# Impact Assessment Methodology

***1. Nature***
This is a brief written statement of the environmental aspect being impacted upon by a particular action or activity.

***2. Extent (E)***
Extent refers to the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact.

- Site (1) – Within the construction site.
- Local (2) – Within a radius of 2 km of the construction site.
- Regional (3) – the scale applies to impacts on a provincial level and parts of neighbouring provinces.
- National (4) – the scale applies to impacts that will affect the whole South Africa.

***3. Duration (D)***
Duration indicates what the lifetime of the impact will be.

- Short-term (1) – less than 5 years.
- Medium-term (2) – between 5 and 15 years.
- Long-term (3) – between 15 and 30 years.
- Permanent (4) – over 30 years and resulting in a permanent and lasting change that will always be there.

***4. Intensity (I)***
Intensity describes whether an impact is destructive or benign.

- Very High (4) - Natural, cultural and social functions and processes are altered to extent that they permanently cease.
- High (3) - Natural, cultural and social functions and processes are altered to extent that they temporarily cease.
- Moderate (2) - Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way.
- Low (1) - Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.

***5. Probability (P)***
Probability describes the likelihood of an impact actually occurring.

- Improbable (1) - Likelihood of the impact materialising is very low.
- Possible (2) - The impact may occur.
- Highly Probable (3) - Most likely that the impact will occur.
- Definite (4) - Impact will certainly occur.

***6. Cumulative (C)***

In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

***7. Significance (S)***

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

| Score | | Elaboration |
|---|---|---|
| **- (13 - 16 points)** | NEGATIVE VERY HIGH | Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw. |
| **- (10 - 12 points)** | NEGATIVE HIGH | These are impacts which individually or combined pose a significantly high negative risk to the environment. These impacts pose a high risk to the quality of the receiving environment. The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment. |
| **- (7 - 9 points)** | NEGATIVE MODERATE | These are impacts which individually or combined pose a moderate negative risk to the quality of health of the receiving environment. These systems would not generally require immediate action but the deficiencies should be rectified to avoid future problems and associated cost to rectify once in HIGH risk. Aesthetically and/or physically non-compliance can be expected over a medium term. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable. Mitigation is possible with additional design and construction inputs. |
| **- (4 - 6 points)** | NEGATIVE LOW | These are impacts which individually or combined pose a deleterious or adverse impact and low negative risk to the quality of the receiving environment, and may lead to potential health, safety and environmental concerns. Aesthetically and/or physical non-compliance can be expected for short periods. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure. |
| **0** | NEUTRAL | Impact is neither beneficial nor adverse. These are impacts which cannot be classified as either positive or negative or classified and null and void in the case of a negative impact being adequately mitigated to a state where it no longer renders a risk. |
| **+(4 - 6 points)** | POSITIVE LOW | These are impacts which individually or combined pose a low positive impact to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is short term, local in extent, not intense in its effect and may not be likely to occur. A low impact has no permanent impact of significance. |

| | | |
|---|---|---|
| **+(7 - 9 points)** | POSITIVE MODERATE | These are impacts which individually or combined pose a moderate positive effect to the quality of health of the receiving environment. In this case the impact is medium term, moderate in extent, mildly intense in its effect and probable. |
| **+(10 - 12 points)** | POSITIVE HIGH | These are impacts which individually or combined pose a significantly high positive impact on the environment. These impacts pose a high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is longer term, greater in extent, intense in its effect and highly likely to occur. The effects of the impact may affect the broader environment. |
| **+ (13 - 16 points)** | POSITIVE VERY HIGH | These are permanent and important beneficial impacts which may arise. Individually or combined, these pose a significantly high positive impact on the environment. These impacts pose a very high benefit to the quality of the receiving environment and health, and may lead to potential health, safety and environmental benefits. In this case the impact is long term, greater in extent, intense in its effect and highly likely or definite to occur. The effects of the impact may affect the broader environment. |

# Planning and Design Phase: Bridge Design Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Planning and Design - Bridge Design** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | Inadequate or incompetent Planning and Design for infrastructure | 1 | Without | -2 | -3 | -2 | -2 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | 3 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -3 | -3 | -3 | -10 | Negative high |
| | **Mitigation**: (a) Ensure best practicable solutions of design which is best suited to the study area and receiving environment which will then result in the provision of infrastructure for the use of people in the surrounding communities. (b) The consideration for wider spanned culverts must be considered with less intrusion into the Umtamvuna River. (c) Consideration must still be given to design which will minimise the need for maintenance and costs associated with that. (d) Consideration should also be given to a spanned bridge. (e) Ensure correct, peer and supervisor reviewed designs are developed. Furthermore, it is paramount that the findings of this BAR and the associated specialist studies are incorporated into the design to avoid sensitive areas. (f) In light of the ecological importance of the Mtamvuna River, the river crossing should make use of a spanned bridge structure with no in stream piers rather than a box culvert crossing to avoid the risks/impacts identified in Section 6.1 above. (g) The use of box culverts to cross the river is not recommended due to the perceived impact on flows, habitat and biota. (h) The motivation for this recommendation is linked to the current health and importance of this river (B PES Class and High EIS) as well as its FEPA status as a flagship free flowing river. Any alteration natural flow regimes and habitat condition for sensitive/migratory aquatic biota is undesirable and significant in this context. (i) The height of the bridge should accommodate the 1:100yr flood events. (j) Bridge abutments should not be located within 10m of the edge of the delineated riparian zone to allow for natural channel migration/adjustments over time. (k) Where necessary, box culverts should be installed within abutments/embankments to allow for the natural spreading out of flood flows, and minimise the blocking of flood flows and the deactivation of flood terraces. | | | | | | | | |
| 2 | Location and design of the access bridge could lead to impacts on the natural environment | 1 | Without | -2 | -2 | -2 | -1 | -7 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -2 | -4 | -2 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | | 3 | Without | -2 | -4 | -2 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -3 | -2 | -10 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: All elements must be considered in the location and design of the bridge, such as avoiding areas with greater scour probability and meanders in the river. The location of the bridge should also avoid the removal of trees or any shrubs. Implementation of design option 1 is a form of mitigation as it is a spanned bridge which has significantly less impact on the Umtamvuna River, however, still provides the needed service. | | | | | | | | |
| | Consideration for national, provincial and local plans in the planning for the development | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | 2 | 4 | 3 | 4 | 13 | Positive very high |
| | | 2 | Without | -1 | 0 | -2 | -4 | -7 | Negative Moderate |
| | | | With | 2 | 4 | 3 | 4 | 13 | Positive very high |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | 2 | 4 | 1 | 1 | 8 | Positive moderate |
| 3 | Mitigation: All relevant plans for the area must be considered and adequate consultation with the relevant planning officials in the area. | | | | | | | | |
| | Development in sensitive habitats could lead to the diminishing of the socio-economic benefits. | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| 4 | **Mitigation**: All measures and considerations for the design of the bridge must consider the triple bottom line and ensure optimisation of social, economic, environmental and practical benefits. | | | | | | | | |
| | Appropriate planning of exclusion of sensitive vegetation and steep areas. | 1 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 3 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| 5 | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) Avoidance of the point and design of the bridge which will require the link road to follow an alignment along the severe current gully erosion in the area. (b) The height of the bridge should accommodate the 1:100yr flood events. (c) Bridge abutments should not be located within 10m of the edge of the delineated riparian zone to allow for natural channel migration/adjustments over time. (d) Where necessary, box culverts should be installed within abutments/embankments to allow for the natural spreading out of flood flows, and minimise the blocking of flood flows and the deactivation of flood terraces. | | | | | | | | |
| 6 | Possible lack of consideration of what the environment can accommodate. | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -3 | -3 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -3 | -3 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: All measures and considerations for the design of the bridge must consider the triple bottom line and ensure optimisation of social, economic, environmental and practical benefits. | | | | | | | | |
| 7 | Unsound design which will require maintenance in the near future | 1 | Without | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | **Mitigation**: Ensure that the best practicable design is used and that the professionalism and integrity of the bridge design is maintained. | | | | | | | | |
| | **Sub-phase: Indirect Impacts** | | | | | | | | |
| 8 | The banks of the river will the altered which may impact on the functioning of the river and the integrity of the structure | 1 | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -2 | -1 | -1 | -5 | Negative low |
| | | 2 | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -2 | -2 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -2 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: The use of protective measures such gabions and revetments to protect the riverine habitats. | | | | | | | | |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Sub-phase: Cumulative Impacts** | | | | | | | | | |
| 9 | The provision of the bridge may lead to increased / mushroomed development | 1 | Without | 2 | 2 | 2 | 2 | 8 | Positive moderate |
| | | | With | 3 | 4 | 3 | 3 | 13 | Positive very high |
| | | 2 | Without | 2 | 2 | 2 | 2 | 8 | Positive moderate |
| | | | With | 3 | 4 | 3 | 3 | 13 | Positive very high |
| | | 3 | Without | 2 | 2 | 2 | 2 | 8 | Positive moderate |
| | | | With | 3 | 4 | 3 | 3 | 13 | Positive very high |
| | **Mitigation**: The development will promote accessibility which can only have a positive impact in terms of socio-economic opportunities as well as safety. | | | | | | | | |
| | | | | | | | Average for Bridge Design Alternative 1 without mitigation | -6.2 | Negative Moderate |
| | | | | | | | Average for Bridge Design Alternative 1 with mitigation | -0.3 | Negative Low |
| | | | | | | | Average for Bridge Design Alternative 2 without mitigation | -7.6 | Negative Moderate |
| | | | | | | | Average for Bridge Design Alternative 2 with mitigation | -2.4 | Negative Low |
| | | | | | | | Average for Bridge Design Alternative 3 without mitigation | -7.7 | Negative Moderate |
| | | | | | | | Average for Bridge Design Alternative 3 with mitigation | -3.1 | Negative Low |

## Planning and Design Phase: Road Alignment Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Planning and Design - Road Alignment Alternatives** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | Inadequate or incompetent Planning and Design for the road infrastructure (taking into consideration the best environmental solutions which can be accommodated by the budget assigned) | 1 | Without | -2 | -3 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | 2 | Without | -2 | -3 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -2 | -1 | -1 | -5 | Negative low |
| | | 3 | Without | -2 | -3 | -3 | -2 | -10 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | **Mitigation**: (a) Ensure best practicable solutions of design which is best suited to the study area and receiving environment which will then result in the provision of infrastructure for the use of people in the surrounding communities. (b) Consideration must still be given to design which will minimise the need for maintenance and costs associated with that. (c) Ensure correct, peer and supervisor reviewed designs is developed. Furthermore, it is paramount that the findings of this BAR and the associated specialist studies are incorporated into the design to avoid sensitive areas. (d) Of the three link road alternatives, RA 2 should be used as this aligns largely with existing informal dirt tracks and avoids the crossing of additional water resources currently not impacted. (e) The unnecessary crossing of Unit W-01 should be avoided. (f) Notwithstanding the above, the road alignment must avoid long stretches that run perpendicular to steep slopes and should be re-aligned to run as close to parallel to contours as possible. (g) The bridge crossing must be aligned along the existing corridor of disturbance i.e. where river bed and banks have already been modified. (h) Under no circumstances must the bridge cross at un-impacted sections of the river. | | | | | | | | |
| 2 | Location and alignment of the road could lead to impacts on the natural environment | 1 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | 2 | Without | -2 | -3 | -1 | -1 | -7 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | | With | -1 | -3 | -3 | -3 | -10 | Negative high |
| | **Mitigation**: All elements must be considered in the location and design of the road, such as avoiding areas with greater scour probability and where additional watercourse crossings would be needed. The alignment should also avoid the removal of trees or any shrubs. | | | | | | | | |
| 3 | Consideration for national, provincial and local plans in the planning for the development | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | 2 | 2 | 3 | 4 | 11 | Positive high |
| | | 2 | Without | -1 | 0 | -2 | -2 | -5 | Negative low |
| | | | With | 2 | 4 | 3 | 4 | 13 | Positive very high |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | 2 | 4 | 1 | 1 | 8 | Positive moderate |
| | **Mitigation**: All relevant plans for the area must be considered and adequate consultation with the relevant planning officials in the area. | | | | | | | | |
| 4 | Development in sensitive habitats could lead to the diminishing of the socio-economic benefits. | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | 2 | 4 | 3 | 3 | 12 | Positive high |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | 2 | 4 | 3 | 3 | 12 | Positive high |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | | With | 2 | 4 | 3 | 3 | 12 | Positive high |
| | **Mitigation**: All measures and considerations for the design of the road must consider the triple bottom line and ensure optimisation of social, economic, environmental and practical benefits. Socio-economic benefits will actually be enhanced. | | | | | | | | |
| 5 | Appropriate planning of exclusion of sensitive vegetation and steep areas. | 1 | Without | -1 | -4 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -2 | -3 | -2 | -8 | Negative Moderate |
| | | 2 | Without | -1 | -4 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | 3 | Without | -1 | -4 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -2 | -3 | -2 | -8 | Negative Moderate |
| | **Mitigation**: Avoidance of the areas with severe current gully erosion in the area and steep areas. | | | | | | | | |
| 6 | Possible lack of consideration of what the environment can accommodate. | 1 | Without | -2 | -2 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | 2 | Without | -2 | -2 | -2 | -2 | -8 | Negative Moderate |
| | | | With | -1 | -2 | -1 | -1 | -5 | Negative low |
| | | 3 | Without | -2 | -2 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | **Mitigation**: All measures and considerations for the design of the road must consider the triple bottom line and ensure optimisation of social, economic, environmental and practical benefits. | | | | | | | | |
| 7 | Unstable design which will require maintenance in the near future | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -2 | -5 | Negative low |
| | | 2 | Without | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -2 | -1 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| | **Mitigation**: Ensure that the best practicable design is used and that the professionalism and integrity of the road design is maintained. | | | | | | | | |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Sub-phase: Indirect Impacts** | | | | | | | | | |
| 8 | Permeability of the area will be lessened by the hardening of surfaces of the footprint of the road | 1 | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | | With | 1 | 4 | 3 | 2 | 10 | Positive high |
| | | 2 | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | | With | 1 | 4 | 3 | 2 | 10 | Positive high |
| | | 3 | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | | With | 1 | 4 | 3 | 2 | 10 | Positive high |
| | **Mitigation**: Sufficient stormwater management must be instated. Currently there is no stormwater management; hence this is a positive development for the area. | | | | | | | | |
| **Sub-phase: Cumulative Impacts** | | | | | | | | | |
| 9 | The provision of the road may lead to increased / mushroomed development | 1 | Without | 2 | 3 | 2 | 2 | 9 | Positive moderate |
| | | | With | 3 | 4 | 3 | 3 | 13 | Positive very high |
| | | 2 | Without | 2 | 3 | 2 | 2 | 9 | Positive moderate |
| | | | With | 3 | 4 | 3 | 3 | 13 | Positive very high |
| | | 3 | Without | 2 | 3 | 2 | 2 | 9 | Positive moderate |
| | | | With | 3 | 4 | 3 | 3 | 13 | Positive very high |
| | **Mitigation**: The development will promote accessibility which can only have a positive impact in terms of socio-economic opportunities as well as safety. | | | | | | | | |

| | | |
|---|---|---|
| Average for RA Alternative 1 without mitigation | -7.2 | Negative Moderate |
| Average for RA Alternative 1 with mitigation | 1.0 | Positive low |
| Average for RA Alternative 2 without mitigation | -6.0 | Negative low |
| Average for RA Alternative 2 with mitigation | 2.7 | Positive low |
| Average for RA Alternative 3 without mitigation | -7.4 | Negative Moderate |
| Average for RA Alternative 3 with mitigation | 0.4 | Positive low |

## Planning and Design Phase: No-Go Alternative

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Planning and Design - No-Go** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | All the impacts outlined above will not apply to the No-Go alternative as the status quo will apply and the environment will remain as it is currently. However, it is important to note that the benefits associated with the development will also not materialise, and it must be noted that the majority of the impacts identified for the development were mitigated to a negative low or positive impact once the measures for mitigation were applied, indicating that maintaining the status quo is to lose the opportunity of a beneficial development with negligible environmental impacts. | | | | | | | 0 | Neutral |

## Construction Phase: Bridge Design Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Construction - Bridge Design** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | The proposed development will likely result in clearing of the Umtamvuna River riparian vegetation, the reshaping of the bed and banks of the river, and the infilling of such riverine habitat within the bridge footprint for the establishment of the culverts and embankments of the bridge (Although some degree of alteration is evident) | 1 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -3 | -1 | -1 | -6 | Negative low |
| | | 2 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -3 | -2 | -2 | -8 | Negative Moderate |
| | | 3 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -3 | -2 | -2 | -8 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) A method statement for each finalised bridge crossing must be compiled by the Contractor in line with the mitigation measures proposed below and in conjunction with the appointed ECO to confirm all methods of watercourse crossing/ encroachment include effective steps to minimise the impacts to freshwater habitat.(b) It is recommended that construction take place in the winter/dry months to reduce erosion and sedimentation risks associated with high summer rainfall in this region. (c) Stormwater and erosion control measures must be implemented during the construction phase to ensure that erosion and sedimentation impacts to the river including in-stream habitats are minimised and avoided. In this regard, the following measures must be implemented: (1) The natural flow of rivers or streams shall not be permanently diverted or blocked. (2) Maintain adequate through flows to downstream aquatic ecosystems to protect aquatic life, and prevent the interruption of existing downstream uses. (3) Clearing activities must only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected, clearing activities should be put on hold. In this regard, the contractor must be aware of weather forecasts. (4) Construction activities should be scheduled to minimise the duration of exposure to bare soils on site, especially on steep slopes. | | | | | | | | |
| | Direct faunal fatalities for those sedentary and immobile fauna inhabiting the areas to be transformed as well as a result of onsite poaching or killing during the construction phase (i.e. cattle safety as a concern raised by I&APs). | 1 | Without | -3 | -4 | -4 | -2 | -13 | Negative very high |
| | | | With | -3 | -1 | -1 | -1 | -6 | Negative low |
| | | 2 | Without | -3 | -4 | -4 | -2 | -13 | Negative very high |
| | | | With | -3 | -1 | -1 | -1 | -6 | Negative low |
| | | 3 | Without | -3 | -4 | -4 | -2 | -13 | Negative very high |
| | | | With | -3 | -1 | -1 | -1 | -6 | Negative low |
| 2 | **Mitigation**: (a) Staff environmental induction must take place prior to construction commencing and any subcontractors utilised must be inducted before starting work onsite. (b) All contractor employees must receive basic environmental awareness training and shall be educated on the requirements of the EMPr. (c) The environmental induction training is the responsibility of the project manager and the contractor and should be undertaken by the EO or a suitably qualified person. (d) The ECO must oversee and monitor the induction training to ensure that the training is sufficient and that adequate training is provided prior to construction commencing. (e) All staff involved in work within the freshwater habitats must receive specific inductions related to the detailed methods statements. (f) All managers, contractors, labourers and personnel involved during the project are to be familiar with the method statement. (g) It is vital that all personnel are adequately trained to perform their designated tasks to the accepted standards. (h) The ECO must monitor the compliance of the Contractors and instruct the Contractors where necessary. (i) The ECO may request that the Project Manager suspend part or all the works if the Contractors repeatedly cause damage to the environment. (j) The suspension should be enforced until such time as the offending actions, procedure or equipment is corrected and the environmental damage repaired. | | | | | | | | |
| 3 | The bridge would likely result in a small loss of wetland habitat under the crossing, as well as clearing of wetland vegetation within the construction servitude. | 1 | Without | -2 | -3 | -2 | -2 | -9 | Negative Moderate |
| | | | With | -1 | -2 | -1 | -1 | -5 | Negative low |
| | | 2 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -2 | -2 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -2 | -3 | -3 | -9 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) Staff environmental induction must take place prior to construction commencing and any subcontractors utilised must be inducted before starting work onsite. (b) All contractor employees must receive basic environmental awareness training and shall be educated on the requirements of the EMPr and all those staff working within the aquatic habitats must receive specific training. (c) The environmental induction training is the responsibility of the project manager and the contractor and should be undertaken by the EO or a suitably qualified person. (d) The Environmental Control Officer (ECO) must oversee and monitor the induction training to ensure that the training is sufficient and that adequate training is provided prior to construction commencing. (e) All staff involved in work within the freshwater habitats must receive specific inductions related to the detailed methods statements. (f) All managers, contractors, labourers and personnel involved during the project are to be familiar with the method statement. (g) It is vital that all personnel are adequately trained to perform their designated tasks to the accepted standards. (h) The ECO must monitor the compliance of the Contractors and instruct the Contractors where necessary. (i) The ECO may request that the Project Manager suspend part or all the works if the Contractors repeatedly cause damage to the environment. (j) The suspension should be enforced until such time as the offending actions, procedure or equipment is corrected and the environmental damage repaired. | | | | | | | | |
| 4 | Increased sediment loads, increased bed sedimentation and increased turbidity that will likely contribute to decreased local water quality and degradation in local aquatic habitat integrity. | 1 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -1 | -1 | -2 | -5 | Negative low |
| | | 2 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | 3 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -1 | -1 | -3 | -2 | -7 | Negative Moderate |
| | **Mitigation**: (a) In mitigating this impact it is imperative that the construction servitude/working area is defined. The construction servitude/working area will comprise the following: (1) Bridge footprint and working area. (2) Selected access road option (option 2 preferred) (3) Soil stockpile area. (4) Equipment laydown and storage area. (5) Vehicle turning area. At watercourse crossings, a maximum construction working servitude of 4m should be allowed within the riparian, in stream and/or wetland habitat. (b) The temporary access roads must be strictly one-way and be a maximum width of 3m. (c) No vehicle turning areas must be located within 32 m of any watercourse. (d) No equipment laydown or storage areas must be located within 50 m of any watercourse and/or within the 1:100 year floodline. (e) No soil stockpile areas must be located within 20 m of any watercourse. | | | | | | | | |
| 5 | Inconvenience from noise and dust will pose a nuisance to nearby residents. | 1 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -2 | -1 | -2 | -3 | -8 | Negative Moderate |
| | | 2 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -2 | -1 | -2 | -3 | -8 | Negative Moderate |
| | | 3 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -2 | -1 | -2 | -3 | -8 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) Frequent and effective dust-suppression is advised, particularly along dirt roads. (b) Dust must be suppressed on the construction site during dry periods by the regular application of water. (c) Water used for this purpose must be used in quantities that will not result in the generation of run-off. (d) Surrounding communities and adjacent landowners are to be notified upfront of noisy construction activities. (e) Provide all equipment with standard silencers. (e) Maintain silencer units on vehicles and equipment in good working order. (f) Construction staff working in areas where the 8-hour ambient noise levels exceed 60 dBA should wear ear protection equipment. | | | | | | | | |
| 6 | Local labour will be recruited to perform short term, unskilled labour on the project. | 1 | Without | 2 | 1 | 3 | 2 | 8 | Positive moderate |
| | | | With | 2 | 1 | 3 | 3 | 9 | Positive moderate |
| | | 2 | Without | 2 | 1 | 3 | 2 | 8 | Positive moderate |
| | | | With | 2 | 1 | 3 | 3 | 9 | Positive moderate |
| | | 3 | Without | 2 | 1 | 3 | 2 | 8 | Positive moderate |
| | | | With | 2 | 1 | 3 | 3 | 9 | Positive moderate |
| | **Enhancement**: It is recommended that every effort is made to employ local labour. | | | | | | | | |
| 7 | There exists the possibility of an encounter of a gravesite during construction | 1 | Without | -1 | -4 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | | 2 | Without | -1 | -4 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | | 3 | Without | -1 | -4 | -3 | -2 | -10 | Negative high |
| | | | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | **Mitigation**: (a) In the event that a grave is encountered during construction, all work must immediately cease and the CLO called to the site. (b) Contact must be made with AMAFA and the family contacted, if possible, to begin negotiations for possible relocations. | | | | | | | | |
| 8 | Chemical and toxic substance spillages | 1 | Without | -1 | -2 | -4 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -2 | -4 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -1 | -2 | -4 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation:** (a) measures involve preventing toxic spillages and severe disturbance to the bed of the river and stream and confining any impacts to the 4 m wide construction footprint. (b) Damage or destruction of protective grassland beyond this footprint that may lead to erosion should be avoided. (c) Mitigation measures are likely to result in negative low levels of significance where impacts cause small negative changes in natural habitats and biota, but ecosystem functions remain essentially unchanged. | | | | | | | | |
| 9 | Impacts caused by pollution of waste. Negative impacts on the aquatic and wetland habitats and biodiversity include pollution due to spillage of toxic fluids or substances and waste materials and agitation or disturbance of the river and stream beds causing siltation downstream during the construction phase. | 1 | Without | -1 | -2 | -4 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -2 | -4 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -1 | -2 | -4 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | **Mitigation**: (a) Eating areas must not be located within 15m of the wetland/riparian habitats. (b) Provide adequate rubbish bins and waste disposal facilities on-site and educate/encourage workers not to litter or dispose of solid waste in the natural environment but to use available facilities for waste disposal. (c) Clear and completely remove from site all general waste, constructional plant, equipment, surplus rock and other foreign materials once construction has been completed. (d) Recycling/re-use of waste is to be encouraged. (e) Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly at registered sites by a registered waste management company. (f) No litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties during or after the construction period, but disposed of at an approved dumping site. (g) The construction site must be kept clean and tidy and free from rubbish at all times. | | | | | | | | |
| 10 | The movement of machinery within the area of residual hydromorphic soils could cause compaction or physical disturbance of these soils | 1 | Without | -1 | -3 | -4 | -3 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 2 | Without | -1 | -3 | -4 | -3 | -11 | Negative high |
| | | | With | -1 | -1 | -3 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -1 | -3 | -4 | -3 | -11 | Negative high |
| | | | With | -1 | -1 | -3 | -2 | -7 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) In mitigating this impact it is imperative that the construction servitude/working area is defined. The construction servitude/working area will comprise the following: (1) Bridge footprint and working area. (2) Selected access road option (option 2 preferred) (3) Soil stockpile area. (4) Equipment laydown and storage area. (5) Vehicle turning area. At watercourse crossings, a maximum construction working servitude of 4 m should be allowed within the riparian, in stream and/or wetland habitat. (b) The temporary access roads must be strictly one-way and be a maximum width of 3 m. (c) No vehicle turning areas must be located within 32 m of any watercourse. (d) No equipment laydown or storage areas must be located within 50 m of any watercourse and/or within the 1:100 year floodline. (e) No soil stockpile areas must be located within 20 m of any watercourse. | | | | | | | | |
| 11 | Cement - spillages from poor mixing and disposal practices. | 1 | Without | -1 | -2 | -4 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -2 | -4 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -3 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -1 | -2 | -4 | -3 | -10 | Negative high |
| | | | With | -1 | -1 | -3 | -2 | -7 | Negative Moderate |
| | **Mitigation**: No batching or chemical / fuel storage areas to be located within 50 m of the area of residual hydromorphic soils or the stream and associated riparian corridor. | | | | | | | | |
| | **Sub-phase: Indirect Impacts** | | | | | | | | |
| 12 | A reduction in bank stability, exposed bank erosion and in-stream and riparian habitat sedimentation downslope and downstream, aquatic habitat burying, increased water turbidity (increased suspended solid load) and aquatic fauna fatalities. Ultimately, the potential direct and indirect impacts of freshwater habitat will result in deterioration in local freshwater ecosystem ecological condition downstream, particularly increased turbidity and sedimentation within the | 1 | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 2 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | downstream pool habitats. This will result in a local reduction in the availability of intact natural habitat, particularly if mitigation measures are not implemented effectively. | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | **Mitigation**: (a) In-stream sediment control measures must be instated. (b) Before any work commences in the river channel, sediment control/silt capture measures (e.g. bidim/silt curtains) must be installed downstream of the working areas within the river. (c) Quantities of silt fences/curtains shall be decided on site with the engineer, contractor and ECO. (d) The ECO should be present during the location and installation of the silt curtains. (e) During works within the channel, the downstream silt fences/curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. (f) Other areas which are eroded or denuded of vegetation should receive topsoil and transplanted grassland sods such as those badly eroded areas on the Eastern Cape side of the Umtamvuna River on the steep slopes in the vicinity of the proposed bridge. (g) A copy of the method statement will need to be made available at the construction site offices/site camp at all times. (h) Run-off generated from cleared and disturbed areas/slopes that drains into rivers, streams or wetlands must be controlled using erosion control and sediment trapping measures like silt fences, sandbags, earthen berms and synthetic logs, particularly where slopes are exposed. (i) These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment. (j) Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms, retaining walls and check dams) must be established to protect water resources from erosion and sedimentation impacts from upslope. (k) Sediment barriers should be regularly maintained and cleared so as to ensure effective drainage. (l) The berms, sandbags and/or silt fences must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. (m) The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed areas post-rehabilitation. | | | | | | | | |
| | The banks of the river will be altered which may impact on the functioning of the river and the integrity of the structure | 1 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | 2 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| 13 | **Mitigation**: As per items 10 and 12 above. | | | | | | | | |
| | The construction of the bridge could affect the ecological condition of the freshwater habitat during working within the freshwater | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| 14 | | 1 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | habitat as it involves dust and noise pollution and vibration impacts during the construction phase that could contribute to increased water column turbidity and short-term disturbance impacts for fauna utilising the local freshwater habitat. | 2 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10 and 12 above. | | | | | | | | |
| 15 | The physical disturbance of the wetland and river/riparian habitat (soils and vegetation) around the construction footprint will open up the riparian habitat to invasion by locally occurring indigenous and alien invasive, pioneer and ruderal plant species, particularly if rehabilitation of the disturbed areas is not undertaken effectively. Alien plants and weeds have the ability to out-compete and replace indigenous flora, which will in turn impact on natural biodiversity. Such an impact could result in the gradual invasion of the local riparian habitat by these undesirable species and the alteration of the current composition of the freshwater vegetation communities. | 1 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) The core impact must be avoided, that is the introduction or allowance of the occurrence of alien invasives in the construction area. (b) All alien invasives found must be immediately removed and disposed of responsibly in accordance with the requirements of the ECO. (c) No artificial plants are permitted to be brought to site. (d) Cleared areas must be planted with the present, indigenous grass sods as soon as is possible. (e) All alien invasive vegetation that has colonised the construction site must be removed, preferably by uprooting. (f) The contactor should consult the ECO regarding the method of removal.(g) All bare surfaces across the construction site must be checked for alien invasive plants at the end of every month and alien pants removed by hand pulling/uprooting and adequately disposed.(h) Herbicides should be utilised where hand pulling/uprooting is not possible. (i) ONLY herbicides which have been certified safe for use in wetlands by independent testing authority to be used. (j) The ECO must be consulted in this regard. | | | | | | | | |
| 16 | Vegetation changes could lead to negative changes in aquatic in stream habitat through decreased bank stability and soil cover that could lead to increased rates of erosion and sedimentation, and changes to the composition and structure of wetland and riparian/in-stream habitat that could alter microhabitats in terms of degree of shading, temperature and marginal vegetation biotopes. | 1 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 2 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 3 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -2 | -1 | -2 | -1 | -6 | Negative low |
| | **Mitigation**: (a) The mitigation measures offered in item 15 above must be adhered to, and furthermore, erosion/sediment control measures such as silt fences, low soil berms or wooden shutter boards must be placed around the stockpiles to limit sediment runoff from stockpiles. (b) Subsoil and topsoil is to be stockpiled separately. (c) Stockpiled soil must be replaced in the reverse order as to which it was removed (subsoil first followed by topsoil). (d) Stockpiles of construction materials must be clearly separated from soil stockpiles in order to limit any contamination of soils. (e) The stockpiles may only be placed within demarcated stockpile areas, which must fall within the demarcated construction area. (f) The contractor shall, where possible, avoid stockpiling materials in vegetated areas that will not be cleared. (g) Stockpiled soils are to be kept free of weeds and are not to be compacted. (h) The stockpiled soil must be kept moist using some form of spray irrigation on a regular basis as appropriate and according to weather conditions. (i) The slope and height of stockpiles must be limited to 2 m to avoid collapse. (j) If rehabilitation is undertaken effectively and is signed off after successful indigenous vegetation re-establishment, the risks of these impacts should be minimised. (k) Indigenous vegetation and topsoil cleared for the construction servitude/working area should be rescued and stored at the designated vegetation and soil stockpile area outside of the wetland/aquatic zone for use later in rehabilitation. (l) In this regard, vegetation will need to be cleared in-situ (with sods/topsoil). | | | | | | | | |
| 17 | The wetland is a lot more sensitive to onsite erosion and excessive erosion could result in headcut and gully formation that | 1 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | could threaten the integrity of the entire wetland unit. Burying of wetland habitat with eroded sediment is also a serious issue as this could also alter through flow dynamics and result in localised erosion. Ultimately, erosion impacts would result in a change from diffuse to channelled flows and decreased soil saturation rates adjacent to gullies leading to habitat transformation. Ultimate consequences would be habitat deterioration and decreased levels of indirect ecosystem service delivery | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| 18 | Increased downstream drift by benthic invertebrates causing localised reductions in population densities. | | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | 1 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | 2 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| 19 | Sewage pollution into the Umtamvuna River from possible leakages from and/or poor servicing of chemical toilets and/or informal use of surrounding bush by workers. | | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | 1 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | 2 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -2 | -1 | -5 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) Sanitation - portable toilets (1 toilet per 10 users) to be provided where construction is occurring. (b) Workers need to be encouraged to use these facilities and not the natural environment. (c) Toilets must not be located within the 1:100yr flood line of a watercourse or closer than 50 m or from any natural water bodies including rivers, streams, riparian areas and wetlands. (d) Waste from chemical toilets must be disposed of regularly (at least once a week) and in a responsible manner by a registered waste contractor. (e) Toilet facilities must be serviced weekly and in a responsible manner by a registered waste contractor to prevent pollution and improper hygiene conditions. (f) Sanitation safe disposal / clearance certificates must be maintained on site for construction duration. | | | | | | | | |
| 20 | Lack of alien plant control | 1 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | **Mitigation**: (a) All alien invasive vegetation that has colonised the construction site must be removed, preferably by uprooting. (b) The contactor should consult the ECO regarding the method of removal.(c) All bare surfaces across the construction site must be checked for alien invasive plants at the end of every month and alien pants removed by hand pulling/uprooting and adequately disposed. (d) Herbicides should be utilised where hand pulling/uprooting is not possible. (e) ONLY herbicides which have been certified safe for use in wetlands by independent testing authority to be used. (f) The ECO must be consulted in this regard. | | | | | | | | |
| 21 | The creation of low light conditions reducing photosynthetic activity and the visual abilities of foraging aquatic biota; | 1 | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 2 | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 3 | Without | -2 | -2 | -3 | -2 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | **Mitigation**: (a) Artificial lighting is not permitted. (b) The width of the bridge is limited to 3.9 m and hence is a relatively short distance for such an impact to occur. (c) No mitigation can be offered however, as the flow under the bridge will inevitable receive limited light. | | | | | | | | |
| 22 | Erosion in the vicinity of the bridge and culvert due to damage or destruction of grassland resulting from road, bridge and culvert construction activities will add to | 1 | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | the siltation impact. Siltation may result in secondary negative ecological impacts on aquatic and wetland habitat and biodiversity. Negative impacts on the riparian habitat and biodiversity include disturbed river bank conditions resulting in the spread of nearby alien plant invaders such as Black Wattle *(Acacia mearnsii*) at the Umtamvuna site and American Bramble (*Rubus cuneifolius*) and Black Wattle at the stream site | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| 23 | Due to an increased workforce in the local area (at the construction camp), there would be increased need for health services. | | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 1 | With | 2 | 4 | 3 | 2 | 11 | Positive high |
| | | | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 2 | With | 2 | 4 | 3 | 2 | 11 | Positive high |
| | | | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 3 | With | 2 | 4 | 3 | 2 | 11 | Positive high |
| | **Mitigation**: Development of rural areas often begins with accessibility, therefore, in effect providing accessibility will lead to development of other much needed services and infrastructure | | | | | | | | |
| 24 | Due to an increased worker population and potentially non-locals in the area, there may be incidents of increased crime, violence (domestic), and security incidents. | | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 1 | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 2 | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | 3 | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | **Mitigation**: (a) To as great an extent as possible, local labour must be sourced. (b) The Community Liaison Officer (CLO) must be regularly engaged and the community must be encouraged to work together to limit any possible crime. | | | | | | | | |
| 25 | Habitat alteration downstream of crossing points due to increased | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 1 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | sediment deposition | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| **Sub-phase: Cumulative Impacts** | | | | | | | | | |
| 26 | Reduced density and diversity in benthic invertebrate and fish communities as a result of reduced water quality (suspended solids impacting intolerance taxa), habitat degradation caused by smothering of aquatic habitat, changes in streambed and biotope composition (i.e. reduced habitat suitability through the destruction of pool and/or riffle habitat). | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 1 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| 27 | The bridge construction could alter the volume (reduced flows), timing and pattern of flows reaching downstream water resources. This ultimately effects the aquatic habitat and biota present directly dependant on water inputs and hydrological variability. | | Without | -2 | -2 | -2 | -1 | -7 | Negative Moderate |
| | | 1 | With | -2 | -1 | -1 | -1 | -5 | Negative low |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| 28 | Lowering of a watercourse bed caused by excavations and culvert installations will also increase the | 1 | Without | -2 | -3 | -2 | -2 | -9 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | velocity of flows to downstream habitat due to a localised increase in gradient, this can result in scouring downstream of the crossing and headward erosion if the base level is not maintained. Conversely if the bed of a watercourse is raised, upstream habitat will be inundated and sediment will be retained within the system. The downstream effect of this would be increased erosive energy of flows through an increased local gradient and a disruption of the water-sediment balance resulting in scouring - sediment free water is more erosive than sediment laden water. | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| | Abstraction of water for construction purposes within the Umtamvuna River will result in a reduction of flows reaching downstream habitat, more so if undertaken during the dry season. Ultimately this will have an effect on in stream habitat suitability to aquatic biota. Given the scale of the proposed bridge it is unlikely that direct impacts from reduced flows will have a significant impact on the availability of in stream habitat. | | Without | -2 | -1 | -3 | -2 | -8 | Negative Moderate |
| | | 1 | With | -2 | -1 | -1 | -1 | -5 | Negative low |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -4 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| 29 | **Mitigation**: As per items 10, 12 and 14 above. | | | | | | | | |
| | | | | | | | Average for Bridge Design Alternative 1 without mitigation | -9.7 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Average for Bridge Design Alternative 1 with mitigation | -4.5 | Negative low |
| | | | | | | | Average for Bridge Design Alternative 2 without mitigation | -10.3 | Negative high |
| | | | | | | | Average for Bridge Design Alternative 2 with mitigation | -5.0 | Negative low |
| | | | | | | | Average for Bridge Design Alternative 3 without mitigation | -10.3 | Negative high |
| | | | | | | | Average for Bridge Design Alternative 3 with mitigation | -5.1 | Negative low |

## Construction Phase: Road Alignment Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Construction - Road Alignment Alternatives** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | Vegetation clearing and exposure of bare soils within and upslope of the freshwater habitats during construction will decrease the soil binding capacity and cohesion of the upslope soils and thus increase the risk of erosion and sedimentation downslope. | 1 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 2 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -2 | -2 | -1 | -1 | -6 | Negative low |
| | | 3 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | | With | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | **Mitigation:** (a) The temporary access routes must avoid all water resources not being crossed by the preferred route 2. In addition, the access routes must not be located within 32 m of unaffected watercourses (i.e. Wetland and river habitat not being crossed by option 2 must be considered 'No Go' areas. (b) This includes R-02, R-03, R-04 and W-04). (c) The temporary access roads must not be aligned perpendicular to the slopes for long stretches to avoid the road acting as a preferential flow path for runoff. (d) Stormwater runoff and erosion control measures must be installed as part of the temporary access road and should include the establishment of many small shallow chute type drains and/or berms/cut-off drains at regular intervals along slopes that direct surface run-off from the road into adjacent grassland to avoid rill erosion and gully formation. (e) Many small must be favoured over few large and these outlets must be armoured against erosion using dump rock/riprap. (f) Wherever possible, the temporary chutes/berms must not be aligned perpendicular to the slope. (g) The access roads must be one-way and adequate turning areas outside of the sensitive areas will need to be identified and demarcated in conjunction with the ECO. | | | | | | | | |
| 2 | Disturbances to catchment landcover and topography may also lead to | 1 | Without | -2 | -4 | -3 | -3 | -12 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | increased surface runoff velocities entering the river due to soil compaction, reduced infiltration and the creation of preferential flow paths by machinery and labourers accessing the site. These impacts will be more pronounced during rainfall events and/windy conditions. | | With | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | 2 | With | -2 | -2 | -1 | -1 | -6 | Negative low |
| | | | Without | -2 | -4 | -3 | -3 | -12 | Negative high |
| | | 3 | With | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | **Mitigation:** (a) Access routes must be agreed upon prior to construction commencing and should be signed off by the ECO appointed. (b) Access points and routes must be selected based on least impact and greatest distance from watercourses. | | | | | | | | |
| | Due to the absence of access roads to the bridge site, the construction of temporary access roads is required to which will also pose a serious erosion risk, particularly if surface runoff is not managed and if the access road is aligned perpendicular to the slopes where it can act as a preferential flow route. The high erodibility of the catchment soils also needs to borne in mind. | | Without | -2 | -3 | -2 | -2 | -9 | Negative Moderate |
| | | 1 | With | -2 | -2 | -2 | -1 | -7 | Negative Moderate |
| | | | Without | -2 | -3 | -2 | -2 | -9 | Negative Moderate |
| | | 2 | With | -2 | -2 | -1 | -1 | -6 | Negative low |
| | | | Without | -2 | -3 | -2 | -2 | -9 | Negative Moderate |
| | | 3 | With | -2 | -2 | -2 | -1 | -7 | Negative Moderate |
| 3 | **Mitigation**: (a) Topsoil and grassland which are removed from the preferred option should be used to rehabilitate the gravel track and erosion donga. (b) Demarcations and No-go Areas. (c) The outer edge of the construction servitude/working area as defined above must be clearly demarcated for the entire construction phase using plastic orange bonnox fencing. (d) Once the temporary access route has been agreed to by the ECO, the outer edge of the access route must be staked out by the contractor using brightly coloured stakes prior to the access route being used by machinery. (e) All demarcation work must be signed off by the ECO before any work commences. (f) Any contractors found working inside the 'no-go' areas (areas outside the working servitude) should be fined as per fining schedule/system setup for the project. (g) Off-site mitigation should be conducted to fill the serious erosion donga which has developed along the gravel track. (h) Eroded areas would first have to be filled with soil before grassland sods are transplanted. (i) Removed topsoil and grassland sods should also be used to rehabilitate sections along the chosen alignment where construction activities have extended beyond the four metre wide construction width of the proposed gravel road resulting in damage to or destruction of the grassland. (k) With this recommended on-site and off-site rehabilitation, top-soils, sub-soils and grassland sods would have to be conserved and protected in a nursery area where the grassland sods would have to be watered to keep the plants alive. (l) Eragrostis curvula which is one of the grasses that is present in the study area is one of the best grasses to stabilise exposed soil as it establishes easily. | | | | | | | | |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| 4 | Hydrocarbons – leakages from petrol/diesel stores and machinery/vehicles, spillages from poor dispensing practices. | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | **Mitigation:** (a) The following measures should be implemented in conjunction with the generic pollution prevention measures provided in the Construction EMPr: (b) Hazardous storage and refuelling areas must be bunded prior to their use on site during the construction period following the appropriate SANS codes. (c) The bund wall should be high enough to contain at least 110% of any stored volume. (d) The surface of the bunded surface should be graded to the centre so that spillage may be collected and satisfactorily disposed of. (e) The proper storage and handling of hazardous substances (e.g. Fuel, oil, cement, bitumen, paint, etc.) needs to be administered. (f) Storage containers must be regularly inspected so as to prevent leaks. (g) Mixing and/or decanting of all chemicals and hazardous substances must take place on a tray, shutter boards or on an impermeable surface and must be protected from the ingress and egress of stormwater. | | | | | | | | |
| | (h) The following mitigation measure must also be ensure: (i) Drip trays should be utilised at all dispensing areas. (j) No refuelling, servicing nor chemical storage should occur within 50 m of the delineated wetland/aquatic habitat or within the 100-year flood line, whichever is applicable. (k) No vehicles transporting concrete, asphalt or any other bituminous product may be washed on site. (l) Vehicle maintenance should not take place on site unless a specific bunded area is constructed for such a purpose. (m) Ensure that transport, storage, handling and disposal of hazardous substances is adequately controlled and managed. (n) Correct emergency procedures and cleaning up operations should be implemented in the event of accidental spillage. (o) If a water pump is required, the water pump must operate inside or on top of a drip tray to prevent any spillage of fuel and limit the risk of soil/water contamination. (p) The drip tray will need to be lined with absorbent pads and checked daily while in use. (q) All equipment to be used within the sensitive working areas (within the channel) must be checked daily for oil and diesel leaks before gaining access to these working areas. (r) An emergency spill response procedure must be formulated and staff are to be trained in spill response. (s) All necessary equipment for dealing with spills of fuels/chemicals must be available at the site. (t) Spills must be cleaned up immediately and contaminated soil/material disposed of appropriately at a registered site. (u) 44-gallon drums must be kept on site to collect contaminated soil. (v) These should be disposed of at a registered hazardous waste site. (w) Fire prevention facilities must be present at all hazardous storage facilities. | | | | | | | | |
| 5 | Oils and grease - leakages from oil/grease stores and machinery/vehicles, spillages from poor handling and disposal practices. | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) Staff environmental induction must take place prior to construction commencing and any subcontractors utilised must be inducted before starting work onsite. (b) All contractor employees must receive basic environmental awareness training and shall be educated on the requirements of the EMPr. (c) The environmental induction training is the responsibility of the project manager and the contractor and should be undertaken by the EO or a suitably qualified person. (d) The ECO must oversee and monitor the induction training to ensure that the training is sufficient and that adequate training is provided prior to construction commencing. (f) All staff involved in work within the freshwater habitats must receive specific inductions related to the detailed methods statements.(g) All managers, contractors, labourers and personnel involved during the project are to be familiarized with the method statement. (h) It is vital that all personnel are adequately trained to perform their designated tasks to the accepted standards.(i) The ECO must monitor the compliance of the contractors and instruct the Contractors where necessary. (j) The ECO may request that the Project Manager suspend part or all the works if the Contractors repeatedly cause damage to the environment. (k) The suspension should be enforced until such time as the offending actions, procedure or equipment is corrected and the environmental damage repaired.(l) A copy of the method statement will need to be made available at the construction site offices/site camp at all times. | | | | | | | | |
| | Nuisance caused by dust pollution during construction of the road | 1 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| | | 2 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| | | 3 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| 6 | **Mitigation**: (a) Frequent and effective dust-suppression is advised, particularly along dirt roads. (b) Dust must be suppressed on the construction site during dry periods by the regular application of water. (c) Water used for this purpose must be used in quantities that will not result in the generation of run-off. | | | | | | | | |
| | Cement - spillages from poor mixing and disposal practices. | 1 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| | | 2 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| | | 3 | Without | -2 | -2 | -3 | -4 | -11 | Negative high |
| | | | With | -1 | -1 | -2 | -3 | -7 | Negative Moderate |
| 7 | **Mitigation**: No batching or chemical / fuel storage areas to be located within 50 m of the area of residual hydromorphic soils or the stream and associated riparian corridor. | | | | | | | | |
| | Pollution caused by waste / littering | 1 | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -2 | -5 | Negative low |
| 8 | | 2 | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | | With | -1 | -1 | -1 | -2 | -5 | Negative low |
| | | | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -1 | -2 | -5 | Negative low |
| | **Mitigation**: (a) Eating areas must not be located within 15 m of the wetland/riparian habitats. (b) Provide adequate rubbish bins and waste disposal facilities on-site and educate/encourage workers not to litter or dispose of solid waste in the natural environment but to use available facilities for waste disposal. (c) Clear and completely remove from site all general waste, constructional plant, equipment, surplus rock and other foreign materials once construction has been completed. (d) Recycling/re-use of waste is to be encouraged. (e) Litter generated by the construction crew must be collected in rubbish bins and disposed of weekly at registered sites by a registered waste management company. (f) No litter, refuse, wastes, rubbish, rubble, debris and builders wastes generated on the premises be placed, dumped or deposited on adjacent/surrounding properties during or after the construction period, but disposed of at an approved dumping site. (g) The construction site must be kept clean and tidy and free from rubbish. | | | | | | | | |
| 9 | Grassland habitat will be removed and lost to accommodate the four metre wide gravel road. There will be edge effects as well during the construction and operational phases that probably will result in at least another metre of grassland habitat being damaged or lost on either side of the road. | 1 | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | | With | -1 | -4 | -1 | -4 | -10 | Negative high |
| | | 2 | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | | With | -1 | -4 | -3 | -4 | -12 | Negative high |
| | | 3 | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | | With | -1 | -4 | -3 | -4 | -12 | Negative high |
| | **Mitigation**: (a) Little or no mitigation can be offered for this. (b) The grassland area will be lost, however, it will be limited to a 4 m width of road and the working area can be rehabilitated to restore the grassland. (c) RA 2 is also the shortest road, and hence will result in the least loss of grassland, and also follows an existing track for 700 m. | | | | | | | | |
| 10 | No threatened plant or animal species or species of conservation concern were found in the 4m wide footprint and 20m wide buffer on either side of the road for each option when the ecological assessment was conducted in the winter month of May, 2015. The specialist have confirmed that it is unlikely that such species will be found during spring in September, 2015, when a re-assessment is conducted. The negative ecological impacts of the proposed | 1 | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | | With | -1 | -4 | -1 | -4 | -10 | Negative high |
| | | 2 | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | | With | -1 | -4 | -3 | -4 | -12 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | gravel road therefore will be mainly in terms of the loss of the two Endangered grassland habitats and their biodiversity | | Without | -1 | -4 | -4 | -4 | -13 | Negative very high |
| | | 3 | With | -1 | -4 | -3 | -4 | -12 | Negative high |
| | **Mitigation**: (a) No mitigation measures are going to be able to prevent the loss of the grassland and its biodiversity for each of the three options, but they will help in minimising grassland loss and preventing unnecessary damage to the grassland. (b) One such measure is to ensure that construction related activities remain within the 4 m wide footprint of the road. (c) Without this mitigation measure, the negative ecological impacts would extend beyond the construction area or site. | | | | | | | | |
| 11 | All road users are at risk during the construction phase due to exposure to heavy duty vehicles and increased traffic. There are a few impacted households already identified along this route. Households found along the current main road (D1100) will also be affected. | | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | 1 | With | -1 | -1 | -1 | -3 | -6 | Negative low |
| | | | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | 2 | With | -1 | -1 | -1 | -3 | -6 | Negative low |
| | | | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -1 | -3 | -6 | Negative low |
| | **Mitigation**: (a) Social responsibility by the construction staff must be ensured at all times. (b) A safety officer must be delegated specific safety management tasks and the CLO must maintain a regularly open channel of communication with the surrounding homesteads. (c) Furthermore, all applicable safety regulations must be adhered to and clear signage in Zulu erected, as well as in Xhosa. | | | | | | | | |
| 12 | All free roaming livestock are at risk during the construction phase due to exposure to heavy duty vehicles and increased traffic. | | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | 1 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | 2 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | 3 | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | **Mitigation**: Due care must be taken to protect animals from construction hazards. No animals are to be harmed, snared, or caught and killed. | | | | | | | | |
| 13 | Local labour will be recruited to perform short term, unskilled labour on the project. | | Without | 1 | 2 | 3 | 3 | 9 | Positive moderate |
| | | 1 | With | 1 | 2 | 3 | 3 | 9 | Positive moderate |
| | | | Without | 1 | 2 | 3 | 3 | 9 | Positive moderate |
| | | 2 | With | 1 | 2 | 3 | 3 | 9 | Positive moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | 3 | Without | 1 | 2 | 3 | 3 | 9 | Positive moderate |
| | | | With | 1 | 2 | 3 | 3 | 9 | Positive moderate |
| | Enhancement: Wherever possible and to the greatest extent, labourers must be sourced from the neighbouring local communities. | | | | | | | | |
| 14 | Noise pollution caused by construction activities and machinery | 1 | Without | -2 | -2 | -4 | -4 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | 2 | Without | -2 | -2 | -4 | -4 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | 3 | Without | -2 | -2 | -4 | -4 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | **Mitigation**: (a) Surrounding communities and adjacent landowners are to be notified upfront of noisy construction activities. (b) Provide all equipment with standard silencers. (c) Maintain silencer units on vehicles and equipment in good working order. (d) Construction staff working in areas where the 8-hour ambient noise levels exceed 60 dBA should wear ear protection equipment. | | | | | | | | |
| 15 | There exists the possibility of an encounter of a gravesite during construction | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -1 | -5 | Negative low |
| | **Mitigation**: (a) In the event that a grave is encountered during construction, all work must immediately cease and the CLO called to the site. (b) Contact must be made with AMAFA and the family contacted, if possible, to begin negotiations for possible relocations. | | | | | | | | |
| 16 | Attendees at Kubhudlu primary will be affected - although to a lesser degree on RA 1 and RA 2 (greater on RA 3) | 1 | Without | -2 | -1 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -2 | -1 | -1 | -1 | -5 | Negative low |
| | | 2 | Without | -2 | -1 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -2 | -1 | -1 | -1 | -5 | Negative low |
| | | 3 | Without | -2 | -1 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -2 | -1 | -2 | -3 | -8 | Negative Moderate |
| | **Mitigation**: (a) A teacher or appointed traffic coordinator should be outside the school to ensure that the scholars are crossing roads safely. (b) Scholars should also be educated at school on road safety. (d) Scholars are not to be permitted within close proximity of the construction sites. | | | | | | | | |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| 17 | Crossing of a perennial stream where a culvert will have to be built .The culvert may have negative ecological impacts on the stream, nearby wetlands and associated biodiversity during the construction and operational phases (only occurs for RA 1) | 1 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -3 | -2 | -1 | -7 | Negative Moderate |
| | | 2 | Without | 0 | 0 | 0 | 0 | 0 | Neutral |
| | | | With | 0 | 0 | 0 | 0 | 0 | Neutral |
| | | 3 | Without | 0 | 0 | 0 | 0 | 0 | Neutral |
| | | | With | 0 | 0 | 0 | 0 | 0 | Neutral |
| | **Mitigation**: Any unnecessary or avoidable watercourse crossings must be ensured. The RA which does not traverse watercourses is preferred. | | | | | | | | |
| 18 | If runoff and erosion control measure are not effectively implemented by the contractors, erosion rills and gullies may form along the cleared and exposed slopes upslope within the construction footprint and lead to increased rates of erosion and sedimentation within the riparian, in-stream and wetland habitat in the vicinity of the construction zone. Any erosion within the construction footprint will likely result in the sedimentation of the watercourses immediately below the construction servitude and the partial to complete burying of in stream habitat depending on the severity of erosion. | 1 | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | 2 | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -1 | -2 | -5 | Negative low |
| | | 3 | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | **Mitigation**: (a) Many small shallow chute/mitre type drains and/or berms/cut-off drains must be installed at regular intervals along the road to direct surface run-off from the road into adjacent grassland. (b) Many small must be favoured over few large and these outlets must be armoured against erosion using gabion Reno-mattresses or riprap. | | | | | | | | |
| **Sub-phase: Indirect Impacts** | | | | | | | | | |
| 19 | Due to an increased workforce in the | 1 | Without | -2 | -1 | -2 | -1 | -6 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | local area (at the construction camp), there would be increased need for health services. | | With | 2 | 4 | 3 | 2 | 11 | Positive high |
| | | 2 | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | | With | 2 | 4 | 3 | 2 | 11 | Positive high |
| | | 3 | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | | With | 2 | 4 | 3 | 2 | 11 | Positive high |
| | **Mitigation**: Development of rural areas often begins with accessibility, therefore, in effect providing accessibility will lead to development of other much needed services and infrastructure | | | | | | | | |
| 20 | Due to an increased worker population and potentially non-locals in the area, there may be incidents of increased crime, violence (domestic), and security incidents. | 1 | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 2 | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | 3 | Without | -2 | -1 | -2 | -1 | -6 | Negative low |
| | | | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | **Mitigation**: To as great an extent as possible, local labour must be sourced. The CLO must be regularly engaged and the community must be encouraged to work together to limit any possible crime. | | | | | | | | |
| 21 | If construction is undertaken in a poor manner with little consideration of minimising erosion and sedimentation impacts, there could be significant impacts in and around the construction zone that will contribute to deterioration in local wetland and riverine wetland habitat, onsite and downstream. | 1 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -3 | -2 | -2 | -8 | Negative Moderate |
| | | 2 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -3 | -2 | -2 | -8 | Negative Moderate |
| | | 3 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -3 | -3 | -3 | -10 | Negative high |
| | **Mitigation**: (a) Many small shallow chute/mitre type drains and/or berms/cut-off drains must be installed at regular intervals along the road to direct surface run-off from the road into adjacent grassland. (b) Many small must be favoured over few large and these outlets must be armoured against erosion using gabion Reno-mattresses or riprap. | | | | | | | | |
| 22 | Alien plant control. Negative impacts on the riparian habitat and associated biodiversity of both watercourses will add to existing negative impacts on | 1 | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | those natural systems in terms of creating disturbed conditions suitable for the spread of alien plant invaders such as Black Wattle (*Acacia mearnsii*) and American Bramble (*Rubus cuneifolius*) which are already present in the area | | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | 2 | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | | Without | -1 | -2 | -3 | -3 | -9 | Negative Moderate |
| | | 3 | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | **Mitigation**: (a) All alien invasive vegetation that has colonised the construction site must be removed, preferably by uprooting. (b) The contactor should consult the ECO regarding the method of removal. (c) All bare surfaces across the construction site must be checked for alien invasive plants at the end of every month and alien pants removed by hand pulling/uprooting and adequately disposed. (d) Herbicides should be utilised where hand pulling/uprooting is not possible. (e) ONLY herbicides which have been certified safe for use in wetlands by independent testing authority to be used. (f) The ECO must be consulted in this regard. (g) Off-site mitigation is strongly recommended and would involve removing all the alien invader trees along the left and right banks of the Umtamvuna River downstream and upstream of the proposed bridge site over a 1 km distance from the bridge site and destruction of invasive American Bramble and Sisal (*Agave sisalana*). (h) Removal of all alien invader trees along the left and right banks of the Umtamvuna River over a 1 km distance downstream and upstream of the proposed bridge site and the eradication of invasive American Bramble and Sisal along option 3 from waypoint 70 to 74 would help reduce the negative cumulative ecological impacts | | | | | | | | |
| 23 | The wetland is a lot more sensitive to onsite erosion and excessive erosion could result in headcut and gully formation that could threaten the integrity of the entire wetland unit. Burying of wetland habitat with eroded sediment is also a serious issue as this could also alter through flow dynamics and result in localised erosion. Ultimately, erosion impacts would result in a change from diffuse to channelled flows and decreased soil saturation rates adjacent to gullies leading to habitat transformation. Ultimate consequences would be habitat deterioration and decreased levels of indirect ecosystem service delivery | | Without | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | 1 | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | | Without | -1 | -2 | -2 | -2 | -7 | Negative Moderate |
| | | 2 | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | | Without | -1 | -2 | -3 | -4 | -10 | Negative high |
| | | 3 | With | -1 | -2 | -2 | -1 | -6 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) Sediment control measures such as the following must instated. (b) Before any work commences within a wetland, sediment control/silt capture measures (e.g. bidim/silt curtains) must be installed. (c) Quantities of silt fences/curtains shall be decided on site with the engineer, contractor and ECO. (d) The ECO should be present during the location and installation of the silt curtains. (e) During works within the channel, the downstream silt fences/curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. (f) Other areas which are eroded or denuded of vegetation should receive topsoil and transplanted grassland sods. (g) Run-off generated from cleared and disturbed areas/slopes that drains into rivers, streams or wetlands must be controlled using erosion control and sediment trapping measures like silt fences, sandbags, earthen berms and synthetic logs, particularly where slopes are exposed. (h) These control measures must be established at regular intervals perpendicular to the slope to break surface flow energy and reduce erosion as well as trap sediment. Sediment barriers (e.g. silt fences, sandbags, hay bales, earthen filter berms, retaining walls and check dams) must be established to protect water resources from erosion and sedimentation impacts from upslope. (i) Sediment barriers should be regularly maintained and cleared so as to ensure effective drainage. (j) The berms, sandbags and/or silt fences must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. (k) The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed areas post-rehabilitation. | | | | | | | | |
| | **Sub-phase: Cumulative Impacts** | | | | | | | | |
| 24 | Contaminants may enter the channel during construction activities and have the capacity to negatively affect the aquatic habitat within the vicinity of the construction corridor and downstream, particularly aquatic flora and fauna sensitive to changes in turbidity levels, nutrient levels, chemical oxygen demand and toxicants. Where significant changes in water quality occur, this will ultimately result in a shift in aquatic species composition, favouring more tolerant species, and potentially resulting in the localised reduction of sensitive species. Sudden drastic changes in water quality can also have chronic effects on aquatic biota leading to localised extinctions. Measurable negative water quality impacts are of significance within this system due to the largely intact nature of the in stream environments and the sensitivity of habitats such as pools and riffles. | 1 | Without | -2 | -1 | -4 | -4 | -11 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | 2 | Without | -2 | -1 | -4 | -4 | -11 | Negative high |
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | | 3 | Without | -2 | -1 | -4 | -4 | -11 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | | With | -2 | -1 | -2 | -2 | -7 | Negative Moderate |
| | **Mitigation**: (a) In-stream sediment control measures such as the following must be instated. (b) Before any work commences in the river channel, sediment control/silt capture measures (e.g. bidim/silt curtains) must be installed downstream of the working areas within the river. (c) Quantities of silt fences/curtains shall be decided on site with the engineer, contractor and ECO. (d) The ECO should be present during the location and installation of the silt curtains. (e) During works within the channel, the downstream silt fences/curtains must be regularly checked and maintained (de-silted to ensure continued capacity to trap silt), and repaired where necessary. (f) Berms, sandbags and/or silt fences must be maintained and monitored for the duration of the construction phase and repaired immediately when damaged. (g) The berms, sandbags and silt fences must only be removed once vegetation cover has successfully re-colonised the disturbed areas post-rehabilitation. (h) Measures involve preventing toxic spillages and severe disturbance to the bed of the river and stream and confining any impacts to the 4 m wide construction footprint. (i) Damage or destruction of protective grassland beyond this footprint that may lead to erosion should be avoided. (j) Mitigation measures are likely to result in negative low levels of significance where impacts cause small negative changes in natural habitats and biota, but ecosystem functions remain essentially unchanged. | | | | | | | |
| 25 | Potential for erosion is together with its secondary negative ecological impacts on the adjacent Moist Coast Hinterland Grassland habitat and associated biodiversity | 1 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | 2 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | 3 | Without | -1 | -1 | -3 | -3 | -8 | Negative Moderate |
| | | | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | **Mitigation**: Many small shallow chute/mitre type drains and/or berms/cut-off drains must be installed at regular intervals along the road to direct surface run-off from the road into adjacent grassland. Many small must be favoured over few large and these outlets must be armoured against erosion using gabion Reno-mattresses or riprap. | | | | | | | | |
| 26 | Grassland degradation caused by overgrazing and over-burning will also contribute to the negative cumulative impacts on the grassland | 1 | Without | -1 | -3 | -4 | -4 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | | 2 | Without | -1 | -3 | -4 | -4 | -12 | Negative high |
| | | | With | -1 | -2 | -1 | -2 | -6 | Negative low |
| | | 3 | Without | -1 | -3 | -4 | -4 | -12 | Negative high |
| | | | With | -1 | -2 | -2 | -3 | -8 | Negative Moderate |
| | **Mitigation**: Little can be offered as mitigation for grazing impacts; however, cumulatively the impact can be lessened by minimising the loss of grassland. This can be done by ensuring the least loss of grassland through the smallest footprint of construction. | | | | | | | | |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| 27 | Loss of the grassland in each of the three options will add to the cumulative loss of grassland in the area due to various factors including creation of new *umuzis* and expansion of the residential area, planting of crops, soil erosion, expansion of areas occupied by alien plant invaders and fragmentation of the veld through the creation of numerous informal vehicle tracks and footpaths | 1 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -2 | -4 | -2 | -2 | -10 | Negative high |
| | | 2 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -2 | -4 | -2 | -2 | -10 | Negative high |
| | | 3 | Without | -2 | -4 | -4 | -3 | -13 | Negative very high |
| | | | With | -2 | -4 | -2 | -2 | -10 | Negative high |
| | **Mitigation**: Development in such indigent areas is vital for the upliftment of the area. The only mitigation that can be offered is that a healthy amount of pristine grassland areas is maintained while development occurs. | | | | | | | | |
| 28 | Enhanced erosion as a result of concentrated flows (i.e. from diversion return flow) can also lead to scouring of wetland and river habitat downstream resulting in increased turbidity. | 1 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | 2 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | | 3 | Without | -1 | -3 | -3 | -3 | -10 | Negative high |
| | | | With | -1 | -2 | -2 | -1 | -6 | Negative low |
| | **Mitigation:** (a) Many small shallow chute/mitre type drains and/or berms/cut-off drains must be installed at regular intervals along the road to direct surface run-off from the road into adjacent grassland. (b) Many small must be favoured over few large and these outlets must be armoured against erosion using gabion Reno-mattresses or riprap. | | | | | | | | |

| | | |
|---|---|---|
| Average for RA Alternative 1 without mitigation | -8.7 | Negative Moderate |
| Average for RA Alternative 1 with mitigation | -5.3 | Negative low |
| Average for RA Alternative 2 without mitigation | -8.3 | Negative Moderate |
| Average for RA Alternative 2 with mitigation | -4.9 | Negative low |
| Average for RA Alternative 3 without mitigation | -8.4 | Negative Moderate |
| Average for RA Alternative 3 with mitigation | -5.3 | Negative low |

## Construction Phase: No-Go Alternative

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Construction - No-Go** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | All the impacts outlined above will not apply to the No-Go alternative as the status quo will apply and the environment will remain as it is currently.<br><br>However, it is important to note that the benefits associated with the development will also not materialise, and it must be noted that the majority of the impacts identified for the development were mitigated to a negative low or positive impact once the measures for mitigation were applied, indicating that maintaining the status quo is to lose the opportunity of a beneficial development with negligible environmental impacts. | | | | | | | 0 | Neutral |

## Operational Phase: Bridge Design Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Operational - Bridge Design** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | In stream structures increase channel cross sectional area downstream of the crossing and decrease water depths downstream. These impacts are as a result of channel restriction and increased flow velocity and scouring | 1 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -2 | -3 | -1 | -1 | -7 | Negative Moderate |
| | | 2 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -2 | -3 | -2 | -2 | -9 | Negative Moderate |
| | | 3 | Without | -2 | -3 | -3 | -3 | -11 | Negative high |
| | | | With | -2 | -3 | -2 | -2 | -9 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: (a) The 'precautionary principle' therefore applies and cost-effective measures must be implemented to pro-actively prevent degradation of the region's water resource and the social systems that depend on it. Ultimately, the risk of water resource degradation must drive sustainability in development design. (b) The protection of water resources (wetlands and rivers in this instance) begins with the avoidance of adverse impacts and where such avoidance is not feasible; to apply appropriate mitigation in the form of reactive practical actions that minimizes or reduces impacts. (c) Examples of mitigation can include changes to the scale, design, location, siting, process, sequencing, phasing, and management and/or monitoring of the proposed development activities, as well as the restoration or rehabilitation of disturbed sites. (d) Where environmental impacts can be severe, the guiding principle should be "anticipate and prevent" rather than "assess and repair." | | | | | | | | |
| | The upgraded road and new bridge link will encourage the flow of traffic and road users. | 1 | Without | -2 | -4 | -2 | -1 | -9 | Negative Moderate |
| | | | With | 2 | 4 | 2 | 2 | 10 | Positive high |
| | | 2 | Without | -2 | -4 | -2 | -1 | -9 | Negative Moderate |
| | | | With | 2 | 4 | 2 | 2 | 10 | Positive high |
| | | 3 | Without | -2 | -4 | -2 | -1 | -9 | Negative Moderate |
| | | | With | 2 | 4 | 2 | 2 | 10 | Positive high |
| 2 | **Mitigation**: (a) The attraction of traffic as an impact is twofold, being both positive and negative. (b) The increased traffic flow will be enough to promote development that is much needed but not too high that it results in a significant disturbance. (c) It is also a safer option rather than walking the currently unstable slopes and rolling topography. | | | | | | | | |
| | Residents and businessmen will have the advantage of travelling across provinces in quicker time | 1 | Without | 1 | 3 | 3 | 2 | 9 | Positive moderate |
| | | | With | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 2 | Without | 1 | 3 | 3 | 2 | 9 | Positive moderate |
| | | | With | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 3 | Without | 1 | 3 | 3 | 2 | 9 | Positive moderate |
| | | | With | 2 | 3 | 3 | 3 | 11 | Positive high |
| 3 | **Mitigation:** N/A. This is a beneficial impact which could lead to much needed development in the area. | | | | | | | | |
| | Health care facilities are more accessible, and ambulances have increased accessibility. | 1 | Without | 1 | 3 | 2 | 3 | 9 | Positive moderate |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | 2 | Without | 1 | 3 | 2 | 3 | 9 | Positive moderate |
| | | | With | 3 | 3 | 3 | 3 | 12 | Positive high |
| 4 | | 3 | Without | 1 | 3 | 2 | 3 | 9 | Positive moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | | | With | 3 | 3 | 3 | 3 | 12 | Positive high |
| | **Enhancement**: The bridge will provide for safe and faster accessibility over the Umtamvuna River. The best engineering design should be ensure, which will have a long life span with minimal maintenance required. | | | | | | | | |
| 5 | Educational facilities would become more accessible to those in need. | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 1 | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 2 | With | 3 | 3 | 3 | 3 | 12 | Positive high |
| | | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 3 | With | 3 | 3 | 3 | 3 | 12 | Positive high |
| | **Enhancement**: This is a beneficial impact which could lead to much needed development in the area. Access is a key infrastructure which leads to social upliftment. If the bridge is the best option (best design) it will have a long life span and lay the foundation for inter-provincial linkages. | | | | | | | | |
| | **Sub-phase: Indirect Impacts** | | | | | | | | |
| 6 | Culverts can also reduce through flows causing inundation of habitat upstream of the structures and sedimentation on in stream habitat. Rivers in particular are highly dynamic systems and are continually reshaping their bed and banks through erosional and depositional processes | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 1 | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 2 | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | **Mitigation**: (a) The best practicable design must be instated, which will utilise the least piers in the Umtamvuna River but still meet the engineering safety and cost specifications. (b) Structures such as gabions must also be used around piers to prevent stagnating of water flow and the culverts must be kept clean of debris at all times. | | | | | | | | |
| 7 | Compounded by noise and light disturbances which will limit to some degree the natural patterns of species movement within water courses at various | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 1 | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 2 | With | -1 | -1 | -2 | -2 | -6 | Negative low |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | spatial scales, depending on species life stage, feeding and breeding requirements | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | **Mitigation**: No mitigation can be offered as it is inevitable that light will be hindered under the culvert. Smaller culvert sizes are preferred with more numbers of culverts. | | | | | | | | |
| 8 | Due to greater mobility and opportunities for trading, there is the possibility that small crimes may also increase - primarily due to increased movement of people and access to economic opportunities. (Due to the very rural nature of the area, this is not deemed a high risk). | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 1 | With | -1 | -1 | -1 | -1 | -4 | Negative low |
| | | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 2 | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | | | Without | -2 | -2 | -2 | -3 | -9 | Negative Moderate |
| | | 3 | With | -1 | -1 | -2 | -2 | -6 | Negative low |
| | **Mitigation**: Policing in the area must be increased and crime prevented by the local police officers. It is unlikely that crime will increase. The bridge will actually allow for greater access and responses from law enforcement. | | | | | | | | |
| | **Sub-phase: Cumulative Impacts** | | | | | | | | |
| 9 | In stream structures modify the natural geomorphic processes of erosion and deposition by fixing bed and bank form and dimension. In stream culverts may restrict the channel, disconnecting flow and sediment from adjacent floodplains, in which the dissipation of energy (sediment and water) would occur during high flows under natural conditions. This restriction will | | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | 1 | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | | | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | 2 | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | | 3 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | result in increased scouring downstream of the crossing with a subsequent increase in channel dimension (deepening and widening) and increased in suspended soils (turbidity). | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | **Mitigation**: (a) The culvert design of the preferred alternative will enable the most flow through and the least impediment of the river flow. (b) While a spanned bridge may be the best option for the river, the size and flow of the river also dictates the most suitable design according to safety and SANRAL design regulations, and for this Umtamvuna River, a culvert is the best design, with spanned piers which allow for the greatest flow of river water through, while meeting the stipulated budget. | | | | | | | | |
| 10 | Bank erosion and channel widening would therefore likely result from the installation of in stream culverts in this context. The ultimate result would be a shift in the structure and composition of the river habitat including biotope types and overall habitat diversity. | 1 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | | 2 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | | 3 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | **Mitigation**: Gabions and other silt fencings must be instated to protect the integrity of the Umtamvuna River banks. The width of the culvert is relatively short to ensure minimal impact in this regard. | | | | | | | | |
| 11 | In stream structures that impede the natural flow regime also act as physical, hydrological, and behavioural barriers to the movement of aquatic biota such as fish and macro- invertebrates. Culverts can result in significant modification to channel bed form and flow conditions due to increased flow velocities, turbulence and reduced flow depth through the structure. | 1 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | | 2 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | | 3 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation**: Gabions and other silt fencings must be instated to protect the integrity of the Umtamvuna River banks. The width of the culvert is relatively short to ensure minimal impact in this regard. | | | | | | | | |
| 12 | Wetlands and rivers by nature are largely linear features often providing key linkages between important habitats including feeding and breeding habitat. This is of particular importance for migrating fish species that rely on habitat connectivity to complete their life-cycle. Wetland and river crossings that use culverts may present more of a barrier by creating higher velocities, shallow flow depths, length of run with no resting areas, or excessive jump height for aquatic species | | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | 1 | With | -1 | -4 | -1 | -1 | -7 | Negative Moderate |
| | | | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | 2 | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | | | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | 3 | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | **Mitigation**: Gabions and other silt fencings must be instated to protect the integrity of the Umtamvuna River banks. The width of the culvert is relatively short to ensure minimal impact in this regard. | | | | | | | | |
| | | | | | | | Average for Bridge Design Alternative 1 without mitigation | -5.2 | Negative low |
| | | | | | | | Average for Bridge Design Alternative 1 with mitigation | 0.3 | Negative Low |
| | | | | | | | Average for Bridge Design Alternative 2 without mitigation | -5.2 | Negative low |
| | | | | | | | Average for Bridge Design Alternative 2 with mitigation | -1.5 | Negative Low |
| | | | | | | | Average for Bridge Design Alternative 3 without mitigation | -5.2 | Negative low |
| | | | | | | | Average for Bridge Design Alternative 3 with mitigation | -1.5 | Negative Low |

# Operational Phase: Road Alignment Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Operational - Road Alignment Alternatives** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | Roads will increase the extent of hardened surfaces in the catchment of watercourses as well as result in the increased occurrence of point source surface water discharges associated with the stormwater management system of the new link road. Road networks intercept, direct and concentrate flows which essentially changes volume and timing of peak flows reaching aquatic ecosystems. | 1 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -2 | -2 | -9 | Negative Moderate |
| | | 2 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -1 | -2 | -8 | Negative Moderate |
| | | 3 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -4 | -1 | -2 | -8 | Negative Moderate |
| | **Mitigation**: (a) Stormwater drainage should be *via* open drains/swales adjacent to the road with energy check structures rather than concrete drains. (b) Under no circumstances must drop inlets and concrete pipes be utilised. (c) Wherever possible, the temporary chutes/berms must not be aligned perpendicular to the slope. (d) Outlet erosion protection structures must be designed to reduce outflows to energy levels that do not pose an erosion risk to downslope soils. (e) Outlet erosion structures must be properly installed along the grade and elevation of the slope. (f) Under no circumstances must the structures be placed higher than the ground surface thereby creating a drop off that may cause erosion. | | | | | | | | |
| 2 | Increased hardened surfaces within the catchment will result in a small increase in surface water runoff but more importantly it will result in increased runoff velocities at discharge points that will become areas at risk from erosion | 1 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -3 | -2 | -2 | -8 | Negative Moderate |
| | | 2 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -2 | -1 | -2 | -6 | Negative low |
| | | 3 | Without | -1 | -4 | -3 | -3 | -11 | Negative high |
| | | | With | -1 | -3 | -1 | -2 | -7 | Negative Moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | **Mitigation:** (a) Stormwater drainage should be via open drains/swales adjacent to the road with energy check structures rather than concrete drains. (b) Under no circumstances must drop inlets and concrete pipes be utilised. (c) Wherever possible, the temporary chutes/berms must not be aligned perpendicular to the slope. (d) Outlet erosion protection structures must be designed to reduce outflows to energy levels that do not pose an erosion risk to downslope soils. (e) Outlet erosion structures must be properly installed along the grade and elevation of the slope. (f) Under no circumstances must the structures be placed higher than the ground surface thereby creating a drop off that may cause erosion. | | | | | | | | |
| 3 | Far reaching community benefits of the access created, extends to the communities of • Ngqubushini, • Nomganya, • Mkandlwini, and • Ntalamvukazi. • Bhudlu, • Nyandeni, • Reedsdell, and • Mbizweni. | 1 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 3 | 4 | 14 | Positive very high |
| | | 2 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | 3 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 3 | 4 | 14 | Positive very high |
| | **Enhancement**: The road will enable far reaching connectivity, even inter-provincial. | | | | | | | | |
| 4 | The upgraded road and new bridge link will encourage the flow of traffic and road users. | 1 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 3 | 4 | 14 | Positive very high |
| | | 2 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 3 | 4 | 14 | Positive very high |
| | | 3 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 3 | 4 | 14 | Positive very high |
| | **Enhancement**: Over and above the encouragement to use this access, the RA will be safer provision of travelling options for surrounding communities and also lead to further connectivity. | | | | | | | | |
| 5 | Residents and businessmen will have the advantage of travelling across provinces in quicker time | 1 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | 2 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | 3 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | **Enhancement**: Overall the development will lead to beneficial impacts for the indigent area. | | | | | | | | |
| 6 | Health care facilities are more | 1 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | accessible, and ambulances have increased accessibility. | | With | 4 | 4 | 4 | 4 | 16 | Positive very high |
| | | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 2 | With | 4 | 4 | 4 | 4 | 16 | Positive very high |
| | | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 3 | With | 4 | 4 | 4 | 4 | 16 | Positive very high |
| | **Enhancement:** Accessibility to healthcare and particularly emergency healthcare remains a prevalent problem in rural areas, for these communities, this impact will be significantly lessened as ambulances will be able to access patients much faster and more efficiently. | | | | | | | | |
| 7 | Educational facilities would become more accessible to those in need. | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 1 | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 2 | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | 3 | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | **Enhancement**: Overall the development will lead to beneficial impacts for the indigent area. | | | | | | | | |
| **Sub-phase: Indirect Impacts** | | | | | | | | | |
| 8 | W-01 is also highly sensitive to flow concentration and the establishment of a new base level and such a disturbance could result in adjustments in wetland longitudinal profiles ultimately resulting in the loss of wetland habitat associated with gully erosion. | | Without | 0 | 0 | 0 | 0 | 0 | Neutral |
| | | 1 | With | 2 | 4 | 4 | 4 | 14 | Positive very high |
| | | | Without | 0 | 0 | 0 | 0 | 0 | Neutral |
| | | 2 | With | 2 | 4 | 4 | 4 | 14 | Positive very high |
| | | | Without | -2 | -4 | -3 | -4 | -13 | Negative very high |
| | | 3 | With | -2 | -4 | -3 | -4 | -13 | Negative very high |
| | **Mitigation**: Only RA 3 will traverse this W-01 watercourse and can be avoided by implementing RA 1 or RA 2, however, with RA 2 being the shorter route, if preferred for further reasons. | | | | | | | | |
| 9 | Due to greater mobility and opportunities for trading, there is the possibility that small crimes | | Without | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 1 | With | 2 | 2 | 2 | 2 | 8 | Positive moderate |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| | may also increase - primarily due to increased movement of people and access to economic opportunities. (Due to the very rural nature of the area, this is not deemed a high risk). | | Without | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 2 | With | 2 | 2 | 2 | 2 | 8 | Positive moderate |
| | | | Without | -1 | -1 | -2 | -1 | -5 | Negative low |
| | | 3 | With | 2 | 2 | 2 | 2 | 8 | Positive moderate |
| | **Mitigation**: This is an unlikely impact and on the flipside, the accessibility also allows for fast response of law enforcement. The access will actually allow for the better delivery of services and protection. | | | | | | | | |
| **Sub-phase: Cumulative Impacts** | | | | | | | | | |
| 10 | Stormwater discharges from formal rural roads in steep and erodible settings are known to pose serious gulley erosion risks and such impacts are already evident within the local catchment as a result of poor road alignment and stormwater management. If road stormwater is collected and discharged at few outlet points at low points in the road and limited erosion protection is installed (as would be expected in a rural setting), it is highly likely that erosion will occur below the stormwater discharge points which could lead to further erosion downslope and ultimately the sedimentation and/or erosion of riverine and wetland habitat, particularly the tributary systems, and ultimately increased transportation of sediment to the Umtamvuna River. | | Without | -2 | -2 | -3 | -3 | -10 | Negative high |
| | | 1 | With | -2 | -2 | -2 | -2 | -8 | Negative Moderate |
| | | | Without | -2 | -2 | -3 | -3 | -10 | Negative high |
| | | 2 | With | -2 | -2 | -2 | -2 | -8 | Negative Moderate |
| | | | Without | -2 | -2 | -3 | -3 | -10 | Negative high |
| | | 3 | With | -2 | -2 | -2 | -2 | -8 | Negative Moderate |
| | **Mitigation**: Gabions and other silt fencings must be instated to protect the integrity of the Umtamvuna River banks. The width of the culvert is relatively short to ensure minimal impact in this regard. | | | | | | | | |

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| 11 | There are numerous other communities in both the KZN and EC provinces that are likely to benefit. The need and desire for such an access bridge link may even stretch to a distance of 20 kms (straight line) to Harding (the nearest town in KZN), and a distance of 18 kms (straight line) to Bizana (the nearest town in the EC). | 1 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | 2 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | | 3 | Without | 2 | 3 | 3 | 3 | 11 | Positive high |
| | | | With | 3 | 4 | 4 | 4 | 15 | Positive very high |
| | **Enhancement**: The development, of the most suitable RA will ultimately lead to numerous benefits. | | | | | | | | |
| | | | | | | | Average for RA Alternative 1 without mitigation | 2.6 | Negative low |
| | | | | | | | Average for RA Alternative 1 with mitigation | 7.8 | Positive moderate |
| | | | | | | | Average for RA Alternative 2 without mitigation | 2.6 | Negative low |
| | | | | | | | Average for RA Alternative 2 with mitigation | 8.2 | Positive moderate |
| | | | | | | | Average for RA Alternative 3 without mitigation | 1.5 | Negative low |
| | | | | | | | Average for RA Alternative 3 with mitigation | 5.5 | Positive low |

## Operational Phase: No-Go Alternative

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Operation - No-Go** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | All the impacts outlined above will not apply to the No-Go alternative as the status quo will apply and the environment will remain as it is currently.<br>However, it is important to note that the benefits associated with the development will also not materialise, and it must be noted that the majority of the impacts identified for the development were mitigated to a negative low or positive impact once the measures for mitigation were applied, indicating that maintaining the status quo is to lose the opportunity of a beneficial development with negligible environmental impacts. | | | | | | | 0 | Neutral |

## Decommissioning Phase: Bridge Design Alternatives and Road Alignment Alternatives

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Decommissioning - Bridge Design Alternatives** | | | | | | | | | |
| Not Applicable | | | | | | | | | |
| **Phase: Decommissioning - Road Alignment Alternatives** | | | | | | | | | |
| Not Applicable | | | | | | | | | |

## Decommissioning: No-Go Alternative

| No. | Impact | Alternative | Mitigation | Extent | Duration | Intensity | Probability | Significance = E+D+I+P | Interpretation |
|---|---|---|---|---|---|---|---|---|---|
| **Phase: Decommissioning - No-Go** | | | | | | | | | |
| **Sub-phase: Direct Impacts** | | | | | | | | | |
| 1 | All the impacts outlined above will not apply to the No-Go alternative as the status quo will apply and the environment will remain as it is currently.<br>However, it is important to note that the benefits associated with the development will also not materialise, and it must be noted that the majority of the impacts identified for the development were mitigated to a negative low or positive impact once the measures for mitigation were applied, indicating that maintaining the status quo is to lose the opportunity of a beneficial development with negligible environmental impacts. | | | | | | | 0 | Neutral |