study area, namely the Groot Goerap River, the Sout River, natural pans in the hard pan area of high botanical significance and excavated pans that would in any case be lost to the approved East OFS mining activities. The latter have not been considered further in this study.

The aquatic assessment relied heavily on the findings of the geohydrology and surface water specialist reports for this EIA (SRK 2020c and 2020b respectively). Few impacts to aquatic ecosystems were in fact identified, and these revolved around:

- Physical disturbance to the hard pan area and Groot Goerap as a result of increased passage of vehicles in these areas;
- Although unlikely, seepage of water of a similar salinity to ground water into the Sout River from the proposed RSF – this could affect a length of some 50m of river bank and bed, by increasing wetted conditions suitable for reed growth. This change would be localised, but might be prolonged, lasting several years / decades after the end of mining operations;
- Seepage of saline water into the Groot Goerap River from tailings backfill in the slopes draining towards the river – this would be a relatively short-term impact but could have a prolonged duration, until flushed out by a major natural flood;
- Possible erosion / sedimentation into the Groot Goerap River from disturbed slopes.

With the exception of the possible degradation of the pans in the hard pan area, which was rated Medium negative Significance prior to mitigation, all of the above impacts were rated as of Low Significance before mitigation and all impacts were assessed as of Low or Very Low negative significance with mitigation.

The above assessments considered the RSF as an unlined system - lining of the RSF to reduce salt water contamination is thus not required, at least from the perspective of its impacts to aquatic ecosystems.

On the basis of the above findings, and from the perspective of surface aquatic ecosystems, the proposed project assessed here, namely to construct a single RSF to accommodate all fine reside from the project, two large Sand Tailings Facilities (STFs) and a short-term overburden RAS tailings facility, in an approved mining area, could be authorized in terms of the NEMA and / or the NWA.

The mitigation measures included in this report ought to form conditions of authorisation and be included in the EMPr.

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APPENDICES

APPENDIX A
Assessment Methodology for determining Present Ecological State (PES) using the Index of Habitat Integrity (IHI) adapted from Kleynhans et al (2008)

Habitat integrity assessment is approached from an instream and riparian zone perspective. Both of these are formulated according to metric groups, each with a number of metrics that enable the assessment of habitat integrity. The model functions in an integrated way, using the results from the assessment of metric groups, or metrics within a metric group, for the assessment of other metric groups where appropriate.

Assessment of habitat integrity is based on an interpretation of the deviation from the reference condition. Specification of the reference condition follows an impact based approach where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physico-chemical conditions and how these changes would impact on the natural riverine habitats.

Metrics are rated as shown in **Table A1**.

Table A1
Habitat integrity assessment categories according to physical drivers and likely habitat responses (based on Kleynhans 1996) – Table after Kleynhans et al (2008)

HABITAT INTEGRITY CATEGORY	DESCRIPTION	RATING (% OF TOTAL)
A	Unmodified, natural reference condition: All physical drivers unmodified or virtually unmodified. If use of the resource is present, the impact of such use falls completely within the natural disturbance regimes both in terms of extent and severity.	90-100
B	Largely natural with few modifications: A small change in natural habitats may have taken place but the ecosystem functions are essentially unchanged. *Physical drivers:* Hydrology: The flow regime has only slightly been modified Geomorphic: limited to slight sediment changes Physico-chemical changes: Water clarity may sporadically be slightly influenced. At worst, only sporadic traces of toxics present. Salts may sporadically be slightly increased. *Associated habitat conditions:* Instream: Very little change in habitat types and their dimensions and frequency. Connectivity between habitats virtually unchanged. Riparian: Riparian habitat close to natural in terms of biophysical characteristics. Very little modification and use of riparian zone. Virtually no fragmentation.	80-89
`C	Moderately modified: Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged. *Physical drivers:* Hydrology: The flow regime may have been significantly modified and direct manipulation by impoundments may be present. Geomorphic: sediment changes due to increased inputs or flow may have increased significantly. Physico-chemical changes: changes in nutrients, salts, oxygen concentration and temperature may deviate significantly from the reference. Low levels of toxics may sporadically be present. *Associated habitat conditions:* Instream: Dimensions and frequency of some habitat types have changed significantly. Fragmentation of habitats may often be present	60-79

HABITAT INTEGRITY CATEGORY	DESCRIPTION	RATING (% OF TOTAL)
	Riparian: Changes in the structure of the zone may be common. Some fragmentation of the zone may often be present.	
D	Largely modified. A large loss and change of natural habitat, biota and basic ecosystem functions has occurred. *Physical drivers:* Hydrology: The flow regime has been extensively modified and manipulation by impoundments may be present. Geomorphic: Drastic changes in sediment loads due to increased inputs or flow modification may have occurred. Physico-chemical changes: nutrients, salts, oxygen concentration and temperature may deviate considerably from the reference. Low levels of toxics may regularly be present. *Associated habitat conditions:* Instream: Dimensions and frequency of some habitat types may differ drastically from the reference. Fragmentation of habitats may often and extensively be present. Riparian: Extensive changes of the zone may be present. Significant fragmentation of the zone may have occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive. *Physical drivers:* Hydrology: The flow regime may have been extensively and severely modified and manipulation by impoundments is likely to be present. Geomorphic: Extensive and severe changes in sediment loads due to increased inputs or flow modification may have occurred. Physico-chemical changes: nutrients, salts, oxygen concentration and temperature may deviate severely and regularly from the reference. Significant levels of toxics may regularly be present. *Associated habitat conditions:* Instream: Dimensions and frequency of some habitat types may differ extensively and severely from the reference. Fragmentation of habitats may regularly and extensively be present Riparian: Severe and extensive changes of the zone may be present. Extensive fragmentation of the zone may have occurred.	20-39
F	Critically / Extremely modified: Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. *Physical drivers:* Hydrology: The flow regime may be extensively and extremely modified and manipulation by impoundments is often present. Geomorphic: Extensive and extreme changes in sediment loads due to increased inputs or flow modification may have occurred. Physico-chemical changes: Nutrients, salts, oxygen concentration and temperature may deviate extremely and very regularly from the reference. High levels of toxics may regularly be present. *Associated habitat conditions:* Instream: Dimensions and frequency of some habitat types may differ extensively and extremely from the reference. Fragmentation of habitats may be severe. Riparian: Extreme and extensive changes of the zone may be present. Fragmentation of the zone may be severe.	0-19

Interpretation of the severity of impacts is based on the natural characteristics ("reference condition") of the river. The premise is that the severity of impacts on the habitat integrity of a river will vary according to the natural characteristics of the river, i.e. particular river types will be more sensitive to certain impacts than other types.

The method requires the scoring of attributes associated with a particular criterion (see Table A2). The mean of all scores is then used to place the wetland in a Habitat Integrity category .

Table A2
List of criteria and attributes considered in the evaluation of PES.

Criteria and attributes	Relevance
Hydrological	
Flow Modification	• flows reduced by abstraction (surface and/or groundwater, upstream or within wetland) or impoundment (dams, weirs or spillways), alien plant infestation or silviculture; • increased runoff from hardened catchment, agricultural drains, effluent disposal or change in watershed:wetland ratio; • alteration in flow regime (timing, duration, frequency, volume or velocity); • outflows constricted by vegetation; and • altered inundation pattern of wetland habitats resulting in floristic changes or incorrect cues to biota.
Permanent Inundation	impoundment or water level regulation resulting in destruction of natural wetland habitat.
Water Quality	
Water Quality Modification (nutrient loading and/or toxics and/or faecal pollution)	• from surface or groundwater point and/or diffuse sources (agricultural activities, human settlements, industrial or wastewater effluent); • internal loading from accumulated sediments; • aggravated by volumetric decrease in flow delivered to the wetland (scored under flow modification); and • change in ambient (desired) salinity as a consequence of altered freshwater or marine intrusion.
Sediment Load Modification	• reduction due to upstream retention by impoundment; and • increase due to land use practices such as overgrazing, unnatural rates of erosion or in-filling, and resulting in atypical accretion and/or turbidity.
Hydraulic/Geomorphic	
Canalisation/culverts	• desiccation, shrinkage, altered inundation patterns and changes in habitats; and • point discharges as opposed to broad or sheet flows.
Topographic Alteration/Habitat Fragmentation	• consequence of infilling, ploughing, dykes, causeways, trampling, bridges, roads, railway lines and other substrate disruptive physical changes that alter wetland habitat either directly or through changes in inundation patterns.
Biotic	
Terrestrial Encroachment	• desiccation of wetland and/or encroachment of terrestrial plant species due to changes in hydrology, geohydrology or geomorphology, resulting in a change from wetland to terrestrial (upland) habitat and associated loss of wetland function.
Loss of Shoreline (riparian) and/or fringing Vegetation (indigenous)	• loss or reduction in herbaceous or woody vegetation cover, and/or increased distance between upland vegetation and permanent water; • switch from macrophyte to algal dominance; • loss of critical riparian or upland vegetation as a consequence of development, farming activities, grazing or firewood collection affecting wildlife habitat, overland attenuation of flows, input of organic matter or increased potential for erosion; • loss of shading.
Invasive Plant Encroachment	• altered habitat characteristics through changes in community structure and/or water quality (oxygen reduction and shading).
Faunal Disturbance/ Alien Fauna	• faunal disturbance due to human presence, domestic animals, noise, light, footpaths, roadways, airports, electricity servitudes;

Criteria and attributes	**Relevance**
	• presence of alien fauna affecting faunal community structure (e.g. top down imbalance due to coarse fish, excessive zooplankton grazing etc; bird predation; gerbils); and • atypical fauna due to human presence.
Over utilisation of biota	overgrazing, fishing, mowing, burning or harvesting leading to alterations and imbalances in community structure and food web interactions.

The river IHIA is based on two components of the drainage line, the riparian zone and the instream channel. Assessments are made separately for both aspects, but data for the riparian zone is primarily interpreted in terms of the potential impact on the instream component. The method involves the rating of the perceived modification of nine instream criteria and eight riparian criteria against a set of scoring guidelines. The final score is derived by calculating the average scores, which places the final score in one of the categories listed in **Table A1**.

APPENDIX B

METHODOLOGY FOR DETERMINING ECOLOGICAL IMPORTANCE AND SENSITIVITY

APPENDIX B

Methodology for determining the Environmental Importance and Sensitivity (EIS) of rivers and drainage lines.

The ecological importance and sensitivity (EIS) is determined using the approach described in the DWA documented entitled, "Resource Directed Measures for Protection of Water Resources" (DWA 1999). In the method, a series of determinants are assessed on a scale of 0 to 4, where "0" indicates no importance while "4" indicates very high importance. The EIS score also provides guidance on the recommended ecological category of the watercourse assessed. The final score is placed within an EIS category and the score is used to determine the

EIS Category	**Range of Median**	**Recommended Ecological Category**
Very high Watercourses that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these watercourses is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Watercourses that are considered to be ecologically important and sensitive. The biodiversity of these watercourses may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Watercourses that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these watercourses is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Watercourses that are not ecologically important and sensitive at any scale. The biodiversity of these watercourses is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

APPENDIX C

IMPACT ASSESSMENT METHODOLOGY
AS PROVIDED BY SRK

Impact Assessment Methodology for EIAs - Instructions to Specialists

The significance of all potential impacts that would result from the proposed Project is determined in order to assist decision-makers. The significance rating of impacts is considered by decision-makers, as shown below.

- **INSIGNIFICANT**: the potential impact is negligible and **will not** have an influence on the decision regarding the proposed activity.
- **VERY LOW**: the potential impact is very small and **should not** have any meaningful influence on the decision regarding the proposed activity.
- **LOW**: the potential impact **may not** have any meaningful influence on the decision regarding the proposed activity.
- **MEDIUM**: the potential impact **should** influence the decision regarding the proposed activity.
- **HIGH**: the potential impact **will** affect a decision regarding the proposed activity.
- **VERY HIGH**: The proposed activity should only be approved under special circumstances.

The **significance** of an impact is defined as a combination of the **consequence** of the impact occurring and the **probability** that the impact will occur. The significance of each identified impact[4] must be rated according to the methodology set out below:

Step 1 – Determine the **consequence** rating for the impact by determining the score for each of the three criteria (A-C) listed below and then **adding** them[5]. The rationale for assigning a specific rating, and comments on the degree to which the impact may cause irreplaceable loss of resources and be irreversible, must be included in the narrative accompanying the impact rating:

Rating	Definition of Rating	Score
A. *Extent*– *the area over which the impact will be experienced*		
Local	Confined to project or study area or part thereof (e.g. site)	1
Regional	The region, which may be defined in various ways, e.g. cadastral, catchment, topographic	2
(Inter) national	Nationally or beyond	3
B. *Intensity*– *the magnitude of the impact in relation to the sensitivity of the receiving environment, taking into account the degree to which the impact may cause irreplaceable loss of resources*		
Low	Site-specific and wider natural and/or social functions and processes are negligibly altered	1
Medium	Site-specific and wider natural and/or social functions and processes continue albeit in a modified way	2
High	Site-specific and wider natural and/or social functions or processes are severely altered	3
C. *Duration*– *the timeframe over which the impact will be experienced and its reversibility*		
Short-term	Up to 2 years (i.e. reversible impact)	1
Medium-term	2 to 15 years (i.e. reversible impact)	2
Long-term	More than 15 years (state whether impact is irreversible)	3

[4] This does not apply to minor impacts which can be logically grouped into a single assessment.
[5] Please note that specialists are welcome to discuss the rating definitions as they apply to their study with the EIA team.

The combined score of these three criteria corresponds to a **Consequence Rating**, as follows:

Combined Score (A+B+C)	3 – 4	5	6	7	8 – 9
Consequence Rating	Very low	Low	Medium	High	Very high

Example 1:

Extent	Intensity	Duration	**Consequence**
Regional 2	Medium 2	Long-term 3	**High** 7

Step 2 – Assess the **probability** of the impact occurring according to the following definitions:

Probability– the likelihood of the impact occurring	
Improbable	< 40% chance of occurring
Possible	40% - 70% chance of occurring
Probable	> 70% - 90% chance of occurring
Definite	> 90% chance of occurring

Example 2:

Extent	Intensity	Duration	**Consequence**	**Probability**
Regional 2	Medium 2	Long-term 3	**High** 7	Probable

Step 3 – Determine the overall **significance** of the impact as a combination of the **consequence** and **probability** ratings, as set out below:

		Probability			
		Improbable	Possible	Probable	Definite
Consequence	Very Low	**INSIGNIFICANT**	**INSIGNIFICANT**	**VERY LOW**	**VERY LOW**
	Low	**VERY LOW**	**VERY LOW**	**LOW**	**LOW**
	Medium	**LOW**	**LOW**	**MEDIUM**	**MEDIUM**
	High	**MEDIUM**	**MEDIUM**	**HIGH**	**HIGH**
	Very High	**HIGH**	**HIGH**	**VERY HIGH**	**VERY HIGH**

Example 3:

Extent	*Intensity*	*Duration*	***Consequence***	***Probability***	***Significance***
Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**

Step 4 – Note the **status** of the impact (i.e. will the effect of the impact be negative or positive?)

Example 4:

Extent	*Intensity*	*Duration*	***Consequence***	***Probability***	***Significance***	***Status***
Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**	**– ve**

Step 5 – State your level of **confidence** in the assessment of the impact (high, medium or low).

Depending on the data available, you may feel more confident in the assessment of some impact than others. For example, if you are basing your assessment on extrapolated data, you may reduce the confidence level to low, noting that further groundtruthing is required to improve this.

Example 5:

Extent	*Intensity*	*Duration*	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**	**– ve**	High

Step 6 – Identify and describe practical **mitigation** and **optimisation** measures that can be implemented effectively to reduce or enhance the significance of the impact. Mitigation and optimisation measures must be described as either:

- **Essential**: best practice measures which must be implemented and are non-negotiable; and.
- **Best Practice**: recommended to comply with best practice, with adoption dependent on the proponent's risk profile and commitment to adhere to best practice, and which must be shown to have been considered and sound reasons provided by the proponent if not implemented.

Essential mitigation and optimisation measures must be inserted into the completed impact assessment table. The impact should be re-assessed with mitigation, by following Steps 1-5 again to demonstrate how the extent, intensity, duration and/or probability change after implementation of the proposed mitigation measures.

Example 6: A completed impact assessment table

	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Regional 2	Medium 2	Long-term 3	**High** 7	Probable	**HIGH**	**– ve**	High
Essential mitigation measures: • Xxx1 • Xxx2 • Xxx3								
With mitigation	Local 1	Low 1	Long-term 3	**Low** 5	Improbable	**VERY LOW**	**– ve**	High

Best practice measures (which are assumed not to affect impact significance ratings) must be presented in the text, in bullet format.

Step 7 – Summarise all impact significance ratings as follows in your executive summary:

Impact	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Impact 1: XXXX	Medium	Improbable	**LOW**	–ve	High
With Mitigation	Low	Improbable	**VERY LOW**		High
Impact 2: XXXX	Very Low	Definite	**VERY LOW**	–ve	Medium
With Mitigation:	*Not applicable*				