

SECTION 5

Potential Environmental Impacts



5 Potential Impacts

This section describes potential impacts on aspects of the physical, biological and socio-economic environment resulting from the Proposed Development, supported by a description of the existing physical, biological and socio-economic environment in **Section 4, Existing Environment** and by proposed mitigation measures described under **Section 7, Mitigation, Management and Monitoring**.

The Guidelines identified major risk arising from the Proposed Development as (NRETAS, 2010a):

- Disturbance to terrestrial soils, in particular ASS during construction of the duplicated rising main
- Impacts on listed migratory species and listed threatened species and communities along the Proposed Development corridor.

Potential impacts associated with operating the Ludmilla WWTP and existing East Point outfall are described in the *Public Environmental Report for Ludmilla Wastewater Treatment Plant and Associated Facilities* (Sinclair Knight Merz, 1998).

The PWC is committed to reducing environmental impacts associated its operations and plans to extend the existing East Point outfall into deeper water, with the aim of promoting dilution of treated effluent discharged through the outfall. Extending the existing East Point outfall will be subject to a separate assessment under the EA Act and EPBC Act (see **Section 1.3, Regulatory Framework**). The proponent will prepare and submit the required approval documentation prior to extending the East Point outfall. The Guidelines identified major risk associated with extending the East Point outfall, which will be addressed under a subsequent PER for the outfall extension project. These impacts were not considered under the PER for the Proposed Development and include (NRETAS, 2010a):

- Disturbance to marine sediments, in particular erosion of benthic sand waves and the fate of disturbed sediment during construction of the outfall.
- Water quality issues during the operation including for:
 - flocculation of effluent at the outfall opening and the dispersal, persistence and accretion of nutrients
 - impacts on listed migratory species and listed threatened species and communities along the proposed East Point outfall development corridor
 - impacts on sensitive marine benthic habitats, including corals and seagrass beds supporting local ecosystems, and fisheries.
- Natural disasters.

5.1 Impacts on the Physical Environment

The regional and local geology, topography and soils in the vicinity of the Proposed Development is described in **Section 4.1, Physical Environment** and proposed mitigation measures are discussed under **Section 6.2, Mitigation of Impacts on the Physical Environment**.

5 Potential Impacts

5.1.1 Erosion and Sedimentation

The Proposed Development is traverse an area that is mostly flat, with a gradient varying between 1 and 3 % (DCC, 2009a; DCC 2009b) with a low erosion potential alignment (see **Table 4-2**). However, the erosion potential along the alignment may increase due to the conflicting factors of very low slope and exposed soils and fill material used during construction.

Some runoff generated within the catchment is directed to the receiving environment through drainage channels, nonetheless runoff from site may interact with workings, mobilise sediment and leading to erosion. The potential for sedimentation and erosion is further increased due to terrain disturbance during construction and rehabilitation activities post construction.

Potential effects resulting from site preparation, excavation and construction activities, which must be appropriately managed, include:

- Soil erosion as result of high rainfall and subsequent pump out of trenches and excavations.
- Mobilised sediment and sediment accumulating in the receiving environment.

5.1.2 Acid Sulphate Soils

Acid sulphate soils (ASS) are wet anaerobic soils which when exposed to air form sulphuric acid. This lowers pH levels and mobilises metals in the soil creating an acid leachate with elevated metal concentrations (Sinclair Knight Merz, 1998).

An investigation into the occurrence of ASS along the Proposed Development corridor identified four locations of ASS (see **Section 4.1.4, Soils**). Potential activities that may contribute to ASS oxidising include:

- Excavation may bring ASS to the surface.
- Stockpiling of material containing ASS.
- Heavy machinery used in the construction process may cause gouging and turning of the subsoils (Cardno Ullman & Nolan, 2011).

Without treatment excavated and/or stockpiled ASS could result in the release of acidic leachate into the surrounding environment. Exposure of material containing ASS to rainfall is the most likely to release acidic leachate during rainfall, which may impact stormwater, surface soils and the marine environment. Acid leachate may also present health risk if contact or ingestion occurs.

5.1.3 Contaminated Runoff

There is a potential for localised runoff from the construction site during periods of rainfall and subsequent runoff from water pumped out of trenches and excavations. In addition to potential runoff from rainfall, accidental discharges of treated effluent may also occur if construction activities damage the existing effluent rising main. However, the Proposed Development corridor was selected to minimise interaction with the existing effluent rising main, which will remain in operation during construction activities. Construction activities are scheduled to take place during the dry-season.

Discharges from the construction site may adversely impact on the receiving environment, in particular of the discharge contains acidic leachate or treated effluent from the Ludmilla WWTP.

5 Potential Impacts

5.1.4 Noise and Vibration

Noise and vibration associated with the Proposed Development may impact on both surrounding land users, including nearby residential premises and recreational users of East Point.

Construction activities will require heavy machinery, supported by light vehicles accessing the construction site, which may adversely impact on nearby residential premises and recreational users of East Point. Noise nuisance and vibration impacts are highest if construction is allowed to occur at night and / or on Sundays when East Point has the highest number of recreational users.

However, noise nuisance and vibration resulting from construction is considered minimal, since most of the Proposed Development corridor is away from areas frequented by recreational users and residential buildings, limiting exposure to noise and vibration.

Much of the Proposed Development corridor is in soft ground, limiting the use of rock breakers when excavating the pipeline trench (Sinclair Knight Merz, 1998).

5.1.5 Air Quality

Dust Generation

Dust may be generated during construction of the Proposed Development, due to site clearing activities, loss of vegetation, excavation and handling of soils, rock breaking, wind erosion from disturbed areas and material stockpiles, site grading activities and vehicle movements.

It is anticipated that the resultant dust impacts from construction activities would be localised and predominantly affect land-users in close proximity to the Proposed Development corridor, typically residential premises and recreational users of East Point.

Dust from construction activities is likely to be more a nuisance impact and is considered to have a negligible impact on human health. Furthermore, dust resulting from construction activities can be managed through dust suppression measures, reducing ambient levels.

Contributing to Air Pollution

In addition to dust, relatively minor emissions of oxides of carbon (CO_x), oxides of nitrogen (NO_x) and oxides of sulphur (SO_x) are expected as a result of the operation of machinery and support vehicles during construction of the Proposed Development. Construction is expected to take 12 weeks. During this period an estimated 15,000 kL of diesel may be used. Equating to the emission of 40.5 t carbon dioxide equivalents (CO_{2-e}).

Odour

Odour is not an easy problem to solve in the context of the high temperature of wastewater in Darwin, which leads to rapid decomposition of the organic content, depleting of dissolved oxygen and generation of odours (Sinclair Knight Merz, 1998), and in the context of this Proposed Development can be associated with the Ludmilla WWTP currently receiving upgrades to combat odour.

5 Potential Impacts

A local odour problem may be experienced during the excavation of ASS (see **Section 4.1.4, Soils**) along the Proposed Development corridor. It is expected that odour will only persist during the construction phase of the project and limited to areas with ASS. Sensitive receptors to odour are limited to residential premises in close proximity to areas with identified AASS. The potential impact of odour on these receptors is considered low due to the distance between the potential source of odour and the receptors.

Another potential source of odour is the effluent transported through the proposed effluent rising main leading from Ludmilla WWTP to the terminal manhole at East Point. However, the occurrence of odour associated with the effluent rising main is unlikely since no vents are planned for the pipeline.

5.2 Impacts on the Biological Environment

The existing biological environment, i.e. fauna and flora, in proximity to the Proposed Development is described under **Section 4.2, Biological Environment** and supported by a full species list and results from a field survey included as **Appendix F**.

5.2.1 Disturbance Area

The Proposed Development corridor (10 m in width) will result in clearing of approximately three (3) hectares (ha) of terrestrial vegetation, of which 2.54 ha (85%) is classified as Community 5 disturbed and urban areas with regrowth. The development will also result in the clearing and potential disturbance of 0.05 – 0.13 ha of Mangrove Forest area. Additional area of potential disturbance to vegetation and soil resulting from the clearing and construction activities (measured at 5 m either side of the 10 m corridor) have also been calculated to depict the maximum and minimum areas of disturbance.

Table 5-1 below provides the details of the disturbance of the vegetation communities as calculated in ArcGIS. The table illustrates that the majority of the Proposed Development corridor will pass through disturbed urban parkland and development areas with regrowth (Community 5).

Table 5-1 Areas of Clearing and Disturbance of Each Vegetation Community (1 to 5)

Vegetation Community	Map unit	Cleared (hectares)	Potentially disturbed (hectares)	Total (hectares)
Community 1: Coastal Monsoon Vine Forest	12	0.034	0.081	0.115
Community 2: Low to Mid, Mixed Species Closed Forests	6	0.363	0.379	0.742
Community 3: Low to Mid High, Mixed Species Open Woodland to Woodland	13	0.652	0.686	1.338
Community 4: Mangrove Forest	4	0.056	0.078	0.134
Community 5: Disturbed Areas with Regrowth	16	1.893	1.8	3.696
<i>Total Terrestrial Vegetation</i>	-	<i>2.94</i>	<i>2.95</i>	<i>5.89</i>
<i>Total Vegetation Marine Component</i>	-	<i>0.056</i>	<i>0.078</i>	<i>0.134</i>
Total Area	-	2.99	3.03	6.02

5 Potential Impacts

5.2.2 Terrestrial Flora, Fauna and Weeds

Noting that the area proposed for the construction of the Proposed Development was selected to minimise the potential for clearing of vegetation, the impacts on terrestrial fauna and flora is considered to be minimal.

Potential for Impact on the Fauna and Flora

The Coastal Monsoon Vine Forest Community is recognised as significant vegetation under the *Northern Territory Land Clearing Guidelines* (NRETAS, 2010b). It is not listed as significant or threatened under the EPBC Act. The Coastal Monsoon Vine Forest Community within the Proposed Development corridor is a modified rainforest community largely comprised of regrowth through self-seeding and supplementary plantings by DCC between 1974 and 1984 (Franklin et al., 2010) and as a result is floristically simplified.

Whilst this vegetation community is unlikely to be providing significant habitat for wildlife, it provides habitat within the East Point Reserve for local fauna populations, such as the Agile Wallaby, and Rainbow Pitta (*Pitta iris*) in the greater landscape matrix (Franklin et al., 2010).

The overall area of Monsoon Vine Forests located within, or adjacent to, the Proposed Development corridor is very small and the community is bordered by managed urban parkland, management tracks and the Model Aeroplane Club grounds.

The Proposed Development corridor passes through an area of Mixed Species Open Forest and patches of Mixed Species Open Woodland regrowth and revegetation. These vegetation communities are in poor ecological condition. They are generally disturbed with evidence of weeds and impacts from adjacent urban land uses. Whilst these vegetation communities are unlikely to provide significant habitat for wildlife, the habitat value of these areas is similar to the Monsoon Vine Forest described above; that is, they provide habitat for local fauna and threatened fauna, such as the Yellow-spotted Monitor, to persist in the greater landscape matrix.

A small area of *Ceriops tagal* Mangrove Forest is proposed to be cleared for the Proposed Development corridor. Mangrove communities are recognised as sensitive, or significant vegetation, under the *Northern Territory Land Clearing Guidelines* (NRETAS, 2010b). They are not listed as threatened under the EPBC Act. Species listed in the threatened species schedules of the EPBC Act and the TPWC Act were not observed in this community. The area of impact on the mangrove forest will be limited to the edge of this vegetation community. The impacts on terrestrial vegetation and habitat are likely to be lessened because of this, as it is likely that core areas of Mangrove Forest and Mangrove Forest zones not impacted by the pipeline are of greater significance for wildlife (Noske, 1996; Clay and Andersen, 1996).

The mangrove habitats directly adjacent to the existing sewage rising main, Ludmilla WWTP and urban areas are already impacted to some degree by edge effects associated with the land uses including drainage, sedimentation, noise and artificial light. Despite these impacts, the Mangrove Forest area continues to support a suite of mangrove and wetland specialist fauna species, including small numbers of listed migratory shorebirds (Noske, 1996; Clay and Andersen, 1996).

Mangrove and salt marsh / saline wetland habitats within and surrounding the study area support a number of listed migratory marine birds and shorebirds. Under EPBC significance criteria these areas qualify as important habitat for migratory species listed under the *EPBC Act 1999*. These areas also support a range of other mangrove specialist fauna species.

5 Potential Impacts

Threatening processes for migratory shorebirds include habitat loss, habitat degradation and disturbance (e.g. night lighting, noise, human access, dogs). It is noted that the mangrove vegetation is connected to larger tracts of remnant mangrove habitat, Ludmilla Creek, to the north and east.

The *Northern Territory Land Clearing Guidelines* (NRETAS, 2010b) state that applications to clear in coastal areas, or in areas subject to tidal influence (e.g. floodplain systems associated with tidal rivers and creeks, Coastal Monsoon Vine Thickets and Mangroves), must be supported by additional information, which may include:

- Potential, or expected, impacts of the land clearing on sensitive or fragile coastal landscapes and the steps taken to reduce and manage risks.

Weeds

Two of the five vegetation community types recorded in the study area are regarded as sensitive, or significant vegetation, including the patches of Coastal Monsoon Vine Forest and the Mangrove Forest. The construction of the Proposed Development could potentially spread weeds already present at the East Point Reserve, thus having a negative impact through the invasion and replacement of native plant species. This could modify the existing habitats for native animals and in a larger scheme may have a negative impact on ecosystem functions, such as nutrient and water cycles, in addition to changing fire regimes.

5.2.3 Biting Insects

Biting insects are not just a highly irritating biting pest of man and animals, but are also carriers of debilitating viral diseases. Coastal areas and especially mangroves provide attractive habitats for mosquitoes. The construction of the Proposed Development could potentially create more breeding sites for mosquitoes if water is allowed to pool. Therefore, it is important to minimise the extent of stagnant water during the construction process by drainage to avoid ponding of water.

Section 4.3, Biting Insects provides further information on the existing environment for biting insects and also describes potential impacts on human health and vector transmitted abroviral diseases. Key actions that lead to mosquito breeding and the associated negative impacts on public health and amenity include (URS, 2004a):

- Creation of ponding areas during earth works related to construction and maintenance activities.
- Poor drainage of landscaped areas leading to mosquito breeding and providing breeding sites.

Potential Impact on Mosquito Habitats

Construction in tidal areas, or on sites with some saline soil, generally has the most potential to create productive mosquito breeding sites. Mosquitoes, such as *Ae. vigilax* and *Cx. Sitiens*, may breed in very high numbers in disturbed upper tidal areas, such as those created through site disturbance, or the embankment of tide water. Inappropriate site clearing and grading adjacent to tidal areas may create *Ae. vigilax* and *Cx. annulirostris* problems. All construction activities in tidal areas should therefore be carefully considered in the planning stage, and any previous or resultant disturbed areas appropriately rehabilitated upon completion of development (Warchot and Whelan, 2011).

New breeding sites could be created due to the creation scrapes, trenching, site clearing and reclamation, stormwater drains and water discharge sites, and inappropriate storage of artificial receptacles and materials that could pond water (Warchot and Whelan, 2011).

5 Potential Impacts

Future residential development has the opportunity to rectify existing mosquito breeding sites. Rectification of existing mosquito breeding sites will be of benefit to workers, residents and visitors to East Point / Ludmilla, by reducing pest problems and the risk of mosquito borne disease transmission (Warchot and Whelan, 2011).

5.3 Impacts on the Built Environment

The Proposed Development will traverse an area from the Ludmilla WWTP to the EPO, which is largely undeveloped cleared areas, designated as Public Open Space, Community Purpose and Utilities (see **Section 4.4, Built Environment**).

The alignment was selected to minimise potential impacts on vegetation, infrastructure and adjacent land-uses. Services and infrastructure directly impacted by the Proposed Development (see **Figure 4-7**) include:

- Existing effluent rising main from Ludmilla WWTP to the East Point outfall, which will be retained as support infrastructure although regular flow through the pipeline will cease once the Proposed Development is commissioned).
- The East Point Bicycle track along the north-eastern section of East Point Reserve.
- Colivas Road adjacent to East Point Reserve and Lake Alexander.
- East Point reserve, used for recreational purposes.
- Areas of recent rehabilitated (i.e. tree planting by the Friends of East Point) adjacent to Colivas Road.

5.3.1 Land-use

The construction of the Proposed Development will occur within a new PWC easement. The Proposed Development aligns with current and future land-use planning and no changes to zoning or land-use are required. Permission will be gained from the respective property owners prior to construction. Nearby recreational and residential users will also be informed.

Impacts on adjacent land-use are considered minimal and limited to construction and maintenance activities.

5.3.2 Road Network and Traffic

The proposed pipeline will intersect Colivas Road and a section of the East Point bicycle (see **Figure 4-8**) track constructed for recreational purposes by the Darwin City Council. A temporary diversion will be installed at Colivas Road and a portion of the bicycle track will be closed during construction activities. Once construction is complete, both Colivas Road and the East Point bicycle track will be reinstated.

Interruption to traffic along Colivas Road will be minimal and limited to construction activities. The East Point bicycle track will be closed for an extended period during construction, adversely impacting on recreational users wishing to use the north-eastern section of the East Point bicycle track. The Proposed Development will not impact on other areas of recreational use at East Point Reserve.

Infrastructure impacted by the Proposed Development will be reinstated upon completion of the Proposed Development, with impacts limited to the construction phase.

During construction, tracks will be required to access areas such as the pipeline corridor and work areas. Existing roads, tracks and disturbed areas will be utilised as far as practicable to minimise disturbance to the surrounding areas.

5 Potential Impacts

The selection of access track routes will be based on the pipeline route and gates will be installed where fence lines are breached. Hours of construction will be specified in the construction contracts to minimise adverse impacts due to noise and disturbance. Construction activities will align with NRETAS Noise Guidelines for Development Sites, June 2011. Estimated vehicle movements during the construction of approximately 12 weeks include:

- Heavy vehicles: average 1 per day; peak 5 per day
- Trucks: average 12 per day; peak 25 per day
- Cars: 1 per day; peak 55 per day.

5.4 Impacts on the Socio-economic Environment

5.4.1 Visual Amenity, Dust and Noise Levels

Construction activities will be visible from various locations along the proposed alignment, with regular vehicle movements potentially generating nuisance dust and noise. The potential visual amenity, dust and noise nuisance impacts are considered low and are limited to the construction phase.

5.4.2 Employment

The Proposed Development will have a positive impact in generating local direct and indirect employment. It is estimated approximately 10 people will gain employment during construction (12 weeks) of the Proposed Development. However, due to the low maintenance design of the Proposed Development, limited employment opportunities existing during the operational phase of the duplicated effluent rising main.

5.4.3 Sites of Recreational and Socio-economic Importance

The Proposed Development will have a short term impact on the recreational activities at East Point, which include limiting access along North-Eastern section of the East Point bicycle track. However, in the medium to longer term, it is unlikely that the Proposed Development will impact on recreational activities at East Point. All construction work areas will be clearly signposted and demarcated to prevent unsolicited entry.

The proposed alignment will also require removal some small trees recently planned next to Colivas Road (see **Figure 5-1**). The Proponent is committed to minimise environmental impacts associated with its activities (see **Section 7, Mitigation, Management and Monitoring**) and propose to rehabilitate areas of disturbance.

5.4.4 Itinerants

East Point and in particular the East Point Reserve is frequented by itinerants staying illegally within proximity of the Proposed Development corridor. During construction, itinerants may be exposed to activities that may result in injury.

5.4.5 Cultural Heritage

No impacts on cultural heritage are envisaged associated with the Proposed Development (see **Section 4.5.3, Cultural Heritage**).

5 Potential Impacts



Figure 5-1 Trees Planted Adjacent to Colivas Road