15.0 SURFACE WATER

15.1 INTRODUCTION

This Chapter describes the assessment of potential impacts on the quality and hydrology of surface waters, most notably the streams in Rupert's Valley, Dry Gut and Sharks Valley which could potentially be directly affected by the proposed scheme. Potential impacts on groundwater and the ecology associated with aquatic features are covered in the Geology, Contaminated Land and Hydrogeology, and Terrestrial and Ecology Chapters 13 and 9, respectively.

15.2 METHODS

15.2.1 General Approach

Broadly, the method for assessment of effects on the surface water environment involves the following stages:

1) Description of the existing surface water features which might be affected. This includes a discussion regarding the value and importance of each of the features – see Appendix 15.1 which describes the assessment of importance and significance.
2) Assessment of the potential effects which could occur temporarily during construction and permanently during operation.
3) Identification of the mitigation measures which will be, and have been, incorporated into the scheme to reduce the effects.
4) Description of the residual effects, i.e. prediction of the effects which would occur, taking into account mitigation measures.

This Chapter covers several aspects of the proposed scheme which could potentially affect the surface water environment, including:

- **Diversion of the stream** around the proposed new Bulk Fuel Installation in Rupert's Valley
- The **temporary quarry** in Rupert's Valley
- **Drainage** from the new **access road**
- **Crossings of watercourses** by the new access road
- Proposed **new culvert of Dry Gut** under the runway embankment
- **Permanent water supply to the airport -** abstraction of water from point A1/A2 in **Sharks Valley** close to Hencock Hole

There are three options for the possible source of water to supply the construction works. A number of assumptions have been made in this regard and these have been made clear in the text. It may be that these supply options are used in combination with each other. The options are as follows:

- **Temporary** water supply to the construction works - **abstraction of water from Sharks Valley close to the waterfall at the beach;** or
- **Temporary Storage Reservoir in Dry Gut** for water supply during construction; or
- **Abstraction and use of sea water** for compaction of the Dry Gut embankment during construction

All the potential effects have been investigated following the same broad approach which is detailed in Volume 4, Appendix 15.1. The potential effects have been identified and possible mitigation measures to reduce the impacts are discussed in the following sections. The assessment process described has three stages:

1) Each water feature (or specific attribute of a water feature) is assessed for **importance**;
2) The **magnitude** of potential impacts is then determined; and
3) Finally, the importance of a water feature is compared against the magnitude of potential impacts in the assessment of **significance matrix** as described in Volume 4, Appendix 15.1**.**

15.3 EXISTING SURFACE WATER FEATURES

An environmental baseline sufficiently detailed for the assessment of potential impacts was determined following a desk study and site walk-over. Monitoring data was also reviewed where available.

Table 15.1 identifies the main features within the vicinity of the site of the proposed airport, haul roads and permanent access roads. Figure 15.1, Volume 3 also identifies the watercourses. Photographs 15.1 to 15.15 are presented on Figure 15.3, Volume 3 of the ES.

Table 15.1 Watercourses

Name	Location	Flow	Importance	Photo No. in Figure 15.3, Vol. 3 of this ES
Rupert's Valley	Drains a large catchment including Rupert's Hill and Bunker's Hill	Ephemeral	High	15.1, 15.2 and 15.3
Streams which outfall to Rupert's Bay and Bank's Valley Bay	In addition to the main stream in Rupert's Valley two streams outfall to the Bay one via Bloody Bridge the other close to the Bulk Fuel Farm	Ephemeral	Medium	
Tributaries of Rupert's Valley	Drain the slopes of Rupert's Hill and Bunker's Hill and join the watercourse at the bottom of the valley	Ephemeral	Low	
Streams which outfall to Bank's Valley Bay	These streams drain Rupert's Hill and Bank's Ridge	Ephemeral	Medium	

Name	Location	Flow	Importance	Photo No. in Figure 15.3, Vol. 3 of this ES
Netley Gut	Drain Deadwood Plain and flows to Turk's Cap Bay via Turk's Cap Valley	Ephemeral	Medium	
Mulberry Gut	Rises in Longwood and flows to Turk's Cap Bay via Turk's Cap Valley	Ephemeral	Medium	
Bilberry Field Gut	Rises in Longwood and flows to Turk's Cap Bay via Turk's Cap Valley	Ephemeral	Medium	
Watercourse close to Bottom Woods met station and the landfill site at Horse Point	Rises close to the met station at Bottom Woods and meets the coast to the south of Turk's Cap	Ephemeral	Medium	
Fisher's Valley and Prosperous Bay Valley	Rises in the higher ground close to the peaks and flows in an easterly direction, meeting the coast at Prosperous Bay. Fisher's Valley has been identified as a candidate site for a Ramsar due to its importance for wetland birds.	Ephemeral During October/ November 05 site visit low flow over base rock waterfalls and dry in sections of deep soft sediment bottom substrate.	High	15.4, 15.5 & 15.6
Tributaries of Fisher's Valley	Drain the northern extent of Prosperous Bay Plain	Ephemeral	Medium	15.7
Guts draining Prosperous Bay Plain	Drain Prosperous Bay Plain directly to Dry Gut Bay to the east of the proposed airport	Ephemeral	Medium	
Dry Gut	Rises in Woody Ridge and flows east between Bencoolen and Prosperous Bay Plain to reach the coast close to Gill Point	Ephemeral	High	15.8 & 15.9
Tributaries of Dry Gut	Carry drainage from the southern extent of Prosperous Bay Plain	Ephemeral	Medium	

Name	Location	Flow	Importance	Photo No. in Figure 15.3, Vol. 3 of this ES
Sharks Valley	Drains a large catchment which includes Levelwood. Flows from west to east to reach the coast at Stone Top Bay	Normally flows all year round. A summary of the flow data is provided in Volume 3, Appendix 15.1 and 15.2.	Very High – being one of only two steams on St Helena which flow throughout the year	15.10 to 15.15

The majority of the guts and valleys are heavily eroded steep sided valleys with dry and easily eroded gravel and boulder substrates although some watercourses have stretches of bedrock, including sections of Dry Gut. With the exception of Sharks Valley, the majority of the watercourses were dry during the October/November 2005 site visit. During April 2006 water was flowing in Dry Gut.

15.4 ASSESSMENT OF EFFECTS

This assessment firstly summarises potential effects, then sets out the measures which will be taken to avoid, reduce or offset these effects and finally summarises the residual impacts i.e. those effects that remain after the implementation of mitigation. Impacts assessed as moderate or higher are considered to be 'significant'. Appendix 15.1 provides a detailed description of the potential effects which could occur and provides a description of the mitigation which will be implemented to reduce the residual effects.

15.4.1 Potential Construction Effects

If site activities are not adequately controlled, pollution of watercourses could occur as a result of the following:

a) Storage of **oils, fuels or chemicals** have the potential cause pollution of watercourses.
b) Deposition of **silt or detritus** in watercourses.
c) Washing of **tools or materials** in watercourses.
d) Silt from **pumped water from excavations** entering watercourses.
e) **Interference with banks and channels** of watercourses.
f) **Vehicles driving** in watercourses.
g) **Batching plant** discharges to watercourses.
h) Lack of environmental awareness of construction workers.
i) Lack of effective clean-up after an incident.
j) Additional run-off from increased permeable area.
k) Silt could wash off road surface into watercourses.
l) Foul sewage from contractor's compound could cause pollution if not adequately treated.

Abstraction of water from Sharks Valley will have the effect of reducing the volume of water in the watercourse downstream of the abstraction point. Locations close to the waterfall and at point A1/A2 have been cited as potential abstraction points. Point A1/A2 at which the intake works would be constructed, the route of the pipeline, break tank and storage tanks are all shown in Figure 15.1. Flows in Sharks Valley may also be affected by groundwater abstraction elsewhere within the catchment, if this were to occur.

The reduction in water volume, depth and flow rates downstream of the abstraction point during construction is unlikely to cause the permanent loss of any plant species or habitats. Less water in Sharks Valley could have a range of effects downstream which are described in full in Appendix 15.1, Volume 4.

A 15m high weir has been proposed to create a storage reservoir in Dry Gut capable of storing 100,000m^3 of water. Dry Gut is an ephemeral stream only flowing for certain months of the year. There is currently no information available concerning the characteristics of flow in Dry Gut. A weir would act as a dam trapping a significant quantity of the ephemeral flow limiting the flow experienced further downstream this could have a range of effects as described in Appendix 15.1, Volume 4.

The Contractor may abstract sea water from Gill Point for use during compaction of the embankment in Dry Gut. It is during this activity that the peak in demand for water would occur.

15.4.2 Potential Permanent and Operational Effects

If adequate mitigation is not implemented during the operation phase of the development, pollution and deterioration of watercourses could occur as a result of the following:

a) Increased impermeable area causing **increased rate of surface water run-off** and risk of erosion
b) Contamination of watercourses from **foul sewage** from the airport and BFI.
c) Contamination of watercourses from **oil or silt** from roads, airfield, AFF and BFI.
d) **Erosion** of watercourses.
e) Spillage of **aviation fuel** causing contamination of local watercourses.
f) Erosion of the toe of Dry Gut **embankment** causing instability.
g) Contamination of watercourses from **fire fighting foam** from fire training ground.
h) Presence of the road affecting drainage catchments.
i) Erosion of land and watercourses alongside road from surface water run-off.
j) Inadequate sized culverts and bridges could cause erosion or flooding.
k) Abstraction of water from Sharks Valley for the permanent supply for the airport
l) Culverting and embankment in Dry Gut leading to loss of habitat

15.4.3 Mitigation

The development of mitigation measures has been informed by the following good practice guidance for the protection of the surface water environment which is detailed in Appendix 15.1.

Mitigation has been developed through the design and incorporated into the technical specification which the Contractor must follow. Mitigation measures have also been developed for the construction and operation of the proposed scheme and these are set out in the EMP.

The measures described in the tables 15.2 and 15.3 below are proposed to mitigate the effect of these potential adverse impacts. Further mitigation, particularly relating to the abstraction and use of water during construction is provided in Appendix 15.1, Volume 4 and the Landscape and Ecological Mitigation Plan enclosed in Appendix 10.2 of Volume 4 and the EMP.

15.5 SUMMARY OF RESIDUAL EFFECTS

Tables 15.2 and 15.3 provide a description of the residual effects which would occur during construction and operation respectively.

Table 15.2 Residual Construction Effects Summary Table

Description of Potential Construction Impact	Classification of Potential Impact	Assessment of Significance Without	Proposed and Recommended Mitigation Measures	Residual Impact
The mobilisation of sediment laden runoff which could enter local watercourses and drains	Temporary Short term	Moderate to Major adverse	Appropriate mitigation measures to prevent sediment laden runoff being discharged to local watercourses untreated will be put in place. These are described in detail in the EMP they include adequate provision for treatment of discharges, such as settlement lagoons or silt traps fitted with oil absorbent booms, to ensure that pollution shall not occur	**Neutral**
The potential risk of chemical and fuel (oil) spillages entering local watercourses	Direct Temporary Short term	Moderate to Major adverse	Appropriate mitigation measures to protect local watercourses from the potential risk of chemical/fuel spillages will be in place. These are described in detail in the EMP they include requirements for storage and handling of fuel, oil and chemicals. They shall also include an emergency procedure to be followed in the event of a spillage or other pollution incident.	**Neutral**
The potential erosion of and damage to the banks of local watercourses and drains	Direct Temporary Short term	Minor adverse	Appropriate measures will be implemented to protect minor watercourses from erosion and bank damage, although by the nature of the improvement works, adverse impacts will occur.	**Minor adverse**
Temporary culverting and diversion of existing watercourses	Direct Temporary Short term	Minor adverse	Appropriate planning and execution of diversion to ensure potential for contamination and erosion is minimised	**Minor adverse**

Description of Potential Construction Impact	Classification of Potential Impact	Assessment of Significance Without	Proposed and Recommended Mitigation Measures	Residual Impact
Disposal of construction site foul water	Direct Temporary Short term	Neutral	Foul drainage will be collected and treated on site or connected to a cesspool which will be regularly emptied for disposal off site. If a treatment plant is provided by the Contractor it will meet appropriate limits to control the quality of effluent discharged.	**Neutral**
Quarry	Temporary Short term	Major adverse	Adequate planning prior to commencement of quarry construction to ensure effect of construction is mitigated as far as possible	**Neutral**
Diversion of the stream in Rupert's Valley around the proposed Bulk Fuel Installation	Temporary Short term	Minor adverse	Appropriate planning and execution n of diversion to ensure potential for contamination and erosion is minimised	**Minor adverse**
Dry Gut embankment and culvert	Temporary Short term	Moderate adverse	Appropriate planning and execution of diversion to ensure potential for contamination and erosion is minimised	**Neutral**
Water for construction supply - Sharks Valley close to the beach waterfall and point A1/A2	Direct Temporary Short term	Moderate to major adverse	The Contractor shall minimise the demand for water as far as possible so as to reduce the volume of water that is required during construction. Abstraction quantities will be kept to a minimum. A maximum of $40m^3$ per day may be abstracted from Point A1/A2 in Sharks Valley. Should water be abstracted from the waterfall, the Contractor must leave in the stream, at least $138m^3$ per day (a figure equivalent to just over a quarter of the flow based on current data). Flows will be monitored, as will changes to environmental baseline conditions. Management to control loss of water dependant species.	**Minor adverse**
Abstraction, management, storage and use of water for construction supply - Dry Gut Storage	Direct Temporary Short term	Moderate adverse	The Contractor shall minimise the demand for water as far as possible so as to reduce the volume of water that is required during	**Minor adverse**

Description of Potential Construction Impact	Classification of Potential Impact	Assessment of Significance Without	Proposed and Recommended Mitigation Measures	Residual Impact
			construction. Abstraction quantities will be kept to a minimum. Monitoring of flows and changes to environmental baseline conditions. Demolition of the weir after construction would have to be done in a controlled manner to avoid a large body of water cascading down the valley.	
Abstraction, management, storage and use of water for construction supply - Sea Water abstraction from Gill Point	Direct Temporary Short term	Moderate adverse	Sea water may only be used in the Works subject to the Contractor demonstrating that he can meet the strict environmental constraints stated in the EMP. These measures include a requirement that sea water shall only be used for the core of the Dry Gut embankment if it is proven that salt will not migrate to the surface of the land or groundwater. The Contractor shall minimise the demand for water as far as possible so as to reduce the volume of water that is required during construction. Abstraction quantities will be kept to a minimum.	**Neutral**

Table 15.3 Residual Permanent Operational Effects Summary Table

Description of Potential Operational Impact	Classification of Potential Impact	Assessment of Significance Without	Proposed and Recommended Mitigation Measures	Residual Impact
Road drainage potentially affecting several watercourses Including Rupert's Valley stream.	Permanent Long term	Moderate Adverse	Culverts and bridges to ensure flow paths are maintained and the risk of erosion and flooding are reduced. In the area of Deadwood, specific drainage provisions are required as the run off from the road needs to be collected and discharged downhill of residential properties.	**Neutral**

Description of Potential Operational Impact	Classification of Potential Impact	Assessment of Significance Without	Proposed and Recommended Mitigation Measures	Residual Impact
Diversion of the stream in Rupert's Valley around the proposed Bulk Fuel Installation	Permanent Long term	Minor adverse	Appropriate design and planning of diversion channel to ensure potential for contamination and erosion is minimised.	**Minor adverse**
Dry Gut embankment and culvert	Permanent Long term	Moderate Adverse	Appropriate planning and execution of diversions and culverts to ensure potential for contamination and erosion is minimised.	**Minor adverse**
Airfield drainage - contaminated surface water discharge (routine run-off of pollutants from runway, apron, and spillage risk).	Permanent Long term	Moderate Adverse	Silt and oil interception facilities will be provided.	**Neutral**
Erosion of watercourses from surface water run-off	Permanent Long Term	Moderate Adverse	Attenuation of surface water drainage to Greenfield run-off rate rates for all return period storms up to a 1 in 100 year event. Provision of energy dissipation structures and bank protection.	**Neutral**
Erosion of embankments	Permanent Long Term	Major adverse	Adequate drainage and erosion control at the toe of embankments	**Neutral**
Contamination of watercourses from oil, fire-fighting foam or sewage	Temporary Short term	Moderate Adverse	Interception of contaminants at source using oil interception, dedicated drainage system and treatment. Treatment of foul water in a sewage treatment plant at the airport with appropriate limits for biochemical oxygen demand, ammonia and total suspended solids. Pollution control measures will be included in the BFI and AFF fuel storage facilities. Penstocks will be provided at the outlets from the airfield drainage storage ponds which can be closed in the event of a fire or spillage to prevent contaminated drainage from reaching receiving watercourses.	**Neutral**

Description of Potential Operational Impact	Classification of Potential Impact	Assessment of Significance Without	Proposed and Recommended Mitigation Measures	Residual Impact
Water supply – abstraction of 40m^3 per day from Sharks Valley at point A1/A2	Direct Permanent Long Term	Moderate to major adverse	The Contractor shall minimise the demand for water as far as possible so as to reduce the volume of water that is required during operation. Abstraction quantities will be kept to a minimum. Flows will be monitored, as will changes to environmental baseline conditions. Management to control loss of water dependant species.	**Minor adverse**