I WATER DISCHARGE MANAGEMENT

I.1 Discharging Water to the Environment

As part of the testing, commissioning, operation and ongoing maintenance requirements for the Northern Pipeline Interconnector Stage 2 (NPI Stage 2), water will be discharged from the pipeline and associated infrastructure at various points into the environment. Effective management of these water discharges is necessary to satisfy the Northern Network Alliance's general environmental duty imposed under s. 319 of the *Environmental Protection Act 1994* (Qld).

Water may be discharged from the pipeline and associated infrastructure under any of the following circumstances:

- pressure testing of the pipeline prior to commissioning (hydrostatic testing);
- wet commissioning of the pipeline;
- cleaning of the pipeline;
- drain-down of pipeline sections and balance tanks for maintenance or repairs;
- regular valve maintenance;
- automatic opening of a safety-relief valve to relieve pressure in the system;
- overflows from balance tanks in the event of a systems failure;
- pipe bursts or leaks resulting from a structural failure; or
- purging of the pipeline in the event of an emergency.

These discharges will be managed according to the Guidelines for Water Discharge Planning and Operation that have been prepared by the Northern Network Alliance (NNA) to address the legal, environmental and operational implications of discharging water into the environment. A summary of these guidelines is provided in Attachment 1.

The likely discharges of water to the external environment associated with the testing, commissioning, operation and maintenance of bulk water pipelines typically fall into three categories: planned discharges; unplanned discharges; and emergency discharges.

I.1.1 Planned Discharges

These are primarily limited to the maintenance of the pipeline, drain-down valve maintenance, cleaning operations, and balance tank and pump station maintenance. The timing, location, volume and duration can be controlled for most planned discharges.

I.1.2 Unplanned Discharges

These are typically the result of pipeline breaks, leaks or overflows that may occur as the result of systems or structural failures during the operation of the pipeline.

The volume and duration of discharges due to pipeline breaks or leaks are harder to control due to response time, staff availability and/or the difficulty in locating the discharge. However, such occurrences are very unlikely.

Unplanned discharges that result from overflows from balance tanks or safety-relief valves will occur from a fixed location; however, it is impossible to predict when such events might occur. These discharges are dependent on multiple system failures occurring simultaneously during operation of the pipeline; therefore it is unlikely that such discharges would occur frequently.

I.1.3 Emergency Discharges

These typically occur as a consequence of water main flushing as a management response to an increase in coliform counts and/or taste and odour complaints from the public etc. Such occurrences will be highly unlikely during the operation of the NPI Stage 2 due to the implementation of a preventative maintenance program.

I.2 Water Discharge Characteristics

The NPI Stage 2 will carry potable water; therefore the majority of discharges will be water that has been treated to Australian Standards for drinking water. The water discharged from the pipeline will either be potable water or non-potable water, depending on the reason for the discharge.

I.2.1 Potable Water

Potable water discharges may be the result of:

- overflows from balance tanks in the event of a systems failure;
- depressurising or dewatering of pipeline sections for maintenance;
- pressure relief in the event of a system failure; and
- regular valve maintenance.

The key environmental contaminant in these waters will be the free chlorine residual. Potable water is disinfected to maintain the water quality in a form safe for human consumption in accordance with the Australian Drinking Water Guidelines 2004. After initial disinfection at the water treatment plant, a disinfection residual is created in the treated water to control microbiological activity in the distribution system. Available chlorine will be maintained as a free residual in the NPI Stage 2 by dosing water with chlorine at various points along the main line (boosting).

Free chlorine in water degrades over time; therefore, the concentrations in water released from the pipeline are dependent on how far the discharge point is from the water treatment plant or a chemical dosing facility. The water in NPI Stage 2 will have a free chlorine residual of 5.0 mg/L to 0.5 mg/L depending on the distance from a chemical dosing facility.

I.2.2 Non-potable Water

Non-potable water discharges from the NPI Stage 2 will be the result of:

- hydrostatic testing prior to commissioning;
- cleaning and pre-disinfection stages of commissioning for the new pipeline; or
- cleaning of the pipeline as part of the regular maintenance program.

In addition to free chlorine residual, these waters may include sediments, organic matter or other contaminants depending on the reason for the discharge.

Hydrostatic testing of the pipeline and associated infrastructure will be conducted to ensure the integrity of the pipeline prior to commissioning. The quality of this discharge will largely be dependent on the source water (potable water) and how much debris is present in the pipe post construction. Changes to water chemistry may also occur as a result of leaching from pipeline material when water is held in the pipe during or between test events, such a slightly increased pH level.

The NPI Stage 2 will be cleaned or 'pigged' prior to commissioning to remove any material accumulated during construction. This process involves a flexible foam insert being passed though the pipeline under pressure. The amount of sediments and organic material in water discharged from pigging activities will be dependent upon how much material has accumulated in the pipe during construction.

Pigging may also take place once the pipeline is operational to ensure hydraulic integrity and maintain water quality standards. The NPI Stage 2 is designed to be pigged approximately every five years. Overtime, organic matter or 'bio-films' may accumulate on the inside of the pipe along with sediments. Therefore, the quality of this water is largely a function of how long the pipeline has been in service, how often it has been cleaned, and the disinfectant residual maintained in the system. The water discharged during pigging of an operational pipeline is usually highly turbid, coloured and potentially odorous, with a high organic loading.

Water used to disinfect the pipeline during the wet commissioning process will have a free chlorine residual of approximately 10 mg/L. This water will be chemically dechlorinated using sodium bisulfate prior to discharge into the environment.

I.2.3 Water Discharge Locations and Volumes

The amount of water discharged during planned or unplanned events can range from a few thousand litres for valve maintenance to several megalitres (ML) for pressure relief, overflow events and the drain-down of pipeline sections. The ultimate volume of water discharged is generally dependent on: the maximum design flow of the system or maximum design flow of valves; the diameter and length of the pipe section (for section drain-down); or, the duration of the discharge activity.

Maximum design flows for drain-down and safety-relief valves on the NPI Stage 2 are in the order of 500–600 L/s, and the maximum design flow of the pipeline system in 2861 L/s.

The amount of water that may need to be discharged as the result of hydrostatic testing of the pipeline will be dependent of the length of each test section, and how much water can be reused for testing other sections. Generally, 1km of the pipeline has a maximum capacity of between 1.2 ML and 1.3 ML for 1290 mm diameter pipe. Depending on the location of section valves, 5–10 km of pipe will be tested during each event. Three pigging stations have been proposed for the NPI Stage 2.

Water discharges resulting from pigging the pipeline will be about 1–2 ML per pipeline section. Dirty water from the pigging process is discharged at pigging stations which are located at 10–15 km intervals along the pipeline.

Water discharged as the result of the wet commissioning process, such as pipeline flushing and disinfection, may be in excess of 100 ML (in total), depending on the process and how much water can be reused.

The volumes of water that may be released from a balance tank overflow or safety-relief valve during the operational life of the pipeline are largely dependent on the frequency and duration of the discharge event. It is possible that these discharges could be in excess of 1 ML per event. While such discharges are possible, they would only occur as the result of multiple systems failures occurring simultaneously while the pipeline was in operation.

I.3 Potential Environmental Impacts

The key characteristics of a water discharge that can impact on the environment include the depth, volume and velocity of the flow, and any environmental contaminants present. The technique of releasing the water can have as much impact on the environment as the quality or quantity of water released.

Aquatic ecosystems are more likely to be adversely affected by discharges from potable water pipelines as the result of sediments or environmental contaminants present in the discharge. In terrestrial ecosystems, it is unlikely that there would be any significant impact on soil or plant development from the contaminants in discharges from a potable water pipeline. The likely impact to soils and plants would be erosion resulting from the volume and velocity of overland flows.

I.3.1 Erosion and Sedimentation

Water released from the pipeline in large volumes and at high velocity has the potential to cause erosion of soils at the point of discharge and mobilise sediments along the flow path. If the velocity of the flow is sufficient, these sediments may be carried over a long distance to be deposited at low points in the immediate catchment area such as waterways, drainage infrastructure or roadways.

Nutrients may be mobilised by the disturbance of soils, particularly in rural areas where fertilisers are used. The nutrients nitrogen and phosphorus are essential for plant growth; however, high concentrations indicate the potential for excessive weed and algal growth. Excessive growth of algae and aquatic plant life may reduce waterway aesthetic values and can have an effect on public health and use of waterways (eg blue-green algae).

Sediments deposited in waterways can damage stream vegetation, and degrade habitats by filling deep holes in streams which are favoured by some species. They can block up and de-oxygenate the spaces within coarse stream substrates (gravel and cobble riffle zones) which are used by invertebrates and other aquatic organisms. They can also smother bottom-dwelling plants and animals (or their egg and larval forms), and reduce aquatic plant communities by blocking out sunlight.

In extreme cases, the accumulation of sediments can alter the physical characteristics (depth, width, flow path) and flow in a waterway, which may result in restricted movement for some species within a stream, or the intensification flood events.

Erosion of soils on land can expose plant and tree roots, remove nutrient-rich top soils and create channels and ridges that may interfere with natural overland flows.

I.3.2 Suspended Solids and Organic Loading

Suspended solids and organic loading in water discharged from the pipeline can result from the dislodging of material that has accumulated on the inside of the pipe, such as biofilms. Water discharges with high organic loads and suspended solids (eg pigging water) can exert a high biochemical oxygen demand on receiving waters, depleting dissolved oxygen (DO) levels. A decrease in DO concentrations in water bodies can result in fish kills, reduced aquatic plant growth and result in an overall reduction of ecosystem health.

Water discharges with high organic and suspended solid concentrations can increase the turbidity levels in surface water. Turbidity in waterways reduces the penetration of light which affects the photosynthesis rates of aquatic plants, reduces aesthetic value of streams, clogs fish gills and hinders the ability of aquatic predators to see their prey.

I.3.3 Dissolved Oxygen

Dissolved oxygen is essential for the life processes of most aquatic organisms. Low concentrations of DO can indicate the presence of excessive organic loads in the system, while high values can indicate excessive plant production (ie eutrophication). Most aquatic organisms require a certain minimum amount of DO in the water in order to survive.

DO levels can be reduced in a waterway by the addition of oxygen demanding substances, such as organic material, or by the addition of reducing chemicals, such as those used in the dechlorination process.

I.3.4 Temperature and pH

Water discharged from the NPI Stage 2 may be at different temperatures to surface waters depending on the weather at the time or the location of the discharge. Increased water temperature in waterways reduces oxygen concentrations, favours blue-green algae, alters growth and reproduction rates of biota, causes heat stress, and makes many organisms more susceptible to mortality from other causes (for example metal toxicity). Alternatively, water discharged into a waterway that is significantly cooler that the ambient water temperature may also have deleterious effects on aquatic biota.

Extremes of pH can be acutely toxic to aquatic organisms, although this is dependent on the natural pH of the waterway.

I.3.5 Chlorinated Water

As free available chlorine is readily degraded in the environment, it does not accumulate in water, sediments or the tissues of organisms. However, free chlorine is a potent biocide and can be harmful to aquatic life even at low concentrations. Therefore, there is the potential to cause harm to aquatic systems if chlorinated water is discharged near waterways without first allowing the free chlorine to degrade through natural attenuation or dechlorinating the water.

Water with concentrations of 10–50 mg/L or more of free chlorine (super-chlorinated water) will be used to disinfect the system during commissioning. This water will either be diluted or chemically dechlorinated before being released into the environment.

I.3.6 Chemically Dechlorinated Water

Dechlorination is the practice of removing all or a specified fraction of the total chlorine residual from water. Where passive dechlorination techniques are unable to provide a safe level of residual chlorine, chemical dechlorination may be required before the water can be released to the environment. Chemical dechlorination is usually required to treat superchlorinated water prior to disposal.

Dechlorinating agents containing sulphite, such as sodium sulphite and sodium bisulphite, exert an oxygen demand on the water it is being applied to. Over-application of reducing agents will result in an oxygen depleting residual in the treated water which can deplete the DO concentration in receiving waters. Care must be taken to ensure that oxygen levels are not significantly altered with the addition of such chemicals.

Impacts of dechlorination chemicals on the water quality of receiving streams are not well documented. Many dechlorinating agents produce hydrochloric and sulphuric acids while neutralising chlorine, which lowers the pH of the water. They can also increase the level of sodium chloride in the discharged water.

I.3.7 Social Impacts

The volume, depth, velocity and quality of a water discharge could impact on landowners, residents or recreational users of land or waterways. For potable water discharges, the key issues are with the volume, depth and velocity of flow. Even flows that comply with the maximum permissible velocities prescribed by the Stormwater Quality Control Guidelines for Local Government to limit erosion may still be sufficient to cause damage, harm or nuisance to people or property in the flow path.

Highly turbid water with a high organic loading from cleaning operations could cause a visual or odour nuisance if discharged overland, into open stormwater infrastructure, lakes, dams or other water bodies near residences or recreational areas.

If a drainage flow path for water discharged from a particular point is likely to be required for the operational life of the pipeline, the flow path may need to be protected with planning instruments such as infrastructure easements. A drainage easement will create restrictions on the use or development of the land along the flow path, maintaining access for drainage of water during the ongoing operation and maintenance of the pipeline.