



ASSESSMENT REPORT 27

LUDMILLA
WASTEWATER TREATMENT PLANT AND
ASSOCIATED FACILITIES

**ENVIRONMENTAL ASSESSMENT REPORT AND
RECOMMENDATIONS**

by the

ENVIRONMENT AND HERITAGE DIVISION
DEPARTMENT OF LANDS, PLANNING AND ENVIRONMENT

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ABBREVIATIONS

CBD	Central Business District
DLPE	Department of Lands, Planning and Environment
EHD	Environment and Heritage Division
EMP	Environmental Management Plan
LUO's	Land Use Objectives
NTPA	Northern Territory Planning Authority
NOI	Notice of Intent
NPI	National Pollutant Inventory
PASS	Potential Acid Sulfate Soils
PAWA	Power and Water Authority
PER	Public Environment Report
THS	Territory Health Services
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

This report assesses the environmental impact of the proposal by the Power and Water Authority (PAWA) to upgrade the Ludmilla Wastewater Treatment Plant and Associated Facilities (WWTP). The major components of the proposal include: the augmentation of the Ludmilla WWTP; pipelines to transfer wastewater from Larrakeyah and the Central Business District to the Ludmilla WWTP; tertiary filtration and disinfection arrangements to produce high quality effluent for reuse; effluent pumping stations and pipelines to convey effluent to the Larrakeyah outfall; increased capacity of East Point outfall and the possible extension of the East Point outfall.

This Report reviews the Public Environment Report (PER), public comments as well as information and advice provided by Northern Territory Government agencies.

Environmental impact assessment is the process of defining those elements of the environment which may be affected by a development proposal and of determining the significance, risk and consequences of the potential impacts of the proposal. Recommendations arising from the assessment address methods to mitigate these impacts.

Major Issues

The principal environmental issues identified with the proposal to augment the Ludmilla WWTP and construct the associated infrastructure to support the augmentation are:

1. short term impacts during pipeline construction, principally noise, dust, localised vibration, traffic congestion, restrictions to access and temporary loss of a small number of trees and shrubs;
2. production and disposal of about 1 tonne per day wastes (screenings and grit) as a result of increased removal of these materials by improved treatment;
3. increased discharge of effluent through the Larrakeyah outfall;
4. potential loss of mangroves due to the expansion of the Ludmilla WWTP ;
5. management of potential acid sulfate soils and old sludge during the augmentation of the Ludmilla WWTP; and

The potential benefits associated with the proposal include:

1. removal of the present macerated sewage discharge at Larrakeyah;
2. reduced frequency of discharge through East Point outfall;
3. substantially reduced number of days of overflow to Ludmilla Creek as well as improved treatment before discharge to the Creek;
4. reclaimed water available for reuse;
5. potential long term prospect for reuse of biosolids;
6. reduction in organic and nutrient loads discharged to Darwin Harbour; and
7. substantial reduction in organic and nutrient loads discharged at East Point during the dry season.

Conclusion

It is considered that the environmental issues associated with the proposed project have been adequately identified. Some of these issues have been resolved through the assessment process, while others will be addressed through monitoring and management actions detailed in Environmental Management Plans (EMPs) to be completed when the proposal has been finalised but before commencement of construction. The EMPs will be subject to review by relevant NT Government agencies before finalisation.

The EMPs, licence requirements and development permits will be the major vehicles for the implementation of PAWA's management and monitoring commitments outlined in the PER and the recommendations detailed in this assessment report. The EMPs will be working documents and will require continual review in the light of operational experience and changed circumstances. If the extension to the East Point outfall proceeds, it should be subject to further environmental assessment.

The augmentation of the Ludmilla WWTP, the subsequent improvement in effluent quality being discharged at Larrakeyah and East Point outfalls as well as PAWA's commitment to effluent and biosolid reuse are positive initiatives in the improvement of the Darwin Sewage System.

Provided that the environmental commitments and safeguards detailed in the PER are undertaken, the recommendations in this report are adopted and regular compliance auditing and reporting are undertaken, long term impacts should be avoided or mitigated.

SUMMARY OF RECOMMENDATIONS

Recommendation 1

PAWA shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the Ludmilla WWTP Public Environment Report and as recommended in this assessment report. All safeguards and mitigation measures outlined in the PER are considered to be commitments by PAWA.

Recommendation 2

PAWA shall liaise with the Planning Division and Development Assessment Services of DLPE regarding:

- **rezoning of Lot 5794;**
- **consent for the upgrade of the Ludmilla WWTP; and**
- **the development of Lot freehold Lot 5234 and Crown Lot 4990 (2 ½ Mile Depot).**

Recommendation 3

PAWA shall liaise with the Parks and Wildlife Commission of the NT and Darwin City Council regarding the route of the pipelines through the Darwin Botanic Gardens and along Gilruth Avenue.

Recommendation 4

Storm surge should be considered in the design of the upgraded WWTP at Ludmilla.

Recommendation 5

PAWA shall incorporate overflow precautions into the detailed pipeline designs, taking into consideration possible off-site impacts.

Recommendation 6

The storage of diesel at the Ludmilla WWTP should be in accordance with AS 1940-1993 rather than AS 1940- 1988. Adequate emergency control measures should be in place at the Ludmilla WWTP to ensure that diesel does not overflow during times of refueling. Measures for the management of chemicals should be detailed in the EMP for the operation of the Ludmilla WWTP.

Recommendation 7

PAWA shall include an odour complaints register in the EMP for construction and the EMP for the operation of the Ludmilla WWTP.

Recommendation 8

- a) **PAWA should undertake, in consultation with DLPE, analysis of potential acid sulfate soils at both the Ludmilla and Hudson Creek site before the material is disturbed. The material should be tested for acid production according to the methods adopted by the NSW Acid Sulfate Soils Management Advisory Committee so that appropriate management options can be developed.**

- b) A contingency plan for the management of acidic groundwater should be included in the EMP for construction of the upgraded Ludmilla WWTP. The Plan should be incorporated into the Section of the EMP which covers the management of PASS and old sewage sludge at this site.
- c) The final management option, including possible leachate control, acidic groundwater management and water quality monitoring should be included in the EMP for construction of the upgraded Ludmilla WWTP.

Recommendation 9

- a) PAWA should conduct a geotechnical study of low lying areas along the routes of all pipelines to check for PASS.
- b) A contingency plan for the management of these soils should be considered during the detailed planning stages of these pipelines rather than waiting until the soil is actually disturbed. The management of PASS should be included in the EMPs for the construction of the pipelines.

Recommendation 10

- a) Removal of trees should be minimised and short term traffic delays should be allowed in preference to tree loss. No trees should be removed from Council or Botanic Garden land without thorough consultation with the Darwin City Council and the Parks and Wildlife Commission.
- b) The Greening Australia 'List of Significant Trees' should be consulted before any trees are removed.

Recommendation 11

The Department of Arts and Museums and DLPE should be consulted during the design of any surveys or monitoring programs.

Recommendation 12

The dry season flushing of the East Point outfall should be timed to coincide with elevated tides.

Recommendation 13

Any proposal to extend the East Point outfall should be referred to DLPE for consideration of the need for further environmental impact assessment.

Recommendation 14

PAWA should liaise with the Ludmilla Creek Landcare group and the Darwin City Council regarding a holistic approach to monitoring impacts from development on Ludmilla Creek. PAWA should actively support environmental monitoring associated with a catchment wide approach.

Recommendation 15

PAWA shall ensure that changes to the flow regime in the tidal channel at Ludmilla WWTP do not create mosquito breeding sites. The management of the tidal creek should be included in the EMP for the operation of the Ludmilla WWTP.

Recommendation 16

PAWA consult with DLPE to explore options for re-use or disposal of wastes, and before adopting the option of disposing of screenings and grit at the Leanyer WWTP.

Recommendation 17

Any open drains that are disturbed during the construction or operation phase will be reconstructed or rectified to the satisfaction of THS to ensure mosquito breeding sites are not created. Pooling of freshwater or effluent should be avoided in any areas.

Recommendation 18

PAWA should consider signing up to the Greenhouse Challenge program again in 2000 and consider means to abate emissions from the upgrade, and other PAWA developments, in the next agreement.

Recommendation 19

PAWA and Darwin City Council should consult both the DLPE and THS regarding the release of sewage effluent to stormwater drains along the rising main between Ludmilla WWTP and Larrakeya outfall.

Recommendation 20

- a) During the preparation of the EMPs PAWA shall consult with DLPE to determine mechanisms of feedback and reporting to DLPE. All EMPs will be auditable documents.**
- b) Weed control should be included in the EMP for the operational phase of the Ludmilla WWTP.**
- c) All EMPs should ensure that construction and operation activities are conducted with minimal public health impact.**
- d) All monitoring and survey commitments and those recommended within this Assessment Report shall be detailed in the relevant EMP. All results from monitoring and surveys should be available as part of the auditing process.**
- e) Performance criteria against commitments and recommendations made in the PER and this Assessment Report should be clearly stated in all EMPs.**

Recommendation 21

Environmental Management Plans shall include the details of all monitoring programs and biological surveys.

Recommendation 22

Monitoring for mosquito larvae shall be conducted in consultation with Medical Entomology Branch, Territory Health Services.

1. INTRODUCTION AND BACKGROUND

This report assesses the environmental impacts of the proposal by the Power and Water Authority (PAWA) to upgrade the Ludmilla Wastewater Treatment Plant (WWTP) and associated facilities. The Assessment Report reviews the Public Environment Report (PER) and public comments on the PER. It also relies on information, comments and advice provided by Northern Territory Government agencies and previous studies undertaken in the region.

1.1 Environmental Assessment Process

Environmental impact assessment is based on adequately defining those elements of the environment which may be affected by a proposed development, and on quantifying the significance, risks and consequences of the potential impacts of the proposal at a local and regional level.

The PER provides a description of the existing environment in the area and the proposed operations, and evaluates the environmental impacts and proposed mitigating measures to minimise the expected impacts.

This report will assess the adequacy of the PER in achieving the above objectives, and will evaluate the undertakings and environmental safeguards proposed by the proponent to mitigate the potential impacts. Further safeguards may be recommended as appropriate.

The safeguards may be implemented at various levels within the planning framework of a project. These include, but are not limited to:

1. Site selection;
2. Design and layout of facilities;
3. Management of construction activities;
4. Processes used in operations and facilities (i.e. inputs and outputs); and
5. Management of operations, processes and facilities.

The contents of this report form the basis of advice to the Northern Territory Minister for Lands, Planning and Environment on the environmental issues associated with the project.

1.2 Environmental Assessment History

PAWA (the proponent) lodged a Notice of Intent (NOI) with the Department of Lands, Planning and Environment (DLPE) on 27 November 1997, proposing the upgrade of the Ludmilla WWTP and associated facilities. The NOI was examined by the Environment and Heritage Division (EHD) of DLPE. It was considered that the environmental issues associated with the proposal were of enough significance to warrant assessment under the NT *Environmental Assessment Act 1982* at the level of a PER.

The Minister for Lands, Planning and Environment accepted the EHD's recommendation and on 6 January 1998 directed that a PER be prepared for the proposal.

Draft guidelines for the preparation of a PER were advertised for public comment and circulated to NT Government advisory bodies for comment on 10 January 1998. Final guidelines were prepared taking into

account the comments received from the public and government agencies. The Minister issued the final guidelines and a direction to the proponent to prepare the PER on 13 February 1998.

The PER was submitted on 28 October 1998 and placed on public review for 4 weeks from 28 October to 25 November 1998. It was also circulated to government advisory bodies for review and comment. A number of public inquiries regarding the proposal were received by PAWA, however, only one public submission was received from Darwin City Council.

2. THE PROPOSAL

The proposal to upgrade the Ludmilla WWTP and associated facilities is a key step in the implementation of the Darwin Sewerage Strategy of 1996. The goals of the Sewerage Strategy are to augment the Darwin sewerage system to handle future growth in residential, commercial and industrial flows, to upgrade the treatment and effluent outfall facilities to meet increasingly stringent environmental requirements and to reuse an increasing proportion of effluent and biosolids in the future.

The proposal involves providing increased treatment capacity at the Ludmilla plant to handle present and future flow from the Larrakeyah and Ludmilla catchments, upgrading the level of treatment at the Ludmilla plant to biological secondary treatment (with a proportion of the flow receiving tertiary treatment), encouragement of effluent reuse and augmentation of the East Point outfall.

The major components of the proposal are:

1. New pumping station and pipelines to transfer wastewater from Larrakeyah and central city area to Ludmilla treatment plant;
2. Upgrade capacity of Ludmilla WWTP in stages to handle additional flows and high flows in the wet season;
3. Screening, grit removal, additional wet weather treatment capacity and backup solids handling;
4. Additional odour and noise controls (for the new aeration equipment) at the Ludmilla WWTP;
5. Tertiary filtration and disinfection arrangements to produce reclaimed effluent;
6. Arrangements to develop markets for reuse of effluent, including a pipeline to reticulate reclaimed effluent to sites near the Ludmilla WWTP;
7. New effluent pumping station and pipeline to convey effluent in excess of reuse demand to the existing Larrakeyah outfall;
8. Special arrangements to handle mangrove mud and old sludge removed from Ludmilla site as part of construction;
9. Discharge of excess flows in wet weather through the existing East Point outfall, and possibly extension of that outfall in future if monitoring shows that to be necessary;
10. Increased capacity of East Point outfall to 60 ML/d; and
11. Environmental Management Plans (EMPs) to ensure construction and operations are conducted with minimal environmental impact.

3. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

3.1 Introduction

The information provided in the PER has been assessed and then used, along with submissions from advisory bodies and public comment on the PER, to determine the adequacy of the information provided by the proponent and the accuracy and acceptability of predicted impacts and safeguards. The outcome of

this assessment is that the proposal can be implemented without significant environmental impacts. Specific recommendations for mitigation and monitoring of impacts are made. In respect to the environmental impacts, this Assessment Report has adopted a similar layout to Chapter 10 of the PER. The issues, as identified by PAWA, are initially stated. This is followed by the commitments made by PAWA in the PER (Mitigation and Safeguards). Comments and recommendations, based on public submissions and comments from Government advisory bodies, are then made. New issues raised during the public review period are included in Section 3.2.20.

It is acknowledged that during implementation of proposals outlined in the PER, flexibility is necessary and desirable to allow for minor and non-substantial changes to the design and specifications which have been examined as part of this assessment. It is considered that subsequent statutory approvals for this project could make provisions for such changes, where it can be shown that the changes are not likely to have a significant effect on the environment.

It is important for interpretation purposes that the recommendations (in **bold**) are not considered in isolation, as the text identifies concerns, suggestions and undertakings associated with the project.

Subject to decisions which permit the project to proceed, the primary recommendation of this assessment is:

Recommendation 1

PAWA shall ensure that the proposal is implemented in accordance with the environmental commitments and safeguards identified in the Ludmilla WWTP Public Environment Report and as recommended in this assessment report. All safeguards and mitigation measures outlined in the PER are considered to be commitments by PAWA.

3.2 Issues

3.2.1 Land Planning

PAWA's goal is to carry out the project in accordance with land use zoning and planning, and in a manner consistent with present and future land use.

Mitigation Measures and Safeguards

According to the PER the proposal is in accordance with existing zoning and future planning and no specific mitigation measures are required.

Comments and Recommendations

There was inadequate coverage of NT Government legislation in the PER.

In addition to the legislation and policies outlined in Section 2-7 of the PER, the following should be taken into consideration during the planning, construction and operational stages of the proposal:

- *Planning Act, 1993*
- *Port Authority Act, 1983* and associated regulation
- Public Health (Nuisance Prevention) Regulations, 1982
- Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations, 1982

- Work Health (OH & S) Regulations, 1992
- *Crown Lands Act, 1992*
- *Dangerous Goods Act, 1980* and Regulations
- *Waste Management and Pollution Control Act, 1998*
- Construction practice near tidal areas in the NT - Guidelines to prevent mosquito breeding (1988). THS Medical Entomology Branch publication - prepared for the Coastal Management Technical Advisory Group.
- Guidelines for preventing biting insect problems for urban residential developments and subdivision in the Top End of the NT (1997) THS Medical Entomology Branch publication.
- Drainage considerations for mosquito control (1988) THS Medical Entomology Branch publication - prepared for the "Australian Mosquito Control Manual, 1988".
- Mosquito breeding and sewage treatment in the NT (1988) Water 15 (5): 34-37.
- Policy for the design of off-site sewerage ponds and the disposal or reuse of sewerage pond effluent (1997). THS Environmental Health Directorate publication.
- Recommendations for design details of sewage pond effluent reuse or disposal facilities to prevent mosquito breeding (1998). THS Medical Entomology Branch publication.
- The prevention of mosquito breeding in sewage treatment facilities (1998) THS Medical Entomology Branch publication - prepared for the "Australian Mosquito Control Manual, 1998".
- National Environment Protection Measure - National Pollutant Inventory

The Commonwealth *Native Title Act, 1993* is also relevant.

Section 7.6 of the PER refers to two land claims by local Aboriginal groups. These are native title claims under the *Native Title Act* rather than land claims under the *Aboriginal Land Rights (NT) Act*.

The PER refers to the expansion of the WWTP onto adjoining vacant Crown Land (Lot 5794) to accommodate three intermittently decanted aeration lagoons. On four occasions in the PER Lot 5794 is referred to as zoned for further expansion of the Ludmilla plant. This is not technically correct because Lot 5794 is currently zoned 01 (Open Space) in the Darwin Town Plan 1990 (as amended) which does not allow for development of this nature. Future development of Lot 5794 for the WWTP will require a rezoning application to the Northern Territory Planning Authority (NTPA) to have lot 5794 rezoned to CP (Community Purpose).

The Darwin Town Plan 1990 (as amended) permits the construction or maintenance of facilities for the reticulation of sewage but the treatment of effluent requires consent. This means that the construction of the pipelines do not require consent from the NTPA but the upgrade of the Ludmilla WWTP will require the consent of the NTPA.

The '2 ½ Mile Depot' site in Ludmilla consists of freehold Lot 5234 and Crown Lot 4990. DLPE has consulted the local residents group and produced a preliminary concept plan for the development of the total site for low to medium density residential. The timing of the development of the '2 ½ Mile Depot' site may have some bearing on the augmentation works to the Parap trunk sewer as part of the proposed sewage alignment to transfer wastewater from Larrakeyah to the Ludmilla WWTP.

Recommendation 2

PAWA shall liaise with the Planning Division and Development Assessment Services of DLPE regarding:

- **rezoning of Lot 5794;**
- **consent for the upgrade of the Ludmilla WWTP; and**
- **the development of Lot freehold Lot 5234 and Crown Lot 4990 (2 ½ Mile Depot).**

PAWA have indicated that the a new sewage pumping station associated with the rising main between Ludmilla and Larrakeyah outfall will be built at the WWTP. The effluent pipeline and reclaimed water pipeline route along Gilruth Avenue to Conacher Street is mostly on land within the Botanic Gardens. Further, parts of the pipeline route is on land controlled by Darwin City Council. The final route of both the effluent pipeline and the reclaimed water pipeline should be to the satisfaction of both the Parks and Wildlife Commission and the Darwin City Council.

Recommendation 3

PAWA shall liaise with the Parks and Wildlife Commission of the NT and Darwin City Council regarding the route of the pipelines through the Darwin Botanic Gardens and along Gilruth Avenue.

Coastal areas in the Darwin region are exposed to periodic flooding and inundation hazards when the sea level rises above normal levels during tropical cyclones or storm activity. During these conditions storm surge can cause extensive damage when normal high water levels are exceeded causing flooding and wave damage. The Ludmilla WWTP is located within the primary and secondary storm surge contours, and flooding may present a significant public health risk due to the release of sewage and the loss of an essential facility.

Recommendation 4

Storm surge should be considered in the design of the upgraded WWTP at Ludmilla.

There are a number of proposed pump stations associated with the construction of the proposed pipelines. Overflows may result in public health risks. No details of overflow precautions at the proposed Frances Bay, Dinah Beach and Ludmilla Pump Stations were provided in the PER. Overflow precautions, in case of power failure at the Frances Bay and Dinah Beach Pump Stations, should be incorporated into the detailed design of the pipeline between Larrakeyah and Ludmilla and the effluent main between Ludmilla and Larrakeyah. The discharge point for overflow pipes must be at the daily flushed tidal area to prevent the formation of mosquito breeding sites.

Recommendation 5

PAWA shall incorporate overflow precautions into the detailed pipeline designs, taking into consideration possible off-site impacts.

3.2.2 Runoff, Sediment and Erosion Control

PAWA's goal is to undertake the proposal without creating a sedimentation and erosion problem and to minimise the volume and impact of runoff occurring during:

- construction of trenches and pipelines;
- construction of the pumping station;
- upgrading of Ludmilla WWTP; and
- operation of expanded Ludmilla WWTP

Mitigation Measures and Safeguards

Safeguards which will be applied to minimise impacts due to erosion are as follows:

- carry out excavation and pipeline installation as much as possible during the dry season;
- limit the excavation/disturbed area and revegetate, backfill or seal the surface soon after excavation;
- limit the time and duration of the construction periods; and
- where appropriate, install silt fences or sediment traps to capture sediment.

Comments and Recommendations

PAWA states that these safeguards, including bunding, will be incorporated in sediment control procedures in the EMPs for construction and operations. The commitments made by PAWA to control sediment runoff associated with the construction and operation phases of this proposal are adequate.

3.2.3 Chemical Storage and Contaminated Runoff

PAWA's goal is to undertake the proposal while minimising the risk to the environment from chemical spills and contaminated runoff.

Mitigation Measures and Safeguards

Safeguards which PAWA will apply to minimise impacts due to contaminated runoff from the Ludmilla WWTP are as follows:

- store all chemicals and fuel within bunds, and provide bunds around loading and transfer areas;
- chlorine will be stored in facilities that meet the requirements of the Work Health Authority; and
- diesel is stored at the Ludmilla WWTP in an underground tank. Waste diesel and waste oil (from the power station) is stored at the site in 200 L drums. A bunded storage area for the drums will be constructed in accordance with the Australian Standard for the storage and handling of flammable and combustible liquids (AS 140-1988).

Recommendation 6

The storage of diesel at the Ludmilla WWTP should be in accordance with AS 1940-1993 rather than AS 1940- 1988. Adequate emergency control measures should be in place at the Ludmilla WWTP to ensure that diesel does not overflow during times of refueling. Measures for the management of chemicals should be detailed in the EMP for the operation of the Ludmilla WWTP.

3.2.4 Noise and Vibration

PAWA's goal is to construct the pipelines and augment the treatment plant, and operate the system, without causing a noise nuisance, and in accordance with the Draft NT Noise Regulations attached to the *Waste Management and Pollution Control Act*.

Key aspects for which noise (and vibration) need to be considered are:

- construction of pumping stations and excavation of pipeline trenches;
- construction of treatment plant;
- operation of pumping stations; and
- operation of treatment plant, including traffic to treatment plant.

To control and minimise noise and vibration impacts of the proposal, the following recommendations will be included in the EMPs for construction and operation:

- construction of pipelines near residences will be restricted to daytime hours; night time construction may be required near offices;
- blasting will not be permitted;

- large rockbreakers will not be permitted to operate within 20 m of residences and masonry buildings;
- the Ludmilla WWTP augmentation will be designed to minimise noise emissions. Plant and equipment will be fitted with silencers and acoustic enclosures as required to meet the regulatory noise limits;
- submerged pumps and shrouded ventilation outlets will be used at pumping stations: the station buildings will be constructed of noise deadening materials;
- the public will be kept informed on the timing (and a contact person *given*) for pipeline construction in their locality; and
- a complaints register will be kept to monitor noise and traffic complaints during construction and operation. The cause of complaints will be investigated and appropriate steps will be taken to ensure the causes are not repeated.

Comments and Recommendation

The above commitments made by PAWA to control noise and vibration associated with the construction and operations phases of this proposal should minimise the risk of noise and vibration problems.

3.2.5 Air Quality and Odour

PAWA's goal is to operate the system, including wastewater pipelines, treatment plant and outfalls, without causing an odour nuisance, and in accordance with statutory environmental requirements concerning air quality.

Key aspects for which odour control need to be considered are:

- odour from sewage pump stations
- odour from mud and sludge at Ludmilla WWTP during construction; and
- odour from augmented treatment plant when operating.

Mitigation Measures and Safeguards

To control and minimise odour impacts of the proposal, PAWA made the following recommendations:

- completion and implementation of PAWA odour strategy for wastewater sewers and pumping stations, including as many as feasible of the controls listed in the PER;
- continued operation of the odour scrubbing system for incoming air;
- inclusion of the odour control measures listed above in the design of the augmented Ludmilla WWTP, including aerated grit removal tanks, soil bed filter, foul air ducting to the furnace, lime dose in the primary tanks to increase pH and reduce hydrogen sulfide emissions to air, and aerators in the wet weather sedimentation tank;
- aeration for the secondary treatment process and the wet weather tank to be provided by blowers and submerged diffusers, rather than surface aerators, to minimise potential odour (and aerosol) emissions;
- minimise duration of excavation of mud and sludge at Ludmilla;
- cart excavated material away quickly in covered trucks to the Hudson Creek site, and cover the material on the same day; and
- operate odour masking system during excavation period; and include odour control as a key part of the EMP for operation of the augmented Ludmilla WWTP.

Comments and Recommendations

In general the above commitments made by PAWA to control odours associated with the construction and operations phases of this proposal should minimise the risk of odour problems. Statutory public health as well as statutory environmental requirements should be taken into consideration in the management of odour. All works that produce offensive odours and carting of malodorous material need to be carried out to the satisfaction of the Manager, Environmental Health, Public Health Services Operations North, Territory Health Services. Management of these materials shall be detailed in the appropriate EMPs.

Recommendation 7

PAWA shall include an odour complaints register in the EMP for construction and the EMP for the operation of the Ludmilla WWTP.

3.2.6 Acid Sulfate Soils

Acid sulfate soils are wet anaerobic soils which, when exposed to air, form sulfuric acid. This lowers the pH levels and mobilises metals in the soil creating an acid leachate with elevated metal concentrations. PAWA's goal is to construct the pipelines and the treatment plant without creating a significant quantity of acid leachate.

Mitigation and Safeguards

To control and minimise acid leachate impacts of the proposal, PAWA propose to do the following:

- areas of potentially acid sulfate soils found in construction areas will be isolated and handled like the Ludmilla mud (see below);
- soil removed from acid sulfate areas will be carted quickly to Hudson Creek and placed in excavations or the existing clay-lined lagoons;
- excavation will be carried out in the dry season to minimise leachate formation, and any leachate will be neutralised with lime;
- if there is acidic groundwater from the excavation at the Ludmilla WWTP it will be pumped into the treatment works and neutralised using the alkaline effluent; and
- the EMPs for construction will contain, if necessary, specific provision for the management and handling of acid sulfate soils.

Comments and Recommendations

Sections 4.11 and 4.12 of the PER states that the construction of the new facilities at the Ludmilla Site will involve removal of mangrove mud (potential acid sulfate soils - PASS) and accumulated sludge to a Hudson Creek site. At Hudson Creek, a triangular area of land of approximately 0.5 ha has been designated to receive the excavated PASS and sludge.

According to the PER the material will be placed in a 1 m deep layer just below the high tide line and capped so that the mud is kept in an anaerobic state and production of leachate is minimised. A clay bund installed across the lower side of the proposed fill area will restrict the movement of leachate. The composition of the old sludge at the Ludmilla site has low levels of metals and according to the PER there is not considered to be a leachate problem provided the mud and sludge are prevented from drying out. The PER did, however, indicate that groundwater in the vicinity of the excavations at the Ludmilla WWTP may become acidic due to the disturbance of mangrove mud. If acid groundwater is produced during the excavation of PASS at the Ludmilla WWTP, care will be needed to ensure that the nearby creek is not impacted.

The PER then states that about 1 ha will be trenched and filled which is inconsistent with the 0.5 ha given above.

According to the PER the excavated area will end up about 1 m higher than the original level, but will return toward the original contours due to the effects of settlement. This is not entirely accurate as tidal movement and resuspension of the material (possibly including the PASS and old sludge from the Ludmilla site) will also contribute to the land being returned to its original level.

No other options for the management or disposal of the PASS and the old sludge were explored in the PER and the detail provided in the PER was insufficient to predict the potential environmental impacts of the proposed option. There has been no testing of the acid producing potential of the material at the Ludmilla WWTP site or at the proposed disposal site. The potential environmental impacts associated with the proposed management option are difficult to predict unless a thorough understanding of the reactivity of the material at both these sites is obtained.

The proposal to bury the material below the high water mark at Hudson Creek is not supported without detailed investigations of the PASS and consideration of other options.

Recommendation 8

- a) **PAWA should undertake, in consultation with DLPE, analysis of potential acid sulfate soils at both the Ludmilla and Hudson Creek site before the material is disturbed. The material should be tested for acid production according to the methods adopted by the NSW Acid Sulfate Soils Management Advisory Committee so that appropriate management options can be developed.**
- b) **A contingency plan for the management of acidic groundwater should be included in the EMP for construction of the upgraded Ludmilla WWTP. The Plan should be incorporated into the Section of the EMP which covers the management of PASS and old sewage sludge at this site.**
- c) **The final management option, including possible leachate control, acidic groundwater management and water quality monitoring should be included in the EMP for construction of the upgraded Ludmilla WWTP.**

There is a possibility that PASS could be disturbed during the construction of the pipelines in the Frances Bay vicinity and along the low lying areas of East Point Road and Gilruth Avenue, especially near Vestey's Lake. Problems with acid generation due to excavation of PASS have been experienced at Vestey's Lake.

Recommendation 9

- a) **PAWA should conduct a geotechnical study of low lying areas along the routes of all pipelines to check for PASS.**
- b) **A contingency plan for the management of these soils should be considered during the detailed planning stages of these pipelines rather than waiting until the soil is actually disturbed. The management of PASS should be included in the EMPs for the construction of the pipelines.**

3.2.7 Terrestrial Flora and Fauna

PAWA's goal is to minimise the impacts of the proposal on terrestrial flora and fauna.

Mitigation Measures and Safeguards

To control and minimise impacts of the proposal on terrestrial flora and fauna, PAWA have stated that the pipeline route will avoid trees as far as possible, and additional advice or recommendations for the Darwin City Council botanists will be followed. The construction contracts and EMP for pipeline construction will contain specific provisions requiring protection of vegetation near the routes and revegetation of the ground using local species.

Comments and Recommendations

The Parks and Wildlife Commission of the Northern Territory has indicated that approximately a 1 km section of the effluent pipeline (Figure 4.4 of the PER) and the reclaimed water pipeline (Figure 4-5 of the PER) pass through the Botanic Gardens. Several trees of natural heritage value are threatened by the proposed pipeline routes.

Recommendation 10

- a) **Removal of trees should be minimised and short term traffic delays should be allowed in preference to tree loss. No trees should be removed from Council or Botanic Garden land without thorough consultation with the Darwin City Council and the Parks and Wildlife Commission.**
- b) **The Greening Australia ‘List of Significant Trees’ should be consulted before any trees are removed.**

3.2.8 East Point Outfall Region

PAWA’s goal is for the discharge of effluent through the East Point outfall to have minimal impact on marine life and adjacent recreation.

Mitigation Measures and Safeguards

The proposed scheme of effluent treatment and discharge represents an improvement over the existing dry season situation and may be considered a measure to mitigate potential impacts on the East Point Aquatic Life Reserve.

As a safeguard, PAWA recommended that a marine biological monitoring program be established at East Point to determine:

- the extent of effect of the present and proposed scheme on mudflat infauna; and
- baseline conditions at East Point Aquatic Life Reserve and suitable controls (eg, Old Man Rock and Lee Point) which can be used to compare future conditions when the proposed discharge scheme is commissioned.

The discharge of effluent through the East Point outfall is subject to licences issued under the *Water Act, 1992* which specifies various limits and requirements including monitoring.

Additional safeguards will be needed in the event that the East Point outfall is extended further offshore. These would be defined in the EMP for outfall extension which would be developed as part of the detailed design of the extension.

Comments and Recommendations

The East Point Aquatic Life Reserve is a unique natural area not just for its diversity of sponges and corals but for all types of marine life. It is also an important recreational and research area.

The description of the impact of the effluent discharge at East Point on the Aquatic Life Reserve and on the marine environment in the vicinity of the outfall was disjointed and not substantiated. Two of the reports cited did not look at the impacts of effluent on the marine biota but addressed water quality issues. Further, due to the lack of knowledge regarding the dynamics of the environment in the vicinity of the outfall, a report written ten years ago may not reflect the current situation. It would have been useful if quotations and scientific fact could have been taken from these reports to substantiate the statements made in the PER.

The commitment to conduct biological surveys at the East Point Aquatic Life Reserve and of the infauna in the vicinity of the East Point Outfall is supported by the Department of Arts and Museums and DLPE. Well designed biological surveys would provide a valuable benchmark and aid in the predictions of future impacts with the increased load to the outfall. The surveys need to have clear objectives, be statistically rigorous, and have comparable control sites. Biological surveys should consider both species abundance and diversity. Old Man Rock would not be an appropriate control site due to its cultural sensitivity and the dissimilarity in habitats (one is surrounded by sand and the other by mud).

Recommendation 11

The Department of Arts and Museums and DLPE should be consulted during the design of any surveys or monitoring programs.

PAWA already have a licence to discharge from the Larrakeyah outfall and the East Point outfall. Licence conditions are determined by the 'Controller of Waters', Natural Resources Division, DLPE not by the 'Office of Water Resources' as stated in Section 2.7 of the PER. Although constituent loads will be quantified by current licence data requirements, there is no intention to institute 'load based' licencing at this stage. In the future, the focus will be on a requirement to assess the environmental health of the receiving waters. This information will be linked with other monitoring programs in and around the Harbour. This approach is consistent with the declared 'Beneficial Use' of the Harbour which are 'the protection of aquatic ecosystems' and 'recreational and aesthetics'. A commitment to the monitoring of biological communities at the East Point outfall is also consistent with this approach.

It is understood that PAWA has an extensive program in place to attenuate the inflow of stormwater and groundwater to the sewer systems in Darwin. Discussion on wet season flows (Section 2.3) would have benefited from background information on infiltration to the sewer, ongoing maintenance and refurbishment initiatives by PAWA to stabilise or attenuate groundwater inflow and the relative costs of this activity compared to the costs of duplicating East Point rising main and possible modifications to the East Point Outfall. If there was significant attenuation of inflow from groundwater the East Point riser could possibly be decommissioned.

During the dry season, it has been proposed to flush the East Point riser on a daily basis in order to retain the integrity of the outfall.

Recommendation 12

The dry season flushing of the East Point outfall should be timed to coincide with elevated tides.

The detail concerning the proposed extension of the East Point outfall, provided in the PER, is not sufficient for the potential environmental impacts to be fully assessed. There is also some inconsistency in the PER regarding the timing of the proposed extension. In Section 3.5 the proposed extension would occur in 2005 whereas in Section 4.8 it is proposed for 2002. Details regarding the criteria that will be used to make the decision to extend the East Point outfall were missing from the PER. This information would be required as part of a further environmental impact assessment.

Recommendation 13

Any proposal to extend the East Point outfall should be referred to DLPE for consideration of the need for further environmental impact assessment.

3.2.9 Larrakeyah Outfall Region

PAWA's goal is for the discharge of effluent through the Larrakeyah outfall to have minimal impact on marine life and adjacent recreation.

Mitigation Measures and Safeguards

According to the PER, the evidence from studies of Darwin Harbour water quality, of the plume from the Larrakeyah outfall, as well as bacteriological monitoring along the shore, is that there is no identified impact from the present discharge. As the proposed scheme will substantially improve the quality of effluent discharged from the Larrakeyah outfall, it is unlikely that there will be future adverse impacts.

The scheme will substantially reduce suspended solids loads from the Larrakeyah outfall.

Monitoring effluent quality and flows to the outfall is recommended by PAWA to ensure that loads are reduced. The potential mitigation measures are:

- continued effective treatment, so that the reduction in loads discharged is maintained; and
- promotion of effluent reuse, so the quantity of effluent discharged is reduced.

The discharge of effluent through the Larrakeyah outfall is subject to licences issued under the *Water Act, 1992* which specifies various limits and requirements including monitoring.

Comments and Recommendations

The PER indicated that previous reports have investigated the impacts of the Larrakeyah outfall on biological communities. The two reports cited in the PER looked at water and sediment quality not biological communities. There are no reports available on the impacts of the outfall on the biological communities.

The commitment to survey the benthic communities in the vicinity of the outfall (Section 10.22 of the PER) is supported. A survey of this type would provide a valuable benchmark by which to measure predicted improvements associated with the better quality effluent being discharged at this outfall. This would also provide a quantitative measure of the goal to have minimal impact on marine life.

3.2.10 Ludmilla Creek Region

PAWA's goal is for the overflows of effluent to Ludmilla Creek to have minimal impact on marine life and adjacent recreation.

Mitigation Measures and Safeguards

PAWA recommended that the monitoring program should be continued to detect any changes due to the reduced overflow frequency and volume.

Comments and Recommendations

Much of the Ludmilla Creek catchment is urban. Parts of the mangroves have been drained, cleared or filled and stormwater and litter impact the water quality of Ludmilla Creek. A major benefit of the augmentation of the Ludmilla WWTP is the reduced number of overflow events to Ludmilla Creek from approximately 100 to 8 per year. The overflows would also be of better quality. It is a current discharge licence requirement that PAWA report any overflow events into Ludmilla Creek to DLPE.

The PER stated that a visual inspection of the overflow channel showed no readily apparent effects and that detailed studies of mangroves in Darwin Harbour that are subject to much higher loads of effluent have found no apparent adverse effects. These studies, did however, find that there were changes in fauna species diversity and abundance in areas subject to effluent discharge. A visual inspection is not accurate enough to make a judgement in respect to impacts on Ludmilla Creek from wastewater discharge especially impacts on the marine life of the creek (the main goal of this Section).

The discussion of the 'existing Ludmilla Creek environment' was not sufficient to make a judgement on the present and future impacts of wastewater overflow to Ludmilla Creek. Other catchment influences on Ludmilla Creek were briefly addressed in the PER but are described in more detail in the draft Ludmilla Creek Catchment Management Plan prepared by the Ludmilla Creek Landcare group. In this document, water quality was identified as a major issue impacting on the creek. It would be difficult to separate the potential impacts caused by wastewater discharge from those caused by stormwater flow and other activities occurring in the Ludmilla Creek Catchment. A catchment wide approach to water and biota monitoring in Ludmilla Creek is needed. This was acknowledged in the draft Ludmilla Creek Catchment Management Plan.

Recommendation 14

PAWA should liaise with the Ludmilla Creek Landcare group and the Darwin City Council regarding a holistic approach to monitoring impacts from development on Ludmilla Creek. PAWA should actively support environmental monitoring associated with a catchment wide approach.

In Section 3.8 of the PER, reference is made to a tidal channel that extends through mangroves to the north of the site at the existing Ludmilla WWTP. The proposed upgrade of the WWTP will reduce overflow periods in the tidal channel from about 100 days per year to an estimated 8 days per year. The reduction in the frequency of overflow periods may provide a potential for mosquito breeding. To ensure that mosquito breeding sites are not created, sufficient tidal exchange must occur in the channel.

Recommendation 15

PAWA shall ensure that changes to the flow regime in the tidal channel at Ludmilla WWTP do not create mosquito breeding sites. The management of the tidal creek should be included in the EMP for the operation of the Ludmilla WWTP.

3.2.11 Waste Minimisation

PAWA's goal is to construct and operate the project while minimising the production of wastes.

Mitigation Measures and Safeguards

To minimise waste generation, the following recommendations are made by PAWA:

- excavated material should be used as clean fill wherever possible;

- the EMP for construction should contain provisions designed to reduce wastes from construction activities;
- the EMP for operation of the Ludmilla WWTP should contain provisions to minimise waste generation; and
- procedures to reuse sludge (e.g.: as compost or a soil amendment) should be developed as part of PAWA sludge management strategy.

Comments and Recommendations

The operation of wastewater treatment at Ludmilla results in the production of a number of significant waste streams, including:

- wastewater
- sludge
- screenings and grit
- waste associated with the use of chemicals and other substances
- construction stage waste

Each of these wastes have an associated environmental impact. Such impacts can include both the impacts of treatment/disposing the waste and the life-cycle impacts associated with the production of items that become waste.

Options exist to minimise the production of these wastes, for example, effluent and biosolid reuse are positive methods for waste minimisation associated with wastewater treatment.

According to the PER the proposal is required for the following reasons:

- To provide a volume of high quality effluent suitable for reuse on irrigating playing fields and open space;
- To encourage the reuse of high quality effluent now and in the future on parks and landscaping in the Darwin urban area; and
- To develop backup facilities for handling the biosolids removed in treatment, and to encourage reuse of biosolids in the future.

However, the PER does not expand on these options.

A waste minimisation strategy that considered all the sources of waste from the proposal, including the feasibility of effluent and sludge reuse, would have been a useful companion document to the PER.

Some relevant issues are:

1. Wastewater

Although an effluent reuse pipeline has been included in the proposal described by this PER no detail has been provided as to the viability of the project and its likelihood of proceeding. Further, irrigation on parks and gardens has been the only potential market considered for the treated wastewater.

Potential parks and gardens users of reclaimed water should be made aware that there will be an increased potential for mosquito breeding in any pooling in ground depressions due to the increased nutrient load in this water.

2. Sludge

The sludge from the Ludmilla STP has the potential to be a valuable resource, especially as:

- the catchment is predominantly residential - leading to a relatively clean sludge
- the phosphorus in the sludge could be a benefit to local agriculture

Rather than allowing for the sludge to be a resource, current disposal practices see the sludge contribute to environmental problems:

- current incineration practices lead to relatively high emissions and consumption of fossil fuels.
- land filling or on-site storage can lead to greenhouse gas production (methane) and the potential for leachate production.

Methods of wastewater treatment can, for example, impact on the potential reuse of biosolids. Given the nature of the catchment, and in the interest of developing the widest range of uses for sludge, sludge re-use programs should aim for producing a product that has “unrestricted use”. Issues such as this should have been considered as part of the proposed upgrade.

3. Screenings and grit

Section 4.9 of the PER discusses screening and grit waste management. Screenings comprise plastics, nappies, sanitary goods and other large solid objects which are removed on the screens at the head of the plant. These materials have no practical reuse applications and tend to be smelly and objectionable. These wastes will be incinerated at the Ludmilla plant or taken in sealed polyethylene bags to an approved landfill, which is defined as either the Council landfill or a new burial site adjacent to the Leanyer lagoons. The Leanyer site is not an approved landfill site. If this area is used there may be a licence requirement under the *Waste Management and Pollution Control Act*.

Recommendation 16

PAWA consult with DLPE to explore options for re-use or disposal of wastes, and before adopting the option of disposing of screenings and grit at the Leanyer WWTP.

3.2.12 Sacred Sites

PAWA’s goal is to construct and operate the project with no impact on Sacred Sites.

Mitigation Measures and Safeguards

According to the PER no mitigation measures are necessary. As a safeguard, construction will be supervised and if any archaeological material is discovered by excavation, work will cease until appropriate action is taken.

Comments and Recommendations

Although PAWA have sought access to the Aboriginal Areas Protection Authority’s Register of Sacred Sites, an Authority Certificate has not been applied for. There is a statutory requirement for PAWA to obtain an Authority Certificate for all construction activities during the planning stage of the project.

3.2.13 Heritage Sites

PAWA’s goal is to construct and operate the project with no impact on heritage sites.

Mitigation Measures and Safeguards

According to the PER no mitigation measures are necessary. As a safeguard, construction will be supervised and if any heritage site is discovered by excavation, work will cease until appropriate action is taken.

Comments and Recommendations

Section 9.1 of the PER states that the proposal does not involve any areas nominated or listed on the Register of the National Estate or the Interim list of the Register of the National Estate. The Darwin Foreshores are a place registered in the coastal environments group of the Register of the National Estate (File No. 7/03/004/0035). The East Point outfall is within the land registered as the Darwin Foreshores, and the Ludmilla WWTP borders the registered area. The Australian Heritage Commission Official Statement of Significance lists a number of important features and values of the Darwin Foreshores.

It is unlikely that the proposed extension to the Ludmilla WWTP or the construction of the proposed pipelines will impact on any of these values. The proposed extension to the East Point outfall, however, has not been covered in enough detail in the PER. If the proposed extension proceeds it will need to be subject to further assessment. The above statement of significance can be addressed for the proposed extension to the East Point outfall at the time of assessment.

3.2.14 Traffic Issues

PAWA's goal is to construct and operate the project with no unacceptable effect on traffic, or access to residential and commercial sites.

Mitigation Measures and Safeguards

To minimise the impacts of construction on road users, the following measures are recommended by PAWA:

- construction is planned so that sections of the roadway are excavated and reinstated in a period not exceeding six weeks;
- access is maintained at all times to shops and commercial premises;
- access is maintained to residential premises;
- all property owners are kept advised of the proposed schedule of construction and the person they need to contact in the event of any problems with access;
- suitable fencing and warning signs are provided to minimise the risk to the public;
- in the CBD and perhaps other commercial areas, construction is scheduled at night to minimise disruption; and
- The EMPs for construction reflect the need to minimise impacts on traffic.

Comments and Recommendations

During pipeline construction the Darwin City Council requires that two way traffic flow is maintained to any significant traffic distributors. All traffic disruptions caused by pipeline construction should be managed to the satisfaction of Darwin City Council.

3.2.15 Landscape and Visual Aspects

PAWA's goal is to construct and operate the project with no detrimental effect, and possibly an enhancement, of the landscape and visual aspects of the proposal.

Mitigation Measures and Safeguards

To minimise the impacts of the proposal on visual aspects, the following measures are recommended by PAWA:

- rapid and appropriate revegetation of pipeline construction sites;
- sympathetic landscaping and plantings at pumping stations sites; and
- maintain landscaping of Ludmilla WWTP.

Comments and Recommendations

The PER satisfactorily addressed potential landscape and visual impacts of the proposal.

3.2.16 Tourism and Commercial Aspects

PAWA's goal is to construct and operate the project with no detrimental effect, and possibly an enhancement, on tourism and commercial activities in Darwin.

Mitigation Measures and Safeguards

The proposal is mildly positive with respect to tourism, and removed a potential risk to tourism; i.e.: adverse publicity about discharge of poor quality effluent at Darwin. To minimise the impacts of construction on tourism and commercial activities, the following measures are recommended by PAWA:

- construction is planned so that sections of the roadway are excavated and reinstated in a period not exceeding six weeks; hence the maximum time any residence or business would be affected is six weeks;
- access is maintained at all times to shops and commercial premises;
- all property owners are kept advised of the proposed schedule of construction and the person they need to contact in the event of any problems with access;
- suitable fencing and warning signs are provided to minimise the risk to the public; and
- in the CBD and perhaps other commercial areas, construction is scheduled at night to minimise disruption.

Comments and Recommendations

The PER satisfactorily addressed potential tourism and commercial issues associated with the proposal.

3.2.17 Recreational Aspects

PAWA's goal is to construct and operate the project with no detrimental effect, and possibly an enhancement, on recreation in Darwin.

Mitigation Measures and Safeguards

No specific mitigation measures are necessary as the proposal is a potential benefit to recreation.

Comments and Recommendations

Except for the potential impact of the proposal on the recreational values of the Botanic Gardens (in both the proposed construction of the effluent pipeline and the possible effluent reuse proposed for this area), the PER satisfactorily address potential recreational issues associated with the proposal.

3.2.18 Community Health

PAWA's goal is to construct and operate the project so that it enhances community health.

Mitigation Measures and Safeguards

To minimise the impacts of construction on community health, the following measures are recommended by PAWA:

- construction is planned and carried out in a safe manner;
- construction is carried out in a short period with little disruption to residences and commercial premises; and
- operations do not cause unacceptable noise, odours or insect numbers.

Comments and Recommendations

The Public Health (Nuisance Prevention) Regulations, which are relevant to both the construction and operational phases of the proposal require: "that no premises (including land and easements), accumulation or deposit may be in such a state as to be a nuisance or injurious or dangerous to health"; and that "any matter from which offensive or unwholesome smells arise must only be conveyed in a properly covered vehicle."

The Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations, 1982 require the landholder to ensure that mosquito breeding sites are not created in any form of water holding receptacle, drain or ground depression. These requirements can largely be met by adherence to appropriate construction practices and policies (see Recommendation ?). For any areas that retain water for more than five days, however, there will be a requirement to monitor for mosquito larvae on a weekly basis and control when necessary. These regulations will apply during both the construction and operational phases.

In reference to dot point three of the above safeguards and mitigation measures, construction and operations should not cause unacceptable noise, odours or insect numbers and should be carried out to the satisfaction of THS.

The adopted terminology of "insect vector" in the PER does not distinguish between mosquito species that are vectors of diseases and other mosquito species that may become significant pests (e.g.: *Culex sitiens* or *Cx. quinquefasciatus*) but that are not vectors of human disease. It would be more accurate to refer to "biting insect". The reduction in biting insects is only one aspect of the impact. The more important aspect is to reduce the potential for the transmission of mosquito borne disease to nearby residents.

The proposed pipeline route from Larrakeyah to Ludmilla will traverse sections of Woolner Rd, Frances Bay Drive, and the easement between the Daly Street Bridge and Frances Bay Drive where there are open lined drains. Further, the proposed effluent and reclaimed water pipeline routes from Ludmilla to Larrakeyah will traverse the northern section of the Vestey's Lake open space. There is a series of open

drains that discharge from East Point Rd into Vestey's Lake that have been constructed with concrete low flows to prevent the formation of mosquito breeding sites. These drains are maintained under the combined Mosquito Engineering Program (jointly funded by THS and the Darwin City Council) to prevent the formation of mosquito breeding sites.

The commitment made by PAWA to avoid pools of freshwater runoff or effluent at high tide level adjacent to construction works or treatment plant, to control mosquitoes and other biting insects is supported.

Recommendation 17

Any open drains that are disturbed during the construction or operation phase will be reconstructed or rectified to the satisfaction of THS to ensure mosquito breeding sites are not created. Pooling of freshwater or effluent should be avoided in any areas.

3.2.19 Greenhouse Gases

PAWA's goal is to construct and operate the project with minimal increase in Greenhouse gas emissions.

Mitigation Measures and Safeguards

There are no practical alternatives to additional energy use if the proposal is to be implemented. The principal mitigation measures are to use energy efficiently, and to continue to explore energy production at the plant.

Comments and Recommendation

The PER states that the upgrade of the Ludmilla Wastewater Treatment Plant will result in an increase in greenhouse gas emissions of approximately 1700 t of CO₂ per annum as a result of increased power usage at pumping stations and the treatment plant.

There will also be additional emissions from an increase in the amount of sludge incinerated at the treatment plant. This increase is not quantified. The quantity of diesel fuel used in the incinerator will increase by 700 litres per month. The increase in emissions resulting from increased fuel use is not quantified.

The PER has not thoroughly assessed changes in greenhouse gas fluxes resulting from this proposal. Total emissions and sinks have not been quantified.

The National Greenhouse Gas Inventory Committee estimates the Territory's greenhouse gas emissions for 1995 at 8.6 million tonnes of CO₂ equivalent. The stated increase in emissions as a result of the proposal to upgrade the Ludmilla Treatment Plant (1700t per annum from increased electricity use) represents an increase of less than 0.02% of the Territories 1995 emissions. The apparent magnitude of increased emissions is small compared to total NT emissions. PAWA is at present party to the Greenhouse Challenge Program and is voluntarily seeking to reduce greenhouse emissions through continuous improvement in energy and process efficiency and by enhancing greenhouse sinks. The current Greenhouse Challenge agreement expires in 2000 and does not address emissions from this proposal.

Recommendation 18

PAWA should consider signing up to the Greenhouse Challenge program again in 2000 and consider means to abate emissions from the upgrade, and other PAWA developments, in the next agreement.

3.2.20 Other Issues Raised

Water Quality

The PER contained little discussion of the effluent qualities at each of the outfalls especially in respect to heavy metals and nutrients. It is understood that this information is available in PAWA reports. It would have been useful for the PER to contain a summary table of current effluent quality and predicted effluent quality after the upgrade of the Ludmilla WWTP. The PER should have also summarised the water quality in the vicinity of the outfalls and predicted the mixing zones required to reach background water quality. This information was requested in the PER guidelines.

Scour valves

The PER provided no information on the inclusion of scour valves in the proposed effluent main between Ludmilla WWTP and the Larrakeyah outfall. The effluent main will create several low points which will require scour outlets for maintenance. In some cases these scours can be discharged to adjacent sewers but a couple may require discharge to the stormwater drainage system. Specifically this will be required at the following locations: Larrakeyah Primary School and Lambell Terrace at Schultz Street (to stormwater pipes); Gilruth Avenue at the Palmerston Park creek crossing and the Botanic Gardens creek crossing (to open drains). The effluent will initially be primary effluent from the existing Ludmilla WWTP but secondary treated effluent following the upgrade of this WWTP within a couple of years. Scours will be used only to drain the main for maintenance (making new connections etc) but could be required to discharge up to 250 KL of water (effluent).

Although the management of the stormwater drains in Darwin is the responsibility of Darwin City Council, details regarding the requirement for scour valves on the rising main between Ludmilla WWTP and the Larrakeyah outfall should have been included in the PER as they form part of the proposal and because of potential environmental and public health issues associated with the release of effluent to stormwater drains.

The management of released sewage effluent to stormwater drains is an issue of concern to DLPE and to THS.

Recommendation 19

PAWA and Darwin City Council should consult both the DLPE and THS regarding the release of sewage effluent to stormwater drains along the rising main between Ludmilla WWTP and Larrakeyah outfall.

Power Supply

A concern was raised that increased electricity demand from the Ludmilla WWTP may impact on the power supply to residents in the local area.

According to PAWA the general electrical distribution system in Parap and Fanny Bay is adequate for the loads imposed on it with minimal voltage drop under peak load conditions. However, if localised incidents of low voltage are being experienced the Authority will establish monitoring equipment to ascertain the voltage on the system.

The Authority is currently considering options for the upgrading of the power supply capacity into the western side of the CBD from the Snell street Zone Sub Station. If a new feeder is required this will include supply to the Ludmilla plant, relieving load from the existing power system. If a new feeder is not

required, the power supply system will be strengthened or augmented to meet the increased power demand from the plant, as required.

Trade Waste

The upgraded Ludmilla WWTP will only accept sewage waste collected in the sewerage reticulation network. PAWA is currently developing a Trade Waste Policy which will involve definition of acceptance limits and declaration by Gazettal of additional trades requiring Trade Waste Agreements.

PAWA's Hudson Creek Waste Management site may be developed to take the more difficult non domestic wastes and the Authority is currently evaluating options for this site to accept some bulk industrial wastes.

National Pollutant Inventory Reporting Requirements

The National Environment Protection Measure (NEPM) for the National Pollutant Inventory establishes obligations for the occupiers of certain facilities to report information relating to the emission of certain substances.

While it is the responsibility of PAWA to determine what substances it is required to report to the NPI, it is likely that NPI reporting will include:

- the nutrient loads (nitrogen and phosphorus) predicted for discharge at the Larrakeyah and East Point outfalls;
- emissions from the sludge burning at the Ludmilla WWTP; and
- use of NPI listed substances in the wastewater treatment process.

PAWA is consulting DLPE regarding reporting requirements under the NPI.

3.2.21 Environmental Management Plans

An Environmental Management Plan (EMP) is a document prepared to ensure that the commitments made in the PER (and subsequent approvals) are met, and that a positive approach is taken to managing the environmental aspects of the project. The EMPs for construction will provide the procedures, safeguards and measures required to enable construction of the pipelines in accordance with mitigation measures and safeguards outlined in the PER and subsequent approval conditions.

The Comments and Recommendations

The PER makes a commitment to several EMPs for the separate construction phases of the project and an EMP for the operational phase of the Ludmilla WWTP (Section 10.21). The EMP for the operation of the Ludmilla WWTP is a long term working document that extends for the life of the plant. The majority of the commitments outlined in the PER and the recommendations provided in this Assessment Report can be implemented through the appropriate EMP. The EMPs should be completed during the detailed design phase of the project in consultation with DLPE.

The need to minimise public health impacts (including mosquito control) has not been considered in the Construction EMPs or the Operational Phase EMP nor has weed control in construction areas and at the Ludmilla WWTP has not been considered.

Recommendation 20

- a) **During the preparation of the EMPs PAWA shall consult with DLPE to determine mechanisms of feedback and reporting to DLPE. All EMPs will be auditable documents.**
- b) **Weed control should be included in the EMP for the operational phase of the Ludmilla WWTP.**
- c) **All EMPs should ensure that construction and operation activities are conducted with minimal public health impact.**
- d) **All monitoring and survey commitments and those recommended within this Assessment Report shall be detailed in the relevant EMP. All results from monitoring and surveys should be available as part of the auditing process.**
- e) **Performance criteria against commitments and recommendations made in the PER and this Assessment Report should be clearly stated in all EMPs.**

3.2.22 Environmental Monitoring

The following monitoring commitments were made in the PER (Section 10.22).

1. Licence Requirements: Effluent quality (monthly) for conductivity, total phosphorus, total nitrogen, faecal coliforms, BOD, Suspended solids and volatile suspended solids.
2. Water Quality at East Point (four sites) and Larrakeyah (three sites): (this monitoring has occurred since 1994). Conductivity, turbidity, total phosphorus, total nitrogen, faecal coliforms, dissolved oxygen, Chlorophyll-a and light attenuation are measured.
3. Annual marine biological monitoring be undertaken as a safeguard to:
 - determine the extent of effect of the discharge on infauna in the vicinity of the outfalls; and
 - confirm that marine biological conditions at the northeastern boundary of the East Point Aquatic Reserve are not affected by the discharge in the future.
4. The EMPs for construction include monitoring and auditing procedures to ensure that plans are fully implemented.
5. Additional monitoring should include:
 - collection of sediment samples near the discharge locations and at reference sites for analysis for organic carbon and metal levels, as well as infauna composition; and
 - conduct dye and other tracer dispersion tests to confirm initial dilution achieved at the Larrakeyah outfall.
6. Assessment of impacts of East Point discharge to establish the need for extension of the outfall.

Comments and Recommendations

The majority of these commitments to monitoring programs are consistent with the recommendations made throughout the Assessment Report and are therefore supported.

Recommendation 21

Environmental Management Plans shall include the details of all monitoring programs and biological surveys.

A commitment to a monitoring program for biting insects was not included in the PER. Monitoring of any impoundments of water for the presence of mosquito larvae should be included in the environmental monitoring program. Any concentrations of mosquito larvae will need to be controlled with an appropriate insecticide. This program would need to be conducted on a weekly basis until the impoundments are rectified by filling or draining.

Recommendation 22

Monitoring for mosquito larvae shall be conducted in consultation with Medical Entomology Branch, Territory Health Services.

4. Conclusion

It is considered that the environmental issues associated with the proposed project have been adequately identified. Some of these issues have been resolved through the assessment process, while others will be addressed through monitoring and management actions detailed in Environmental Management Plans (EMPs) to be completed when the proposal has been finalised but before commencement of construction. The EMPs will be subject to review by relevant NT agencies before finalisation.

The EMPs will be the major vehicle for implementing the proponent's management and monitoring commitments outlined in the PER and the recommendations detailed in this Assessment Report. The EMP for the operation of the upgraded Ludmilla WWTP will be a working document for the life of the plant and it will require continual review in the light of operational experience and changed circumstances.

In addition, the outfalls at Larrakeyah and East Point plant are licenced under the *Water Act* and will be required to comply with any licence conditions as well as regulations set out under the Act.

Provided that the environmental commitments and safeguards detailed in the PER are undertaken, the recommendations in this Assessment Report are adopted and regular compliance auditing and reporting are undertaken, long term impacts should be avoided or mitigated.