QUEENSLAND WATER COMMISSION

REPORT

on

ISSUES ASSOCIATED WITH DEVELOPMENT AND SITING OF A DESALINATION PLANT ADJACENT TO SUNSHINE COAST AIRPORT

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Desalination Plant near Sunshine Coast Airport

1 Executive Summary

Issues relevant to the proposed development of a desalination plant adjacent to Sunshine Coast Airport have been studied with respect to influences on the existing airport infrastructure and implementation of a new runway on the 13/31 configuration. This study was undertaken using data provided by the Sunshine Coast Airport and Queensland Water Commission. The study was based on the current Australian regulations, international standards and best practice.

Although a more detailed study will be required when more accurate data on the proposed runway and associated infrastructure is available and the details of the actual site works for the desalination plant are available, the initial study shows:

- The plant footprint lies under the Obstacle Limitation Surfaces (specifically the transitional surface) associated with the new runway; therefore:
  - Structures at the south west corner (point D) must be limited to a maximum height of 5.5 metres. This restriction eases 80-100 metres into the site.
  - There do not appear to be any restrictions necessary for structures to a height of 20m at the south east corner of the site (point C).
- There do not appear to be any implications for the current airport configuration and instrument approaches.
- There may be some limitations for relocation of the existing navigation aids; however, it is assessed is that the current locations will adequately provide for the new runway.
- Provided the structure remains below the transitional surface of the new runway, potential instrument approach procedures for the new runway will not be restricted.
- If an ILS is provided for the new runway there may be issues with reflections of the signals in space from the localisers. If reflections occur they can most likely be reduced to an acceptable level by use of non metal cladding.
- There are no issues for current electronic surveillance (radar) above the site.
- Potential improvements in surveillance above and on the surface of the airport are likely to be non radar, most likely ADS/B and Multilateration, which will not be affected by the structures on the desalination site.
- Lighting at the plant will need to be shielded to ensure integrity of approaches to the new runway. Suitable lighting is available.
- Based on advice from QWC and information provided by the operators of similar plants, high velocity efflux will not be an issue.
- There are no issues for communications associated with aeronautical activities at the airport.

2 Background

Queensland Water Commission (QWC) is investigating development of a desalination plant at Marcoola as part of a siting study considering a number of sites in South East Queensland. There is potential for the development to have an impact on the current runway at Sunshine Coast Airport and a greater potential for the development to inhibit infrastructure developments critical for the operation of the proposed new runway at the airport. These infrastructure developments include the siting of the essential navigation aids and the instrument approach procedures associated with the new runway.

The regulation of developments and building heights in the vicinity of airports is determined by a number of factors. The most significant of these are the Obstacle Limitation Surfaces (as defined in ICAO Annex 14 and specified for Australian airports in the Part 139 Manual of Standards) and the instrument approach procedure design surfaces as provided in ICAO Doc 8168 (PANS/OPS).

Facilities and buildings reasonably close to an airport may also need to be designed taking account of the siting and protection criteria for navigation aids and communications equipment.

All these matters relate to ensuring the safety, regularity and efficiency of airport operations in accordance with international standards and Australian aviation regulations.

The proposed plant may have structures in any or all of the foot print area to a height of no more than 20m above ground level. The structures may include large metal clad industrial sheds, steel plate water/chemical tanks up to 10m high and large concrete tanks. It is not likely to have any aerosol or gaseous discharges to the atmosphere.

Operators of the airport, Sunshine Coast Regional Council, have identified the potential for activities on the site to clash with aviation activities, in particular options to relocate the existing navigation aids to locations suitable to service aircraft using the new runway.

QWC have commissioned an aeronautical study of the relevant issues to provide advice on siting issues for facilities on the airport, with particular reference to the proposed desalination plant area and the airspace implications of locating the built structures associated with the desalination plant.

3 Introduction

3.1 Abbreviations

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table:

Abbreviation	Meaning
A(PofA)R	Airports (Protection of Airspace) Regulations
ACFT	Aircraft
ADS/B	Automatic Dependent Surveillance/ Broadcast

Abbreviation	Meaning
AHD	Australian Height Datum
AIP	Aeronautical Information Publication
Alt	Altitude
AMSL	Above Minimum Sea Level
ARP	Aerodrome Reference Point
AsA	Airservices Australia
CASA	Civil Aviation Safety Authority
Cat	Category
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
ELEV	Elevation (above mean sea level)
Ft	Feet
GP	Glide Path
H24	Continuous
ICAO	International Civil Aviation Organisation
HIS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
Km	Kilometres
Kt	Knot (one nautical mile per hour)
LAT	Latitude
LONG	Longitude
M	Metres
MDA	Minimum Descent Altitude
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
NDB	Non Directional Beacon
NE	North East
nnDME	Distance from the DME (in nautical miles)
OCH	Obstacle Clearance Height
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation – Operations, ICAO Doc 8168
QWC	Queensland Water Commission
REF	Reference
RWY	Runway
Sec	Second
VOR	Very High Frequency Omni Directional Range
WGS-84	World Geodetic System 1984

3.2 Obstacle Limitation Surfaces

Obstacle Limitation Surfaces (OLS) are defined in ICAO Annex 14 The OLS are fixed by runway geometry and use (instrument or visual). A generic example is shown at Appendix A.

The broad function of the OLS is to define the volume of airspace that should ideally be kept free from obstacles in order to minimise the dangers presented by obstacles to an aircraft, either during an entirely visual approach or during a visual segment of an instrument approach.

In the case of a precision approach runway, portions of the OLS are designated as Obstacle Free Zones (OFZ) which, by definition, must be kept free from fixed objects other than frangible aids to air navigation, or objects of a transient nature.

ICAO Annex 14 states that the role of the OLS is to:

> "*...define the airspace around aerodromes to be maintained free from obstacles, so as to permit the intended aeroplane operations at the aerodrome to be conducted safely and to prevent the aerodrome from becoming unusable by the growth of obstacles around the aerodromes. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which obstacles may project into the airspace*".

In support of the broad objectives, ICAO Annex 14 also states that:

> "*New objects, or extensions of existing objects should not be permitted above the approach surface, transitional surface, … except when, in the opinion of the appropriate authority, the object would be shielded by an existing immovable object, or after aeronautical study it is determined that the object would not adversely affect the safety or significantly affect the regularity of operations of aeroplanes*."

3.3 PANS-OPS Surfaces

PANS-OPS surfaces overlay the OLS and are designed to criteria set out in ICAO's Doc 8168 - Procedures for Air Navigation Services-Aircraft Operations (PANS-OPS). The surfaces are specific to individual instrument approach procedures and are used to provide Minimum Obstacle Clearance (MOC) over terrain, vegetation and man-made structures in defined airspaces for specific instrument procedures. Obstacles penetrating the existing OLS may result in a need to redesign these surfaces to retain the required MOC. As this would, in turn, restrict use of the airport or reduce capacity in conditions of reduced visibility or low cloud, current regulations prohibit the construction of structures which would penetrate the published PANS-OPS surfaces.

In the case of a new runway, an existing obstacle may mean that the minimum approach altitudes or the decision height for an instrument approach to that runway would need to be designed to be higher than otherwise possible. In turn, this may have an impact on the capacity of the airport in adverse weather conditions.

3.4 Proposed Activity in Context

The report considers the existing Sunshine Coast Airport facilities, the development and implementation of a proposed runway 13/31 and possible changes to airport infrastructure to accommodate the new runway.

Data for existing airport facilities and configuration was taken from the Aeronautical Information Publication (AIP), as amended to 20 November 2008.

The report assumes the proposed runway will be sited to provide an ILS category one (CAT I) instrument runway with runway ends in accordance with coordinates provided to the consultant for a previous assignment. Based on those coordinates the runway centreline would be as shown below.

The proposed footprint of the desalination plant has been provided by QWC in both graphical and textural form. As there was some discrepancy between coordinates provided in different geodetic systems, the graphical form was used to determine coordinates in WGS-84 for comparison and calculation. A tolerance was placed on the coordinate data obtained by this method.

The graphical presentation is as shown below.

3.5 Scope

The overall scope of this document is to report the results of an Aeronautical Study which:

- Describes the proposed activity;
- Describes the current airport layout and the proposed runway development;
- Examines airspace issues related to the proposed desalination site taking account of local airspace configuration and use, including the development of the new runway 13/31 and associated navigation facilities and infrastructure;
- Provides advice on relevant current regulations and the usual application of those regulations in Australia in relation to the proposed developments on and near airfields;
- Discusses the risks associated with the proposed activity in the context of the proposed site and its proximity to other aviation activities, principally Sunshine Coast Airport;
- Proposes mitigation strategies to address issues and risks associated with the proposed activity;
- Recommends procedures and agreements which will enable the proposed activity to proceed safely and in harmony with other airspace users on and near Sunshine Coast Airport; and
- Provides discussion points for use in meetings with Council, other airspace and airport users and, if required, the Regional Airspace Users Advisory Council (RAPAC).

4 Methodology

A desktop study has been undertaken using material and data available from other projects and as provided by QWC. This data and material was examined in the light

of regulatory material, common practice and past experience. This study and examination forms the basis of this (preliminary) report, which includes:

- analysis of the issues related to the proposed activity,
- discussion of current Australian (CASA) regulations;
- AsA airspace management principles related to the proposed activity;
- Identification of airspace risks which may be associated with the proposed activity;
- Mitigation strategies, including potential siting, to address issues identified and reduce risks

The results of this phase are based largely on third party provided data and may need to be refined by on site inspection by the consultant and comprehensive discussions with the client and other stakeholders.

Experience has shown that full examination of the aeronautical aspects of developments near airports requires careful analysis and inspection to ensure all aspects of the environment and airspace data and usage are considered. This is only possible following inspection of the site by the consultant and detailed discussions with the relevant stakeholders.

In conducting a full examination, it is also advisable to check data provided against other possible sources. Due to limitations on data availability and difficulty in conversion of coordinate data from one geodetic system to the aviation standard system (WGS-84), cross checking was not able to be adequately completed. In this circumstance, the study applied a very conservative approach to determining restrictions, which may need to be applied to the proposed facility development heights. The result of this conservative approach is that actual restrictions may be less than stated.

Comment in the report with regard to policy changes, flight paths and procedures, new technology and other relevant matters have been based on previous studies and discussions with representatives of Airservices Australia (AsA), Civil Aviation Safety Authority (CASA) and the (then) Department of Transport and Regional Services (DOTRS).

Subsequent to any decision for the development as proposed, it will be necessary to consider the potential for cranes to be a temporary obstacle during construction. This is unlikely to be an issue in relation to the current runway configuration; however, should such occur after the proposed runway is operational, it is most likely that the cranes will be obstructions, as defined by the CASA regulations.

The aeronautical assessment was undertaken in phases, common to previous assessments undertaken by the consultant, as described below:

#	Phase	Description
1	**Obstacle Limitation Surfaces**	The extent of penetration of the Obstacle Limitation Surfaces by the proposed development was determined based on the siting (building footprint) and height data provided by QWC, assuming a maximum height across the footprint of 20m.
2	**Shielding by Existing Obstacles**	The potential shielding by any existing obstacles penetrating the OLS was assessed in relation to CASA standards.

#	Phase	Description
3	**Instrument Approach Procedures**	The current instrument approach procedures were examined to determine whether the development would impose any restriction on those procedures. Based on the requirement of the Airports (Protection of Airspace) Regulations any restriction to the current instrument approach procedures would preclude further consideration of the development on the site.
4	**Possible Changes to Procedures**	Consideration was given to the potential feasible changes to current instrument approach procedures, including those possible for the new runway and any influence the proposed development would have on those procedures.
5	**Control and Safeguarding**	Potential disruption of signals in space from existing and potential communication, navigation and surveillance systems serving the airport were considered.
	Lighting	The lighting likely to be provided on the site was considered with respect to possible impact on aviation activity on and near the airport.
6	**Efflux**	Possible high velocity efflux from the site was considered with respect to current and future flight paths.
8	**Mitigating Factors**	Mitigating factors were considered to enable both the development of the proposed plant and the new runway.
9	**Summary & Conclusions**	A summary of findings and conclusion as to whether the proposal should be further considered was prepared.

5 Issues

5.1 Obstacle Limitation Surfaces

The primary surfaces for consideration in this study are the inner horizontal surfaces associated with the existing runways and the transitional surface for the proposed new runway (13/31).

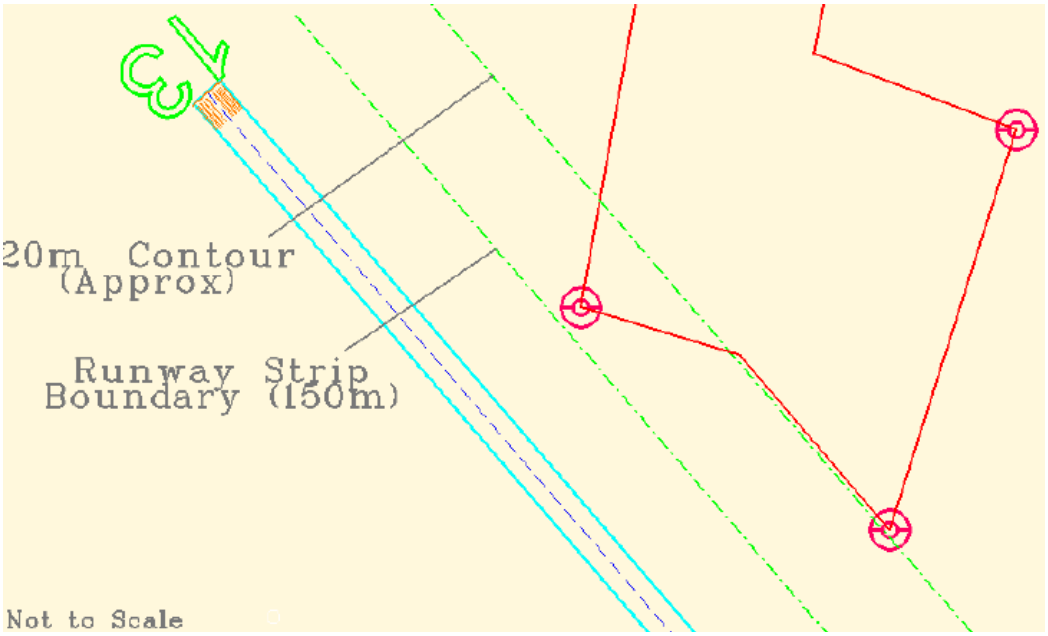
The runway strip is a surface 150m either side of the runway centreline at the elevation of the runway centreline and extending for the length of the runway (plus any associated stopways).

The transitional surface commences at the edge of the runway strip and rises from the elevation of that edge at 14.3% (essentially 1:7) to the elevation of the Inner Horizontal Surface (45m).

The proposed site is sufficiently spaced from the existing main runway (18/36) to enable structures up to 20m without infringing the transitional surface. Similarly, the displacement from the cross runway (12/30) allows construction of structures to a height of 20m throughout the proposed site. The proposed desalination plant site is under the composite inner horizontal surface for the existing runways; however, the proposed maximum height of the structures which comprise the plant are well below the elevation of the surface.

The relative siting of the proposed plant with respect to the transitional surface for the proposed runway 13/31) is shown below.

The position of the 20m contour with respect to the transitional slope height restriction across the proposed site is as shown below. It should be noted that this is representative only and should be confirmed when precise runway and site coordinates are available in the WGS-84 system. It should also be noted that height restrictions are related to the elevation of the edge of the runway strip adjacent and perpendicular to the site boundary. These heights may also be affected by earth works.



5.2 Instrument Approach Procedures

There are no planned changes to the instrument flight procedures for the existing runway at Sunshine Coast Airport and any that may arise would not be relevant to the development of the plant. This is because of the limit of 20m on the proposed development and its location with respect to the geometry of the current procedures. This consideration included assessment of potential approaches, should an ILS be installed for either end of the existing runway.

Procedures likely for implementation with the new runway were considered. In this respect both conventional ILS procedures for both runway ends and a curved approach using GNSS technology to runway 13 were considered. It is considered that provided structures on the site are contained below the transitional surface, there will be no adverse impact on those procedures.

5.3 Shielding

There are no existing obstacles on or near the airport, which would provide shielding as described in CASA Manual of Standards Part 139 – Aerodromes, Section 7.4.

5.4 Control and Safeguarding

5.4.1 Communications

Current facilities used to provide aeronautical communication services for the airport are sited sufficiently remote from the proposed site to ensure no disruption of signals or adverse reflection or shielding.

The type of communication emissions and the proposed frequencies used for any internal communication on the site will need to be checked and approved by the appropriate regulatory authorities, such as the Spectrum Management Agency,

Details of these checks and potential results are considered outside the scope of this report.

5.4.2 Navigation

Large structures on or near airports have potential to disrupt signals from terrestrial based navigation aids (NAVAID), such as ILS and to a lesser extent, VOR, DME and NDB.

There are specific protected areas, which must be kept clear of structures. The proposed site is well clear of protected areas for the existing VOR, DME and NDB

An ILS consists of three elements:

- The Glide Path (GP), which provides guidance in the vertical plane to maintain an aircraft on a safe vertical path to the runway in use. The GP antenna is sited usually within the runway strip and adjacent to the touchdown zone of the runway for which provides a service.
- Precision DME, which provides accurate distance from touchdown information to the aircraft. The antenna is usually cosited with the GP.
- A localiser (LLZ), which provides guidance in azimuth to maintain an aircraft on the extended centreline of the runway. The LLZ is located as an antenna array across the centreline, usually 200-250 metres beyond the upwind end of the runway.

ILS glide path (GP), precision DME and localiser (LLZ) equipment must be sited close to the runway they are intended to serve and with very tight location tolerances. The proposed desalination site is well clear of the possible sites for ILS system elements (GP, precision DME and LLZ) for the existing (18/36) runway and the proposed (13/31) runway.

Reflection of NAVAID signals (sometimes referred to as “multipath”) may also be an issue when large metal structures are sited near such facilities. Based on past experience with several similar structures located with similar relativity to instrument runways equipped with ILS the proposed site is unlikely to present a significant issue in this regard; however, it would be prudent to consider providing non reflective cladding on those surfaces of the desalination plant facing the relevant facilities.

When more precise siting of structures on the proposed site is known and any potential ILS facilities for the airport are determined, it would be prudent to check with specialists in Airservices Australia concerning specific reflection issues. In this regard the provisions of Airways Engineering Instructions issued by Airservices Australia will need to be considered.

The current location of the VOR and DME services the existing (18/36) runway approaches and is also considered a suitable site to provide a suitable geometry and coverage for non precision approaches to the proposed (13/31) runway. In this respect, the location of the VOR and DME at Sydney Airport with respect to the 16R/34R and 07/25 runway configuration is a relevant comparison.

It is possible that future technology will allow the application of curved approaches to precision minima. In these circumstances it will still be necessary to provide a straight in segment for the final portion of the approach to the runway. The position of the proposed development with reference to the distance from and relative position of the runway ends of the current (18/36) runway and the proposed (13/31) runway is such that the existing influence on the current straight in final approach segments will also apply to the final (straight) segments of any future curved precision approaches.

5.4.3 Surveillance

There is no radar sited on or near the airport. Some radar coverage exists in airspace surrounding the airport. This is at higher levels and structures on the proposed site would not disrupt that coverage.

It is likely additional surveillance facilities will be considered for the airport in the future. Based on discussion with Airservices Australia and current international trends, these facilities are likely to be based on the newer technologies of ADS/B and Multilateration. Structures on any or all of the proposed site, to any height, would provide no adverse impact on either technology.

5.4.4 Lighting

It is assumed the proposed facility will operate on a continuous basis (H24). As such, and considering the occupational health and safety issues and regulations with plants of this nature, high intensity lighting of the buildings, external plant equipment and perimeter of the facility is likely to be required.

Bright lights and some patterns and directions of lights on and near airports can present safety issues for aviation activities. This includes both the aircraft using the airport and personnel providing services at the airport, such as safety officers and air traffic controllers. The requirements for shielding and patterns of lights in these circumstances are provided in CASA Manual of Standards Part 139 – Aerodromes, section 9.1.3 and guidance on the design and installation of lights in these circumstances is provided in section 9.21 of the same document.

As it is the intention of QWC to ensure the facilities at the proposed site do not present as obstacles, as defined in ICAO Annex 14 and the CASA Manual of Standards Part 139- Aerodromes, it will not be necessary to specify obstruction lighting for buildings on the site.

5.4.5 Efflux

Efflux with a velocity greater than 4.3 m/sec presents a hazard to aircraft and is considered in the same manner as fixed, solid obstacles.

Advice from QWC and reference to the operation of similar overseas desalination plants indicates that the proposed facility is unlikely to emit gaseous efflux likely to be a hazard to aircraft. Should this not be the case, the requirements of CASA Advisory Circular AC139- 5(0), CASR (1998)139.350 (and others) will need to be considered.

6 Summary

Issues relevant to the proposed development of a desalination plant adjacent to Sunshine Coast Airport have been studied with respect to influences on the existing airport infrastructure and implementation of a new runway on the 13/31 configuration. This study was undertaken using data provided by the Sunshine Coast Airport and Queensland Water Commission. The study was based on the current Australian regulations, international standards and best practice.

Although a more detailed study will be required when more accurate data on the proposed runway and associated infrastructure is available and the details of the actual site works for the desalination plant are available, the initial study shows:

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  - There do not appear to be any restrictions necessary for structures to a height of 20m at the south east corner of the site (point C).
- There do not appear to be any implications for the current airport configuration and instrument approaches.
- There may be some limitations for relocation of the existing navigation aids; however, it is assessed is that the current locations will adequately provide for the new runway.
- Provided the structure remains below the transitional surface of the new runway, potential instrument approach procedures for the new runway will not be restricted.
- If an ILS is provided for the new runway there may be issues with reflections of the signals in space from the localisers. If reflections occur they can most likely be reduced to an acceptable level by use of non metal cladding.
- There are no issues for current electronic surveillance (radar) above the site.
- Potential improvements in surveillance above and on the surface of the airport are likely to be non radar, most likely ADS/B and Multilateration, which will not be affected by the structures on the desalination site.
- Lighting at the plant will need to be shielded to ensure integrity of approaches to the new runway. Suitable lighting is available.
- Based on advice from QWC and information provided by the operators of similar plants, high velocity efflux will not be an issue.
- There are no issues for communications associated with aeronautical activities on or near the proposed site.

Appendix 1
OBSTACLE LIMITATION SURFACES