

شركة تطوير العقبة
AQABA Development Corporation



Aqaba
Development Corporation

Aqaba Ports Relocation and Development Project



Environmental Impact Statement (EIS) Revised 7.0

Prepared by



September 2008

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V.	<i>Air Quality Baseline Report</i>
VI.	<i>Noise Baseline Report</i>
VII.	<i>Consultation Report</i>
VIII.	<i>Coral Damage Valuation Report</i>
IX.	<i>Compliance Matrix</i>
X.	<i>Aqaba Ports Development Project, Contamination Cleanup and Assessment, ADC, 2008</i>

LIST OF ABBREVIATIONS

ADC	Aqaba Development Corporation
API	American Petroleum Industry
ASEZ	Aqaba Special Economic Zone
BGS	below ground surface
CD	chart datum
CEMP	Construction Environmental Management Plan
DAP	di-ammonium phosphate
dBa	decibel
DWT	deadweight tonnage
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
FLT	forklift truck
IB	Important Bird Area
IMO	International Maritime Organisation
IUCN	International Union for the Conservation of Nature
JISM	Jordanian Institution for Standards and Meteorology
JOD	Jordanian Dinar
JPMC	Jordan Phosphate Mines Company
KEMAPCO	Kemira Arab Potash Company
kWh	kilowatt hour
LAT	lowest astronomical tide
LOA	length overall
LPG	liquefied petroleum gas
mASL	meters above sea level
MOP	moruite phosphate
MSL	Mean Sea Level
NOx	nitrogen oxides
NPK	nitrogen phosphate potash
NTU	nephelometric turbidity units
OCIMF	Oil Companies International Marine Forum
OEMP	Operations Environmental Management Plan
OPRC	Oil Pollution Preparedness, Response and Co-operation
PCB	Polychlorinated biphenyls
PPP	Public Private Partnership
RoRo	Roll-on Roll-off
RSCN	Royal Society for the Conservation of Nature
SEA	Strategic Environmental Assessment
SOLAS	Safety of Life at Sea
SVOCs	semi-volatile organic compounds
TDS	total dissolved solids
tph	tones per hour
VOCs	volatile organic compounds
WWTP	Waste Water Treatment Plant

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ملخص تنفيذي

1. مقدمة – مشروع تطوير الموانئ

تعتزم شركة تطوير العقبة إيقاف العمليات في ميناء العقبة الرئيسي، ونقل موقع الخدمات إلى الميناء الجنوبي الموسع والمحدث والموجود على شاطئ العقبة الجنوبي. ويعرف هذا المشروع بمشروع تطوير الموانئ. وتتبع هذه المخططات التوصيات التي قدمت ضمن المخطط الرئيسي لمنطقة العقبة الاقتصادية الخاصة، والتي تم نشرها في عام 2004. ويتضمن المشروع:

الميناء الرئيسي

- إيقاف العمليات
- تفكيك وإزالة المعدات
- إزالة الملوثات البيئية
- هدم وإزالة المنشآت
- تحويل موقع الميناء الرئيسي مستقبلاً إلى مركز تجاري منفي

الميناء الجنوبي

- إنشاء مرسى ومبنى جديد لاستقبال المواد السائلة بانواعها
- إنشاء مرسى جديد لاستقبال الحبوب، بما في ذلك صوامع للتخزين ومعدات تفريغ السفن
- إنشاء مبنى صناعي جديد للمواد المعبأة بكميات كبيرة – الفوسفات و المواد الصناعية الجافة و السائلة. ستتضمن المرافق مراسي ومعدات لرفع البضائع والمواد للسفن، ناقلات للبضائع، مرافق للتخزين، مرافق لتفريغ الشاحنات، وتجديد الرصيف الصناعي.
- مراسي عامة للحمولات مع إمكانية التحميل والتفريغ بطريقة RoRo، بما في ذلك حوض للحمولات حفر حديثاً، مرافق للخدمات البحرية، مراسي للبضائع المعبأة بكميات كبيرة، مرافق لتصريف المياه، حوض تصليح للسفن، معدات للتدبير والتخزين.

لقد تم عرض المشروع بتفصيل أكثر في المخطط الرئيسي للميناء الجنوبي لعام 2007، وفي وثائق لاحقة تم إعدادها في 2006 و 2007 من قبل رويال هاسكونينج لشركة تطوير العقبة.

طلبت سلطة منطقة العقبة الاقتصادية الخاصة إجراء دراسة شاملة وحديثة لتقييم الأثر البيئي، ويعد هذا التقرير الملخص خلاصة لمسودة تقرير دراسة تقييم الأثر البيئي التي تم إعدادها وتقديمها لسلطة منطقة العقبة الاقتصادية الخاصة من أجل وضع الملاحظات وأخذ الموافقة عليها.

2. ترخيص المشروع بيئياً

خضع المخطط الرئيسي الأصلي لمنطقة العقبة الاقتصادية الخاصة لعام 2001 إلى مناقشات تشاورية عامة كثيرة قبل اعتماده، بما في ذلك إجراء تقييم بيئي استراتيجي. وقد تم أخذ القرار الاستراتيجي بتوسعة الميناء الجنوبي، ونقل خدمات الميناء الرئيسي وتطوير موقعه، وتمت الموافقة عليه من قبل سلطة منطقة العقبة الاقتصادية الخاصة في هذه المرحلة. ويجري الآن دراسة تحديد موقع مرافق وخدمات الميناء الجديدة، وقد تم حالياً تنفيذ دراسة لتقييم الأثر البيئي بما يتوافق مع المادة رقم 21 من قانون حماية البيئة لسلطة منطقة العقبة الاقتصادية الخاصة.

وحسب المتطلبات، تم عقد حلقة تشاورية في العقبة في 12 من شهر حزيران لعام 2007، حيث تمت دعوة جميع الأطراف المعنية بالموضوع للتعليق على خطة تطوير الموانئ. وتم عرض تفاصيل المشروع، والتبعات البيئية له، وتم تسجيل و مناقشة الملاحظات والنقاط الهامة. وقد سجل ما تم تداوله في الحلقة التشاورية، بما في ذلك محضر الجلسة بتفاصيلها، ضمن تقرير الحلقة التشاورية. في هذه المرحلة، فإن المشروع المعروف هو المخطط الرئيسي للميناء الجنوبي لعام 2006، والذي تضمن تعرض المرجان الموجود بالقرب من منطقة الميناء الجنوبي لأضرار جسيمة. وبالرغم من وجود إجماع عام على أن المشروع سيحسن إلى درجة كبيرة الإدارة البيئية للموانئ، و سيعمل أيضاً على تقليل التلوث البيئي الناتج عنها، إلا أن أحد أهم القضايا المطروحة كانت الأضرار التي ستلحق بالبيئة البحرية. وقد طلبت الأطراف المعنية بالموضوع إجراء دراسة مستفيضة، ولإلحاق القيمة المالية بالموارد المتضرر. ونتيجة لذلك، تمت مراجعة تصميم الميناء الجنوبي بحيث أخذت التأثيرات على المرجان والبيئة البحرية بعين الاعتبار. تم إدخال تعديلات كبيرة على المرافق العامة للحمولات، مما أدى إلى تقليل التأثير المباشر على المرجان. وقد تم عمل تقدير مالي للأضرار المباشرة – انظر لاحقاً.

سوف يتم تنفيذ تطوير الميناء الجنوبي من قبل القطاع الخاص، على أساس عقد تصميم - إنشاء - تمويل - تشغيل، بالاتفاق مع شركة تطوير العقبة. وسوف يتم استحداث طرف قانوني جديد - أداة لهدف معين - للتعاقد مع شركة تطوير العقبة من أجل ما ذكر آنفاً. سوف يتم التعاقد مع هذه الجهة لإنهاء العمل على تجهيز تصميم الميناء، المخطط التفصيلي وتفاصيل جميع أجزاء الميناء بالإضافة إلى تحديد المعدات والتقنيات الضرورية. وسيتم التعاقد مع إحدى الشركات الإنشائية لتنفيذ الأعمال. ولم يتم تضمين تفاصيل الأسلوب الإنشائي في المخطط الرئيسي، حيث ستترك للجهة المتعاقدة مع شركة تطوير العقبة، ولكن حسب المعطيات التي تحددها الأخيرة.

لذلك، سيكون الترخيص البيئي لهذا المشروع على مرحلتين، كما هو موضح في الجزء الثامن. وتتضمن المرحلة الأولى هذا التقييم للأثر البيئي للمخطط الرئيسي للميناء الجنوبي. ومن خلال إعطاء الرخصة البيئية للمخطط الرئيسي، فإن سلطة منطقة العقبة الاقتصادية الخاصة تقرر التالي:

- الفكرة العامة للمشروع، بما في ذلك تحديد الموقع والمخطط العام.
- توجه شركة تطوير العقبة حيال الموضوع البيئي الرئيسي، و هو الضرر الملحق بالمرجان و التعويض المرافق، بما في ذلك التزام شركة تطوير العقبة بدفع التعويضات.
- بأنه قد تم تحديد جميع مواضيع ودراسات التصميم المتبقية.
- متطلبات الأداء البيئي بشكل عام من أجل الإنشاء والتشغيل.
- متطلبات متابعة عمليات الإنشاء والتشغيل، كما وردت في خطة المتابعة البيئية.
- التنظيم المؤسسي الضروري لمتابعة المشروع.

لذلك، فإن النتائج الرئيسية لدراسة تقييم الأثر البيئي هي عبارة عن متطلبات أداء بيئية مفصلة لتصميم، وعمليات إنشاء وتشغيل بالإضافة إلى خطة متابعة بيئية. ولم يتم وضع العديد من إجراءات التخفيف والمجابهة والضبط المفصلة ضمن دراسة تقييم الأثر البيئي في المخطط الرئيسي، لأنه من الأفضل إتاحة المجال للقطاع الخاص لاقتراح سياسته، توجهاته، أساليبه وتقنياته الخاصة والتي تنتج عن تجربة عملية حديثة ومعايير الأداء الفضلى.

بعد التصميم التفصيلي، ستقوم الجهة القانونية المتعاقدة مع شركة تطوير العقبة، بتقديم وصف مفصل للمشروع، تقرير الوضع البيئي الحالي وخطة المتابعة البيئية لسلطة منطقة العقبة الاقتصادية الخاصة للمراجعة. ستضمن هذه الوثائق تقييم الجهة القانونية للمخاطر البيئية بالإضافة إلى طروحات مفصلة للإدارة البيئية - التقنيات، الضوابط، الموارد البشرية،... الخ. وحالما توافق سلطة منطقة العقبة الاقتصادية الخاصة على هذه الوثائق، تعتبر الالتزامات الموجودة ضمنه جزءاً من شروط الموافقة على المشروع. عندها تقوم سلطة منطقة العقبة الاقتصادية الخاصة بمتابعة والتفتيش على وتنظيم الإجراءات والأداء البيئي للجهة المتعاقدة مع شركة تطوير العقبة حسب النظام البيئي. ولن يكون لشركة تطوير العقبة أي دور في الأداء البيئي في هذه المرحلة أو غيرها، حيث سيتم إلحاق جميع المسؤوليات الموجودة ضمن النطاق البيئي بالجهة المتعاقدة وذلك حسب العقد المبرم. وستقوم سلطة منطقة العقبة الاقتصادية الخاصة بالتعامل مع أية تجاوزات أو خروقات للقانون تقوم بها الجهة المتعاقدة مع شركة تطوير العقبة.

هذه العملية ملخصة في الشكل 2

3. السياسة، الإطار القانوني والتنظيمي

يعرض البند الثالث من تقرير دراسة تقييم الأثر البيئي، السياق القومي و الدولي للمشروع. تتضمن الاتفاقيات الدولية الرئيسية التي تحكم الإدارة البيئية للموانئ، الاتفاقية الدولية لمنع التلوث من السفن (MARPOL 73/78) و الاتفاقية الدولية لسلامة الحياة في البحار (SOLAS 74) و معاهدات أخرى ذات علاقة. يتضمن مشروع تطوير الميناء إنشاء مرفق لتخزين المخلفات النفطية، وإزالة خزان النفط جرش - مما يتماشى مع تأدية بعض التزامات الأردن الدولية العالقة.

إن السياق البيئي التنظيمي لمنطقة العقبة الاقتصادية الخاصة موضح أيضاً، بالإضافة إلى السياسات، القوانين، الإجراءات و الممارسات التي تنطبق على الموانئ. تعتبر المادة رقم 21 من قانون حماية البيئة لسلطة منطقة العقبة الاقتصادية الخاصة، القانون المحلي السائد، مما يتيح لسلطة منطقة العقبة الاقتصادية الخاصة طلب إجراءات مراقبة و حماية صارمة من أية جهة. ومع ذلك، فإن التطبيق الصارم للقانون سيكون ضرورياً للتأكد من أن تأثيرات المشروع سيتم مجابهتها وتخفيفها بشكل كافٍ. ومن الأمور ذات العلاقة بهذا المشروع هي سياسة سلطة منطقة العقبة الاقتصادية الخاصة بعدم قبول أية مخرجات، والتي تمنع أية مخرجات أو إراقة أو سقوط المواد في البحر. وسيتحتم على مشغلي الميناء وضع الطرق و الأساليب المنهجية المثلى للإدارة البيئية. بالإضافة إلى ذلك، سوف يكون هناك رقابة دقيقة من جهة ثالثة خارجية لإنشاء و تشغيل الموانئ، خصوصاً فيما يتعلق بالبيئة البحرية و سلاسل الشعب المرجانية.

أما بالنسبة لتقييم الأضرار الملحق بالبيئة البحرية، فإن التعليمات رقم 37 لسلطة منطقة العقبة الاقتصادية الخاصة تسمح لها بفرض نفقات تعويضية، بعد أخذ قيمة و أهمية المصدر المتأثر بعين الاعتبار.

4. الوصف الابتدائي المرجعي للبيئة الموجودة

يصف البند الرابع من تقرير دراسة الأثر البيئي الجهد الكبير الذي تم عمله لوصف البيئة الموجودة، في موقعي الميناء الرئيسي و الجنوبي على حد سواء، مع التركيز على البيئة البحرية.

لقد كان موقع الميناء الرئيسي بحد ذاته موضوعاً لدراسة تلوث بيئي، والتي كشفت عن عدد من عناصر التلوث الثانوية التي سيتم إزالتها ومعالجتها خلال تفكيك وإعادة تأهيل الموقع. وتتضمن هذه ترسبات من غبار الفوسفات، كميات صغيرة من مواد منسكبة في البحر حول الأرصفة، ومنطقة واحدة فيها تلوث بسيط تحت التربة، نتجت عن تسرب مادة النفط في عام 2003، بالإضافة إلى المعدات و المنشآت التي سيكون من الضروري هدمها وإزالتها من الموقع. ولقد تم عمل حفر في التربة، وإجراء مسح بحري وفحص للموقع، بالتنسيق مع سلطة الموانئ، للخروج بوصف شامل ودقيق لوضع البيئة المحيطة.

ولقد تم أيضاً فحص موقع الميناء الجنوبي الموجود، وهو يعتبر أصلاً منطقة صناعية، حيث يوجد دلائل على وجود تلوث بسيط في كل من ناحية اليابسة (ويتضمن ترسبات ملحية ومواد صلبة للتحميل والتنزيل) و البيئة البحرية (ويتضمن ترسبات من الكبريت ومواد أخرى منسكبة في مياه البحر). وتعتبر محطة تخزين النفط، بما في ذلك خزان جرش للتخزين ذي سعة 300,000 طن، ومحطة تحميل الشاحنات، مصدر غير بسيط لخطر انسكاب النفط، والذي سوف يتم التخلص منه حال إنشاء محطة تخزين النفط الجديدة المقترحة. وكما في الميناء الرئيسي، تم عمل حفر في التربة وإجراء مسح بحري.

وقد تم التفويض لعمل مسح للوضوء، و نوعية الهواء، للحصول على بيانات حديثة لكل من الميناء الرئيسي و الجنوبي.

بشكل رئيسي، فإن أهم مورد بيئي في المنطقة هو البيئة البحرية، وبشكل خاص سلاسل الشعب المرجانية على طول المنطقة المحاذية للشاطئ بالقرب من الميناء الجنوبي. وقد فوضت شركة تطوير العقبة محطة العلوم البحرية في عام 2006 بإجراء مسح للمرجان، و قياس للعمق أيضاً. وقد استخدمت هذه المسوح و القياسات للخروج بوصف دقيق للمرجان الصخري و اللين في المنطقة، بالإضافة إلى الكائنات و النباتات البحرية الأخرى. و يكون المرجان القريب من الميناء الجنوبي جزءاً مهماً من سلاسل الشعب المرجانية في الأردن، ولكنه لا يقع ضمن السبع كيلومترات المحاذية للشاطئ والتي تقع ضمن نطاق حماية منتزه العقبة البحري. و تشير الدراسة إلى أن معظم السلاسل المرجانية في منطقة الميناء الجنوبي قد تضررت من التلوث وحركة السفن، ولكن يوجد بعض المناطق في خليج الدرة حيث تبدو سلاسل الشعب المرجانية فيها بحالة جيدة. ويعتبر موقع الغطس بجانب الجرف المائي في خليج الدرة موقعاً استثنائياً في الأردن، حيث رياضة الغطس المائي بوجود الجرف المائي هناك، ليس لها مثيل في المنطقة. وقد تم الحصول على نتائج نوعية المياه من برنامج مراقبة نوعية المياه الشهرية لمحطة العلوم البحرية.

5. تقييم بدائل المشروع

يوضح البند الخامس من تقرير دراسة التقييم البيئي كيف أن المشروع تحت التقييم يعتبر محصلة لعدة دراسات أقيمت بحسب المخطط الرئيسي لمنطقة العقبة الاقتصادية الخاصة لعام 2001، والذي يأخذ بعين الاعتبار بشكل متزايد الوضع البيئي. وقد تمت مقارنة وتقييم البدائل الثلاثة المطروحة، وهي أ) عدم تنفيذ المشروع، ب) إعادة تطوير الميناء الرئيسي و توسعة الميناء الجنوبي دون نقل المواقع، و ج) توسعة الميناء الجنوبي و نقل موقع الخدمات من الميناء الرئيسي، وتم التوصل إلى أن الخيار المطروح حالياً يمثل أفضل تسوية تأخذ بعين الاعتبار حماية البيئة و استغلال الموارد، بالإضافة إلى إيجاد الحلول للعديد من المشاكل البيئية الهامة من خلال هذا المشروع. و يعتبر الاستثناء الوحيد هو التأثير الحاصل على سلاسل الشعب المرجانية نتيجة للتوسعة في الميناء الجنوبي.

لقد تمت مقارنة مخططين بدليين بتفاصيلهما – المخطط الرئيسي للميناء الجنوبي 2006 و 2007، بشكل يوضح بأن مخطط عام 2007 المعدل قلل إلى حد كبير من التأثيرات الناجمة عن الإنشاءات، على البيئة البحرية في خليج الدرة. و يمثل هذا المخطط المعدل محاولة أخرى هامة وجدية من قبل شركة تطوير العقبة لتقليل التأثيرات على الشعب المرجانية إلى الحد الأدنى، دون التأثير على أهداف المشروع.

6. المشاورات والمناقشات العامة المفتوحة

يوثق البند السادس من تقرير دراسة الأثر البيئي الجهد الإضافي المبذول من قبل شركة تطوير العقبة وسلطة منطقة العقبة الاقتصادية الخاصة لإشراك العموم في التعليق على المشروع. حيث تم عقد خمس جلسات لحلفات مناقشة، بالإضافة إلى ثلاث مقابلات لدراسة معيارية، وذلك فوق ما هو مطلوب حسب متطلبات سلطة منطقة العقبة الاقتصادية الخاصة القانونية. و قد تم تسجيل النقاط والملاحظات التي تم طرحها من قبل المشاركين. وتتضمن النقاط الرئيسية المطروحة أ) صعوبة و تكاليف تنقل العاملين إلى الميناء الجنوبي، ب) التأثيرات الاجتماعية نتيجة احتمال وجود عمال أجانب، و ج) ضرورة توفير معلومات صحيحة في حينه عن المشروع. وقد تم طرح موضوع الأضرار الحاصلة للشعب المرجانية، واحتمالية فقدان طريق الوصول إلى خليج الدرة، و موقع الغطس بوجود الجرف المائي. بشكل عام، توقع المشاركون تحصيل عدة فوائد، من ضمنها أ) وضع موقع الميناء الرئيسي للنفع العام، ب) إيقاف نشاطات الميناء الرئيسي، و ج) الاستفادة الناتجة عن تزايد التجارة من خلال الميناء الجنوبي. وتمت الإشارة إلى المنفعة التي ستلحق بالعاملين في ميناء الحاويات في العقبة نتيجة لمشاركة القطاع الخاص في ميناء الحاويات، مع توقعات بالمعاملة بالمثل للعاملين في شركة موانئ العقبة.

تم وضع التوصيات، بما في ذلك القيام بدراسة اجتماعية اقتصادية للنظر في التأثير الناجم عن أية إعادة هيكلة محتملة للعمالة و عن مشاركة القطاع الخاص، وخصوصاً على عمال الموانئ وعائلاتهم، السكان في المنطقة المحيطة بالميناء، و مقدمي الخدمات. ولم تكن هذه النقاط من ضمن تقرير دراسة الأثر البيئي حيث لا تتوفر عنها حالياً أية تفاصيل. وقد تم أيضاً رفع توصيات بخصوص الكشف بشكل واضح عن المعلومات الخاصة بعملية التقدم للعطاء و التعاقد، بما في ذلك التواريخ وتحديد برامج لعملية نقل المواقع.

7. التأثيرات الناجمة عن المشروع

يوضح البند السابع التأثيرات السلبية و الإيجابية للمشروع، حيث وردت على شكل ملخص في جدول. باختصار، فإن أهم المنافع المتوقعة من المشروع هي كالتالي:

أ. المنفعة البيئية

- خفض انبعاثات غبار الفوسفات نتيجة لإغلاق مرافق الفوسفات في الميناء الرئيسي
- التقليل من الملوثات المؤثرة على وسط المدينة بسبب نقل موقع عمليات الميناء الرئيسي و انخفاض حركة سير الشاحنات في المنطقة.
- تحسين وضع البيئة البحرية في الميناء الرئيسي
- إنشاء أماكن عامة في الموقع المؤهل، بما في ذلك مناطق خضراء مزروعة
- استثمار كبير في تركيب وسائل حديثة لحماية البيئة في الميناء الجنوبي
- توفير مرفق لتخزين المخلفات النفطية

ب. المنفعة الاقتصادية

- توفير 313 دونم في موقع الميناء الرئيسي للاستثمار، التطوير العمراني، السياحي، التجاري، .. الخ.
- تشجيع المشاركة المتزايدة للاستثمارات الخاصة في مجال السياحة و التجارة في مدينة العقبة
- تزايد المرافق الترفيهية لسكان و زوار العقبة
- تسهيل عملية وصول العامة إلى الشاطئ في موقع الميناء الرئيسي
- زيادة العوائد المالية نتيجة لتوسعة الميناء و زيادة الفاعلية التشغيلية
- تحسين الأوضاع الصحية و السلامة و انخفاض الحوادث
- تحسين الأمن البيئي
- حصر نشاطات الموانئ في العقبة في المنطقة الصناعية
- زيادة فرص العمل في قطاعات البيع و التجارة، الضيافة و الفنادق، و الموانئ

تم حصر التأثيرات ضمن ثلاثة مجالات كالتالي:

أ. التأثيرات الناجمة عن إعادة تأهيل الميناء الرئيسي

- التأثيرات على البيئة الأرضية (التربة و المياه الجوفية عند أو إلى الأمام من مواقع التخلص من النفايات) بسبب التخلص من النفايات و الأنقاض
- احتمالية هجرة القوارض من الموقع بعد إغلاق مخازن الحبوب
- تأثيرات على الصحة و السلامة جراء عمليات الهدم

ب. التأثيرات الناجمة عن تطوير الميناء الجنوبي

- التأثيرات على البيئة البحرية جراء التجريف، رسو السفن، الردم و الطمر – انظر الجدول اللاحق
- التأثيرات على نوعية المياه البحرية جراء التجريف، رسو السفن، الردم و الطمر
- التأثيرات على البيئة البحرية جراء تسرب أو تصريف المواد الصلبة أو السائلة
- التأثيرات على نوعية الهواء و البيئة الأرضية جراء النشاطات الإنشائية في الأراضي في المنطقة
- التأثيرات على نوعية الهواء و البيئة الأرضية جراء نقل المواد، المعدات و العمال
- التأثيرات على الطرق و البنية التحتية لعمليات النقل
- التأثيرات جراء عمليات استخراج الحجارة
- التأثيرات على الصحة و السلامة
- التأثيرات الضارة على أنابيب الغاز

سوف يتعرض حوالي 38,000 متر مربع من المرجان الصخري إلى تأثير مباشر أثناء عمليات الإنشاء. ويُلخص الجدول اللاحق أين و لماذا يحدث ذلك.

الوصف	مساحة المرجان الصخري الحي المتأثر (متر مربع)	منطقة التأثير
تجريف جزء صغير من السلاسل المرجانية في المياه الضحلة من أجل قناة الملاحة	1,250	خليج الدرة جنوب
تجريف و طمر الأرض مما يزيل سلاسل من المرجان في المياه الضحلة	17,900	خليج الدرة شمال
تجريف سلاسل المرجان في المياه الضحلة	1,500	الرصيف الصناعي
التجريف و إنشاء الأرصفة و قواعد الأرصفة في مناطق سلاسل الشعاب في المياه الضحلة	500	مرسى المواد السائلة الصناعية
التجريف و إنشاء الأرصفة و قواعد الأرصفة في مناطق سلاسل الشعاب في المياه الضحلة	3,150	مرسى الفوسفات
الردم و الطمر	700	مرسى الحبوب
الردم و الطمر مع مد اليابسة	7,500	مرسى الحبوب و مرسى المواد السائلة المتنوعة
مكب للنفايات، تجريف و إنشاء قواعد الأرصفة	5,476	ميناء العبارات
	37,976	المجموع

ج. التأثيرات عند الميناء الجنوبي أثناء تشغيل الميناء

- التأثيرات على البيئة البحرية جراء الانسكاب، التسربات و/أو السيول الناتجة عن الأمطار
- التأثيرات على البيئة البحرية من تصريفات السفن
- التأثيرات على البيئة البحرية جراء رسو السفن
- التأثيرات على البيئة البحرية جراء الانسكاب و الانبعاثات في الهواء جراء التحميل و التنزيل
- التأثيرات الإيجابية على الكائنات و النباتات البحرية جراء إنشاء مناطق محمية جديدة
- التأثيرات على نوعية الهواء جراء تحميل، تنزيل و التعامل مع البضائع
- التأثيرات على الصحة و السلامة جراء التشغيل
- التأثيرات على نوعية الهواء جراء نقل الفوسفات
- تأثيرات أخرى جراء النقل
- التأثيرات على الخدمات و البنية التحتية جراء تزايد الاستعمال لها

تم إدراج سبب، أهمية، إمكانية عكس و المدى الزمني لكل من التأثيرات في البند السابع

8. التخفيف من و التعويض عن الخسائر في الشعب المرجانية

تم إجراء تقدير مالي للأضرار التي ستلحق بالشعب المرجانية جراء عمليات التجريف، الطمر و الردم الضرورية لإنشاء مرافق الميناء الجديدة و ميناء العبارات. استخدم التقدير مزيجاً من تحليل مرادفات القيمة/المسكن الطبيعي/المورد و تم تنفيذه بحسب مبادئ Equator لمؤسسة التمويل الدولية، معيار الأداء رقم 6. وهذا يؤكد أهمية عدم المساس بتنوع أشكال الحياة البحرية، و يتيح المجال لمجموعة من أشكال التعويض من ضمنها إعادة تأهيل المساكن الطبيعية بعد التشغيل، موازنة الخسائر عن طريق خلق مناطق مشابهة بيئياً، و تعويض المستفيدين بشكل مباشر من تنوع أشكال الحياة في المنطقة.

وقد أدى التقدير المادي إلى وضع التوصيات التالية:

1. التعويض للأضرار المباشرة

تم حساب قيمة التعويض بـ 9 مليون دولار أمريكي، بالنظر إلى إزالة 38,000 متر مربع من الشعب المرجانية الصخرية الحية عند مرافق الميناء الجديدة، و تم التوصل إلى مبلغ 5.2 مليون دولار أمريكي تكلفة إزالة 5,476 متر مربع من الشعب المرجانية الصخرية الحية عند ميناء العبارات الجديد و قد تم عمل التوصيات التالية لتنفيذ هذه التعويضات:

- إنشاء مسكن طبيعي مرادف يماثل سلاسل اصطناعية ستزرع بالمرجان المأخوذ من خليج الدرة قبل البدء بعمليات الإنشاء.
- بالإضافة إلى حاضنات اصطناعية و رؤوس مرجانية نمت في حاضنات اصطناعية
- مراقبة عملية إعادة زرع المرجان
- مساهمة مالية للمساعدة على تقوية الإدارة و تعزيز القوانين في المنتزه البحري، بما في ذلك دراسة تمويلية، لزيادة حماية إجمالي موارد الأردن من المرجان.
- المساهمة في رصد مبالغ للتعليم العام، مما سيساهم في زيادة الوعي بالنسبة لأهمية المرجان و البيئة البحرية في الأردن
- تسجيل وثائقي يتناول سلاسل الشعب المرجانية في خليج الدرة و الجرف المائي هناك، على أن يتم عمله قبل الشروع بعمليات الإنشاء

2. التعويض في حال إعاقه الوصول إلى موقع الغطس المائي

لقد صرحت شركة تطوير العقبة بوجود عدم حدوث أية معيقات للغطس في موقع الغطس بجانب الجرف المائي في خليج الدرة، ولن يكون هناك أضرار مباشرة لهذا الموقع جراء عمليات إنشاء الميناء. مع ذلك، فقد تم تقدير قيمة التعويضات في حال حدوث معيقات لعمليات الغطس في هذا الموقع. وقد حسبت التعويضات بـ 1,2 مليون دولار أمريكي على افتراض وجود معيقات جزئية للوصول إلى الموقع. و سوف يستخدم هذا الرقم لتوفير قيمة تعويضية، لإنشاء موقع ذي أهمية خاصة للغطاسين المختصين على سبيل المثال، وأيضاً لتوفير طرق و مرافق أفضل للغطاسين للوصول إلى مواقع على طول الشاطئ. ويمكن أن يتضمن الموقع الجديد منحوتات مرجانية تحت الماء، أو ما يضاهي ذلك بالأهمية، على مستوى العالم.

9. متطلبات الأداء و خطة المتابعة البيئية

تم تحديد أو التوصية بعدد من الإجراءات الزائدة عن نص العقد خلال عملية التقييم البيئي، وذلك لتعزيز الإدارة البيئية للميناء. وهي تتضمن:

- دراسة حماية وثبات خط الغاز الطبيعي
- دراسة البنية التحتية للنقل وسلامته
- تشكيل لجنة لموضوع تعويض المرجان
- فيلم وثائقي عن الحديقة المرجانية في خليج الدرة
- إدارة عمليات الغطس في موقع الغطس في خليج الدرة
- دراسة اجتماعية – اقتصادية لنقل الميناء

بالإضافة إلى ذلك، تم تحديد متطلبات ضرورية معينة للتصميم النهائي للميناء الجنوبي. هذه المتطلبات تتطرق لعدة نقاط مثل:

- التصميم مع أخذ الإدارة البيئية بعين الاعتبار
- تخفيف التأثيرات على البيئة البحرية
- الاحتواء والتصريف
- التصميم لمجابهة تأثيرات الزلازل
- مخططات أماكن مرافق الميناء لأجل الصحة والسلامة
- التصميم مع أخذ منع حدوث الظروف المسببة لانخفاض نسبة الأكسجين في الماء في حوض البضائع العام، بعين الاعتبار
- وضع ضوابط استخدام لمرفأ السفن وحوض البضائع العام
- التصميم مع أخذ سلامة الأغذية ومجابهة خطر الانفجارات في منطقة تخزين الحبوب، بعين الاعتبار
- ضبط انبعاثات الغبار

عندها، يتم تحديد متطلبات الأداء، والتي ستنقل للجهة المتعاقدة مع شركة تطوير العقبة ضمن العقد. وتالياً ملخص للمواضيع المطروحة:

أ. إعادة تأهيل الميناء الرئيسي

- ضبط عملية التخلص من المواد الخطرة (الأسبست، و PCB)
- ضبط عملية إزالة الملوثات غير الخطرة
- إزالة المواد من قاع البحر
- هدم وإزالة البنية التحتية
- مكافحة القوارض
- توجيهات لتطوير الميناء الرئيسي

ب. إنشاء الميناء الجنوبي

- حماية نوعية المياه و المساكن الطبيعية أثناء القيام بالأعمال البحرية
- ضمان سلامة أنابيب الغاز
- تخزين المواد
- ضبط الانسكابات
- ضبط الضوضاء
- ضبط الانبعاثات في الهواء
- تدبير المخلفات
- التأثيرات على البنية التحتية
- إدارة ورشة الإنشاء البحري
- الصحة والسلامة
- تزويد الحجارة

ج. تشغيل الميناء الجنوبي

- إدارة السفن، رسو و تثبيت السفن، الاتصالات و رفع التقارير
- تحركات السفن
- تحميل، تنزيل و تدبير البضائع
- نقل الفوسفات
- ضبط التصريف و الانسكابات
- التصريف الحراري
- تخزين المواد
- حوض الشحنات العام
- ميناء العبارات

10. خطة المتابعة البيئية

تم وضع خطة متابعة بيئية تحدد إجراءات المتابعة الضرورية لمتابعة التأثيرات البيئية. وتتعامل هذه الخطة مع مراحل المشروع:

- مرحلة ما قبل الإنشاء
- مرحلة الإنشاء
- مرحلة ما بعد الإنشاء
- مرحلة تشغيل الميناء

وتتعامل أيضاً مع التأثيرات على البيئة البحرية، نوعية الهواء، وتتعامل أيضاً مع موقع الميناء الجنوبي، محطة نقل الفوسفات في وادي اليتم، و الطريق الخلفي.

11. الترتيبات المؤسسية والإجرائية الضرورية للتعهد بالمتطلبات البيئية

يطرح هذا القسم من دراسة تقييم الأثر البيئي تفصيلاً للإطار العام المؤسسي لتدابير الإدارة البيئية أثناء الإنشاء والتشغيل. ويتضمن أيضاً المؤسسة والدائرة المسؤولة عن تنفيذ كل إجراء، بالإضافة إلى نظام رفع التقارير وتكرارها، وتحديد مسؤولية الموافقة والتوقيع النهائي على التطبيق الناجح للتدابير. وتالياً المؤسسات التي ستضلع بالمسؤولية المذكورة أعلاه:

- شركة تطوير العقبة. وهي الجهة المانحة المسؤولة عن تطوير الميناء الجنوبي والتي ستظل مرتبطة في المراحل التي تتبع الإحالة.
- الجهة المتعاقدة، والتي تمثل الجهة التي يحال عليها العطاء، والتي ستقوم بتصميم، إنشاء، تمويل وتشغيل مرافق الميناء الجديد. وستمثل هذه الجهة العميل لأغراض التصميم والتنفيذ اللاحقة.
- سلطة منطقة العقبة الاقتصادية الخاصة، وهي الجهة المنظمة لشؤون البيئة والتخطيط. ستكون مسؤولة عن الموافقة على دراسة الوضع البيئي الحالي، بيان أسلوب البناء والوصف التفصيلي للمشروع والتي ستقدمها الجهة المتعاقدة، لضمان

توافقها مع نظام الحناية البيئية رقم 21\2001 وخصوصاً البنود الموجودة ضمن ترخيص المخطط الشمولي وتقييم الأثر البيئي الخاص به.

- اللجنة التوجيهية. تتألف من مندوبين عن سلطة منطقة العقبة الاقتصادية الخاصة، شركة تطوير العقبة، ممثلي العميل، الجهة المتعاقدة ومؤسسات أخرى تقوم على البحوث والدراسات حسب الضرورة للقيام بالمهام الموكولة إليها. وستتطلع هذه اللجنة بمهام الجهة المنسقة الاستشارية أثناء تصميم، إنشاء وتشغيل المشروع.

12. الخلاصة

إن هذا المشروع هو توجه كبير، بتكلفة تقدر بـ 100 مليون دولار أمريكي. وتعتبر الفوائد المتوقعة للبيئة في منطقة الميناء الرئيسي ولإدارة البيئة في الميناء الجنوبي أيضاً هامة وكثيرة. ويمكن إيجاد الحلول للعديد من المشاكل البيئية من خلال هذا المشروع. بالإضافة إلى ذلك، فإن الفوائد الاقتصادية المرجوة من تطوير سعة صناعية إضافية في الميناء سوف تسمح بتوسيع المنطقة الصناعية الجنوبية، مع ما يترتب على ذلك من فوائد. وسيكون في ترك موقع الميناء للاستثمارات التجارية والسياحية تعزيزاً لتطوير مدينة العقبة.

بالإضافة إلى التأثيرات الاعتيادية المرتبطة بعمليات الإنشاء في المشاريع الإنشائية الكبيرة، تعتبر التأثيرات على البيئة البحرية في الميناء الجنوبي من أهمها وأكبرها. وقد تم التقليل من التأثيرات المباشرة على البيئة البحرية إلى حد كبير في مرحلة التصميم، ولكن ما يبقى من التأثيرات لا يمكن تجنبه. وسوف يتم تعويض الأضرار بما يتوافق مع تقدير تم تنفيذه حسب معايير دولية، في أول مثال محلي في الأردن لتعويض بيئي على هذا المستوى.

وسيؤدي تطبيق و مراقبة نقاط الضبط البيئية في الميناء الجنوبي إلى تقليل الانبعاثات و كمية الانسكابات، مما سيققل التلوث الناتج من الأردن في خليج العقبة، بالرغم من الزيادة الكبيرة في سعة و مخرجات الميناء. وسيكون على سلطة منطقة العقبة الاقتصادية الخاصة مراقبة تطبيق مخططات الإدارة البيئية النهائية عن كثب.

بشكل عام، فإن الأطراف المعنية بالمشروع تدعم تنفيذ المشروع، مدركة فوائده الاستراتيجية و الاقتصادية للأردن، بالإضافة إلى الفوائد البيئية، فيما يطالبون بتعويض عن الخسارة في الشعب المرجانية.

EXECUTIVE SUMMARY

1.0 Introduction - The Ports Development Project

Aqaba Development Corporation intends to close port operations at the Main Port of Aqaba, and to relocate the services to an expanded and modernized South Port, on Aqaba's southern coastline. This project is known as the Ports Development Project. These plans broadly follow the recommendations made in the Aqaba Special Economic Zone Master Plan, which was published in 2001. The Project includes;

Main Port

- Cessation of operations
- Removal and dismantling of equipment
- Removal of environmental contamination
- Demolition and removal of structures
- *Future redevelopment of the Main Port site into an urban and commercial centre*

South Port

- Construction of new miscellaneous liquid berth and terminal
- Construction of new grain berth, including unloaders and storage silos
- Construction of new industrial terminal for bulk material - phosphate and industrial dry bulk materials and liquids. Facilities will include berths and ship loaders, conveyors, storage, truck unloading facilities, refurbishment of industrial jetty, terminal facilities and utilities
- General cargo berths with capacity for RoRo, including a newly excavated cargo basin, marine services facilities, RoRo facilities, grain storage, break-bulk berths, outfall, boat yard, handling and storage equipment

The Project is set out in more detail in the South Port Master Plan 2007, and in subsequent documents prepared in 2006 and 2007 by Royal Haskoning, for ADC. Figure 1 illustrates the planned layout at the South

ASEZA requested a leading edge and comprehensive EIA study to be conducted, and this Executive Summary is a synopsis of the draft EIS which has been prepared and submitted to ASEZA for comment and final approval.

2.0 Environmental Clearance of the Project

The original ASEZ Master Plan 2001 underwent significant public consultation before it was adopted, including the completion of a Strategic Environmental Assessment (SEA). The strategic decision on expanding the South Port, relocating services from the Main Port, and developing the Main Port site, was taken and approved by ASEZA at this stage. The siting of the new port services and facilities is now being examined, and an Environmental Impact Assessment (EIA)

has now been carried out in accordance with ASEZA's Environmental Protection Regulation No 21.

In accordance with the legislative requirements, a Scoping Session was held in Aqaba on 12th June 2007, where affected stakeholders were invited to comment on the Ports Development Plan. Presentations on the project details, and the environmental implications were made, and comments and concerns were registered and discussed. The deliberations of the Scoping Session, including full minutes of the meeting, are set out in the Scoping Report.

At this stage, the project presented was the South Port Master Plan 2006, which included significant damage to corals near the South Port. While there was broad agreement that the project would significantly improve the environmental management of the ports, and should, on balance, reduce environmental contamination from the ports, one of the key concerns raised was the damage to the marine environment. The stakeholders asked for this to be assessed in detail, and for a monetary value to be attributed to the damaged resource. As a result, the design of the South Port was revised to minimise the impact on the marine environment and the corals. Significant revisions to the general cargo facilities were made, which reduced the total direct coral impact. An economic valuation of the direct damage was carried out – see later. The EIS was submitted to ASEZA and revised following their comments. The revised version was presented at a Final Review Session in Aqaba on 8th May 2008, in accordance with ASEZA's regulations.

The South Port development will be carried out by the private sector, as a Design – Build – Finance – Operate Contract, under agreement with ADC. A new legal entity (or entities) – to be termed here a Special Purpose Vehicle (SPV) – will be created to contract with ADC for the above. The SPV will be contracted to finalize the port design, develop the detailed layout and makeup of each of the port components, and specify equipment and technology. A contractor will be appointed to construct the works. Details of the construction approach have not been set in the Master Plan and will be left to the SPV to develop. The port will then be operated by the the SPV, within the parameters to set by ADC.

Environmental clearance of this project will therefore be a two stage process. This is outlined in Section 8, and summarized in Figure 2. The first stage includes this Environmental Impact Assessment of the South Port Master Plan. In granting environmental clearance on the Master Plan, ASEZA is approving:

- the overall project concept, together with the siting and overall layout
- ADC's approach to the key environmental issue of the coral damage and compensation, including ADC's commitments to compensation payments
- that any remaining design issues and studies have been identified
- the overall environmental performance requirements for construction and operation
- the monitoring requirements for construction and operation, as set out the Environmental Monitoring Plan
- the institutional set up required to follow up on the project

The main outputs from this EIS are therefore environmental performance requirements for detailed design, construction and operation, and an Environmental Monitoring Plan. Many of the detailed environmental mitigation and control measures have not been developed in the EIS

on the Master Plan, since it is beneficial to allow the private sector to propose its own policies, approaches, methodology, and technologies, and borne out of up to date practical experience and best practice.

Following detailed design, the SPV will then submit a Detailed Project Description, a Baseline Environment Statement and the EMP for ASEZA to review. These documents will include the SPV's environmental risk assessments and detailed proposals for environmental management – technology, controls, staffing, etc. Once ASEZA accepts these documents, the commitments contained therein, become part of the conditions of approval for the project. ASEZA will then monitor and inspect and regulate the activities and the environmental performance of the SPV in accordance with the Environmental Regulation. ADC will have no involvement regards to environmental performance in this or subsequent stages, as all environmental responsibility will have been passed to the SPV through the contract. Non-compliances or breaches of the legislation will be dealt with directly by ASEZA, acting on the SPV.

3.0 Policy, Legal and Regulatory Context

Section 3 of the EIS sets out the international and national context for the project. Key International Conventions governing environmental management of ports include the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78), and the International Convention for the Safety of Life at Sea (SOLAS 74) and other related treaties. The Port Development Project includes the establishment of an oil waste reception facility, and the removal of the oil storage vessel Jerash – which go towards meeting some of Jordan's outstanding international obligations.

The environmental regulatory context of the Aqaba Special Economic Zone is also described, together with the policies, legislation, procedures and practices which will apply to the ports. ASEZA's Environmental Protection Regulation No 21 is the governing local legislation, which allows ASEZA to require strict controls and protection measures from any entity. However, strong application of the regulation will be necessary to ensure that the project's impacts are adequately mitigated. Of particular relevance to this project is ASEZA's 'zero discharge policy', which prohibits any discharge or spillage of material to the sea. The ports operators will be required to establish best practice procedures and methodology for environmental management. In addition, there will be significant third party scrutiny of both the construction and operation of the ports, particularly with regard to the marine environment and the coral reefs.

Regarding the evaluation of damages to the marine environment, ASEZA's Instruction No 37 allows ASEZA to apply compensation charges, after taking into account the value and significance of the impacted resource.

4.0 Baseline Description of the Existing Environment

Section 4 of the EIS sets out the significant amount of work carried out to describe the existing environment, at both the Main and South port sites, with a focus on the marine environment.

The Main Port site itself has been the subject of an environmental contamination study, which has revealed a number of minor elements of contamination, which will be removed and addressed during the decommissioning and rehabilitation of the site. These include the phosphate dust deposits around the site, small amounts of spilled material on the sea bed around the quays, and one area of mildly contaminated sub-soil, resulting from an oil leak in 2003, as well as the equipment and structures at the site which will need demolishing and removal. Sub-soil boreholes, a marine survey and site inspections, in conjunction with the Ports Authority were carried out to provide a full characterisation of the state of the environment.

The existing South Port site was also investigated. The site is already an industrial area, and there is evidence of mild contamination of both the landward side (including deposits of salts and solid material for loading and unloading) and the marine environment (with sulphur deposits and other spilled material on the sea bed). The oil terminal, with the 300,000 tonne storage tanker Jerash, and truck loading station, constitute a significant oil spill risk, which will be eliminated once the proposed new Oil Terminal is established. As with the Main Port, sub-soil boreholes and a marine survey were carried out.

An air quality and noise survey was also commissioned to provide up to date data for both the Main and South Ports.

By far the most significant environmental resource of the area is the marine environment, with particular interest in the coral reef habitats along the coastline near the South Port. ADC commissioned a coral survey from the Marine Science Station (MSS) in 2006, and also a bathymetric survey. These were used to compile a thorough description of the hard and soft corals of the area, as well as the other flora and fauna. The corals close to the South Port constitute an important part of Jordan's coral reef, but do not lie within the 7 km of coastline which is protected in the Aqaba Marine Park. The study shows that much of the coral fields at the South Port are already impacted by contamination and ship activity, but there are areas of reef flat in Dirreh Bay which are in good condition. The Dirreh Bay Wall Dive Site is a particularly unique dive site within Jordan, providing a wall dive, unlike that found elsewhere in the vicinity. Water quality results were obtained from the monthly MSS water quality surveillance programme.

5.0 Assessment of Project Alternatives

Section 5 of the EIS illustrates how the Project under assessment is the culmination of a number of studies, produced in response to the ASEZ Master Plan 2001, which increasingly take into account the environment. The 3 available strategic options of a) no-project, b) redevelopment of Main Port and expansion of South Port without relocation, and c) expansion of South Port and relocation of services from the Main Port were comparatively assessed, with the conclusion that the currently proposed option represents the best balance of environmental protection and use of resources, with many important environmental problems actually being solved by the project. The one exception is the impact on the coral reef as a result of the expansion of the South Port. Details of management processes to minimise this effect have been identified.

Two detailed layout alternatives – the South Port Master Plan 2006, and 2007 were compared, clearly illustrating that the revised 2007 Plan has dramatically reduced the direct construction impacts on the marine environment in Dirreh Bay. This revised plan represents an important and significant attempt by ADC to reduce again the impacts on the corals to a minimum, without affecting the project objectives.

6.0 Consultation and Public Disclosure

Section 6 of the EIS documents the additional work carried out by ADC and ASEZA to engage the public in commenting on the project. 5 Focus Group Discussions, and 3 Structured Interviews were held, over and above ASEZA's regulatory requirements. The issues and concerns which were raised by the participants were documented. The key issues raised included a) the difficulties and costs of transportation of workers to the South Port, b) the social impacts from possible increased number of foreign workers, and c) the need for provision of timely information on the project. The damage to corals, and the possible loss of access to Dirreh Bay and the Wall Dive Site were also raised. In general, participants anticipated overall benefits,

including a) release of the Main Port site for public use, b) removal of Main Port activity, and c) knock on benefits from increased trade through the South Port. The positive benefits to ACT workers as a result of private sector involvement in the Container Terminal were referred to, with expectations of a similar treatment of APC labour.

Recommendations were made, including the carrying out of a socio-economic study to examine the impact of any potential labour restructuring and private sector involvement, especially on the ports workers and families, the residents of the ports neighbourhood, and service providers. This was not included in the EIS since no details are currently known. Clear disclosure of information on the bidding and contracting process, including dates and relocation schedules, was also recommended.

7.0 Project Impacts

Section 7 sets out the positive and negative impacts of the project. A tabular summary is presented. In summary, the most significant benefits expected from the Project are as follows;

A. Environmental Benefits

- Reduction in phosphate dust emissions due to the closure of the phosphate facility at the Main Port
- Reduction of pollutants from town centre due to relocation of Main Port operations, and reduction of truck traffic in the area
- Recovery of the marine environment at the Main Port
- Creation of public space on the rehabilitated site, including irrigated landscaping
- Significant investment in the installation of new environmental protection measures at the South Port
- Provision of an oil waste reception facility as required by MARPOL

B. Economic Benefits

- Release of 313 hectares at Main Port site for investment, development of residential/tourism/commercial/etc
- Knock on encouragement of increased private investment in tourism and commercial purposes in Aqaba town
- Increased availability of amenities for Aqaba residents and visitors
- Improved public access to waterfront at the Main Port site
- Increased fiscal take as a result of port expansion and more efficient operations
- Improved health and safety and reduced accidents
- Improved environmental security
- Clustering of Aqaba port activities into the Industrial Zone

- Increased employment opportunities in both retail, hospitality, commercial and ports sectors

The impacts were considered in three areas, as follows

A. Impacts from Main Port Rehabilitation

- Impacts on the terrestrial environment (soil and groundwater at or downstream of the disposal sites) from the disposal of scrap and waste
- Risk of migration of rodents from the site after closure of the grain storage
- Health and safety impacts from demolition

B. Impacts from South Port Development

- Impacts on the marine habitat from dredging, anchoring, piling and land reclamation – see table below.
- Impacts on the marine water quality from dredging, anchoring, piling and land reclamation
- Impacts on marine environment from leakage or discharge of solid or liquid material
- Impacts on air quality and terrestrial environment from land-based construction activities
- Impacts on air quality and terrestrial environment from transportation of materials, equipment and labour
- Impacts on roads and transportation infrastructure
- Impacts from quarrying
- Health and safety impacts
- Impacts of damage to the gas pipeline

Around 38,000 m² of hard coral will be directly impacted during construction. The table below summarizes where and why this occurs.

Zone of Impact	Area of live hard coral affected m ²	Description
Dirreh Bay South	1,250	Dredging of small portion of shallow reef flat for navigation channel
Dirreh Bay North	17,900	Dredging and filling of land removing shallow reef flat
Industrial Jetty	1,500	Dredging of shallow reef flat
Industrial Liquids Berth	500	Dredging and construction of jetty and dolphins in shallow reef flat
Phosphate Berth	3,150	Dredging and construction of jetty and dolphins in shallow reef flat
Grain Berth area	700	Reclaiming with fill
Grain Berth area and Miscellaneous Liquids Berth	7,500	Reclaiming with fill and extension from land
Ferry Terminal	5,476	Landfill, dredging and creation of the mooring dolphins
Total	37,976	

C. Impacts at the South Port During Operation of the Port

- Impacts on marine environment from spillage, leakage and/or storm water runoff
- Impacts on marine environment from ship discharges
- Impacts on marine environment from ship anchoring and berthing
- Impacts on marine environment from spillage and emissions to air from loading and unloading
- Beneficial impacts on marine flora and fauna from creation of new sheltered areas
- Impacts on air quality from cargo loading, unloading and handling
- Impacts on health and safety from operations
- Impacts on air quality from the transportation of phosphate
- Other impacts from transportation
- Impacts on utilities and infrastructure from increased demand

The cause, significance, reversibility and term of each impact are listed in Section 7.

8.0 Mitigation and Compensation of Coral Loss

An economic valuation of the coral damage envisaged from the dredging, land reclamation and piling required for the construction of the new port facilities and ferry terminal was carried out. The valuation used a combination of the value/habitat/resource equivalency analysis and was carried out in accordance with the IFC's Equator Principles Performance Standard 6. This sets out the aim of ensuring that no net loss of biodiversity occurs, and allows a combination of compensatory actions including i) post-operative restoration of habitats, ii) offset of losses through the creation of ecologically comparable area(s), and iii) compensation to direct users of biodiversity.

The valuation gave rise to the following recommendations;

1. Compensation for Direct Damages

A compensation value of **USD 9.0 M** was calculated, related to the removal of 32,500 m² of live hard coral at the new port facilities and a **USD 5.2 M** was calculated related to the removal of 5,476 m² of live hard coral at the new ferry terminal. The following recommendations were made for application of this compensation;

- Create an equivalent habitat consistent of artificial reefs with corals transplanted from Dirreh Bay before construction begins. Also including artificial substrate and nursery grown coral nubbins.
- Monitor the coral transplanting process
- A financial contribution to help strengthen the management and enforcement of regulations in the Marine Park, including a financing study, to increase the protection to the bulk of Jordan's coral resource
- Contribution to a public education fund which will help to raise awareness of the importance of the corals and Jordan's marine environment
- Documentary record of the Dirreh Bay coral reef and the Wall, to be taken before construction works begin

9.0 Performance Requirements

Section 9 of the EIS sets out the requirements on the project which will be necessary to ensure that adequate mitigation of all environmental impacts is achieved.

During the environmental assessment process, a number of extra-contractual actions were identified or recommended to support the environmental management of the port. These include;

- Stability and Protection Study on the Natural Gas Pipeline
- Transportation Infrastructure and Safety Study
- Formation of Coral Compensation Committee
- Film Documentation of Coral Garden in Dirreh Bay

- Management of Diving at Dirreh Bay Wall Site
- Socio-economic Study on Relocation

In addition, certain specific requirements for the final design of the South Port were identified. These address issues such as;

- Design for Environmental Management
- Minimization of Impacts on Marine Habitat
- Containment and Drainage
- Design for Seismic Effects
- Layout of Port Facilities for Health & Safety
- Design for Prevention of Hypoxic Conditions in the General Cargo Basin
- Setting Usage Constraints for the Boat Yard at General Cargo Basin
- Design for Explosion Risk and Food Safety at Grain Storage Area
- Control of Dust Emissions

Performance requirements are then set out, which will be passed to the SPV through the contract. The topics addressed are summarized below;

A. Main Port Rehabilitation (will not be carried out by South Port SPV)

- Control of hazardous material removal (asbestos, PCBs)
- Control of non-hazardous contamination removal
- Removal of material from sea bed
- Infrastructure demolition and removal
- Rodent control
- Guidelines for Main Port development

B. South Port Construction

- Protection of water quality and habitat during marine works
- Security of the gas pipeline
- Storage of materials
- Spill management
- Control of noise

- Control of emissions to air
- Waste management
- Impacts on infrastructure
- Management of marine construction plant
- Health and safety
- Supply of rock

C. South Port Operation

- Ship management, docking and anchoring, communication & reporting
- Ship movements
- Cargo loading, unloading & handling
- Phosphate transportation
- Drainage and spills management
- Thermal discharges
- Storage of materials
- General Cargo Basin
- Ferry Terminal

10.0 Monitoring Requirements

Monitoring Requirements were then developed which set out the monitoring measures required to monitor the environmental impacts. These address the project phases;

- Pre-construction
- Construction
- Post Construction
- Port Operation

and address impacts on the marine environment, air quality, and addresses both the South Port site, the new Phospahte Transfer Station in Wadi Yutum, and the Back Road. The Requirements include specific details on the type of monitoring, including location, parameters, frequency and reporting.

11.0 Institutional and Procedural Arrangements for Environmental Compliance

This section of the EIS offers a detailed layout to institutional framework for environmental management actions during construction and operation. It also includes the responsible institution and department for implementation of each action, along with reporting structure and frequency, and the final sign-off responsibility for successful implementation of that action. The institutional entities that will take on responsibilities are;

- *ADC - the* Grantor, responsible for the South Port Development as well as continue to be engaged in the subsequent stages of award.
- *SPV* – the Special Purpose Vehicle representing the successful bidder, who will design, build, finance and operate the new port facilities. The SPV will act as the Client for the subsequent design and construction work.
- *ASEZA* – Planning and Environmental Regulator, is responsible for the approval of the SPV Baseline Environment Study, Construction Method Statement and Detailed Project Description making sure they comply with the Environmental Protection Regulation No. 21/2001 and in particular the provisions contained within the Master Plan Clearance and its EIA.
- *Oversight Committee OSC* – Comprised of representative from ASEZA, ADC, Client Representative, the SPV and other required expertise and research institutions as deemed necessary to carry out its mandate. The OSC will act as an advisory and coordinating body during the design, construction, and operation of the project.

12.0 Conclusion

This Project is a major venture, with an estimated capital cost of USD 600 M. The potential benefits to the environment at the Main Port, and to environmental management of the South Port are significant. A number of current environmental problems will be solved by this project. In addition, the potential economic benefits of developing additional industrial port capacity will allow expansion of the Southern Industrial Zone, along with the knock-on economic and social benefits this will provide. The release of the Main Port site for commercial and tourism investment will be a major boost to the development of the town of Aqaba.

Besides the usual construction related impacts from major construction projects, the impact on the marine environment at the South Port is the one major significant impact of the project. As a result of the EIA process, mapping of the coral resource, and consultations with stakeholders, the direct impacts to the marine environment were significantly reduced by revising the design of the port layout to reduce the area of land reclamation required. Unavoidable remaining impacts to the corals will be compensated in accordance with a valuation carried out to international principles, in the first domestic Jordanian example of environmental compensation on this scale.

Of the positive aspects of the project is that investments in up to date environmental management technology, and the application and monitoring of strict environmental controls at the South Port will reduce the emissions and quantities of spillage, and result in an overall reduction of contamination to the Gulf of Aqaba from Jordan, despite the increased port capacity and throughput. A compliance framework has been designed, to rigorously enforce the implementation of the recommended environmental management requirements.

Overall, the stakeholders have come out in support of the project, realizing its strategic economic benefits to the country, as well as the environmental benefits, while requesting compensation for the loss of coral.

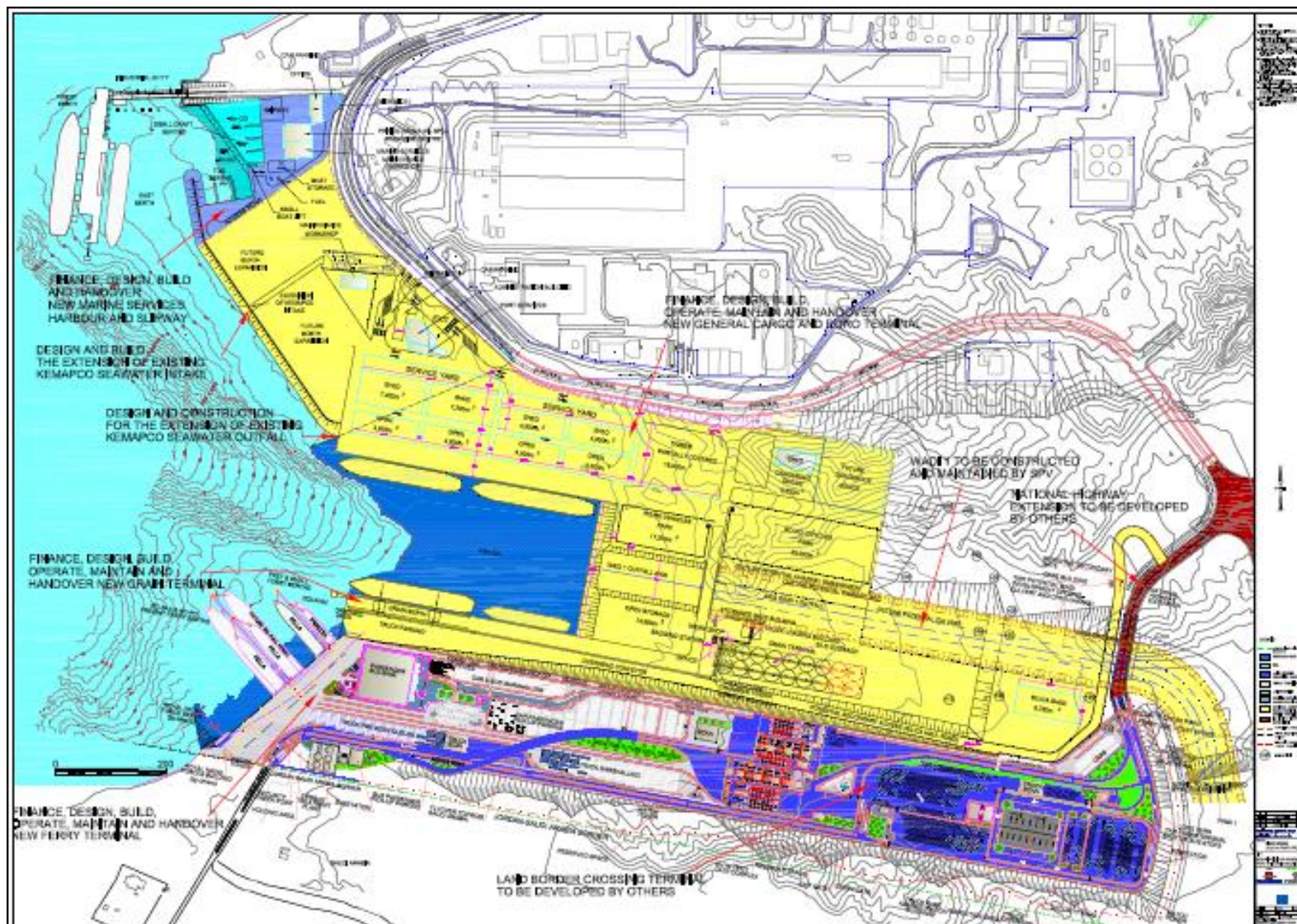


Figure 1 Proposed Layout of Berths and Facilities at the South Port

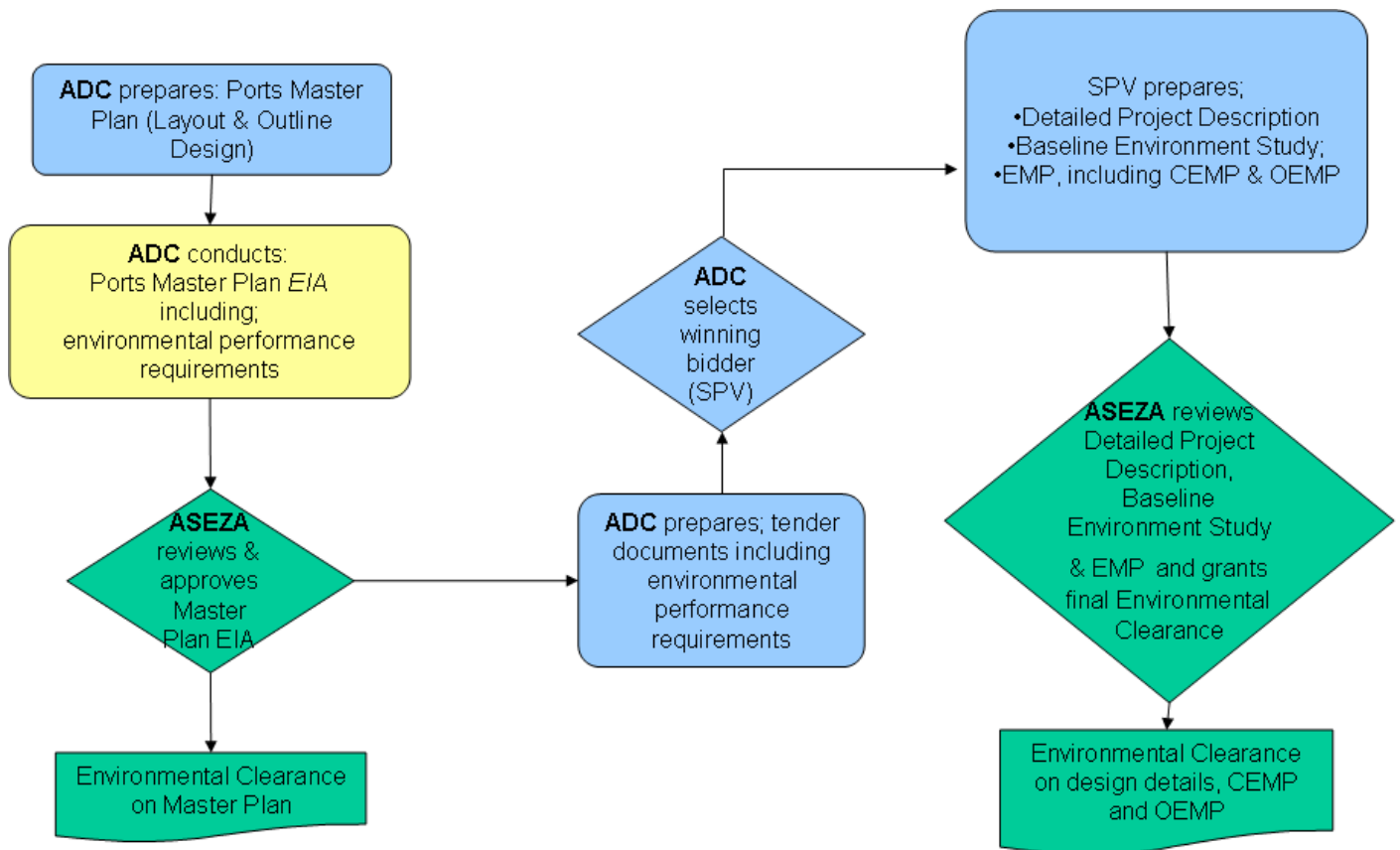


Figure 2 Environmental Clearance Flow Chart

1.0 Introduction

1.1 Background to the Project

In 2001, the Aqaba Special Economic Zone (ASEZ) was established to attract and facilitate investment in Aqaba in the areas of industry, port development, tourism, infrastructure, utilities and services. The ASEZ Master Plan was developed to guide the development process. The Ports Component of the Master Plan included proposals for expanding the economic potential of the ASEZ by enlarging the capacity of the South Port, extending the Southern Industrial Zone, removing the port services from the Main Port, and expanding the tourism potential of Aqaba by converting the Main Port area to tourism and business use, related to the Aqaba Town waterfront. In this way, port operations and related industries would be clustered together into one area in the south.

In 2001, a Strategic Environmental Assessment (SEA) was carried out on the ASEZ Master Plan. This SEA included extensive public and stakeholder consultation. The SEA was approved by ASEZA in 2001 as part of the approval of the Master Plan. The strategic decision on developing the South Port, relocating services from the Main Port and developing the Main Port site, was taken and approved at this stage.

A Ports Development Plan has been developed in response to the Master Plan.

This Plan includes the following components;

1. Decommissioning of the Main Port and relocation of all cargo services
2. Redevelopment of the Main Port into an urban and commercial center
3. Development of facilities at the South Port

The siting of the new port services and facilities is only now being examined as part of the current work on the Ports Development Plan. Part of the regulatory approvals to the Ports Development Plan includes the requirement to gain environmental clearance on the Plan. To this end, an Environmental Impact Assessment (EIA) on the Ports Development Plan has been requested by ASEZA. This document is the Environmental Impact Statement (EIS) which is the product of the EIA process.

1.2 Contracting Mechanism

Main Port

ADC intends to invite the private sector to develop the Main Port site for urban, commercial and residential use. An outline design scheme has been prepared, but no final contracting mechanism or timetable for the bidding process has yet been established. It may be that aspects of the decommissioning and rehabilitation of the Main Port site are carried out by ADC, or it may be that private sector developers are invited to complete these activities. No decisions or timetable have been made or a schedule established. ADC has commissioned an Environmental Due Diligence Study into the Port site to establish any areas of contamination which need to be dealt with in advance of the site being released for development. The Study includes a recommended methodology and guidelines for the demolition of the equipment and facilities on the site. The Study is still under drafting, but will be available to ADC in early 2008. However, this EIA is only concerned with the rehabilitation of the site, not with its future development. The selected developer of the site will be invited to complete an EIA on the detailed development proposals, once these are available.

South Port

ADC has elected to commission the South Port development from the private sector, as a Design-(part Finance)-Build-Operate contract. Qualified companies or consortia of companies, will compete win a contract to;

- complete the detailed design for the South Port,
- construct the works, and
- operate the new port facilities for a period of time.

In the case of the South Port Development, an outline design was commissioned by ADC from Royal Haskoning, and is the basis for this EIA. However, the selected private sector entity will complete this design to construction document stage, and may revise some of the details. If there are significant changes, particularly relating to the marine environment, these will need to be assessed to ensure compliance with the requirements of this EIS. The selected operating company may also introduce policies and practices which are not known at this stage.

The working output from this EIS – the mitigation requirements and EMPs – will be passed to the companies bidding to win the development contract. Certain environmental performance requirements are outlined in this EIS. The selected developer will be required to review these performance requirements, and the suggested measures, and to propose policies, methodologies, operating procedures and other measures, which will ensure that the performance requirements are met. As such, the developer will effectively be required to develop his own EMPs, for review an approval by ADC and ASEZA. This will apply to design, construction and operation of the facilities.

However, since the key issues of siting and interface with the marine environment are known to a high degree of detail, the completeness of this document is sufficient for environmental approval for the project to be considered and awarded by ASEZA, provided that a review of the final designs is made, and the EMPs developed by the selected companies are reviewed to ensure that they comply with the performance requirements set out here.

1.3 The Environmental Impact Assessment (EIA) Process

According to Annex 2 of ASEZA's Environmental Protection Regulation No 21 for year 2001, the Ports Development Plan is classified amongst the type of projects requiring a comprehensive EIA before environmental clearance could be granted.

The objective of an EIA is to identify, examine and define potential environmental impacts that may be associated with a project development so that measures to mitigate these impacts can be identified, which will limit the adverse impacts on the environment and promote sustainability of resources.

Regulation No 21 sets out the requirements for the EIA. Initially, an EIA must include a *scoping process*, whereby affected stakeholders help to identify issues of concern which must be assessed. A Scoping Session was held on 12th June, 2007 in Aqaba. The Scoping Report¹ prepared as a result included the Terms of Reference for the EIA. These were agreed upon with ASEZA and finalized following the Scoping Process. The Terms of Reference form the basis for this assessment and are attached in Annex I.

¹ Aqaba Ports Relocation and Development Project, Environmental Impact Assessment, Study, Draft Scoping Report and Terms of Reference, Aqaba Development Corporation, September 2007

An *environmental assessment* must then be conducted, examining each expected impact on the environment, positive and negative. The assessment must include the direct/indirect, short/medium and long term implications of each impact in relation to when it occurs, namely, at construction, operation or decommissioning phase.

Where the impacts are significant, and have not already been mitigated in the design of the project, additional *mitigation measures* should be developed. Such measures could include design alterations, recommendations for construction operations and techniques, and/or ongoing management requirements.

An *Environmental Management Plan (EMP)* is then developed to ensure that the appropriate mitigation measures are followed during the various project phases. Relevant indicators that need to be monitored are defined and wherever applicable, specific technical design compliance requirements are set. In this case, draft EMPs are developed containing performance requirements and suggested mitigation and monitoring measures. These will be passed to the selected contractor/operator for review and development at a later date, and will be re-submitted to ASEZA for final approval before commencement of work.

The EIS containing all the above must then be prepared and submitted to ASEZA for approval.

1.4 Approach and Assessment Methodology

A number of elements have been brought together to complete this assessment. The steps followed are summarized below.

Stakeholder Consultation

Stakeholder input was canvassed during the Scoping stage, and also in a subsequent stakeholder consultation stage, where focus groups and structured interviews were held in Aqaba. The results from the Scoping Session are contained in the Scoping Report². Output from the subsequent consultation is fully documented in Annex VI, and summarized in Section 6 of the EIS. The views and concerns of the stakeholders informed both the listing and ranking of impacts, and the development of mitigation measures and compensation interventions as discussed in Section 8.

Review of Existing Reports & Studies

A number of existing documents including various previous assessments, reports and studies were reviewed. These related to the development and design of the works and the characterization of the baseline environment. The documents used are listed in the References Section.

Site Inspections

An Environmental Due Diligence Study on the Main and South Ports was conducted in parallel to this assessment. This involved site visits to the Main and South Ports, meetings and consultations with port staff on infrastructure and environmental issues. The Study also involved the acquisition of baseline data on the sub-soil and the marine environment. As part of this study, a demolition assessment was carried out to identify the risks from demolition of the facilities and infrastructure at the Main Port, and to develop methodology and costs for the work. Relevant information from this Study has been included in this EIS.

² Revised Draft Scoping Report and Terms of Reference, ADC, 2007

Additional Baseline Data Collection

In addition to the baseline characterisation from the Due Diligence Study, additional data collection on noise and air quality was taken for this EIS. The results of these have been cited in the report, and included as Appendices.

Marine Survey

The characterization of the issues related to the marine environment made use of two pieces of work commissioned by ADC in advance of the EIS. These were;

- Coral Mapping in the ASEZ South Ports Area, Draft Final Report, prepared by the Marine Science Station, May 2007 – a substantial assessment of the corals in the area. This is presented as Annex II.
- Bathymetry mapping of the South Ports Area, also commissioned by ADC

Description of Marine Environment and Impacts

In addition to the above assessments, the Marine Science Station was commissioned by ECO Consult to provide additional input to the EIS on characterization of the marine environment, assessment of the likely impacts of the project on the marine environment, and the development of mitigation measures. The MSS Report is included as Annex III of the EIS. MSS staff have been consulted throughout this assessment, to provide input to the EIS.

Port Management Report

A study visit and report from an experienced ports operator from New Zealand was commissioned, in order to provide input to the Environmental Management Plan. The inputs from this work have informed the EIS.

Recommendations on Environmental Regulation of Ports

A study on the international regulations and practices applied to ports with respect to environmental management was also commissioned from an international regulatory expert. This report has informed the legislation review, the impacts and mitigation sections of the EIS.

Coral Area Damage Calculation

The coral damage area at Dirreh Bay was calculated by use of a methodology agreed upon by ECO Consult, Royal Haskoning and Marine Science Station. The calculations used as the coral survey carried out by the Marine Science Station, which determined coral coverage (area) and percentage live coral (%).

Drawings were obtained from the Master Plan designers, and the area of coral damaged by each facility or operation during construction (dredging, filling, berth construction, shading from berths, etc) was calculated.

The percentage of live coral equivalent for each of these areas was applied, for the data derived by MSS. The percentage calculations were calculated independently by ECO Consult and the Marine Science Station.

An overview of the methodology used is outlined below;

1. An intensive coral survey was carried out by MSS that covered the area from the shoreline until -30 m depth contour line
2. The area of coral cover was identified and assessed (diversity, sensitivity, etc.). In particular, percent cover of hard corals was calculated
3. Offshore areas prescribed to be filled, dredged, etc. by construction activities were identified and calculated by the use of AutoCAD
4. Coral damage areas were then calculated by multiplying the percent cover of corals by the total area to be filled, dredged, etc.

Coral Damage Valuation

As part of the EIS study, an economic valuation of the damage and loss of coral reef, as a result of the construction works, was commissioned from an independent, international environmental economist with significant experience in coral reef damage valuation. This was a major piece of work, designed to follow a rigorous methodology, which will stand up to full international scrutiny, and which follows the Equator Principles for investment in developing countries. The full report is included as Appendix VIII, and a summary of the key recommendations is given in Section 9.4.

2.0 Project Information

2.1 Development of South Port Master Plan 2007

2.1.1 *The Need for Development*

Having and maintaining efficient port facilities is a strategic necessity for Jordan. The historic development of the variety of port terminals and jetties along Aqaba's constrained coastline is a testament to Jordan's need to import raw materials and goods and export its products. Without the sea ports, Jordan would effectively be landlocked in terms of trade. The recent emphasis on establishing industrial zones to develop Jordan's export sector, as well as the geopolitical factors in the region make it even more important for Jordan to have an expanded and improved port capacity.

Jordan's existing ports have evolved and developed over a number of years. However, underinvestment in staff training and equipment maintenance, and outdated working practices mean that productivity in Jordan's ports is below international norms and does not meet best practice environmental standards. The need to protect the valuable environmental resources of the Gulf of Aqaba means that significant improvements in environmental management at the ports are needed.

Over recent years, a number of port development studies have been conducted, each one attempting to balance the need for better port facilities with the competing demands for coastline use and taking into account the increasing awareness that Aqaba's environmental heritage is of significant economic value to the country and needs to be strongly protected. The project being proposed by Aqaba Development Corporation (ADC) - outlined in Section 2.2 - is the culmination of several years of consideration of options, outline designs and environmental and economic assessments. Throughout the development of options, environmental issues have been one of the main driving forces towards refinement. One result of this is that the proposed project is also the one which most acceptably balances the need for improved port facilities, with the need to maintain and improve the environmental resources in the area. In other words the proposed option is by far the most environmentally friendly option which has been considered. An assessment of the various alterations considered is provided in Section 5.

The following narrative traces the evolution in the South Port planning since the creation of the ASEZ.

2.1.2 *The ASEZ Master Plan 2001*

In 2001, following the creation of the ASEZ, ASEZA published the ASEZ Master Plan³ after extensive planning, projections and consultations. This Plan foresaw the development of the ASEZ in the areas of port infrastructure, tourism, industry and services. The key recommendations of this Plan with regard to the Ports were as follows;

- To remove dusty and pollutive operations from the Main Port to a newly developed South Port. Operations to be relocated included phosphate, general cargo, vegetable oil and fuel oil.

³ Aqaba Port Master Plan, Land Transportation Plan, Special Economic Zone Master Plan Draft Final Report, ASEZA, March 2001.

- To release the land at the Main Port site for additional tourism/urban waterfront access, reconfiguring the inner harbour for ferry and cruise ship access, and relocating administrative services to the Container Terminal and South Port.
- To develop capacity and services at the South Port, effectively clustering pollutive and industrial operations together in the Southern Industrial Area, segregated from any tourism and urban/community areas and facilities. The new capacity would include a multi-purpose general cargo facility, a new phosphate terminal, and a general upgrade of environmental management at all the port. The Industrial Jetty would be upgraded to improve efficiency, health & safety and environmental management.
- Maintain RoRo cargo at the Main Port, unless space is available at the South Port
- Relocate the rice and grain terminals and the unloading of live animals from the Mushtarak Port to the new multipurpose facility at the South Port

A Strategic Environmental Impact Assessment (SEA)⁴ was carried out on the Master Plan. Regarding the Main and South Ports, the following comments and recommendations, were made;

- Set constraint areas to protect important coral reef areas
- The detailed design of all coastal facilities (berths, discharges, jetties, anchorage zones) should minimize impacts on the marine environment
- Management and monitoring of the marine environment should be strengthened
- Install and implement adequate dust management equipment and methods at the phosphate facilities
- Upgrade and enforce environmental legislation to control land and marine discharges

The proposed option described in – Section 2.2 - is based on this Master Plan, and follows it with some amendments.

2.1.3 South Port Master Plan 2006

In 2004, in order to implement the recommendations in the ASEZ Master Plan, ADC commissioned a detailed South Port Master Plan, with specific layouts for the various facilities. The purpose of this layout was to maximize the usage of the available land and coastline, with all the Main Port operations being relocated within the existing constraints. No account of the environmental impacts were taken in this layout.

This is the layout which was presented in the Pre-Scoping Report and the Scoping Session, conducted by ASEZA in Aqaba on 12th June 2007.

The main facilities to be developed in the South Port were to include;

- A new Miscellaneous Liquid Berth

⁴ Strategic Environmental Assessment, Supporting the Development of the ASEZ, The Aqaba Technical Assistance Support Project, May 2001.

- New Grain Berth
- New Industrial Terminals for Bulk Material
- New Multipurpose Cargo Berths with capacity for RoRo
- A redeveloped Oil Terminal with on-shore storage to replace the Jerash oil tanker
- Marine services including bunkering and an oily waste reception facility
- A new Ferry Terminal and land border crossing

However, this Master Plan has two disadvantages;

1. It was developed to maximize the available land and coastline access, without taking into account updated traffic projections. Therefore it provides more port capacity than traffic projections suggest will be needed.
2. Since it was conceptual, the impacts on the marine environment, particularly the coral reef in Dirreh Bay, were not given proper consideration.

For this proposal, approximately 33,000 m² of hard coral would require to be dredged to provide access to the General Cargo Berths alone. An additional estimated 21,600 m² of hard corals would be dredged to provide access to the Ferry Terminal. Much of these corals are of high significance, and the stretch known as the Dirreh Bay Wall Dive Site would be at risk from dredging to a depth of 15 m to the South of the Industrial Terminal. Stakeholders at the Scoping Session raised objections to the degree of coral impact.

2.1.4 Aqaba South Port Master Plan 2007

Following the Scoping Session a detailed revision of the port layout was prepared, with the express purpose of minimizing the impacts on the corals. This revision was carried out based on revised traffic projections for the port, and more up to date information on the location, depths and quality of the corals in the area, based on the Coral Mapping Survey conducted by the Marine Science Station in April - June 2007⁵. Such information was not available when the original layout was devised in 2005/6.

This plan includes 3 major revisions to the 2006 Plan;

- Establishment of a small harbour for marine services, pilotage and a slipway, close to the Industrial Jetty
- Relocation of the general cargo berths from the shoreline south of the Industrial Jetty, to the inner basin
- Removal of the proposed Ferry Terminal

This Master Plan was published in draft in December 2007, and is detailed in Section 2.2. **This is the option which is now being proposed by ADC.**

⁵ Coral Mapping in the ASEZ South Ports Area, Draft Final Report, Aqaba Development Corporation, December 2007.

Following the final public disclosure session held on the 8th of May 2008, a design revision took place in which the Ferry Terminal was relocated to the south of the general cargo basin.

2.2 Project Description

The following is a description of the project upon which this EIS is based.

2.2.1 Main Port Description

The Main Port is located south of Aqaba town and covers approximately 120 hectares of land. There are 12 berths occupying 2,120 meters of coastline located at the Main Port which handle cargo, grain and phosphate. Operations related to vegetable oil, grain and bunkering are carried out onsite. Facilities such as offices, storage area and tanks in addition to road, rail and infrastructure are situated onsite.

The project under assessment includes the decommissioning, demolition and removal of all the port related equipment and infrastructure at the Main Port site in order to release it for re-development. Specifically, the operations and activities to be removed from the Main Port include;

- General cargo loading, unloading and storage
- Activities related to maintenance of plant and equipment located onsite
- Phosphate loading (onto ships), unloading from rail and truck and storage
- Vegetable oil unloading, storage and loading onto trucks
- Grain unloading (from ships), storage in the grain silos and loading (into trucks)
- Bunkering - loading of fuel (including oil and gas) for ships

In order to effectively decommission, demolish and relocated the Main Port the following actions need to take place;

1. Cessation of Operations

The termination all current operations and activities.

2. Removal & Dismantling of Equipment

- Removal of any re-usable equipment and facilities by APC, ASEZA, Customs Department, JoPetrol, JMPC and other entities who currently operate at the Port.
- Dismantling of any unwanted equipment, facilities, buildings, including the railway line, and the phosphate jetties. There is significant opportunity to realize some scrap value of some of the equipment.

3. Removal of Contamination

- Removal of larger deposits of phosphate dust
- Removal of known elements of asbestos from buildings under controlled conditions.
- Removal of other hazardous material, for example PCBs from electrical plant.
- Removal of contaminated sub-soil
- Removal of spilled material in sea

Note that one possible methodology for removal of phosphate dust is the use of bulldozers to lift the dust deposits into trucks, followed by manual sweeping. There is a suggestion that hosing of the area with water to mobilize the dust, and lifting it by vacuum into trucks, followed by

filtering to recover the dust for disposal, and releasing the water for reuse. In this case, bunding would be placed around the hosed area to prevent water from running off to the sea.

4. Demolition & Removal of Structures

- Demolition of buildings, including the phosphate sheds and grain silos
- Removal of underground tanks and services
- Removal of surface pavement, if required
- Transportation off-site of all the above, to either the reuse destination or the hazardous waste facility at Swaqa

2.2.2 South Port Description

In 2005, ADC commissioned the international consulting firm Royal Haskoning to prepare a Master Plan and concept design for the new South Port and expanded Industrial Zone. This was revised in 2007, following new information on the coral reef locations, in order to minimize the environmental impacts. The new South Port Master Plan 2007 was published in December 2007⁶. Detailed information is also available in several separate design reports.

The following sections provide details on the proposals for the various components at the South Port. These details constitute 'the project' upon which this assessment is based. Figure 2.1 illustrates the proposed layout of berths and facilities at the South Port. From north to south, the components begin with the Miscellaneous Liquid Berth and end with the Ferry Terminal in the South. Moving from north to south, each key component is described in more detail in the following sections. Much of the narrative below has been taken from reports and studies prepared by Royal Haskoning for ADC. These reports are referenced appropriately.

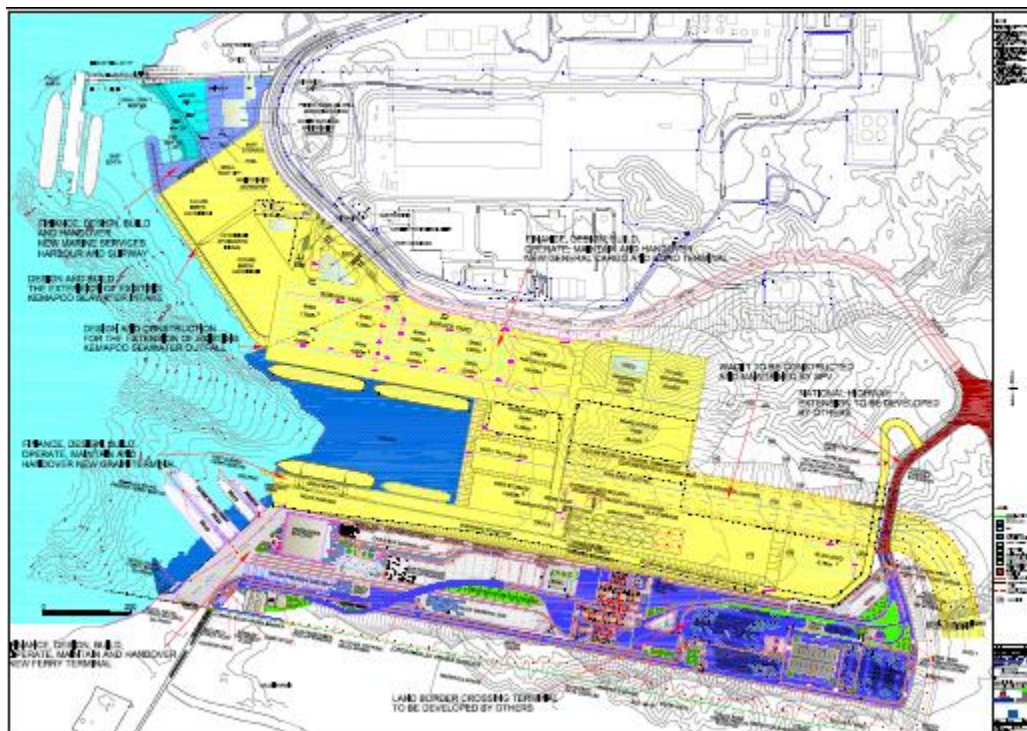


Figure 2.1 Proposed Layout of Berths and Facilities at the South Port

⁶ Aqaba Ports Master Plan, 2nd Edition, ADC, November 2007

2.2.2.1 A New Miscellaneous Liquid Berth and Terminal

In order to meet the future demand for bulk liquids there is a need for four berths in the South Zone. Given the large investment already made in existing storage and pipeline systems and the proximity of existing industries, the future installations will be planned around the existing facilities. It is therefore proposed that a new separate berth be created to handle the other (non-oil) chemicals which are currently handled at the Oil Jetty, together with the vegetable oil, mineral oil, and bitumen currently handled at the Main Port. The storage facilities that are required will be located on partly reclaimed land between the berth and the Coastal Road.

The liquid bulks coming from the Main Port are principally edible oils which are shipped in small parcel sizes. In light of the utilisation levels of the Oil Berth and Industrial Jetty it is not practical to add another product onto either facility. The consolidation of all the “non-oil” liquid bulks which are generally shipped in small parcel sizes onto a new miscellaneous liquids berth will reduce the excessively high utilisation levels of the Oil Berth and Industrial Jetty.

2.2.2.2 New Grain Berth

Figure 2.2 shows the location and layout of the Grain Berth and Terminal. The narrative below was taken from Grain Terminal PPP Report, Royal Haskoning, February 2006.

The forecasts for the import of grain show an increase from 1.7 million tons in the year 2004 to about 2.3 million tons in the year 2025. Imported products will include soya bean meal and grain such as wheat, barley and maize. Wheat and barley are assumed to be the bulk of the grain throughput. No export of grain is foreseen via the Grain Terminal. Presently a rice terminal is located in the Middle Port. In a later stage this terminal could be relocated to the Grain Terminal, but this is not included in this Master Plan. Grain vessels may range from 5,000 DWT up to Panamax (75,000 DWT) size. Based on the anticipated size of ships it is proposed that a 250 m long berth with 200 m of quay is provided with an alongside depth of -14.7 m CD which allows for a minimum under-keel clearance of 1.0 m at LAT.

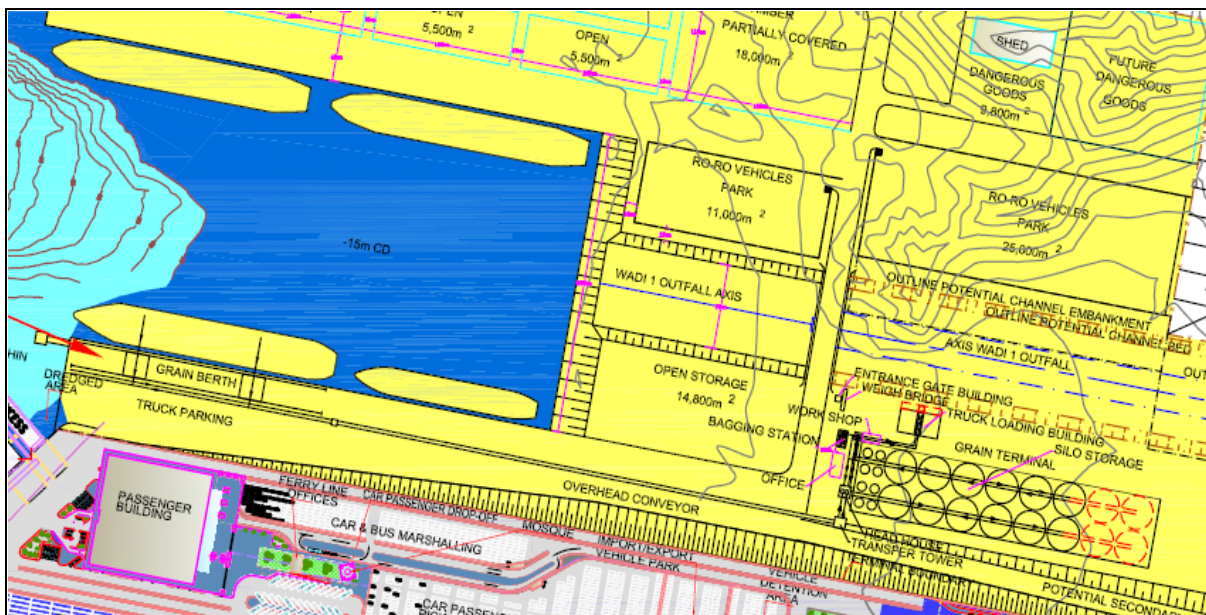


Figure 2.2 Location & Layout of Grain Berth and Terminal

1. Berth and ship unloader requirements

Based on traffic forecasts, the minimum required total average throughput in 2025 will be 2,285,360 tons with an average unloading capacity requirement of 658 tons/hour.

In order to achieve this, one berth with 2 or 3 unloaders is required. In case of 3 unloaders a phased development is possible starting with 2 unloaders and increasing it in a later stage to 3 unloaders. A berth equipped with 2 unloaders is recommended.

For the Grain Terminal the following types of unloaders may be selected:

- Pneumatic unloader
- Mechanical unloader
- Grab unloader

Rice cannot be unloaded with a pneumatic unloader since it will damage the rice kernels. The efficiency of pneumatic or mechanical unloaders is reduced when unloading non free-flowing products and/or auxiliary equipment such as bulldozers are required in the ship's hold to move the product during unloading. Unloading with a grab crane is therefore preferred for non free-flowing products such as soya bean meal. At this stage two mechanical unloaders would appear to be the most attractive for this situation. An additional grab crane will be required if the throughput of non-free flowing products such as soya bean meal increase substantially or rice is handled at the terminal.

Assuming an unloading efficiency of 65% and a ship unloader berth configuration factor of 1.75, two mechanical unloaders with a rated design capacity of 600 tons/hour will be sufficient to handle the forecast throughput until 2025.

2. Silo intake & storage capacity

The total silo intake capacity will be at least equal to or higher than the combined total rated unloading capacity of the two ship unloaders which is 1,200 tons/hour. Two intake conveying lines of 600 tons/hour capacity are recommended in order to provide flexibility in case of conveyor breakdown and also enable unloading of two different products at the same time from one ship.

In order to store the grain unloaded from the largest grain vessel calling at the Aqaba Ports, rule of thumb requires that the capacity should be at least 1.5 times the maximum vessel size. As a consequence a minimum storage capacity of 112,500 tons is required. On the other hand, the storage capacity of an import Grain Terminal should allow for an average dwell time of the grain of at least 2 to 3 weeks in order to provide flexibility in the dispatch. Longer storage may be demanded by clients of the silo complex. The required storage capacity was therefore assessed and it was determined that at least 120,000 tons of storage capacity needs to be provided in 2015 and 150,000 tons in 2025.

3. Silo out-take capacity

Dedicated completely enclosed truck loading stations are foreseen with dust aspirated bellows in order to minimise dust emissions. It was determined that the capacity of one silo out-take conveying line needs to be at least 360 tons/hour. In 2015 at least three truck loading stations are required and at least four in 2025. Assuming one spare truck loading station, four truck loading stations are required in 2015 and five in 2025.

The equipment required to handle the grain based on the forecast throughput will include ship unloaders, conveyors, batch weights, silo bins, truck loaders, bagging lines – further details are provided in the RH report. It has been assumed that none of the existing mechanical handling equipment is reused at the new Grain Terminal because of the need to transfer the existing operations from the Main to the South Port with minimal disruption. In addition the existing equipment is deemed unsuitable for re-use in the new terminal since it is;

- Nearing the end of its operational lifetime
- Not state-of-art and it would be difficult to impose old inefficient cargo handling equipment on a terminal operator whilst expecting him to improve the efficiency of the terminal operation
- Not designed for the new terminal layout.

Potential for future expansion

The Grain Terminal has limited potential for expansion by the addition of a second berth although there may be space for a second berth on the south side if the second basin is not developed. However, a third unloader could be added at the berth together with a third conveying line to the silo complex. The Grain Terminal may also be used in the future for the handling of rice. The additional handling equipment would need to be selected to minimise damage to the rice kernels. Rice imports amounted to some 281,000 tons in 2004 but this level is forecast to fall to some 140,000 tons in 2010-2015 as the volume of transit rice to Iraq reduces. In order to handle rice at the Grain Berth, an additional grain unloader and conveyor would be required in order to increase the capacity of the berth along with hoppers and conveyors for unloading rice using ship's gear. The Grain Silo Complex may also be extended in the future with extra silo rows to provide additional storage capacity. In addition, space is reserved within the layout for a bagging warehouse, a warehouse for storage of non-free flowing agri-bulk

products such as soya bean meal and for processing facilities for grain or other agri-bulk products.

2.2.2.3 New Industrial Terminal for Bulk Material (phosphate and industrial dry bulk materials and liquids)

The new Industrial Bulk Terminal would consist of the existing Industrial Jetty together with a new Bulk Liquids Jetty and a new Phosphate Jetty. This facility would be able to handle the dry and liquid bulks associated with the fertilizer industries. The existing Industrial Jetty will be upgraded to handle import sulphur and export fertilizers, potash and cement if required. A second Industrial Dry Berth may also be constructed.

The locations proposed for the industrial facilities are shown in Figure 2.3. Note that the details of the shoreline/marine interface will be finalised during detailed design and are shown here schematically only.

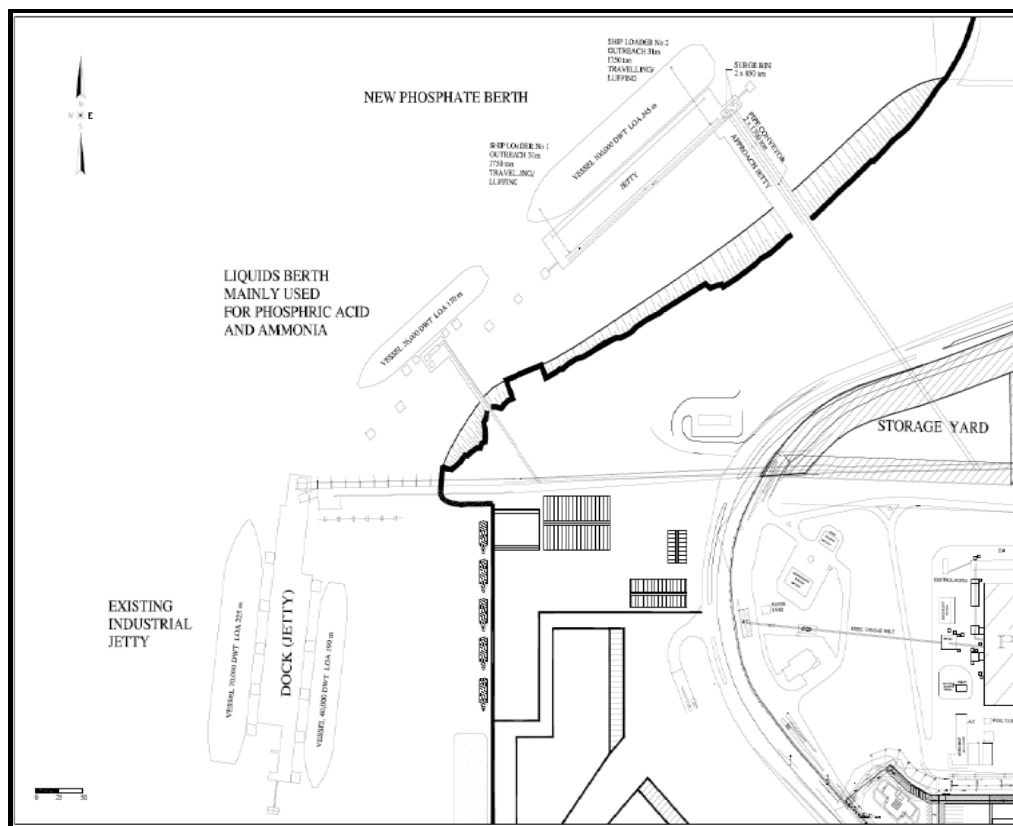


Figure 2.3 Proposed Locations for the Industrial Facilities

Based on predictions for future port traffic, carried out by ADC, the design quantities for handling of the various products were developed, and are included in Table 2.2;

Commodity	Direction	2004 (million tons)	2025 (million tons)
Phosphate	Export	4.5	7.5
Sulphur	Import	0.56	0.81
Salt	Export	0.06	0.50
DAP	Export	0.65	0.80
NPK	Export	0.20	0.20
MOP (KCl)	Export	1.75	2.50
Ammonia	Import	0.26	0.35
Phosphoric Acid	Export	0.40	0.90

Table 2.2 Forecasts for the Handling of Products.

The phosphates vessels may range in size from 10,000 to 100,000 DWT. Based on the anticipated size of ships it is proposed that a 225 m long quay and 280 m long berth is provided with an alongside depth of -15.0 m CD which allows for a minimum under-keel clearance of 1.0 m at LAT. The range of ship sizes using the Industrial Jetty are assumed to vary from 1,000 DWT to 70,000 DWT.

1. Phosphate – berths and ship loader requirements

In order to achieve the design capacity in the year 2025, one berth with 1, 2 or 3 loaders is required. Two loaders are preferred over one loader in view of reliability of the loading process. In case of 3 loaders, a phased development is possible starting with 2 loaders and increasing at a later stage to 3 loaders.

The following types of ship loader may be used for the phosphate terminal:

- Wide range rail-mounted travelling bridge loader with luffing and telescopic boom
- Rail-mounted travelling loader with luffing and telescopic boom
- Rail-mounted loader with slewing, luffing and telescopic boom
- Quadrant radial ship loader
- Quadrant linear ship loader

In this proposal, a rail-mounted travelling loader with luffing and telescopic boom is assumed. The quadrant radial and linear ship loader offer the advantages of easier dust suppression of the conveyor transfer points. However, the slewing operation makes it difficult to manoeuvre between hatches and deck equipment of smaller vessels. The loader should be equipped with a special ship loading device which minimises dust emission. The device should be dust aspirated and should completely enclose the loading point. Loading should be carried out with minimal drop height for the product. Assuming a shed reclaiming efficiency of 85%, a ship loading efficiency 95% and a ship loader berth configuration factor of 1.75, two loaders with a rated design capacity of 1,700 tons/hour will be sufficient to handle the forecasted throughput until the year 2025.

2. Phosphate-conveying system from storage sheds to the jetty

The storage sheds are located approximately 1.5 km from the jetty. Belt conveyors will transport the phosphates from the sheds to the jetty. Surge bins are required at or near the jetty in order to

avoid stopping the long belt conveyors every time the ship loader changes hold in the ship. The conveying system will have a capacity equal to the maximum ship loading capacity. In view of redundancy two intake conveying lines of 1,700 tons/hour are preferred.

In order to reduce spillage and dust emissions from the conveyor lines, belt conveyors with a completely enclosed carrying and return part are proposed, such as pipe conveyors. The investment cost for such a system will be considerably higher than the investment cost of a conventional troughed belt conveyor. However, the dust emissions of a conventional troughed belt conveyor system are expected to be unacceptable for the adjacent industries and companies.

Although the use of pipe conveyors will reduce the dust emissions considerably, some dust emission is unavoidable due to the physical properties and dusty nature of the phosphates, the long conveying distances and the transfer towers required on the route.

3. Phosphate - Storage capacity

The storage capacity needs to be at least 320,000 tons in the year 2015 and 360,000 tons in the year 2025. It is proposed to construct completely enclosed storage facilities which do not need operators inside the storage area during in or out-take of the phosphates in order to reduce dust emissions or exposure of personnel to dust. In this case, domes with automated intake or out-take or sheds similar to the existing shed 3 and 4 may be used. A system similar to that in existing sheds 3 and 4 has been assumed. It is proposed that sheds with a storage capacity of 360,000 tons are initially constructed because it is difficult to extend sheds with different bays for different grades of product.

4. Phosphate - Truck unloading

Dedicated completely enclosed truck unloading pits are foreseen with dust suppression grids in order to minimise dust emissions. Based on the loading assumptions, at least 6 truck unloading stations are required. Since the existing railway line will not be extended and all the phosphates will be supplied by truck to the terminal, it is possible to shift the terminal closer to the jetty. In this case the high capacity conveyors to the jetty may be shortened and substantial savings made on the capital costs. Furthermore, due to the shorter belt conveyor lines, the potential for dust emissions will reduce. Shifting the storage sheds towards the Phosphates Jetty is also possible with the railway line at the present planned location. In this case the length of the high capacity belt conveyors from the storage sheds to the loaders reduces. However, conveyors with a lower capacity are required to convey the product from the rail unloading stations to the shed. This will slightly reduce the overall capital cost but has the disadvantage that operations are more scattered.

5. Overview of required equipment and facilities

The equipment requirement for the phosphates handling based on the forecast throughput of phosphate is;

- Ship loader 2 x 1,700 tph
- Conveyor line from shed to ship loaders 2 x 1,700 tph
- Belt weighers (shed out-take line) 2 x 1,700 tph
- Storage sheds 360,000 ton

- Shed intake conveying lines 4 x 1,000 tph
- Belt weighers (shed intake line) 4 x 1,000 tph
- Truck unloading station 6
- Railcar unloading station 2 x 1,000 tph
- Weighbridge 2
- Samplers 6
- Wheel loader 2

It has been assumed that none of the existing mechanical handling equipment is reused at the new terminal because of the need to transfer the existing operations from the Main to the South Port with minimal disruption. In addition the existing equipment is unsuitable for re-use in the new terminal since it is:

- Nearing the end of its operational lifetime
- Not state-of-art and it would be difficult to impose old inefficient cargo handling equipment on a terminal operator whilst expecting him to improve the efficiency of the terminal operation
- Not designed for the new terminal layout.

6. Industrial Jetty

The current unloading and loading efficiencies for the dry and liquid bulk handling must be improved in order to reduce ship service time and reduce berth occupancies and consequently ship waiting times to acceptable levels. With respect to sulphur unloading, it is required that the current 500 tons/hour ship unloader is replaced by a 1,000 tons/hour new ship unloader. The capacity of the Industrial Jetty is insufficient to handle the forecast throughput. An additional berth is therefore required. It is proposed that the additional berth will be used for unloading and loading of bulk liquids primarily ammonia and phosphoric acid. The reasons for this are:

- For safety reasons it is preferable to relocate the ammonia handling from the Industrial Jetty east berth to a location where it is separated from the dry bulk operations and navigational access is easier. Dry bulk operations at the Industrial Jetty will then not be affected by ammonia unloading as at present.
- The cost of a new Liquids Berth is less than the cost of a Dry Bulk Berth. A single loading platform with pipes and loading arms is required compared with the ship loader rails and supports and the conveyor system required for a Dry Bulk Berth.
- Combining the phosphate and fertiliser loading operations on the phosphate berth or at a second berth is undesirable in terms of the potential for cross-contamination.

7. Upgrade of the Industrial Jetty

The adequate unloading and loading of the various products requires the jetty, unloading and loading equipment, conveying system, dust control system, etc. to be in a proper condition. The following steps should be taken to upgrade the current jetty:

- Check the physical condition of the jetty (corrosion of the steel tubular piles supporting the deck, cracks and damage to the cross-head members along the east berth jetty, corrosion of the reinforcing steel, rails, power supply channels, etc).
- Analysis to assess if the indicated design criteria are still met (i.e. is the jetty suitable for safely and securely berthing of 70,000 DWT vessels at the west berth and 40,000 DWT vessels at the east berth).
- Check the available depths in front of the berths and if not sufficient dredge down to the required design depths.
- Repair and/or renewal of the structural works, jetty deck, mooring facilities, rails, power supply, lighting, safety provisions, etc. based on the outcome of the assessment.

8. Unloading and loading equipment

The present unloading and loading equipment on the jetty is well past its technical and economic lifetime (> 25 years). To be able to meet the required reliability and capacity the replacement of the two 2,000 tons ship loaders is recommended. In addition, taking into account the observed very poor condition, it is recommended to replace the sulphur unloader, either by a new continuous type mechanical unloader with an unloading capacity of 500 tons per hour or by an unloader with a higher capacity of about 1,000 tons per hour. The latter is recommended in order to have sufficient capacity at the jetty. The new equipment should incorporate all “state of the art” measures with respect to environmental control and safety. At a later stage, the capacity of the Industrial Jetty may be increased by installing a second fertilizer unloader at the west berth together with a new conveyor line.

9. Conveying system

The belt conveying system is reported to be in a reasonable and operational condition. However, the following measures should be taken to upgrade the conveying system:

- Check the condition of the belts, idlers, drives, dust and spillage control systems, steel structures, belt covers, wall cladding of the transfer towers and bridges, preservation system, power supply and distribution system, safety devices, interlocking system, lighting system, earthing and lightning system, etc.
- Assess the conveying capacity of the conveyors of the Public Private Partnership (PPP) conveying system in order to determine if the original design capacities are still met. If this is not the case, then the drive units/motors should be checked and if necessary replaced.
- Check if the capacity of the conveying system of the users matches the conveying capacity of the upgraded conveying system under the PPP package. Overloading of the PPP belt conveyor system should be prevented by installing proper dosing equipment on the conveying system of the users.

- Based on the outcome of the assessment the conveying equipment under the PPP package should be repaired and/or replaced.

10. Terminal facilities and utilities

In order to operate the unloading and loading equipment and the conveying systems on the Industrial Jetty as a separate terminal, several facilities are required. These are:

Power supply

At present power is supplied by Jordan Phosphate Mining Company (JPMC) through their substation(s). If this can be maintained then almost no extra investments are required. However, the price per kWh must be agreed with JPMC. If a separate power connection to the main grid is required, then extra investments are required. The required investment strongly depends on the distance to the main grid, available capacity and costs for connection by supplier.

Electrical and control system and building

At present the operation of the unloading and loading equipment and the conveying system are controlled by JPMC from their control room. Also, the electrical and control system of the equipment and communication system with other users is controlled from there. If a separate electrical and control room is required with a new electrical, control system and communication system, then substantial investment costs are involved.

Water supply

At present potable water is supplied by JPMC. If this can be maintained then almost no extra investments are required. However, the price per m³ must be agreed with JPMC. If a separate water supply with connection to the water mains is required, then extra investments are required. The required investment strongly depends on the distance to the water mains and the available capacity.

Fire fighting system

At present the fire fighting system for the Industrial jetty is connected to the fire fighting system of JPMC. If this can be maintained then almost no extra investments are required. However, the price per m³ must be agreed with JPMC. If a separate fire fighting system with pump station and connection to the water mains is required, then extra investments are required. The required investment strongly depends on the distance to the water mains and the available capacity.

Other facilities

Such as office and canteen building, a workshop and store for spare parts.

11. Unloading and loading equipment for liquid bulk products

The present rail-mounted rig with loading/unloading arms for liquid bulks on the jetty is 25 years old. In addition, the unloading and loading installation is unlikely to be in accordance with the current international standards such as the American Petroleum Industry (API), Oil Companies International Marine Forum (OCIMF) and International Maritime Organisation (IMO) standards. Therefore, the new Liquid Bulk Jetty should be equipped with new loading arms for liquid bulk. New pipelines will also need to be constructed to and from the new Liquid Bulk Jetty.

still be possible, and a land based divers' access could be constructed on the shoreline, although sub-surface noise levels from ships may be higher than present, it is not expected that traffic above the Dive Site itself will be changed significantly from the present situation.

In view of the significant volumes of timber and iron and steel products to be handled, and the forecast decline in bagged cargo a multi-purpose berth layout has been adopted. In this form of layout the cargo sheds are placed at the rear of the terminal so that trucks using the sheds do not interfere with quayside operations. Open storage areas are provided directly behind the quay apron area to provide for rapid transfer between the quay apron and greater flexibility of storage for various break-bulk cargo as well as containers.

2. Berth allocation

The area available for the development of the general cargo and RoRo facilities is limited at the southern side by the location of the Ferry Terminal and at the northern side by the Coastal Road and existing buildings. The total width is approximately 500 m. At least 150 m terminal depth is required to provide sufficient space for the quay apron, storage sheds and roads.

With a basin width of 250 m, a total of only 250 m is available for the terminals. This is insufficient for two terminals with storage facilities on each side of the basin. It is therefore proposed that Berth 3, on the south side, is used for commodities such as logs and iron and steel products that are mainly handled by direct delivery. Silica will also be handled at Berth 3 since this will be loaded to ships by conveyor from a covered storage shed adjacent to the berth. Although livestock is also handled by direct delivery it was proposed that this operation is located as far as possible from the Ferry Terminal in order to avoid potential odour.

Break-bulk cargo including timber, miscellaneous general cargo, bagged cargo, iron and steel products requiring buffer storage behind the quay together with RoRo vehicles and livestock will be handled at Berths 1 and 2. Berths 1 and 2 are proposed for handling RoRo vehicles since they are relatively close to adjacent parking lots which will limit the turn-round time for car drivers when loading and unloading vehicles.

3. Marine Facilities

It is proposed to form a protected harbour for marine services and support. The marine facilities will be located at the northern side of the general cargo terminal area adjacent to the Industrial Jetty approach trestle comprise:

- Area 25,000 m²
- Offices 1,000 m²
- Prince Hamza Oil Spill Response Centre 1,500 m² shed
- Marine services maintenance workshop 1,500 m²
- Tug berths - 5 No. with a water depth of -5.0 m CD
- Small craft berths - 13 No. with a water depth of -3.0 m CD
- Slipway 40 m wide

The harbour basin will be dredged to -5.0 m CD in the area where tugs will manoeuvre and to -3.0 m CD for the small craft. Finger piers will be provided for berthing tugs and small craft. Sufficient space is available near the tug jetties for parking road tankers for refuelling tugs. Buildings for the main offices including parking places for passenger cars are located near the entrance from the Coastal Road. A maintenance workshop together with a slipway and adjacent boat storage is provided.

4. RoRo facilities

It is anticipated that more than 320,000 vehicles per year will be handled by 2035. Two areas have been allocated for parking these vehicles. The first covers an area of approximately 70,000 m² located between the general cargo berths and the marine services small craft harbour. This will provide parking for about 3,500 vehicles which will be sufficient to accommodate the projected throughput until about 2020.

A second and third parking area is located at the end of the harbour basin. These areas provide an additional area of 40,000 m² giving a total of 110,000 m² parking for cars and heavy vehicles. In case expansion of the harbour basin is required in the future, this parking area may easily be moved eastwards at minimal cost. Both areas are easily accessed from the two northern berths.

5. Break-bulk facilities Berths 1 & 2

The break-bulk facilities at Berths 1 & 2 will consist of the following:

- Area 146,000 m²
- Quay 2 x 245 m
- Water depth -14.0/-12.0 m CD
- Offices 2,000 m²
- Transit sheds 9,600 m²
- Dangerous goods shed 2,100 m²
- Open storage 40,000 m²
- Dangerous goods storage 7,000 m²

6. Grain

The Grain berth is the south western berth in the basin and is as shown on the layout. The berth will be mainly dedicated to handling cereals in dry bulk used for human consumption and animal feed.

7. Berth 3

An open storage area of about 12,500 m² is provided behind Berth 3. This is sufficient for temporary storage of iron and steel and logs. A closed shed with a capacity of approximately 47,000 m³ or about 26,000 tons for storage of silica awaiting shipment is proposed to the east of Berth 3. Silica will be loaded to ships by fixed overhead and mobile conveyors from the shed to portable ship loaders on the quay.

8. Drainage

Figure 2.5 illustrates the drainage plan for the South Industrial Zone and new port facilities. The drainage system includes earth fill dykes, concrete lined open channels, culverts, and entrance structures that will capture stormwater from upstream and protect the industrial and port facilities. Stormwater will drain into the eastern side of the General Cargo Basin through an open channel of trapezoidal cross section, which will incorporate a stepped channel invert, to prevent material eroded by the wadi flow from being deposited into the harbour basin.

9. Hard Standing Area

An area of hard standing will be located at the end of the harbour basin. The usage of such a yard would be constrained by limitations set by ASEZA to protect the General Cargo Basin from contamination. Proposals for any potentially pollutive uses (such as boat maintenance or fabrication) would require a specific application to ASEZA, and written environmental clearance.

10. Cargo handling equipment

Loading and unloading operations at the General Cargo Berths will be performed by mobile harbour cranes of at least 60 tons capacity at a radius of at least 35 m or using ship's gear. These will be equipped with grabs, spreaders or hooks to allow a variety of cargo to be handled. With the proposed multi-purpose terminal layout the main method of transferring cargo from the quay apron to the storage will be by tractor-trailer combinations using low profile trailers.

Stacking and sorting in the closed storage sheds or open storage areas and delivery from these areas will be carried out by forklift truck (FLT) or mobile cranes. The terminal will be equipped with 3 tons and 10 tons forklift trucks (FLTs) for handling cargo within the warehouses and open storage areas respectively. A reach-stacker will be required for handling the occasional container.

It is assumed that all the equipment listed in Table 5.1 is purchased new with the exception of two mobile harbour cranes currently working in the Main Port which it is assumed will be transferred to the new General Cargo Terminal.

11. Future extensions

Phase 2 of the General Cargo Plan development will comprise a 130 m extension of the south quay to the east. Based on the forecast of vessel sizes the majority of the vessels that will call the port will be in the range of 150-170 m LOA. The 130 m extension when combined with Berth 3 will create a 380 m long quay which will be able to handle two small vessels each 160 m LOA simultaneously. The additional berth will provide sufficient capacity to handle the expected forecast throughput to beyond 2035 at minimal cost.

The harbour basin may be extended to the east in the future. The limit of potential extension is governed by the ability to manoeuvre ships between the open sea and the innermost berths when ships are berthed alongside the north and south quays. This will depend on the size and manoeuvrability of the ships using the basin and the tug assistance provided. It is considered feasible to extend the basin to provide an additional two berths, one on the north and one on the south side of the basin. For general cargo it is proposed that this would comprise a 130 m extension of the harbour basin to the east for the following reasons:

- It is expected that the extension will be required to accommodate growth in trade in RoRo, wood and iron and steel products for which the average vessel size is 180 m. The

northern quay will have a total length of 620 m which is sufficient for berthing three 180 m LOA ships simultaneously.

- Livestock will be handled at the northern berth. These vessels are approximately 190 m LOA and it will be possible to accommodate this size of ship at the northern berth together with two 180 m LOA ships on the adjacent berths.
- The southern quay will be 510 m long which is sufficient for handling two 225 m vessels or three 145 m LOA vessels (e.g. two small general cargo ships and one bulk carrier for silica).

In this case, the parking for RoRo vehicles would need to be relocated.

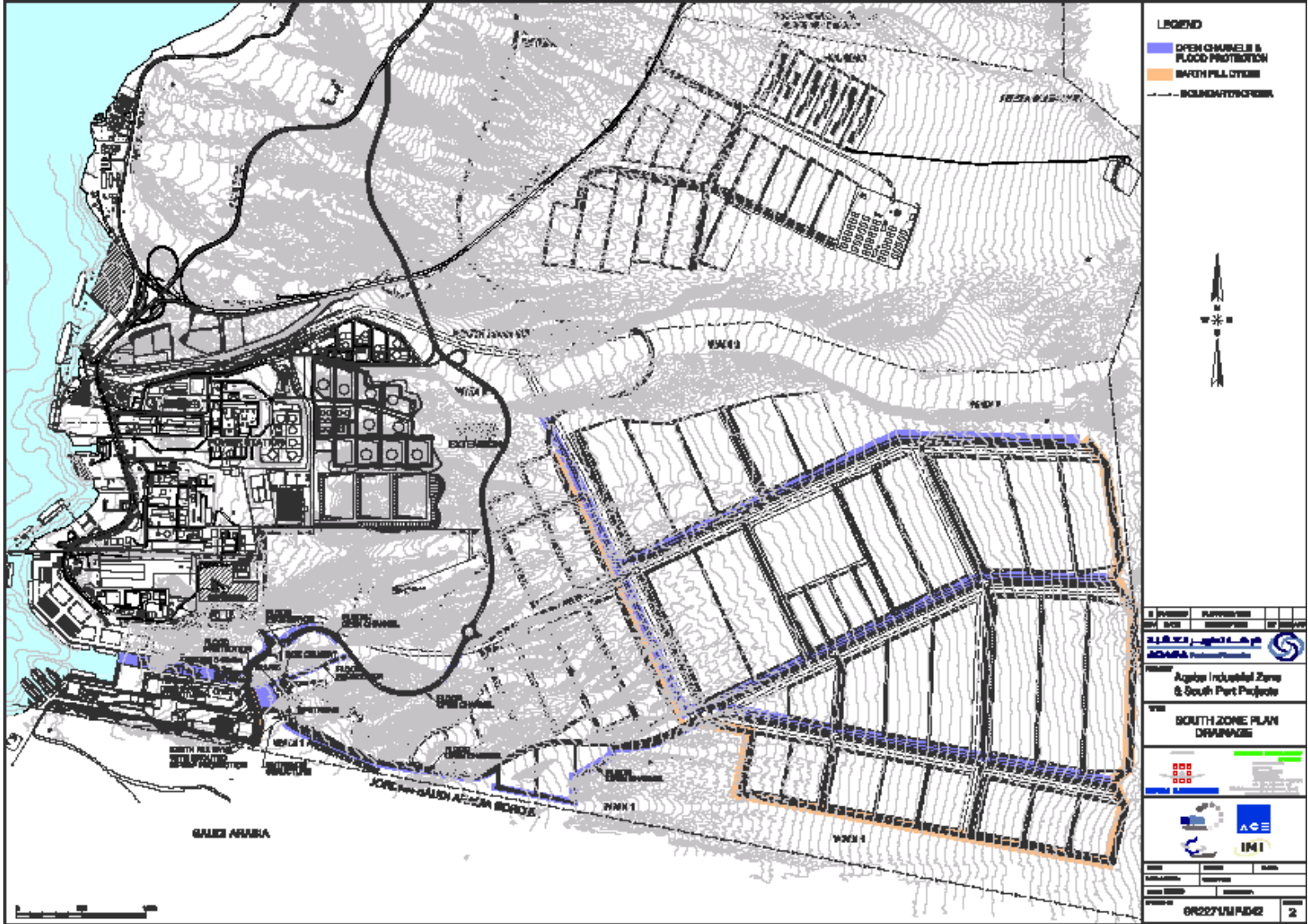


Figure 2.5 Drainage Concept

2.2.2.5 Ferry Terminal

The overall design components of the Ferry Terminal include;

1. Ferry Terminal paved area. Part of the Ferry Terminal will be built out into the sea. This will extend around 20 m into the sea for around 220 m along the shore
2. Mooring dolphins, catwalks and berthing areas. There will be two mooring dolphin extensions into the sea, supporting catwalks. A short one on the north side of the terminal, with five dolphins, where there is berthing space on either side for fast and small ferries. On the south side there will be a longer one, comprising four dolphins, with berthing capacity for two Ro-Pax and RoRo freight ferries, one on either side.

2.2.2.6 Summary of Project Components

For clarity, the following table lists the various components of the proposed work, and notes which are included in this assessment.

	Master Plan 2006	Master Plan 2007	Included in EIA
Oil Berth & Terminal	Yes	Yes	No
Miscellaneous Liquids Berth	Yes	Yes	Yes
Grain Berth	Yes	Yes	Yes
Phosphate Berth	Yes	Yes	Yes
Industrial Liquids Berth	Yes	Yes	Yes
Provision for Marine Services, Tugs, Oil Spill Clean Up	Yes	Yes	Yes
Refurbishment of Existing Industrial Terminal	Yes	Yes	Yes
General Cargo	Yes (along coastline)	Yes (relocated)	Yes
Passenger Ferry Terminal	Yes	No	Yes

Table 2.3 Summary of Project Components

3.0 Policy, Legal, Regulatory Context in Aqaba

The Port Development and Relocation Project must comply with the existing legal context in Jordan, and particularly in the ASEZ. This section summarizes the relevant aspects of the legal context for ports development and operation in Aqaba. Relevant international conventions are first identified, followed by relevant national legislation and institutional framework.

3.1 International Conventions

Jordan is Party to the following international treaties and conventions, each of which is relevant to ports development and operation. A summary is provided in Table 3.1.

International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78), Annexes I, II, III, IV and V. The MARPOL Convention is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. It is a combination of two treaties adopted in 1973 and 1978 respectively and updated by amendments through the years. The Convention includes regulations aimed at preventing and minimizing pollution from ships-both accidental pollution and that from routine operations and currently includes six technical Annexes.

Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention 72), The London Convention contributes to the international control and prevention of marine pollution. It prohibits the dumping of certain hazardous materials,

requires a prior special permit for the dumping of a number of other identified materials and a prior general permit for other wastes or matter. The Convention establishes requirements for the type of waste that may be generated at a port (e.g. Aqaba) and how may be disposed of in the marine environment. In 1996 the London Prevention Protocol was adopted under the Convention; this Protocol was intended to replace the Convention, and contains new approaches to determining the acceptability of disposal of waste in the marine environment. Although Jordan is a party to the original Convention, it is not a party to the London Prevention Protocol. The Convention and Protocol are therefore not included in Table 1.

Technical Annexes included in the MARPOL Convention

Annex I	Regulations for the Prevention of Pollution by Oil
Annex II	Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
Annex III	Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form
Annex IV	Prevention of Pollution by Sewage from Ships
Annex V	Prevention of Pollution by Garbage from Ships
Annex VI	Prevention of Air Pollution from Ships (entry into force 19 May 2005)

Parties to the Convention must accept Annexes I and II, but the other Annexes are voluntary. Jordan is a party to all Annexes, except Annex VI.

International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), The OPRC Convention deals with preparing for and responding to oil pollution incidents from ships, offshore oil exploration and production platforms, sea ports and oil handling facilities. The Convention recognizes that in the event of pollution incident, prompt and effective action is essential. This in turn depends on the establishment of oil pollution emergency plans on ships and offshore installations, and at ports and oil handling facilities, together with national and regional contingency plans as appropriate.

Main features of the OPRC Convention include:

1. a requirement that seaports, oil handling facilities, ships and platforms have an Oil Pollution Emergency Plan.
2. requirements for Masters of ships, port authorities and others to immediately report oil pollution incidents.
3. measures for addressing oil pollution, including roles for port authorities and availability of equipment.

A Protocol to the OPRC (The Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances) was adopted in 2000. This Protocol essentially extends the requirements of the OPRC to other hazardous and noxious substances. However, Jordan is not a party to this Protocol and it is therefore not included in Table 1.

International Convention for the Safety of Life at Sea (SOLAS) 1974, and amendments. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety. Flag States are responsible for ensuring that ships under their flag comply with its requirements, and a number of certificates are prescribed in the Convention as proof that this has been done. Control provisions also allow Contracting Governments to inspect ships of other Contracting States if there are clear grounds for believing that the ship and its equipment do not substantially comply with the requirements of the Convention - this procedure is known as port State control. Primarily, therefore, the obligations of the SOLAS Convention are on the shipping industry; however, port authorities and other national authorised have roles under the port State mechanism to ensure that the requirements of SOLAS are adhered to, and this impacts the operational aspects of seaports.

Although SOLAS is primarily focussed on the safety of ships, it plays an important role in ensuring that ships are designed in such a way as to reduce environmental risks associated with ship design, cargo storage and ship operation. Thus, for example, measures relating to oil tanker design and operation to reduce risks associated with oil pollution were incorporated into a SOLAS Protocol in 1978. Adherence to SOLAS requirements therefore plays an important role in minimizing pollution risks from ships while at sea and in port, and inspection of ships by port authorities or others is important to ensure that SOLAS requirements are maintained.

A 2007 ammendment to SOLAS was approved which comes into force in July 2009. This ammendment includes;

- Amendment to SOLAS chapter IV, to add a new regulation 4-1 on GMDSS satellite providers. The new regulation provides for the MSC to determine the critieria, procedures and arrangements for the evaluation, recognition, review and oversight of the provision of mobile satellite communication services in the Global Maritime Distress and Safety System (GMDSS).

- Amendment to SOLAS chapter VI, to add a new regulation 5-1 on material safety data sheets (MSDS), to require ships carrying MARPOL Annex I cargoes (oil) and marine fuel oils to be provided with a material safety data sheet prior to loading such cargoes. The regulation refers to the recommendation for material safety data sheets (MSDS) for MARPOL Annex I cargoes and marine fuel oils, adopted by the Organization through resolution MSC 150(77)
- Amendment to the International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships (INF Code), specifically, to chapter 2, on Damaged Stability, to bring it into line with updates to SOLAS.
- Amendments to forms contained in the appendix to the Annex to the 1988 SOLAS Protocol to add a section to cover alternative design and arrangements (Passenger Ship Safety Certificate, Cargo Ship Safety Certificate, Cargo Ship Safety Construction Certificate and Cargo Ship Safety Equipment Certificate). Also, similar amendments to the forms for the Nuclear Passenger Safety Certificate and the Nuclear Cargo Ship Safety Certificate contained in the appendix to the Annex to the 1974 SOLAS Convention.

International Convention on Civil Liability for Oil Pollution Damage, 1969. The Civil Liability Convention was adopted to ensure that adequate compensation is available to persons who suffer oil pollution damage resulting from maritime casualties involving oil-carrying ships. The Convention places the liability for such damage on the owner of the ship from which the polluting oil escaped or was discharged. Subject to a number of specific exceptions, this liability is strict; it is the duty of the owner to prove in each case that any of the exceptions should in fact operate. The Convention requires ships covered by it to maintain insurance or other financial security in sums equivalent to the owner's total liability for one incident.

The Convention does not directly impact port development or port operations. However, it does provide a mechanism for recovering costs associated with oil pollution incidents that may otherwise fall to a national government, an agency (e.g. ASEZA) or a seaport to pay and consequently the Convention is an important tool in ensuring a proper environmental response to oil pollution at a seaport caused by a ship.

Jordan is a party to the original Convention. However, Jordan is not a party to the subsequent protocols since that time (most recently in 2000) that have the effect of increasing the liability of ship owners for oil pollution damages. Additionally, broadly similar Conventions have been adopted that address liability for pollution caused by bunker oil and hazardous and noxious substances, but Jordan is not a party to these Conventions.

Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment 1982, and Protocol 1982. This regional Convention and its associated Protocol reinforce many issues also addressed in the international Conventions identified above. Among other things, however, the regional Convention addresses "hazardous substances", pollution from land-based sources and land reclamation (including dredging) and provides for a mutual aid response to environmental emergencies. Also, the Convention places a clear emphasis on prevention of pollution and while the Convention references prevention, abatement and combating of oil pollution, among other types of pollution, the definition of "oil" in the Convention is specifically defined to include "Petroleum in any form

including crude oil, fuel oil, sludge, refined oil, gases and other oil products, whose introduction might impair the marine environment.” (Art. I).

Seaports are not assigned specific responsibilities in the Convention; however, potential pollution sources resulting from seaport (and other) development and operations are included in the Convention. In addition, operational aspects of the new seaport in Aqaba will need to include consideration of Jordan’s role in responding to marine pollution since the port will be the only port in the country.

Jordan is not yet party to the following, implementation of which by Jordan would strengthen efforts to ensure that shipping and port activity in the Gulf of Aqaba can be undertaken in ways that support the integrity of the natural environment for both biodiversity values and other economic activities:

- The Bunkers Convention, 2001
- International Convention on the Control of Harmful Anti-fouling Systems on Ships (2001) – prevents use of harmful organotins on ships
- International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004), - establishes requirements and procedures for the management of ballast water.

Other Environmental Conventions and Treaties to which Jordan is party are listed below. However, it must be noted that these are only of marginal relevance to the ports development project.

- Ramsar Conventions of Wetlands of International Importance – 1971
- Convention on the Prohibition of Development, Production and Stockpiling of Bacteriological) Toxic Weapons and on their Destruction – 1972
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) – 1979
- Treaty Banning Nuclear Weapons Tests in Atmosphere, Outer Space, and Under Water
- Secretariat for both the Vienna Convention and the Montreal Protocol for the Protection of the Ozone Layer
- UN Framework Convention on Climate Change
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal – 1992
- Convention on Biological Diversity (CBD) – 1994
- UN Convention to Combat Desertification (UNCCD) – 1996
- Cartagena Protocol on Biosafety
- Convention on the Protection of African-EuroAsian Migratory Waterfowls

- Convention on the Conservation of Migratory Species of Wild Animals – 1979
- Rotterdam Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
- Stockholm Protocol on Persistent Organic Pollutants (POPs) – 2004
- Kyoto Protocol on Climate Change – 2003
- Convention Concerning the Protection of the World Cultural and Natural Heritage – 1975.

The following table summarizes the conventions discussed above.

Convention	Key Implications for Port Development	Key Implications for Port Operation
MARPOL 73/78 (Note 1)		
Annex 1 (Note 2)	"All ports within the special area to be provided with adequate reception facilities for oily residues and oily mixtures from all ships. Such facilities shall have adequate capacity to meet the needs of the ships using them without causing undue delay." (Reg. 38)	Oil Pollution Emergency Plan required (Reg. 37) An Oil Record Book is required, in which is recorded the movement of cargo oil and its residues from loading to discharging on a tank-to-tank basis; competent national authority may inspect the record book (Reg. 36) Governments authorized to investigate visible traces of oil in or on the water (Reg. 34) Prohibits discharge of oil or oily water in a Special Area (Reg. 34) Authorized officers may inspect vessels for operational compliance with Annex I requirements Reception facilities to be provided/operated for oily wastes and residues. (Note 3)
Annex II	Reception facilities required for Category X washings from ships, unless alternative is accepted by International Maritime Organisation (IMO) (Reg. 13 (6)), and potentially Category Y and Category Z washings from ships	Operation of port reception facilities Liquid substances carried in bulk must be categorized according to their marine hazard (Reg. 6) Materials (and their mixtures) other than water used to wash tanks will be managed as if they were cargo under Annex I or Annex II. (Reg. 13 (5)). Unless an alternative procedure is approved by the Flag State, tanks holding Category X materials must be washed after unloading and residues discharged to a reception facility. (Reg. 13(6)) Tanks holding Category Y or Category Z materials that are not unloaded in compliance with the Procedures and Arrangements Manual must be washed and washings must be managed in reception facilities. A cargo emergency plan is required.

Convention	Key Implications for Port Development	Key Implications for Port Operation
		A Cargo Record Book is required and will be used to record all cargo operations; the competent national authority may inspect the record book (Reg. 15) Authorized officers may inspect vessels for operational compliance with Annex II requirements (Reg. 16)
Annex III		Requirements for packing, labelling, storing and handling Annex III materials are set out (Reg. 1-6) Authorized officers may inspect vessels for operational compliance with Annex III requirements (Reg. 8)
Annex IV	Reception facilities may be required for ship-generated sewage (Reg. 12).	Operation of port reception facilities Authorized Jordanian officers may inspect vessels for operational compliance with standards and requirements of Annex IV (Reg. 13)
Annex V (Note 2)	Reception facilities required for ship-generated "garbage" (i.e. solid waste) (Reg. 5 and Reg. 7)	Operation of port reception facilities Garbage Record Book required on each vessel of 400 tons or more or carrying 15 or more people (Note 4); Jordanian authorities may inspect the record book (Reg. 9)
OPRC 2000 (Note 5)	Provision of equipment sufficient to respond to oil pollution incidents	Inspection by authorized officers of vessels required to have an oil pollution emergency plan (Art. 3). Sea ports and oil handling facilities required to have Oil Pollution Emergency Plans (Art. 3). Discharges of oil from ships, seaports and oil terminals to be reported to national authorities (Art. 4) Parties to the Convention to establish, in cooperation with port authorities and others, programs, equipment, plans and coordination sufficient to respond to oil pollution incidents (Art. 6)
SOLAS, 1974		Establishes requirements for ship-port interface with respect to safe handling of ships Establishes port State control for inspection of ships to ensure that they meet safety requirements for design, cargo stowage and operations
International Convention on Civil Liability for Oil Pollution Damage, 1969		Establishes liability for oil pollution to pay for oil pollution clean up.

Convention	Key Implications for Port Development	Key Implications for Port Operation
Regional Convention For The Conservation Of The Red Sea And Gulf Of Aden Environment, 1982, and Protocol, 1982 (Note 6)	Marine pollution to be prevented from: discharges from ships, including oil, waste and other materials (Art. IV and Art. V); land-based sources, including from outfalls and pipelines (Art. VI); land reclamation (including dredging) to be prevented (Art. VIII). Consideration of marine environmental effects, particularly in coastal areas, to be given in planning and execution of projects. Equipment to be maintained and available to address environmental emergencies (Protocol Art. 2)	Marine pollution to be abated and combated associated with: discharges from ships, including oil, waste and other materials (Art. IV and Art. V); land based sources of (Art. VI); and land reclamation (including dredging) (Art. VIII); Liability frameworks for marine environmental pollution to be established (Art. XIII) Marine emergencies to be promptly reported (Protocol Art. VII) Contracting parties to provide mutual aid when requested in times of emergency, including pollution by oil or other harmful substances (Protocol Art. XI)

Table 3.1: Summary of Key Conventions Related to Seaports and the Marine Environment

Notes:

1. Jordan is not a party to Annex VI of MARPOL, and accordingly the Annex is not included in this table.
2. The Red Sea Special Area under MARPOL Annexes 1, II and V means “the Red Sea proper including the Gulfs of Suez and Aqaba bounded at the south by the rhumb line between Ras si Ane (12°28.5' N, 043°19.6' E) and Husn Murad (12°40.4' N, 043°30.2' E)”.
3. Oily wastes and residues include, at minimum, tank washings (slops), oily mixtures containing chemicals, scale/sludge from tanker cleaning, oily bilge water, and sludge from fuel oil purifier.
4. Requirements for a Garbage Record Book may be waived for vessels on a trip of 1 hour or less, and for platforms engaged in exploration of exploitation of the sea bed.
5. OPRC defines “oil” to include any form of oil in either its crude state or in a processed/refined state, including LPG, or as a waste.
6. From Ras Dharbat Ali (lat. 16°39' N, long. 53°03.5' E), thence to a point (lat. 16°00' N, long. 53°25' E), thence to a point (lat. 12°40' N, long. 55°00' E) lying ENE of Socotra Island, thence to Ras Hafun (lat. 10°26' N, long. 51°25' E).

3.2 Local Legislation

The ASEZ has been provided with a high level of autonomy regarding its governance, including environmental governance. Accordingly, environmental management in the Zone is conducted within the mandate of *Aqaba Special Economic Zone Law (No. 32 of Year 2000)*, which established ASEZ and ASEZA, and which is implemented through a Board of Commissioners.

3.2.1 Regulation for the Protection of the Environment in the Aqaba Special Economic Zone (Regulation No. 21 of Year 2001)

Specifically, environmental management is performed within the framework of *Regulation for the Protection of the Environment in the Aqaba Special Economic Zone (Regulation No. 21 of Year 2001)*, issued under *Aqaba Special Economic Zone Law (No. 32 of Year 2000)*.

Article	Stipulation
4	- Establishes a permitting regime that requires enterprises that engage in economic activities pertaining to disposal of solid wastes, garbage dumps, sewage stations and reception facilities for oil to obtain an Operating Permit. - The Operating Permit may be issued only if the enterprise complies with environmental requirements that the Board may establish.
6	This article stipulates that all legislation in force in the Kingdom of Jordan shall apply to the Zone unless specifically superseded or contradicted by the provisions of ASEZ legislation.
9, F.	ASEZA shall protect the environment in the Zone.
10, B.3.	ASEZA shall assume authority for protecting the environment, water resources, natural resources and biological diversity.
43, B.	ASEZA shall administer the coastal areas.
52	- ASEZA shall be responsible for protecting and maintaining the environment in the Zone and for ensuring sustainable development according to a basis and standards which are not below the adopted levels in the kingdom. - Establishes definitions of "harmful substances" and "noxious liquid substances" in accordance with definitions in international conventions - It stipulates that ASEZA shall assume the powers of the National Environmental Regulation (then the General Corporation for Environmental Protection, now the Ministry of Environment), and that the Chief Commissioner of ASEZA shall assume the powers accorded to the Minister of Environment.
54	Establishes the primary role of ASEZA in collecting solid and liquid wastes from ships
54, B	ASEZA is authorized to extract fines and compensation from polluters of the sea or the environment within the Zone.
53	ASEZA is permitted powers of search and confiscation related to environmental protection.
55	Commits ASEZA to protection of the Gulf of Aqaba in its jurisdiction in accordance with the designation of the Gulf of Aqaba as a MARPOL Annex I "Special Area"
56, 57	Prohibits the discharge from ships and coastal facilities in Regional Waters or the Port of harmful substances, oil, garbage and other items and requires the disposal of these items in accordance with ASEZA approval or direction
56, E	ASEZA is responsible for the regulation and administration of the Aqaba Marine Park.
59	Ships are required to maintain an Oil Record Book and the ship's captain is required to report a discharge of any substance that is a pollutant to the marine environment
62, 66 and 67	Establishes a schedule of charges and penalties for the discharge and removal of pollutants from the marine environment.

Table 3.2 Law No. 32 Articles and Stipulations

- Provides that ASEZA may suspend any operation that causes or threatens to cause environmental pollution.
- Establishes requirements for EIA.
- Provides for environmental audits to be undertaken to ensure compliance with environmental conditions.

ASEZA's Environmental Protection Regulation (No. 21 of the year 2001) provides the basis for environmental management in the Zone. This Regulation lists prohibited acts regarding waste management, use of seawater, and emission of harmful substances to the environment. The regulation addresses the legal framework for environmental management and monitoring in the Zone including environmental clearance and post-clearance phases of economic activities. The regulation also details appropriate measures to prevent environmental pollution and protect the marine resources, and set out a legal framework for the imposing penalties for pollution incidents.

In addition to these laws and regulations issued by ASEZA, there are also a number of Jordanian standards and regulations that apply in the ASEZ. With regard to the environment, it is explicit in the ASEZ Law that current existing environmental legislations in Jordan are applicable to the ASEZ until ASEZA issues its own superseding legislations.

A more detailed summary of relevant environmental legislations and technical requirements, and a listing of applicable international conventions is outlined in the document - "Environmental Management in the ASEZ⁷," which is issued by ASEZA.

Although specific ASEZ environmental legislation supersedes legislation derived from the rest of Jordan, a number of relevant laws, regulations and standards from the rest of Jordan remain in force in the ASEZ as outlined below.

3.2.2 Jordanian Regulations

The major regulations applicable and in force at the ASEZ are summarized in Table 3.3.

Regulation	Stipulation
Regulation No 24 of 2005, for the Management, Transportation & Handling of Harmful & Hazardous Substances	▪ Issued in accordance with paragraph (B) of Article (5) and Paragraph (A) of Article (9) from the By-Law of Hazardous Waste Management and Handling Number (43) of 1999. ▪ Focuses mainly on setting general procedures for hazardous waste producers in terms of storing, handling, collection and disposal procedures for hazardous waste and empty hazardous waste containers, including emergency plans, precautions and setting general procedures before transferring to those who are responsible for transporting. ▪ Deals with special conditions for owners or managers of the specified site for storing, treating and disposing of hazardous waste and registering the waste, ensuring the implementation of safe procedures in order to prevent fire and other accidents, since there are special

⁷ Environmental Management in the Aqaba Special Economic Zone, ASEZA, 2002.

Regulation	Stipulation
	restrictions for safety and health of the employees in the site. ▪ This regulation will relate to the Ports project where hazardous materials are to be handled.
Solid Waste Management Regulation No. 27 of 2005	▪ Ensures the management of solid waste in a way that maintains environmental protection and public health. ▪ Lists details, responsibilities and tasks to be undertaken including observing and collecting operations, transportation of wastes, permitting, supervising, scheduling and archiving and outlining the responsibilities and tasks for the Ministry of Municipalities and the Ministry of Environment. ▪ Sets the duties to be fulfilled by the Ministries in cooperation with the related bodies. These duties include picking up the waste, defining stipulations of storage, collection, sorting, recycling, and treatment and awareness and training programs in addition to dealing with compliance, offences, punishments and fines. ▪ This regulation will be applicable to the Ports project in Aqaba, and its requirements need to be taken into account in the Solid Waste Management Policy of the port development.
Groundwater Control Regulation No. 85 of 2002	▪ Issued pursuant to Articles 6 and 32 of Water Authority Law No. 18 of 1988. ▪ The general rules of the Groundwater Control Regulation are that "the groundwater is state-owned, subject to its control. It is not permissible to pump or utilize groundwater without obtaining a license issued according to the provisions of this law. The purpose of usage and the quantities of pumped water and any other conditions should be identified in the license". Owning a land does not include groundwater ownership. A license is required for drilling wells. Supervision by the authority and a pumping test are required. "Any one who is granted a license to extract ground water shall be committed not to cause water pollution or depletion, and strictly comply with the conditions of the license". The regulation emphasizes on other licensing rules and fees as well as water prices, pollution control, and requirements from private well owners. ▪ At this time, no groundwater abstraction is proposed in the Ports Development and Relocation project. However, it remains an option, in which case the Groundwater Control Regulation would apply
Used Oil Management Regulation 68, 2005	▪ Outlines regulations that prevent oil discharges into sewer systems, cesspits, sources of surface water, groundwater or the environment, whether by individuals or institutions, to prevent mixing oil with household solid waste and dispose the waste in the landfills and prevent mixing oil with hazardous wastes such as solvents or any other chemicals so as to enable the re-use and benefit from the reduced cost of treatment or disposal. ▪ Identify how to deal with oil in emergencies, to develop a contingency plan includes procedures to be followed to minimize the

Regulation	Stipulation
	potential risks of emergency on human health or the environment and to ensure non-proliferation of fire or explosion or leakage to other places. Sets out conditions to be met and followed by oil producers and special requirements that must be followed by oil carriers. As well as particular requirements of the collection points, recycling, oil treatment units, treated and incendiary oils used as fuel, health and safety of dealers with oils, end-use control of treated and untreated oil according to their quality as to be approved specifications that will be used for.
Instructions for the Control and Use of Ozone Depleting Substances, 2003.	- Issued in accordance with Law No1 2003 Articles 9-15; 'Law for the Protection of the Environment'. - Emphasizes the implementation of a program for gradual reduction of the use of Methyl Bromide and its termination by 2015 in addition to providing guidance and technical assistance to farmers in terms of its use. - The regulation relates equally to awareness programs for companies and factories that consume ozone layer depleting substances. And requires companies and factories to place appropriate stickers on their products that display the product's commercial and scientific name and either the phrase: "Harmful to Ozone Layer", or "Ozone Layer Friendly", as appropriate. - Prohibits the parties who received a grant from the Montreal Protocol Multilateral Fund to use or import or export Ozone layer depleting substances, in addition to that, all personnel and public and private institutions are prohibited to export substances depleting the Ozone unless approved by the Ministry of Environment. They should also dismantle old equipment in cooperation with the Ministry of Environment and the presence of the implementing agency. - The regulation may be applicable to the project, both the decommissioning of the Main Port and the operation of the South Port, but its relevance and application will depend on the proposals of the development companies.

Table 3.3 Major Regulations in Force in the ASEZ

3.2.3 Jordanian Instructions

Instructions relevant to specific environmental aspects at the ASEZ are summarized in Table 3.4.

Instruction	Applicability
Instructions No. (37), 2002 Environmental Damages Committee	- Issued according to Article (70) of the Regulation for Environmental Protection No. 21, 2001 - Establishes an Environmental Damages Evaluation Committee to evaluate the damages arising from environmental incidents Annex 2 provides an estimate of the damage value to coral reefs as 4,000 JOD per m² of damage. - However, Article 6 allows the committee to take into account the

Instruction	Applicability
	specific situation regarding damage, include the location, sensitivity, economic value, and authorizes studies and analyses to be carried out to provide the evaluation.
Recycling and Handling of Consumed Oils, 2003	▪ Issued according to article 9 of Regulation 43/1999 on the Management of Harmful and Hazardous Substances. ▪ Defines consumed oils as oils refined from raw petrol or industrial oils that have been used, & which as a result are transferred into polluted waste together with chemicals or physical pollutants and which should be disposed of or treated or recycled. ▪ Other definitions are given for underground tanks used as storage tanks to store & treat oil, oil containers & oil collecting licensed stations. They describe how these instructions are implemented on oil producers, parties that transport oil, collecting stations, treatment units, oil combustors, & all directly or indirectly related parties in the stages of oil use & recycling. ▪ Other definitions of general requirements include: - Prohibition of discharge of oil into sewage networks or septic tanks or surface and ground water resources or the environment. - All parties mentioned in Article 3 must obtain a license from the Public Institution for Environmental Protection. - Oil mixing with solid residential waste and disposal into the municipal dump for residential waste is prohibited. - Oil use for energy production is prohibited in food producing institutions. - Use of raw oil for energy production is prohibited in institutions, factories or houses unless an approval is given. - Mixing of oils with hazardous waste and chemicals is prohibited In addition, general conditions for oil producers, oil collection stations & oil carriers are set and the general conditions for oil carriers include having an identification number, submitting of full information about the company with the license request, transferring the oil into a licensed collection station only. Other articles list the conditions for oil recycling & treatment units. ▪ These instructions will apply particularly to the construction phase, and also to maintenance operations of the facility.
Instructions on the Reduction and Prevention of Noise, 2003.	▪ Issued in accordance with Article 27 of the Environment Law No12/1995. ▪ Concerned with controlling and preventing noise outside the work environment. Instructions for controlling and preventing noise issued by the Ministry of Labor are applied inside the work environment. The measures and recommendations mentioned in the acoustics code shall be applied when establishing buildings and construction for the purposes of night clubs, wedding and dancing halls. ▪ Define the maximum allowed equivalent sound levels and it does not allow in any case exceeding the maximum limit for the equivalent sound level (Decibel A). For industrial areas (heavy industrial), the maximum allowed level is 75 dbA during the day and 65 dbA during the night. ▪ Noise impacts from the development are particularly related to the construction phase, and are considered in the environmental monitoring plan.
Disposal of Industrial and Commercial	▪ Issued in accordance with Water Authority Law No 18 for year 1998 and Article No 23 of the Sewage System Law No 66 for year 1994. ▪ Prohibit the disposal of wastes into the sewage network - mainly any

Instruction	Applicability
Wastewater in to the Sewage Network	substances that may clog the sewage network, or which could cause harmful effects to health, odors, and damage to the sewage network or plants. Also any toxic compound that may cause adverse effects, inhibit the treatment process, coagulate or precipitate and present danger to humans, animals and/or plants is not allowed to be discharged. - Contains a list of all prohibited chemicals, substances and material that may cause adverse effects to the sewage network. - This instruction is applicable.

Table 3.4 Instructions Relevant to the ASEZ

3.2.4 Jordanian Standards

The main regulatory standards controlling the key environmental matrices and enforced in the ASEZ are summarized in Table 3.5.

Standard	Details
Jordanian Standard on Water and Bathing Water JS1563/2004	- Issued by the water and wastewater committee in the Jordanian Institution for Standards and Meteorology (JISM) in 26/7/2004. - Regulates water quality requirements, including microbiological, chemical and physical parameters for swimming pools and other bathing waters and recreational activities. - Sets out monitoring and reporting requirements assure bathing water suitability for recreational activities. - At the Ports Development and Relocation Project, these may be applicable to swimming pools and to tourism development activities at the main port development site, if bathing is to be permitted.
Jordanian Standard JS893 updated 2006 Water- Reclaimed Domestic Wastewater	- Relates to reclaimed wastewater and its reuse. One of the used categories of wastewater is irrigation of recreation grounds, courses and road sides where the guidelines for irrigation must be followed which includes parameters such as BOD, COD, pH, TSS, Cl2, turbidity, E.coli, etc. - Applicable if treated wastewater is used for landscape irrigation at the development of the Main Port site or industrial use at the South Port.
Jordanian Standard JS 1140/2006 Environment - Air Quality - Ambient Air Quality Standards	- Specifies maximum allowable limits of concentration of ambient air pollutants, beyond which, responsible parties should take action. The parameters defined include SO₂, CO, TSP (total suspended particles), NO₂ and H₂S with corresponding average time for taking samples and allowed number of times for exceeding the standard. These standards describe also methods to be used for measuring the above parameters. - Applicable and considered in the Environmental Monitoring Plan.
Jordanian Standard JS 202/2007 Water - Industrial Reclaimed Wastewater	- Concerned with conditions and parameters for industrial wastewater generated and which will be discharged into the surface water or which feeds naturally into the groundwater or which is intended to use for irrigation purposes. - Wastewater generated from industries is defined as water

Standard	Details
	which is discharged or produced from use of water in some or all the phases of production processes, cleaning, cooling, or others, whether treated or untreated. Has relevance to the project, especially for wastewater water effluents from the developed Southern industrial estate or regards to the water effluents from chiller systems which may have additives.
Jordanian Standard 431/1985 Storage - General Precautionary Requirements for Storage of Hazardous Materials	Gives recommendations for storage of hazardous material

Table 3.5 Applicable Standards in the ASEZ

3.2.5 Other Laws

In addition to the above presented regulations, instructions and standards, there are other laws that are relevant to the environment and applicable in the ASEZ. These are summarized in Table 3.6.

Law	Applicability
Jordan Maritime Authority Law	- Sets the objectives to regulate, supervise and develop the marine sector as well as contribute in marine environment protection and boost maritime safety standards. - License all maritime activities in cooperation and coordination with the parties concerned and in conformity with the provisions of ASEZA law in force, issuance of documents and certificates for seafarers in the maritime sector, conducting inspections and surveys on ships and marine equipment in Aqaba Port area, control of pilot age, tugboat activities and coastal navigation as well as investigating maritime accidents within the Jordanian territorial waters.
Antiquities Law of the year 1988, No12, amended by Law No23 for the year 2004	- Requires that significant archaeological sites should be documented and protected by a buffer zone of 5 to 25 m. Sites discovered during excavation operations must be reported to the Department for a decision on whether the site is significant enough to be studied or protected. - At this point, this Law is not relevant to the Ports Development and Relocation Project, since the Southern area is an already developed industrial zone. It is not expected that archaeological remains will be found during the excavation works. However, in case such remains are discovered, the requirements of the Law have been considered in the design of mitigation measures and in the monitoring plan.
Health and Safety – Labor Law (Law No. 8 for the Year 1996, and amendments, including Chapter IX, Occupational Safety & Health)	- The Jordanian Labor law contains regulations concerned with the health and safety of workers and their affairs starting with regulations on work permits and ending with medical aids, social security and exposure limits. - Emphasizes the importance of precaution measures in the work place for the prevention of injuries and the protection of diseases and hazards or other discomforts. Employers must ensure safe conditions for employees, and inform them about occupational risks, hazards, potential fires and explosives and provide them

Law	Applicability
	with proper instructions, and medical emergency facilities in case of injury. ▪ Industrial establishments must ensure a pollution free environment, protection against noise, vibrations, and aspects that may jeopardize employee's health, thus abiding by international standards and implementing special methods of testing and examining for controlling such standards. ▪ If an employee was stricken with one of the occupational diseases, disabilities or death due to work practices with a medical authority report stating the condition, then the employer is obliged to pay the compensation payment according to the law. ▪ An EIS does not form a Health and Safety report or audit. However, some of the provisions of the Labor Law are related to environmental parameters. ▪ This law is applicable both to the contractor and his agents, and to all aspects of related to the operation of the port facilities and the Main Port development.

Table 3.6 Applicable Laws in the ASEZ

3.3 Relevant Institutional and Regulatory Framework

As noted earlier, Jordan's entire coastline lies within one national and municipal jurisdiction - that of the Aqaba Special Economic Zone (ASEZ). The ASEZ was established in 2001 to attract and facilitate investment in Aqaba in the areas of tourism, industry, port development, infrastructure, utilities and commercial services. The ASEZ is governed by the Aqaba Special Economic Zone Authority (ASEZA), which acts both as a municipal government regulator, as well as a regional development agency, investment promoter and facilitator.

ASEZA is governed by a Board of 6 Commissioners. One of these Commissioners has particular responsibility for Environmental Protection. ASEZA is responsible for the environmental management of the Zone as well as the regular monitoring and auditing of industrial activities and other activities which may affect the environment of the zone, and ensuring the development of and compliance with current standards.

ASEZA's Directorate of Environment includes a division responsible for the planning and implementation of environmental inspection and audit activities within the Zone, including the ongoing assessment of both industrial and tourism enterprises, to ensure compliance with environmental standards and regulations. Within the Directorate, there is a division responsible for the development and ongoing assessment of environmental codes and standards to be adopted by ASEZA in order to govern environmental performance within the Zone. Also there is a department that deals with education and public awareness, consumer protection, legal issues, and maritime operations

ASEZA also has a division responsible for reviewing and analyzing the environmental implications of potential investments and projects in the Zone. Specifically, this division will supervise and manage the implementation of both preliminary and comprehensive EIA studies, required as part of the environmental clearance procedure, as well as holding public hearings. This division recommends the acceptance/rejection of EIAs and the project classification with regard to the environmental clearance request.

An additional division is responsible for environmental monitoring programs and studies that provide baseline information on the Aqaba environment. This will include the implementation and maintenance of monitoring networks to cover air and water quality, groundwater quality and quantity, marine currents, fish, corals, and other key parameters. Its responsibilities also include the implementation and maintenance of an environmental database, and development of predictive computer models, and commissioning of new research on the state of the environment.

3.3.1 Environmental Clearance

As noted above, environmental clearance in Aqaba is governed by the Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001. According to this Regulation, any project that may have significant effect on the environment according to its location, nature and effects will require a full EIA, to be provided by the project owner as explained in Section 1.

The Directorate of Environment will review the submitted EIS report, and make a decision on environmental clearance. The Commissioner shall issue the final decision, in writing. If Environmental Clearance is to be granted, the EIS report, together with the proposed mitigation and monitoring plans shall be considered an integral and binding part of the clearance agreement.

3.3.2 Post Clearance

All economic activities within the Zone are subject to periodic environmental inspection to ensure their compliance with environmental regulations and requirements. An inspection program is implemented throughout the Zone by the Directorate of Environment. This inspection program is prioritized to concentrate on those facilities or activities which pose major threats to the environment. The inspection plan covers five main categories: hotels and tourism resorts, industrial facilities, hospitals and medical facilities, storage facilities, port facilities, and other services that have a significant effect on the ASEZ environment. The inspections focus on pollutant effluents, emissions, or wastes resulting from any activity or service in the area.

Given the relatively small scale of the Zone and the limited number of large industries in the large-risk category, in terms of their ability to damage the environment, ASEZA has adopted a participatory approach of working alongside industries, persuading them of the need to ensure compliance.

In addition to the regular environmental inspection program, ASEZA has the authority to initiate an environmental audit of any public and private enterprise in the ASEZ. The purpose of the audit is to ensure that the establishment is complying with environmental rules and regulations, and to ascertain that the best available technologies and practices for the control and prevention of environmental pollution are being utilized. An environmental audit may be initiated in the following cases:

- Where complaints are received from residents or workers in a particular facility about any harm or pollution resulting from the operations conducted therein;
- In case of an accident related to the facility's operations, regardless of whether this occurred within or outside the facility, where such accident resulted or may have resulted in environmental harm;

- If the environmental inspection or monitoring results show that the project's activities are causing the release of pollutants into air, soil or water in excess of permitted levels according to adopted standards in ASEZ, or in amounts that may cause direct harm to the Environment.
- Where a periodical inspection shows the necessity of conducting an environmental audit.
- Where an audit is required to monitor the facility's compliance with mitigation measures or management plans that have been established by the operator in accordance with a previous EIA. In practice, ASEZA relies on the industries to carry out their own monitoring and report the results to ASEZA.

3.3.3 Application of Legislation to the Port Relocation and Redevelopment Project

The new South port will be subject to the international legislation cited above, and to Jordanian legislation regarding environmental management. In addition, the ports operators will be required to establish best practice procedures and methodology over and above applicable legislation. ASEZA's Environmental Protection Regulation No 21, including the over-riding policy of zero discharge to the marine environment allow for strict performance conditions to be applied. There will be third party scrutiny of both the construction and operation of the ports, particularly with regard to the impacts on the marine environment and coral reefs. The SPV should therefore seek to develop policies of responsible environmental management which are comparable to best practices overseas. The visit and statements of Jon Mayson – ports operator from New Zealand – at the Scoping Session, about the possibility of operating and maintaining a very clean port with minimal emissions and spillages have encouraged the stakeholders to expect high performance standards from the new Ports.

During ports operation, the Environmental Protection Regulation will be applied by ASEZA, with the support of other national Jordanian legislation. In the absence of both the local and national standards, relevant international expectations will be referred to, including, but not limited to noise, air quality, marine environment, health and safety, wastewater effluent and bathing water. The Environmental Management Plans – Section 9 – have been developed in accordance with the relevant legislation. It should be noted that the active stakeholders with a concern for protecting the sensitive marine environment will be constantly encouraging ASEZA to apply legislation strictly to the new port, in order to prevent unnecessary deterioration of the marine environment.

One important piece of legislation of relevance to this project is Instruction No 37, 2002 which establishes a Committee to Evaluate Damages to the Environment. The Instruction authorizes the Committee to measure the damage, seek expert advice, take into account the location, sensitivity of the area, economic value of the resource impacted, and to conduct studies to evaluate the extent of damage. However, an annex to the Instruction suggests a value of 4,000 JOD / m² to be applied to the damage of coral reefs. This EIA has conducted a full evaluation of the direct impacts on the corals damages, using recognized international expertise, on the assumption that the Committee will accept the findings of this expertise, and that the damage valuation derived using the agreed methodology will supersede that suggested in the Annex. ASEZA is the ultimate arbiter on this issue.

4.0 Description of the Existing Environment

4.1 General Overview of Aqaba Ports

4.1.1 Location

Figure 4.1 is an aerial photograph of Jordan's 27 km stretch of coastline showing the locations of the town of Aqaba, the Main Port and South Port.

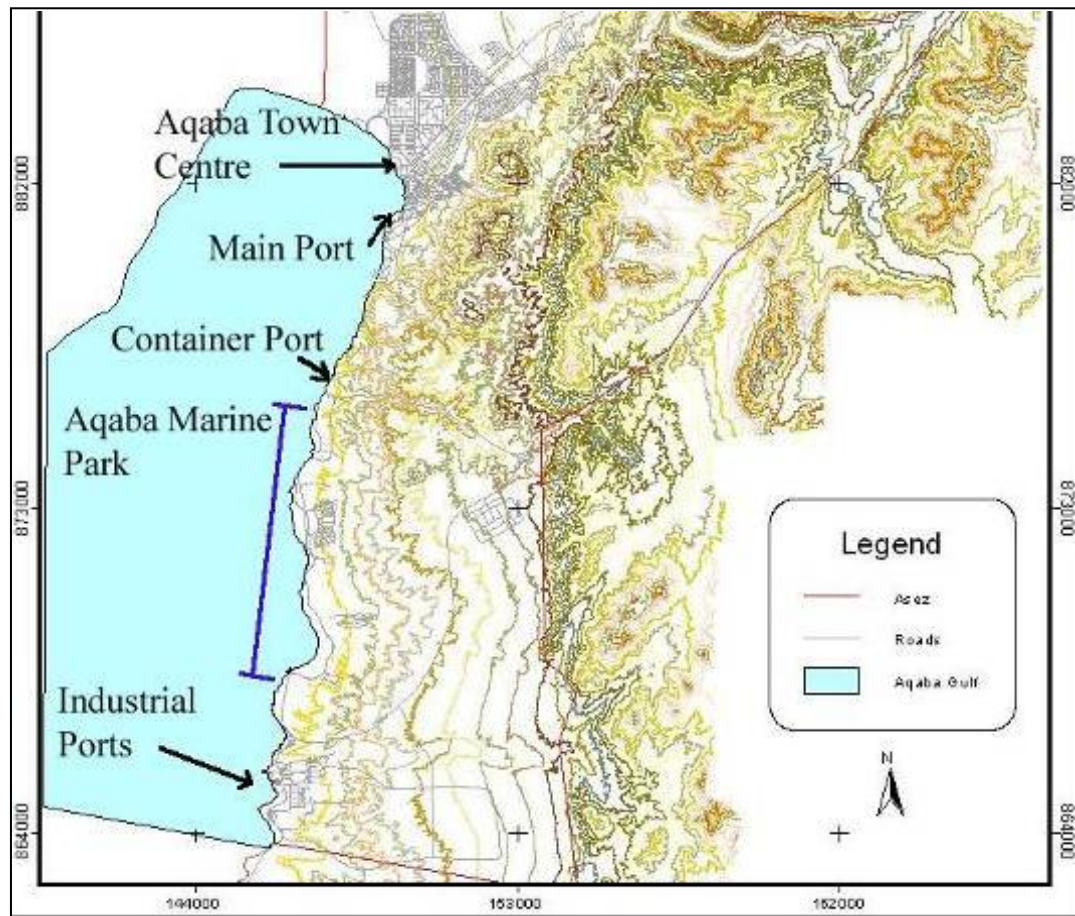


Figure 4.1 Aerial Photograph of Jordan's Coastline

Aqaba is situated at the north eastern tip of the Gulf of Aqaba on the Red Sea. North of Aqaba, undisturbed sandy desert of Wadi Araba stretches towards the Dead Sea. The stretch of northern coastline is now taken up by tourism facilities, and the urban centre of Aqaba. The Main Port, located along the southern edge of the Town of Aqaba, dominates the landscape and coastline to the immediate south of the city. The coastal zone then stretches southwards, fed by alluvial fans that spread westwards from the inland mountains to the shoreline. The shoreline between the Main Port and the Aqaba Container Port is mostly rocky. To the south of the Container Port, the shoreline becomes more dominated by sandy beaches fringed with coral reefs. In this stretch lie the Aqaba Marine Park and the protected coral reserves. The southernmost few km of coastline are dominated by the South Port area and Industrial Zone.

4.1.2 Topography and Landscape

Jordan's coastline zone is bordered to the east by mountains, which reach an elevation of 1,600 meters above sea level (mASL). These mountains run parallel to the coastline towards the north where the Wadi Araba forms the northern edge of the Jordan Rift Valley. The town of Aqaba sits at the northern part of the Gulf at the meeting point of Wadi Araba and Wadi Yutum. It is confined between steep mountain slopes to the east and the coastline to the west. The coastline's beach resources are less pronounced at its northern parts than at the southern coast. Hilly areas, with various slopes, lie behind the beach until the ridge mountains are encountered to the east.

The topography of the basement is characterized by rugged mountain ranges, undulating hills and ridges dissected by wide generally flat-bottomed wadis in the upstream, which are more deeply incised downstream along the western coastline. Lagoonal deposits occur close to the present shoreline in Dirreh area. These deposits consist of grey green gypsiferous marl inter-fringing with remnants of reef of massive branching corals and echinoids contained within a calcreted sand matrix. A previous detailed geological investigation within ASEZ indicated the presence of two major fault systems located within the southern part of ASEZ. These two fault systems are trending N-S and E-W.

As Jordan's only sea outlet, the Main Port and South Port sites at Aqaba, contribute significantly to the national economy, with income generated through the ports, industries and tourism.

4.1.3 Climate

Aqaba lies within the Saharan Mediterranean Bioclimatic Zone, and the Gulf of Aqaba is known for its warm arid climate. The area is characterized by a hot summer and a warm winter with mean monthly air temperature ranging from 14°C in January to 32°C in August.

Wind conditions are calm and northerly in the northern Gulf of Aqaba throughout the year. The prevailing winds in Aqaba are northerly and north-north-easterly occurring 35% and 46% of the time respectively. Winds are strongest during the summer season and calmer during the winter. Annual average wind speed is 4.0 ± 0.5 m/sec.

The relative humidity ranges from 45% in April to 57% in December with monthly averages ranging from 40% in May-July to 52% in August-December. Rainfall is low in Aqaba, averaging 35 mm/year, short spanned and occurring mostly between November and May. Evaporation is high and can reach up to 4 m/year.

4.1.4 Overall Drainage

The Gulf of Aqaba receives stormwater from paved urban and resort areas and floodwater from catchments to the north and east. Flooding is a significant problem in some areas of Aqaba despite low annual average rainfall.

46 catchment areas have been identified which input into the Aqaba basin from the Jordanian side. Table 4.1 lists the main 7 catchments draining to the coastline. Wadi Yutum runoff flows down towards the north of Aqaba and the Gulf. The runoff of Wadi T and Shallalah pass through Aqaba's urban center. Wadi Jeishiek runoff drains towards the Main Port and that of Wadi Mabruk passes through the Container Port. Further south, runoff from Wadi 9 passes through the tourist area of "Coral Coast" and Tala Bay

while Wadi 2 runoff passes the northern end of the industrial area. The remaining 39 catchments vary in size from 0.1 to about 7.4 km².

Catchment's Designation	Drainage Area (km ²)	100 year flood peak (m ³ /s)
Wadi Yutum/Wadi Araba	1,500	900
Wasi T	10	136
Wadi Shallallah	10	133
Wadi Jeisheik	9	122
Wadi Mabruk	65	500
Wadi 9	28	279
Wadi 2	62	455

Table 4.1 Main Seven Catchments Draining Through the Urban Areas of Aqaba

A significant sediment load is carried by runoff from these catchments which pass through urban areas of Aqaba. The Wadi Yutum drainage system delivers sediments into an extensive alluvial fan area located to the north of Aqaba. This drainage system passes through urban Aqaba via outfalls into shallow areas of the upper end of the Gulf, while coastal wadis either flow through short drainage channel or closed drainage systems or directly into deep water of the Gulf.

4.1.5 Main Port Site

Figure 4.2 shows an aerial view of the Main Port site. The Main Port occupies an area of around 1,200,000 m². A separate study, Contamination Cleanup and Assessment of the Aqaba Ports Development Project, 2008⁸ was commissioned by ADC in 2007 to identify any environmental contamination at the site. Some of the results from this study have been used as sources for the following subsections.

The Main Port encompasses 12 berths that handle general cargo, grain cargo, phosphate and light traffic. The general cargo area consists of 9 berths, each 35 m in length. One berth is used for imported grain handling. A mid-basin area contains a 300 tons maintenance slipway, with a workshop and is used for lighter crafts. Other facilities include 245,000 m² of open yard, 103,000 m² of transit sheds and covered warehouses, and cold storage space for 2,000 tons of cargo. An established yacht basin is also present within the Main Port vicinity. A truck area is located above the port in Wadi Jeishieh. Access to the Main Port is provided by 5 gates from the Coast Road.

The visual setting of the Main Port is primarily characterized by the presence of the phosphate facilities, grain silos and the JoPetrol facility, in addition to several hangers and storage sheds. Another characteristic structure is the control tower present in the north western portion of the Main Port.

⁸ Aqaba Ports Development Project, Contamination Cleanup and Assessment, ADC, 2008.



Figure 4.2 Aerial Photograph Showing the Main Port Site.

The site is generally impacted from over 30 years of port activities. In particular, there are significant deposits of phosphate dust released to the air or spilled on the land, buildings and spare ground, as a consequence of the unloading activities of trucks and trains, and loading of ships. Grain dust waste is also found near the grain silos and some past contamination from fuel spillage and oil spills were spotted in the central workshop and the storage areas.

Moreover, there is known to be asbestos in a number of the storage buildings, especially the phosphate storage sites. There is approximately 7,300 m² of cement asbestos board (CAB) on the roofs of buildings A11, A14 and A16 in the General Cargo Area.

There is approximately 2,200 m² of CAB on buildings C3 (covered parking), and C9 and C(a-the old power house and switch gear room). It is also likely that the interiors of C9 and C9a contain additional CAB in the electrical boards or enclosures.

There are also minor amounts of CAB (around 300 m²) around the workhouse and related structures, with some likely asbestos in the piping to the petroleum tank farm.

There is approximately 74,000 m² CAB on the roofs and walls of the large phosphate storage structures, and two large silica storage structures.

There are also some deposits of silica and broken asbestos found in an open disposal site close to Phosphate Berth A and the Wastewater Treatment Plant.

4.1.6 South Port Site

Figure 4.3 shows an aerial view of the South Port site. The South Port and Southern Industrial Zone covers 28 km² of rugged terrain with about 3.5 km of coastline at the southernmost part of ASEZ. It is bounded from the south by Wadi 1 and the Saudi Arabian border, from the east by the Gulf of Aqaba, from the west by the ASEZ boundary, and from the north by a designated buffer zone (wilderness area) running along Wadi 2. The site is crossed by deep and wide wadis (dry river beds) running from the mountains to the coast. Additional land area is included north of the buffer zone for the development of affordable housing and supporting industries.

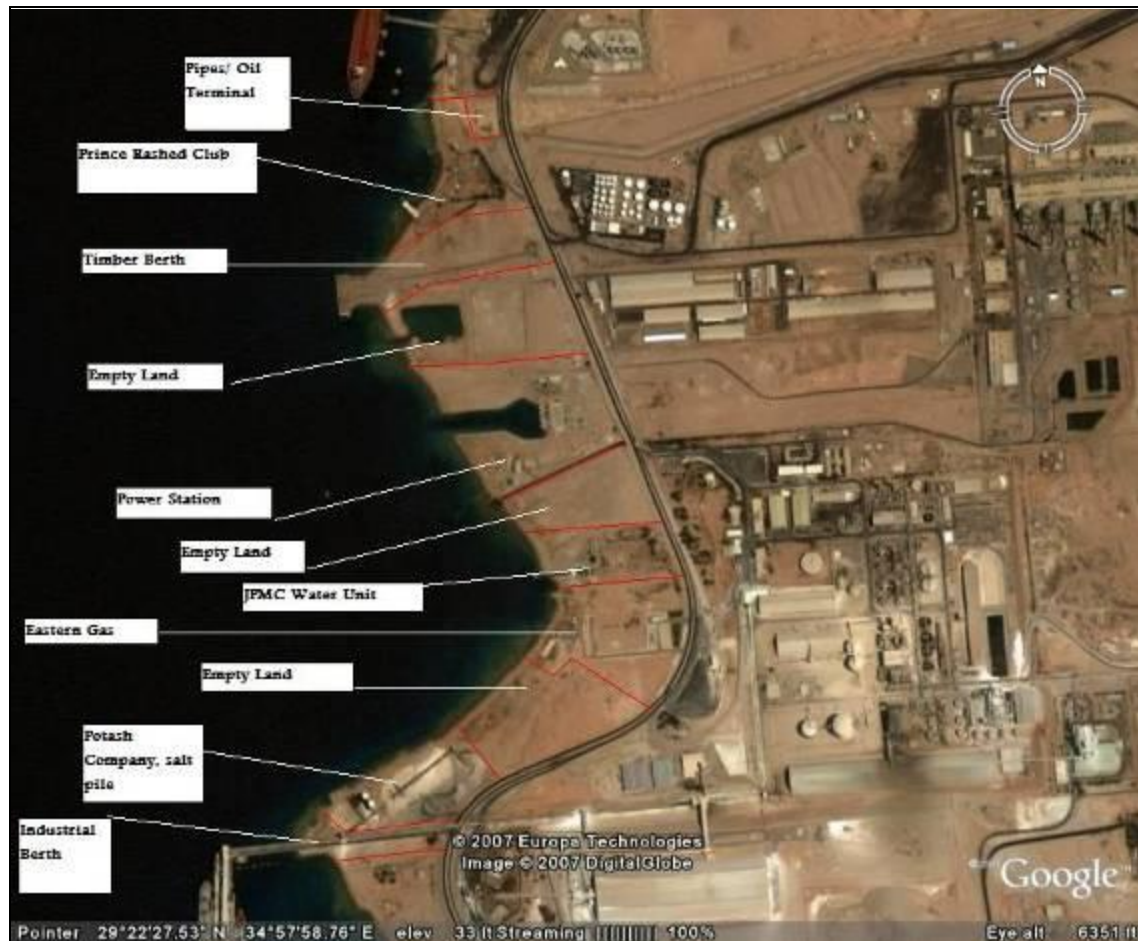


Figure 4.3 Aerial Photograph Showing the South Port Site.

The South Port site has already been classified as an 'Industrial Zone' by ASEZA and existing fertilizer and port works are well-established in the western coastal area of the Zone. Approximately 13% of the Zone is occupied by fertilizer industries, bulk liquid import and storage companies and the Aqaba Thermal Power Plant. About 30% of the available coastline is occupied by the existing port including three jetties, and various seawater outfalls, intakes and gas pipelines.

Figure 4.4 shows some of the relevant utility infrastructure along the coastline. The KEMAPCO facility has a sea water intake and outfall in Dirreh Bay. Both the Aqaba Thermal Power Plant and JPMC have intake and outfall structures in the bay to the north of the Industrial Terminal. Other pipelines include water, wastewater and a fibre optic cable lie along the coastal highway. Of particular importance to this project is the gas

pipeline. The approximate location of this is illustrated on the drawing, but more detailed mapping of its route is available. The need to coordinate with related third parties during construction is highlighted in the Performance Requirements section.

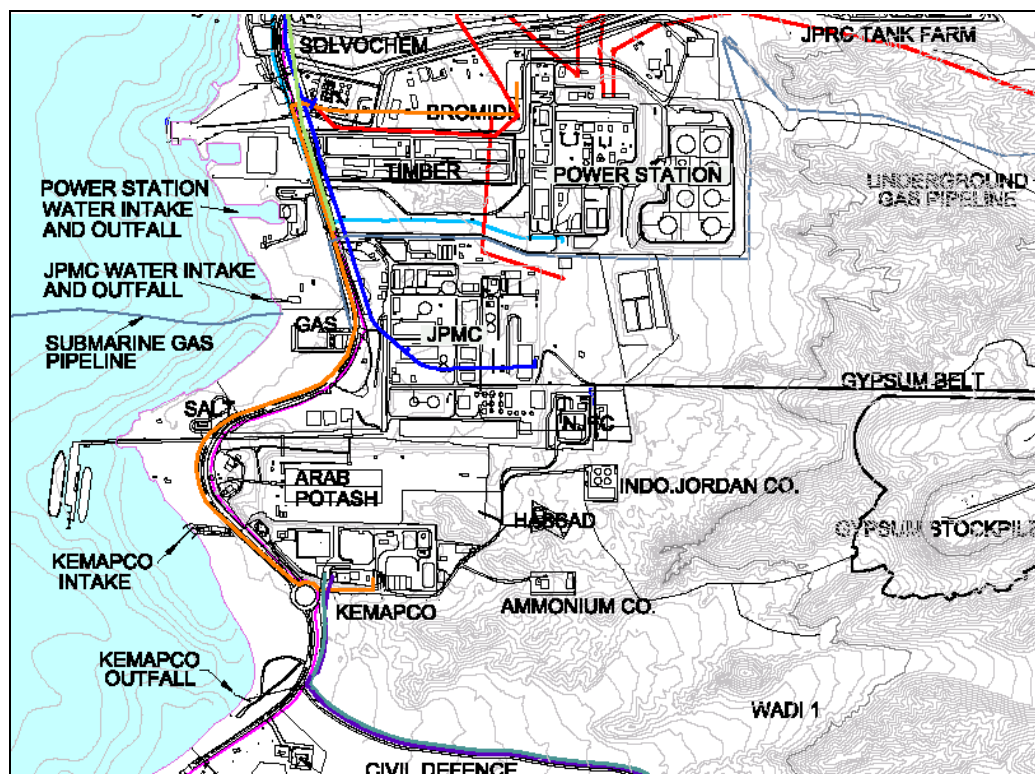


Figure 4.4 Map Showing Existing Utilities on Coastline

Moving from north to south, the Oil Jetty has a design draft of 24 m and consists of a number of concrete mooring dolphins. The terminal was used to unload liquid petroleum gas (LPG). However, it is currently used to berth the 300,000 tons oil tanker - 'Jerash', a single hull tanker which is used as a floating storage facility for crude oil. A fixed jetty connects the jetty to the shore facilities, and contains pipework for gas and oil transfer to and from the ships.

The Timber Berth is an 80 meters long berth capable of receiving ships of up to 14,000 tons. It was used in the past for the unloading of timber and livestock, but is not used extensively at the moment, as most of Jordan's timber imports come through the Main Port. As mentioned above, the Oil jetty was used to load and unload lpg, but given that this terminal is being used by the oil tanker 'Jerash', the Timber Berth is currently used to unload lpg, which is piped directly to the Jordan Petroleum Facility underneath the highway.

The Industrial Jetty handles exports of potash, industrial salt, fertilizers and phosphoric acid, together with imported sulphur, ammonia and fuel oil. It consists of a jetty and two berths constructed to serve the adjacent industrial complex. The west berth is 220 metres long, has a draft of 15 metres, and can receive ships up to 70,000 tonnes displacement. The eastern berth is 190 metres long, 11 metres draft with a capacity of up to 40,000 tonnes. This berth is used mainly for handling bulk fertilizer and ammonia, and chemical products. There are also facilities for unloading lpg and fuel oil at this jetty, but these are reportedly only used exceptionally. A series of conveyor belts runs overhead from the quay area, across the coastal highway, to the industrial area. 23% of the area designated

as 'Industrial Zone' has been previously leased to industries established in the area with lease periods ranging from 5 years to 50 years. Leases on much of this area have now expired and the remaining 87% is available for development.

The current environmental conditions at the southern coast are significantly impacted by the existing industrial installations and ports. However, the southernmost part of the coast is relatively untouched and contains spectacular scenery all the way up to the Dirreh border post. However, the northern areas including the industrial berths and adjacent land areas are disturbed by phosphate and potash dust and fertilizer powder spilled during loading and unloading activities, as well as salt and magnesia piles located near the industrial site.

The South Port area consists of (from north to south):

1. The Oil Jetty
2. The Timber Berth
3. The Industrial Jetty

4.2 Marine Environment

The MSS operates a regular monthly water quality monitoring programme, acquiring data on the physical, chemical and biological properties. Much of the following data is taken from their various annual reports.

4.2.1 General

Bathymetry

The seabed in the Ports areas is characterized by a relatively smooth gradient with no significant hills or valleys. The distance of the -50 m CD contour from the shoreline ranges from about 150 m to 400 m offshore. The bathymetry of the southern part of the Jordanian waters of the Gulf of Aqaba generally follows the ratio 1:10 (i.e. the bottom depth increases 1m for every 10m offshore).

Tides

Tides in the northern Gulf of Aqaba have been measured continuously at 10 minute intervals at a fixed point at the Marine Science Station (MSS) and readjusted with reference to Mean Sea Level (MSL). The maximum recorded sea level range during 2004 was 1.42 m. The highest value was 0.94 m above MSL observed on 15 November 2004 whereas the lowest was -0.48 m below MSL recorded on 31 August 2004. The following Table 4.2 shows the average tidal characteristics recorded at the Aqaba Ports.

Datum	Elevation (LAT, Meters)
Highest Astronomical Tide (HAT)	+1.5
Mean high water springs	+1.10 (MHWS)
Mean low water springs	+0.30 (MLWS)
Mean high water neaps (MHWN)	+0.90
Mean low water neaps (MLWN)	+0.50
Mean sea level (MSL)	+0.70
Lowest astronomical level tide (LAT)	+0.00

(National Imagery and Mapping Agency, 2002)

Table 4.2 Tidal Characteristics at the Aqaba Ports*Currents*

The currents are relatively weak ($< 5 \text{ cms}^{-1}$) and the dominant direction is south-east parallel to the predominant wind direction in the northern Gulf. Currents are stronger at the surface (average of $10.3 \pm 9.0 \text{ cms}^{-1}$ at 2 m depth) than at depth (at 4-26 m depth the average speeds were $2.1 \pm 1.4 \text{ cms}^{-1}$). The average direction of the current recorded at 2 m and between 4-26 m depth was $246 \pm 83^\circ\text{N}$ and $153 \pm 82^\circ\text{N}$, respectively. This indicates that the surface current is five times stronger than subsurface current and the current direction is generally parallel to the wind direction.

4.2.2 Water Quality*Water Temperature*

The relative isolation of this desert-enclosed sea, together with its exposure to an arid, hot climate and high evaporation, is reflected in the water temperature and salinity causing these to be relatively high in comparison with the average range for oceans. Surface water temperatures approaching 28°C may occur during the summer months and fall to 20°C in the winter. Temperatures within the water mass reflect a degree of stratification versus vertical and lateral mixing by water currents. Vertically, the temperature falls with depth in the summer although there appears to be an inversion at certain depths in winter months as the deep water mass has a temperature reportedly above 20°C .

Records of the monthly average water temperature at six stations in front of the industrial complex during the period June 2003 to May 2004 show a normal increase from April (21.9°C) to August (27.1°C) then a gradual drop until March (21.2°C) when the lowest values were recorded in all stations. No significant variations between the water temperatures at the different stations were observed whilst the temporal variation in water temperature was significantly different. The temperature field in front of the industrial complex compares well with records in the offshore water and other coastal areas. No incidents of abnormal temperatures were recorded indicating that there is no significant effect of the cooling water outfalls on the seawater temperature in front of the industrial complex.

Water Chemistry

The waters of the Gulf of Aqaba are clear with very low concentrations of suspended matter. Detailed light field measurements are not available but transparency measurements using a Secchi disk have revealed values exceeding 30 m both in summer and winter. The waters of the Gulf of Aqaba are well known for their strong resistance to change due to the great depth of the Gulf.

Hydrographic measurements indicated a pronounced summer thermal stratification during the period April-October and mixed waters in winter during the period January-March. Isohaline conditions have been reported to exist in the upper 300 m in the northern sector of the Gulf of Aqaba during summer when waters of salinity 40.5 psu overlay waters of salinity 40.6 - 40.7psu. Whilst the upper isohaline water was restricted to the northern parts of the Gulf, the deeper water between 300 to 600 m extended all the length. Below 600 m, salinity is constant all over the year and along the Gulf at 40.8 psu. In winter, the halocline disappears and waters of salinities between 40.6 - 40.7psu comprise a thick layer between the surface and 600 m.

Dissolved oxygen concentration undergoes only minor variations over a 12 month period in the water column and from year to year. The reason is that the waters of the Gulf of Aqaba are poor in organic matter and primary producers which makes dissolved oxygen concentration a function mainly of water temperature and salinity. Dissolved oxygen concentrations in the Jordanian coastal waters range between 6.0 and 7.5 mg/litre.

The physical and chemical seawater data results collected in front of the Industrial Complex of the Jordanian Phosphate Mining Company during the year 2006 are shown on Table 4.3.

Month	Year	Temp. (°C)	Oxygen (mg/l)	NH ₄ ⁺ (μM)	NO ₃ ⁻ (μM)	NO ₂ ⁻ (μM)	PO ₄ ⁻³ (μM)
January	2006	21.60	7.21	0.28	0.33	0.20	0.04
February	2006	21.44	7.35	0.39	0.29	0.12	0.05
March	2006	21.52	7.29	0.29	0.46	0.05	0.04
April	2006	22.27	7.22	0.31	0.36	0.05	0.05
May	2006	22.58	7.11	0.25	0.30	0.03	0.05
June	2006	24.94	6.93	0.28	0.16	0.03	0.04
July	2006	25.66	6.80	0.27	0.12	0.02	0.05
August	2006	25.39	6.65	0.30	0.17	0.02	0.03
September	2006	24.80	6.74	0.20	0.12	0.02	0.03
October	2006	25.08	6.69	0.20	0.17	0.03	0.05
November	2006	24.81	6.94	0.26	0.27	0.04	0.04
December	2006	23.06	6.86	0.96	0.41	0.07	0.03

Table 4.3 Monthly averages of measured physical and chemical offshore water parameters for the year 2006 by the MSS 2006

Conditions at the Main Port

A diving inspection at the Main Port berths was carried out during the period from June 13th to 19th, 2007 by Jordan Frogman (JFM) on behalf of ADC. Observations from the most southern berth to the most northern included the presence of an amount of debris, steel wires, steel pieces, pipes, barrels, thick ropes, wood pieces and broken piles. The area

between 10-20 meters below the surface was also found contaminated with spilled material and debris. Furthermore, berths located within the Marine Department and the Navy Force were also investigated and found to have a number of empty cans, plastic bottles, old fishing net, steel pieces and long thick ropes. These items are all listed and documented in their report, which are included in the 'Aqaba Ports Development Project, Contamination Cleanup and Assessment'⁹ together with GPS coordinates.

The Phosphate Berths were also found to be contaminated with steel wires, thick ropes, tyres, barrels, pipe cables, broken piles, steel tube, steel boxes and barrels beneath the sea bed.

Further inspection was performed for an area which extended to about 570 meters south of the phosphate berth and 70 meters width. Observations noted included sand with small spots of coral covered with phosphate dust closer to the Phosphate Berths along with other spilled material and tires.

Conditions at the South Port

The JFM investigation at the Industrial Jetty at the South Port identified some coral reefs in poor condition. The JFM observations found an accumulation of sulphur and other chemicals close to the jetty including white coloured materials identified as potash dust, which coated and covered the whole area. Some spilled material and aluminium tank barrels, steel cages, steel boards, fishing nets hanging and sticking on coral reefs, long pipes, thick ropes and cement blocks were found. A small sunken boat was also observed in the north side of the Timber Berth. These items are located by GPS and documented in the 'Aqaba Ports Development Project, Contamination Cleanup and Assessment' (ADC, 2008).

4.2.3 Flora and Fauna

A significant length of coastline contains a diverse range of corals species. According to Khalaf (communication by MSS, 2006), the Gulf of Aqaba contains among the most diverse high latitude reefs in the world, with 200 species of hard coral and more than 500 species of fish. However, for some time they have been under pressure from urban, industrial, port and tourism developments. These pressures have resulted in visible deterioration of the reefs.

Corals at the Main Port

No specific survey or assessment of corals at the Main Port was completed as part of this study. There are known corals in the Main Port vicinity, both to the north and south of the port, which show varying degrees of impact from the ports operations. ASEZA has noted that the higher turbidity of the water is due partly to wind-blown sand coming from the north, as well as to settling phosphate deposits, and that this has favoured corals which are used to deeper water. It is expected that project will have no negative impacts on the corals at this site, but should allow an improvement to the water quality in the area. The artificial reef developed by ASEZA at the Royal Yacht Club was surveyed, as noted in Appendix VII, and the presence of coral polyps in the waters of the area is documented in a number of places. It may be useful for a more formal assessment of the stage of coral health in the area, to be carried out after the phosphate port is closed

⁹ Aqaba Ports Development Project, Contamination Cleanup and Assessment, ADC, 2008.

down, to provide a baseline characterization against which to compare the future situation. However, this is not the focus of this EIA.

Corals at the South Port

In order to analyze the existing conditions at the South Port site, a “Coral Mapping in the ASEZ South Ports Area” study was performed by MSS (May, 2007)¹⁰ where the status of coral cover and benthic communities was identified. This report is available at ADC. An additional analysis of the available data on the marine environment was commissioned from MSS as part of this EIA. This study is included as Annex III.

Overall, the surveys have provisionally identified around 180 hard corals species in the southern coastline zone. This represents around 90% of the coral species thought to be present in Jordan’s waters. The survey also identified 170 fish species belonging to 39 families. This means that the southern area hosts more than 86% of known Jordanian fish species and 90% of fish families. In addition, twenty five species endemic to the Red Sea were found. One fish, the humphead wrasse, *Cheilinus undulates* is an IUCN Red Listed endangered species (International Union for the Conservation of Nature and Natural Resources).

The following is a summary of the results obtained from a series of 10 belt transect surveys undertaken as part of the MSS Coral Survey along the 12 zones in which the study area was divided. The 12 zones are named SP1 to SP12 and are defined in order to provide a more detailed quantitative assessment of areas of coral that may be affected in the study area. See Figure 4.5 for location of the SP zones from the MSS Report.

¹⁰ Coral Mapping in the ASEZA South Ports Area, ADC, 2007.

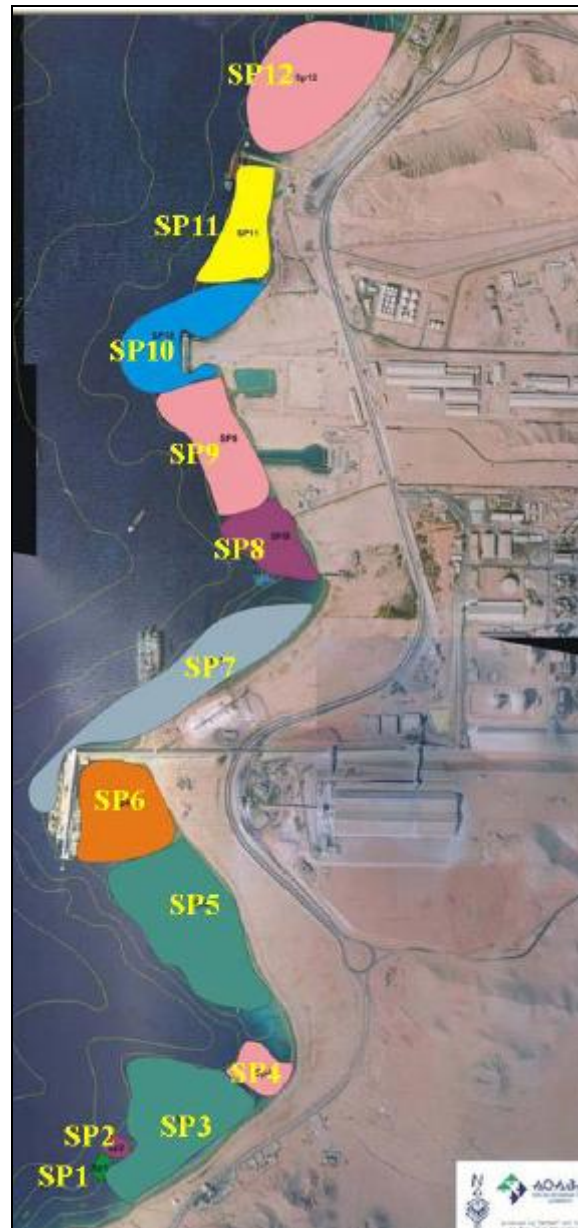


Figure 4.5 Location of SP Zones from the MSS Report.

- **The southern part of the Dirreh Bay, which includes zones SP1, SP2, SP3 and SP4:** This first segment is located immediately north of the Saudi Arabian border. This area, characterized by having a well developed reef flat area, contains an average cover percentage of hard corals of about 30%, while soft corals have about 10% cover. The reef flat is followed by sandy areas (between -5m and -10m depth) and contains batches of corals and coral micro-atolls (i.e. life coral rock and coral aggregates). Going down with the depth contour, an area is present with intensive coral coverage until the -30 m depth is reached (the limiting depth for the study). The north of this segment, known as the valley area and corresponding to the SP4 zone, is characterized by seagrass meadows and areas with sandy bottom. However, along this segment, old coral rubble was identified indicating physical damage of corals happened in the past. A cooling water outlet pipe belonging to the Kemira Company exists in the valley, although no significant impacts was noticed to the surrounding environment since it is a mainly sandy habitat.

- **The northern part of the Dirreh Bay, which includes zone SP5:** This second segment is located between the valley area and the Industrial Jetty. It contains a unique site known as the Dirreh Bay Wall, the only coral wall in Aqaba, which has a very high coral cover and very high biodiversity. This area also contains a very well developed reef flat with moderately substantial percentages of corals, 45% coverage of hard corals in some areas and 12% average cover of soft corals. This is followed by a mixed coral and sandy zone between the -5 m and -10 m depth. In addition, there is a coral garden that has very high coral cover and biodiversity which has more than 80% coral cover. The area is also characterized by having old life corals with ages that can reach hundreds of years. A small area of old coral damage was found in the north limit of the SP5 zone. The coral damage is possibly a result of the ships movements in that area.
- **The Industrial Jetty, which includes zone SP6:** The Industrial Jetty is located between two main coral reefs which are significantly damaged. Some fringing reefs and sea grass beds have been affected and sometimes destroyed by the accumulation of sulphur, phosphates and other chemicals, solid wastes as well as direct destruction of sand topsoil over the past decades from construction and operation of the industrial terminal. In addition, as mentioned before, different types of contaminants were located hanging and sticking on the coral reefs.
- **North of the Industrial Jetty, which includes zone SP7:** This segment is located between the Industrial Jetty and the gas pipeline, which supplies gas imported from Egypt to the power station. It has batches of coral aggregates in the shallow depths and a coral garden in the deeper depths (starting at -10m depth contour). Some coral damage occurred here during the laying of the gas pipeline.
- **South of the Timber Berth, which includes zones SP8 and SP9:** This segment located north to the gas pipeline and south of the Timber Berth, has also very well developed coral garden with some areas of seagrass meadows and sandy bottoms distributed among the coral reefs. The hard coral in this area has around 25% coverage compared with around 10% coverage for the soft coral. However, coral damage was found in the area where the cooling water outlet used in the power station is located. The cooling water discharges are tightly regulated by ASEZA, but the cooling water discharge increases the localized sea surface temperature and creates water currents, which may inhibit coral settlement and growth.
- **The Timber Berth, which includes zone SP10:** At the Timber Berth, localized coral damage is found, possibly due to ship movements and anchoring of ships. Many contaminants were also identified damaging the existing corals.
- **North the Timber Berth, which includes SP11:** This bay segment is located between the Timber Berth and the Oil Terminal. It has discontinuous fringing reefs and seagrass meadows present between the Timber Berth and the Prince Rashid Club. In front of the Club there is also a valley with sandy bottoms. In addition, the zone between the valley and the Oil Terminal has a coral reef area with moderate coral cover, with an average of 35% coverage of hard coral and 15% coverage of soft coral. The distribution of corals in this area varies from one place to another, where some places have very high coral cover, while others' percentage is much lower.

Coral area coverage was estimated from the digital photos taken for each transect. Special software was utilized to analyze each image for the area occupied by the corals. Coral volume calculations were calculated by multiplying the average coral height of 5 readings taken per transect.

Figure 4.6 shows the current distribution of coral reefs in terms of percent coral cover, divided into three categories (25-40%, 40-50%, >50%) in the proposed area of development in Dirreh Bay where the most significant impact will occur. The survey results indicate that a coral coverage area between 25-40% is present roughly between the 7m and 9m depth contour. However, the most valuable coral reef area (operationally defined as the area exhibiting more than 40 % coral coverage) is mainly located below the 9-10 m depth contour. Coral distribution in the South Port area was estimated using survey belts (B1 through B5).

The impacts of the developments on the corals are detailed in Section 7.

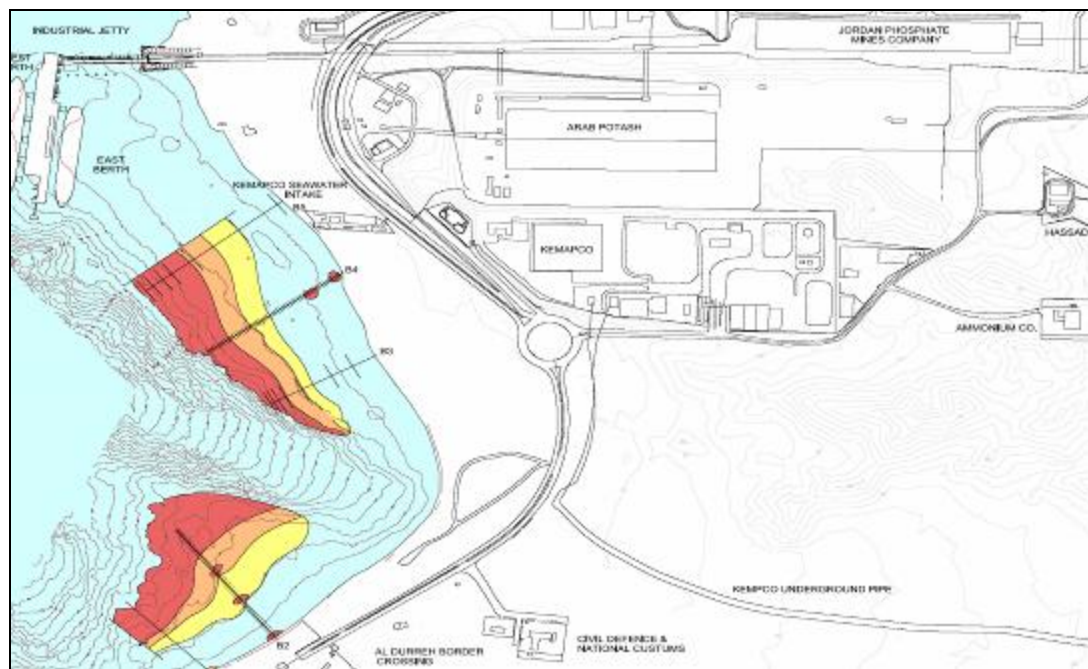


Figure 4.6 Spatial Distribution of Corals in Dirreh Bay

4.3 Terrestrial Environment

4.3.1 Geology

Regionally, Aqaba's geological succession consists of the Pre-Cambrian basement complex represented by the oldest igneous and metamorphic rocks of the Nubian-Arabian shield. These rocks are exposed in the southern and south-eastern parts of the country, occupy about 1,400 km², and extend northwards as far as the south-eastern shore of the Dead Sea.

This basement complex is overlain by the Sandstone Succession and consists of Palaeozoic sandstone and shale sediments, attaining 1,800 m in thickness of marine and continental origins. These rocks are exposed mainly in the southern and south-eastern parts of Jordan (mainly outside the ASEZ) occupying an area of about 8,000 km² and are

overlain by the Holocene and Quaternary coarse gravely deposits. The most recent of the quaternary deposits are fluvial and loose-like deposits.

On the micro-scale, the major rock groups in the local geology occurring with the ASEZ are the basement rocks and the alluvium sediments. The basement rocks extend northward from Saudi Arabia penetrating the southern parts of the ASEZ and stretching as far as Wadi Rum.

4.3.2 Soil

The exposed alluvial deposits in the wadis and on the north and eastern shorelines consist of rounded, weathered granitoid clastics which occur as terraces in the downfaulted blocks and sides of wadis. The wadi sediments consist of unsorted sand and gravel which grades in a shoreward direction to beach sand and up slope into alluvial fans. The fans consist of coarse debris adjacent to mountain foothills.

Soil Quality at the Main Port:

In May 2007, a subsurface investigation commissioned by ADC was carried out by the Arab Center for Engineering Studies (ACES) to determine the concentrations of certain pollutants in the sub soil at the Main and South Port sites. A total of 16 boreholes at the Main Port were advanced for the collection of soil and groundwater samples. Two boreholes were advanced hydraulically up gradient from the main port and represent background values. Boreholes depth ranged from 5 to 10 meters below ground surface (m BGS).

The borehole locations at the Main Port are shown on Figure 4.7. The results are included in Annex IV.

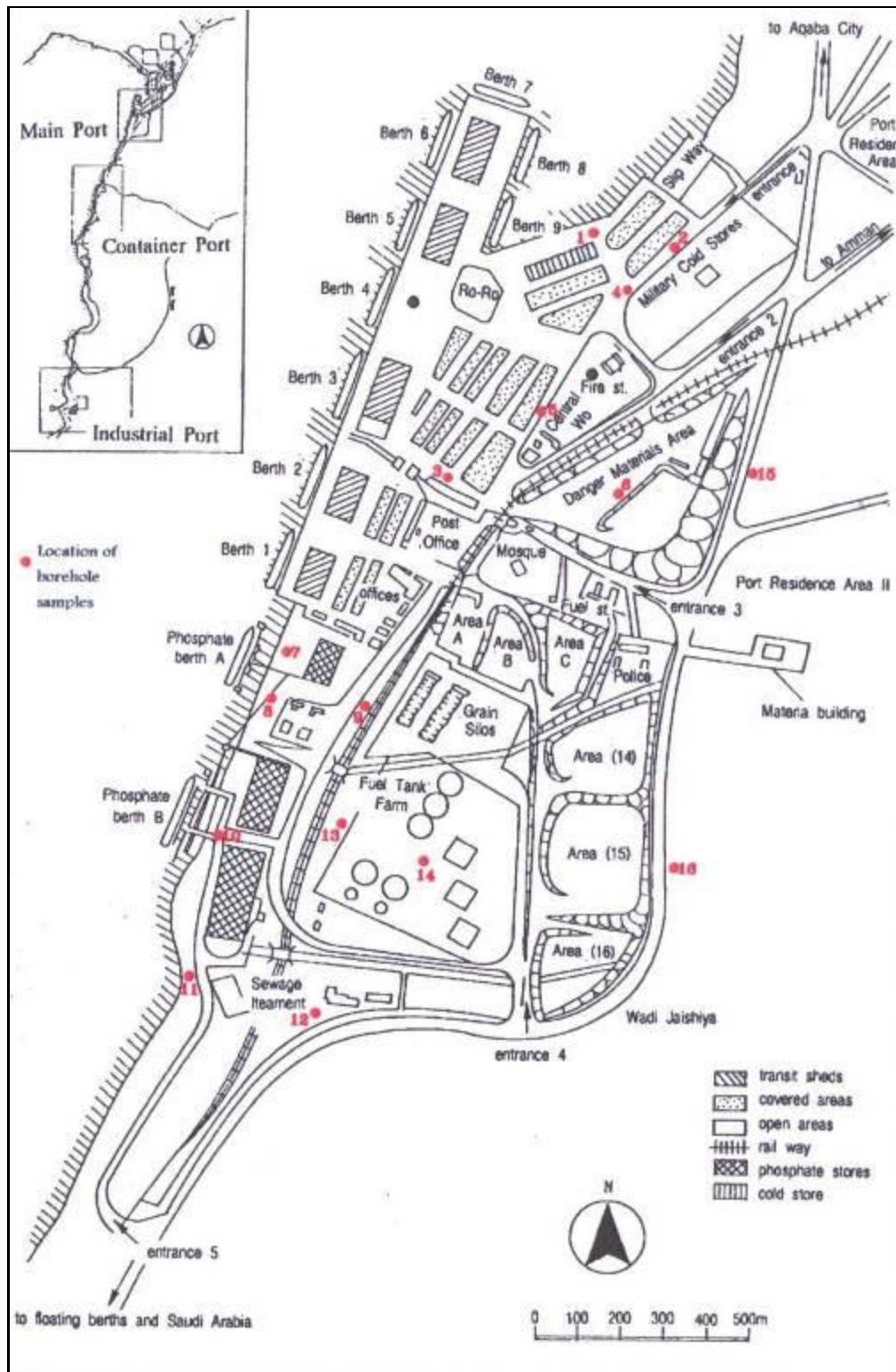


Figure 4.7 Sub Soil Borehole Locations at Main Port.

The following is a summary of the obtained results:

- For all soil samples, the measured pH was above 7.5. Based on soil cleanup guidelines, no significant impact from the presence of heavy metals was apparent. Detections for As, Pb and Hg were low and certainly below or within any cleanup standard recognized by international standards.

- Levels of uranium (U) were low considering the land use patterns and were consistent with background levels.
- The observed levels of VOCs, SVOCs, TH, and TC were reasonably related and reflected the expected trend of SVOCs < VOCs < TH < TC.
- VOCs, SVOCs and THs were well within any international cleanup standards.
- Soil acidity was slightly alkaline. This is consistent with the relatively high mineral content and presence of phosphates in the region as well as marine life, and hence is not an area of concern.
- Although Total Dissolved Solids (TDS) values were high, they are consistent with background levels. It is believed the high TDS values are a reflection of marine activity and high levels of mineral salts.
- However, near the borehole No. 13 the soil was found to be polluted with hydrocarbons as a consequence of an oil spill occurred in a JoPetrol underground pipe in 2003.

Soil Quality at the South Port Site

Figure 4.8 shows the location of the boreholes at the South Port. The results are included in Appendix III. The results obtained from the 5 boreholes drilled at the South Port site were similar to those at the Main Port site. The concentrations of heavy metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total dissolved solids (TDS) and total hydrocarbons were well within international cleanup standards. Uranium (U) concentrations were low and consistent with background levels. Figure 4.7 shows the location of the boreholes at this site.

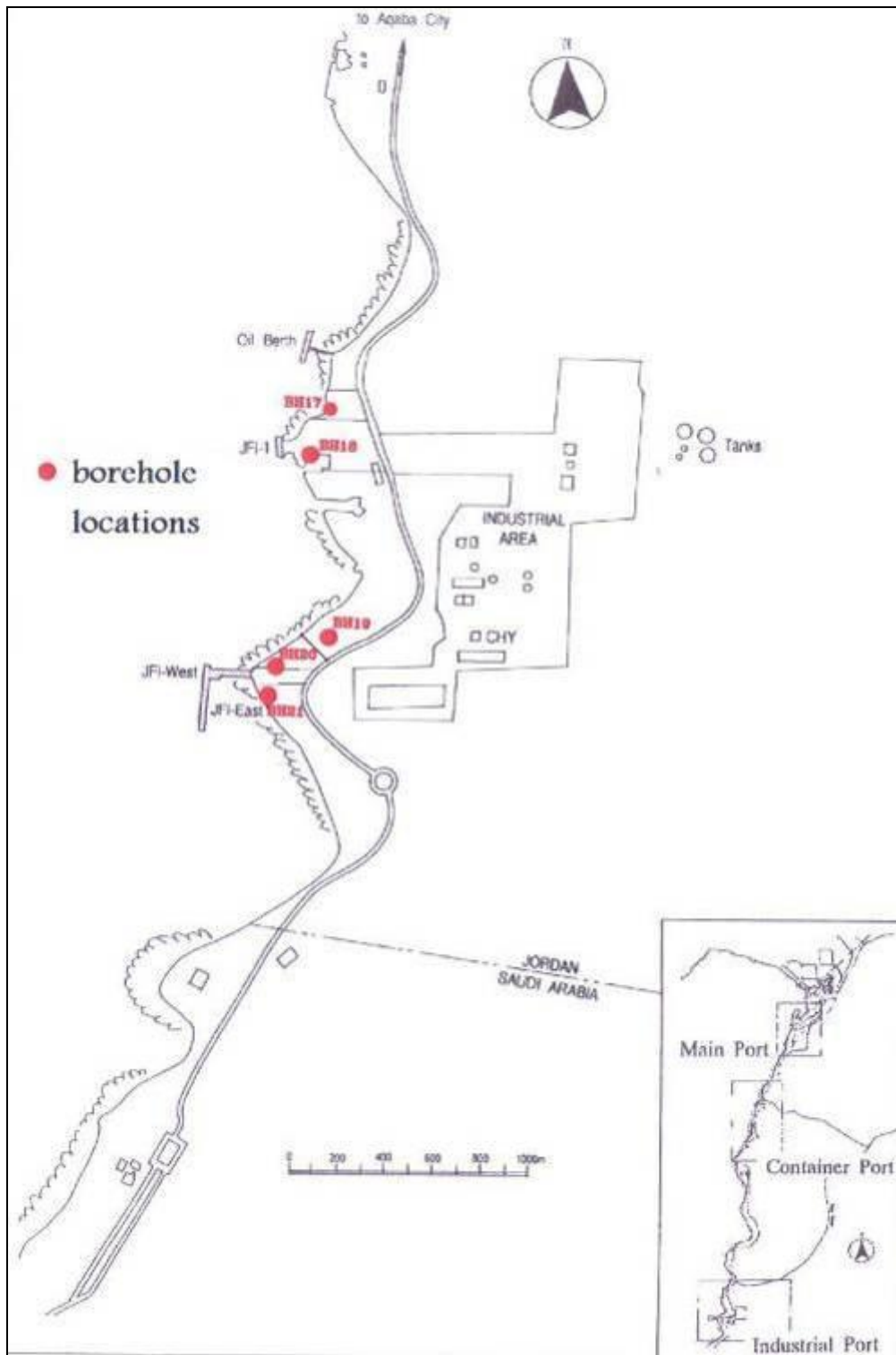


Figure 4.8 Sub Soil Borehole Locations at South Port.

At both sites, contaminant levels are within acceptable limits. However, it will be advisable to remove a quantity of the hydrocarbon tainted soil at the Main Port site before future development, as recommended in the 'Aqaba Ports Development Project, Contamination Cleanup and Assessment' (ADC, 2008).

4.3.3 Bird Activity in the Area

According to a baseline survey conducted in the Aqaba region by The Royal Society for the Conservation of Nature (RSCN) in 2002, Aqaba is considered by BirdLife International to be one of three recognized Important Bird Area (IBA) in Jordan. The RSCN study covered four main habitats including Wadi Araba, the Aqaba mountains, coastal area and the side wadis. In this study area, a total of 152 species were recorded.

The Study noted that the Aqaba Waste Water Treatment Plant (WWTP) is the main bird site in the area, primarily due to the vegetation and various freshwater ponds at the site. This site is 7 km from the Main Port, and 23 km from the South Port. The mountains to the east of the coastline, together with the Wadi Araba to the north of Aqaba, also recorded good numbers of both resident and migrant species. The report did note that the habitat in the side wadis – to the east of the southern coastline – was the least diverse in terms of bird activity, despite having a healthy vegetation cover.

152 bird species were recorded in the Aqaba area, as follows:

- 77 species within the grids and Aqaba Sewage Treatment Station
- 50 species from the waterfowl counts of "The Assessment of the Status of the Huntability Species in Jordan" project
- 25 species during two visits conducted by the study team in Aqaba

The coastal strip itself was cited as a significant habitat for migrating species. However, the study notes that impacts from development along the coast will affect the bird activity and will tend to discourage activity from more sensitive species.

There was no bird data specific to the Main Port or the South Port areas. Neither area was specifically mapped in the RSCN study. However the report noted that bird habitats on the coastline face considerable pressure from waste disposal, the industrial zones and from the construction of new roads and buildings. Air quality was cited as one of the main threats, particularly along the coastline – a clear reference to the emissions from the ports. There was no particular importance given to the South Ports area, where the ports development work will occur. This is likely a result of the environment in the area being already degraded due to the presence of the Industrial Zone.

4.3.4 Surface Water and Groundwater Resources

Surface Water Resources

The southern port and industrial area is located within the Wadi Mabruk sub-catchment area. The total area of this sub-catchment is about 253 km². This sub-catchment borders the eastern shore of the Aqaba Gulf in the west while its northern limit is the Wadi Al-Yutum sub-catchment area. It extends eastwards to the western boundary of Wadi Al-Yutum el Umran sub-catchment whilst southwards it extends beyond the border with Saudi Arabia.

In addition to several minor wadis, this sub-catchment area includes two major wadi systems:

- Wadi 1: the catchment area is not fully defined as it extends into the adjacent areas of Saudi Arabia.
-

- Wadi 2: the catchment of this wadi has an area of 62 km². The oil jetty is located in the downstream portion of it.

Several run-off basins and small wadis are located within the project area and drain into the area extending between and the Oil Jetty and the border with Saudi Arabia. The length of the wadis within the above mentioned two wadi systems varies between 2 km and 11 km.

The available limited flood flow data for the Aqaba area shows a run-off intensity varying between 2 m³/s to 96 m³/s. As a result of past industrial construction and operations in the area many catchment areas have been subject to changes by diversion and landscaping.

Groundwater Resources

In general, the Wadi Araba south basin includes an alluvial deposit aquifer which is within ASEZ in addition to the Rijam, Amman-Wadi Sir, Ajloun, Kurnub, Zarqa and Disi aquifers that mainly outcrop outside the ASEZ.

The static water level of the alluvial aquifer in this basin ranges from 20-150 m below ground level. Groundwater sources in this basin come from rainwater and precipitation and floodwater infiltration through the permeable wadi cover which is composed of gravel, sand and losses.

The South Desert basin includes the Disi aquifer (outside the ASEZ) and the local Wadi Al- Yutum aquifer. The Wadi Al-Yutum aquifer is composed of alluvial wadi deposits overlying the basement complex with a thickness of about 40 m and the water saturated thickness is approximately 10-15 m. Water in this aquifer originates mainly from rainwater and floodwater infiltration during heavy rain in winter. The Disi aquifer is known to be the main groundwater source for the Aqaba area and is located about 65 km east of Aqaba with a thickness of >1,000 m in a huge groundwater reservoir.

Available data from the Ministry of Water and Irrigation and from ASEZA shows that the groundwater level within ASEZ varies between less than 10 m close to the Gulf shore and increases to approximately 100m in the Wadi Al-Yutum area.

On the local level, previous studies carried out to evaluate the groundwater resources in the Aqaba governorate (including ASEZ) indicated that groundwater resources within the Gulf of Aqaba area may be divided into the following three sectors based on the geological and structural setting:

1) Wadi Al-Yutum sector: The major aquifer in this sector is formed by the wadi deposits that have a thickness of 90-200 m. Recharge to this aquifer is mainly from the precipitation and infiltration of the fold flow in the rainy season. The Main Port lies in this sector.

ASEZ encompasses two groundwater basins:

- Wadi Araba south basin; and
- South Desert basin.

2) Wadi Araba groundwater sector: This sector covers the northern parts of the Aqaba governorate and ASEZ. The major aquifer in this sector is the wadi deposits and alluvial deposits. The thickness of the sediments exceeds 40 m and recharge to this zone is

sourced from both the infiltration of rainwater and from infiltration of floodwater originating from adjacent wadis.

3) Dirreh groundwater sector: This sector is located in the south of ASEZ. The major aquifer is formed by the alluvium deposits. The South Port lies in this sector.

Groundwater Quality

In order to establish baseline groundwater quality at the main and South Port sites, an additional subsurface investigation was conducted by ACES and groundwater samples were collected from 8 of the boreholes advanced in the Main (BH2, BH4 and NH7) and South Ports (BH17-BH21) – see Figures 4.6 and 4.7 above for locations. The samples were analyzed for hydrocarbons, phosphate, ammonium, nitrate, nitrite, bacteria, pH and TDS. Analytical results for both sites are shown on Table 4.4.

BH	Hydrocarbons	Phosphate	Ammonium	Nitrate	Nitrite	Total Coliforms	E. Coli	pH	TDS
2	0.463	<0.2	<0.5	5.83	0.27	2200	30	7.3	2010
4	0.123	0.31	0.5	8.51	0.5	17	<2	7	3104
7	0.142	<0.2	2.7	8.34	0.51	≥16000	50	6.9	3872
17	0.067	0.32	<0.5	17.48	<0.2	4	<2	6.9	5152
18	0.096	0.2	0.98	0.53	<0.2	<2	-	7	34368
19	0.396	<0.2	6.96	9.14	6.4	30	<2	6.9	26816
20	0.627	<0.2	0.81	3.12	<0.2	<2	-	7	18176
21	0.055	0.2	1.15	10.9	2.37	<2	-	7.1	18560

Table 4.4 Results Showing Groundwater Quality

In general, groundwater quality in ASEZ varies between freshwater in the Wadi Al-Yutum wells (<1,000 mg/l) to brackish (5,000-6,000 mg/l) in the southern parts and saline (>10,000 mg/l) in the areas close to the Gulf shore.

Groundwater Quality at Main Port

As shown in Table 4.4 above, 3 groundwater samples from boreholes 2, 4 and 7 were analyzed at the Main Port site. In general, the results do not show significant contamination in the area. However, two samples show high levels of Total Coliforms probably due to septic tanks on the port site.

Groundwater Quality at South Port

In the South Port area, groundwater samples were taken from 5 boreholes (BH 17-21). Similar results to the Main Port site were obtained from the analysis of the samples. There is no major contamination at this site in relation to nitrates and nitrites, hydrocarbons and Total Coliforms. However, the high TDS levels indicate that the groundwater quality can be characterized as brackish probably due to the proximity to the Gulf, as mentioned before.

4.3.5 Air Quality and Noise

Air Quality

A baseline air quality monitoring study was commissioned by ADC from the BEN HAYYAN-Aqaba International Laboratories. To perform the study, four sites were selected to monitor criteria pollutants in addition to relevant pollutants to the Aqaba Ports, as well as meteorological parameters including wind speed, rainfall amount and solar radiation. The report is included as Appendix IV.

Air Quality at Main Port

One location was selected to assess the ambient air quality at the Main Port Site, the Phosphate Unloading Terminal. The monitoring period was from October 29th and November 1st, 2007. The results are presented in Appendix IV.

Two daily average values of inhalable particulates (PM₁₀) out of the three sampling days exceeded the limit according to Jordanian Standards. In addition, the results showed that nitrogen oxides (NO_x) values were significantly high. These high values are thought to be caused by the closeness of the site to passing trucks and the exposure to emissions from those trucks.

Air Quality at South Port Site

Three locations were selected to assess the ambient air quality at the South Port Site: the Civil Defense – Adderra Site, monitored between October 5th to 11th. This site lies to the south of the industrial zone, and east of the mid line of Dirreh Bay. The Fajr Natural Gas Company site lies at the mid-line of the Bay to the north of the Industrial Terminal, along the coastline. This site was monitored between October 11th to 17th. The Prince Rashed Marine Club lies just south of the Oil Terminal, and was monitored between October 17th to 29th. The monitoring locations and the raw results are listed in Annex V.

The Civil Defense site showed elevated readings of NO₂, and ammonia. The ammonia levels were significantly higher than is allowed by the Jordanian Standard 1140. PM₁₀ readings were also high. This site normally lies downwind of the industrial zone, which explains these readings. JS1140 does not regulate HF, which is sometimes a cause for concern in this area, but from these observations, the values of HF were well below, for the example, the Californian limit.

Among all the pollutants monitored, JS1140 limits were met for:

- Sulfur dioxide (SO₂)
- Nitrogen dioxide (NO₂)
- Carbon monoxide (CO)
- Ground-level ozone (O₃)

However, ammonia levels at the southern monitoring site were significantly above the limit.

PM₁₀ and NO₂ levels at the Prince Rashid Club site were elevated, with the ammonia levels significantly above the JS 1140 limit. Ammonia emissions from some of the industrial facilities are known to be a problem, and 2008 will see the installation of ammonia scrubbers at the JPMC site, which should ease the situation. High levels of ammonia in the ambient air would constitute a health risk to workers in the area.

Levels at the coastline (al Fajr) site were mostly within the JS1140 limits.

Noise

A noise baseline study was commissioned by ADC to identify the noise levels at the same sites where the Air Quality Study was carried out: the Phosphate Unloading terminal at the Main Port and the Civil Defence, Al Fajr Co. and Prince Rashed Marine Club sites at the South Port. The results were compared to the Jordanian Noise Level Control Regulation (1997), where the highest permissible limit of equivalent sound level (dB(A)) is 75 dB (A) during the day, 65 dB (A) at night and should not exceed 85 dB (A) within the limits of the facilities. See report attached in Appendix V for all results.

Noise at Main Port Site

The noise at the Phosphate facility was monitored from October 29th to 30th, 2007. According to the results, the average level measured (59.1 dB (A)) was within the limits in Jordanian Regulation. However, high noise levels were registered at different hours during the day substantially exceeding the highest permissible limit.

Noise at South Port Site

Noise at the South Port was monitored: from October 9th to 13th, 2007 at the Civil Defence site; from October 14th to 19th, 2007 at Al Fajr Co. site; and from October 20th to 28th, 2007 at the Prince Rashed Marine Club site. The average noise level for the 3 locations is within the limits. However, some measurements at the Al Fajr Co. and the Marine Club were significantly high, especially around noon and rush hour (5 to 6 pm).

4.4 Socio-Economic Baseline

4.4.1 Overview

Aqaba is a coastal city overlooking the Red Sea located in the south of Jordan. It is strategically important to Jordan as it is the country's only seaport and access to the sea. Aqaba was first announced as a district belonging to Ma'an governorate according to the administrative system organized in 1957, and then upgraded in 1994 to be a separate Governorate. Aqaba Governorate includes the Aqaba district (encompassing the Aqaba Sub District and Wadi Araba Sub District) and the Quairah District.

In 2001 Aqaba city was announced as a Special Economic Zone (ASEZ) with its own Authority (ASEZA). The ASEZ encompasses an area of 375 km². Its purpose was to incorporate the entire Jordanian coastline, Jordanian sea-ports, and the historical city of Aqaba as a duty-free, low tax- multi-sectoral development zone. The ASEZ provides global investment opportunities within fields such as tourism, recreational services, professional services, multi-modal logistics, value-added industries, and light manufacturing. The establishment of the ASEZ with its characteristics of low tax and regulations is regarded as a model of government-provided framework for private sector-led economic growth to be emulated throughout the Kingdom.

4.4.2 Demographics

Population and Population Growth

According to the Department of Statistics, in the year 2005, the population of the Governorate of Aqaba was 115,100, comprising 2.1% of the population of Jordan. The gender breakdown was 51,200 females and 63,900 males. The 2004 census estimates the population of the ASEZ region to be 88,905.

Within Aqaba itself (the Qasabet al Aqaba district), there are 6 sub-divisions (residential complexes) with populations as follows.

Residential Complex	Population
Al Muzfar	121
Tatan	14
Trucks Complex	107
Ree' Sa'adeh	14
Al Khalidi	137
Aqaba	80,135
Total	80,528

Table 4.5 Population Distribution According to Residential Complexes in Qasabet Al Aqaba

The population growth of the Aqaba Governorate over the ten year period between 1995 and 2005 is illustrated below¹.

Year	Population	Population Percentage
1995	82,300	1.93%
2005	115,100	2.1%

Table 4.6 Changes in Number of Population over a 10 Year Period. Source; Department of Statistics

This indicates a population growth of around 40% during the indicated ten years, representing an average annual growth of 3.2%. However, taking into account expansionary measures expected to take place in Aqaba, a considerable future increase in the size of the population is expected. A recent population growth study projections indicate that the total population of Aqaba City and Aqaba governorate are to increase by an approximate 50,000 and 70,000 by the year 2020 respectively. It further illustrates that the number of migrants (both Jordanian and non-Jordanian) is to contribute substantially to this population increase. The table below provides details.

Year	Aqaba City Total Population	Aqaba Governorate			
		Total Population	Migrants		
			Subtotal	Jordanians	Non-Jordanians
2006	100,325	118,030	26,492	14,571	11,921
2010	122,536	144,160	43,801	13,140	30,661
2015	153,450	180,530	68,501	23,290	45,211
2020	161,218	201,522	77,090	30,836	46,254

Source: AZEM Internal Migration and Demographic Projections, prepared by Kamal Saleh (May 2007)

Table 4.7 Aqaba Population Projections, 2006-2020.

Age-Gender Breakdown

The age structure is a basic demographic feature of a population which refers to the relative proportion of each age group within a population. The present age structure of the population is a result of past demographic processes and thus future results can be predicted based on present demographic processes.

Trends observed in Aqaba have illustrated a decrease in the younger age population and an increase in the productive-age population (from 15-64 years). A graphical representation of the age-gender structure of the Aqaba Governorate in 2005 is given in the population pyramid displayed below, using data from the Department of Statistics. The graphic indicates a high proportion of children, a rapid rate of population growth, and a lower proportion of older people. There is a bias towards males, probably illustrating the importance of male workers who have come to the city without families for work.

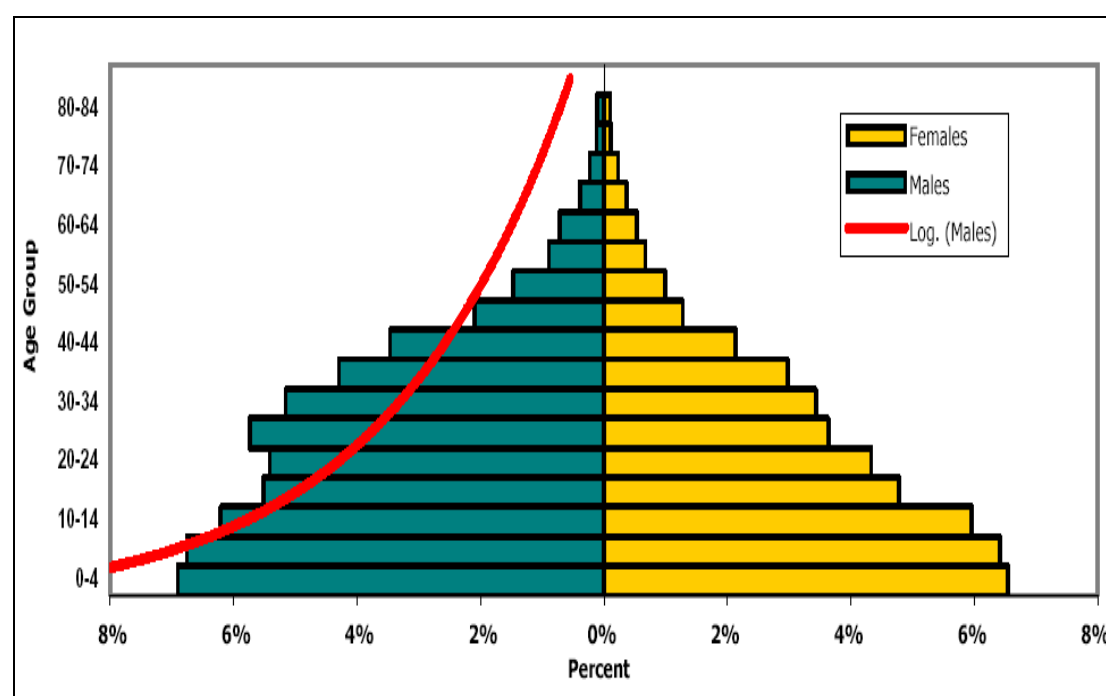


Figure 4.9 Population Pyramid for Aqaba Governorate 2005

Poverty

The most recent report on Poverty Assessment in Jordan was done by the World Bank in 2004. The report cited a reduction in Headcount Ratio in the Aqaba Governorate (the % age of people living below the poverty line) from 37.3% to 24.1% between 1997 and 2002, and a reduction in the Poverty Gap (a measure of the depth of poverty – the average gap expenditure of the poor from the poverty line) from 11.5% to 6.2% over the same period.

Governorate	1997		2002	
	Headcount	Gap	Headcount	Gap
Aqaba	37.3	11.7	24.1	6.2

Table 4.8 Change in Head Count Ratio between 1997 and 2002 (World Bank Poverty Assessment Report, 2004)¹¹

Human Development Index

The Human Development Index is used to determine the overall human well-being in a country, which is then used for its classifications as developed, developing or underdeveloped. There are three indicators used in the measurement:

1. A long and healthy life, measured by life expectancy at birth
2. Standard of living, measured by GDP per capita at purchasing power parity (PPP) in USD
3. Educational attainment, measured by adult literacy and the combined gross primary, secondary and tertiary enrolment criteria

According to the Jordan Human Development Report 2004, the overall HDI for Jordan is 0.743 ranking 90th in the world and classifying the kingdom as a developing country in the year 2003. Within the Kingdom, Aqaba Governorate HDI value for the year 2002 was 0.763 and was second to Amman. Between 1997 and 2002 time period, Aqaba experienced an overall increase in all three indicators used in the HDI measurement. The life expectancy index increased by 3.2 percent, educational attainment index increased by 6.0 percent and GDP index increased by percent.

¹¹ Headcount ratio refers to the percentage of people living below the poverty line. Poverty gap is a measure of the depth of poverty – the average gap expenditure of the poor from the poverty line. Severity is also a measure of depth of poverty but with greater weight on the income gaps of those further below the poverty line.

Human development index by governorate, 1997 and 2002														
Governorate	Life expectancy index			Education index			GDP index			Human Development index (HDI)				
										Value			Rank	
	1997	2002	% +/-	1997	2002	% +/-	1997	2002	% +/-	1997	2002	% +/-	1997	2002
Jordan	0.751	0.775	3.2	0.802	0.846	5.5	0.591	0.621	5.1	0.715	0.747	4.5	-	-
Amman	0.758	0.785	3.6	0.833	0.860	3.2	0.624	0.656	5.1	0.738	0.767	3.9	1	1
Aqaba	0.802	0.828	3.2	0.796	0.844	6.0	0.593	0.618	4.2	0.730	0.763	4.5	2	2
Irbid	0.773	0.798	3.2	0.798	0.849	6.4	0.562	0.606	7.8	0.711	0.751	5.6	5	9
Madaba	0.776	0.817	5.3	0.783	0.841	7.4	0.578	0.590	2.1	0.712	0.749	5.2	4	4
Ajloun	0.770	0.793	3.0	0.781	0.851	9.0	0.544	0.584	7.4	0.699	0.743	6.3	6	5
Zarqa	0.743	0.773	4.0	0.821	0.847	3.2	0.574	0.572	-0.3	0.713	0.731	2.5	3	6
Balqa	0.738	0.733	-0.7	0.761	0.831	9.2	0.578	0.609	5.4	0.692	0.724	4.6	7	7
Jarash	0.725	0.747	3.0	0.789	0.843	6.8	0.547	0.583	6.6	0.687	0.724	5.4	8	7
Karak	0.720	0.752	4.4	0.742	0.810	9.2	0.588	0.611	3.9	0.684	0.724	5.8	9	7
Tafiela	0.692	0.712	2.9	0.757	0.845	11.6	0.547	0.597	9.1	0.665	0.718	8.0	10	10
Ma'raq	0.738	0.768	4.1	0.708	0.784	10.7	0.543	0.565	4.1	0.663	0.706	6.5	11	11
Ma'an	0.709	0.730	3.0	0.703	0.789	12.2	0.553	0.573	3.6	0.655	0.697	6.4	12	12

Source: 1997 data from NHDRI; 2002 from, DoS

Table 4.9 Human Development Indices

4.4.3 Employment

Despite being one of Jordan's smaller Governorates, Aqaba has the most economically active population. An estimated 36% of Aqabawis are employed - approximately 6.1 % more than the average for other regions. Furthermore, Aqabawis work on average more hours per week (2.4%) than the rest of Jordanians. Ref

Jordanian workers make up 73% of the total workforce. 22% of the Jordanian workforce is female, compared with only 4% of the non-Jordanian workers. In terms of the types of work, the following breakdown was listed in the AZEM Study (ref) - skilled agricultural and fishery workers (1.4%), legislators, senior officials and managers (0.9%), professional workers (9.3%), and service workers (8.9%).

Gender plays a crucial role in determining employment distribution per occupation. Women are employed mainly either in elementary occupations or as professionals and managers; while men are distributed among all categories concentrating slightly in technical and skilled work.

Employment at Aqaba Ports Corporation

One of the main employers is the Ports Corporation (APC). Employment at APC is distributed between General and Administration, and Operational. The table below provides a useful summary of employment and salary costs. According to the figures obtained, a total of 3,892 staff are employed.

Sector	Number of Employees	Average Monthly Salary per Sector	Average Annual Salary	Salaries Allocation
General & Admin.	1,758	644,749	7,736,952	45%
DG Office	112	38,934	467,208	
Admin & HR	32	12,409	148,908	
Head Office	6	11,384	136,608	
Legal Depart	14	5,911	70,932	
Training and Devel.	34	15,632	187,584	
Control and Assurance	308	101,077	1,212,924	
Purchases and Procurement	130	52,797	633,564	
Projects and Development	182	70,261	843,132	
Service	445	146,349	1,756,188	
Technical Dept	407	154,137	1,849,644	
Finance Dept	88	35,855	430,260	
Operational Dept	2,177	755,361	9,064,332	54%
Main Port (Main Operations)	1,657	546,244	6,544,928	
Specialized Berths	417	158,627	1,903,524	
Marine Dept	103	50,490	605,880	
Other	47	12,228	146,736	
TOTAL APC	3,982	1,412,335	16,948,020	

Table 4.10 Employment Sector Distribution and Salaries Allocation

4.4.4 Economic Context & Indicators

The ASEZ and Growth Projections

The gross regional product (GRP) for the Aqaba Zone in 2004, with a value of \$540 million, represented 4.5% of the national gross domestic product (GDP) for the Kingdom, with a value of \$11,890 million. Aqaba's economic importance far exceeds that of its population size in relevance to the national scale.

It is estimated that 66,000 new jobs will be created as ASEZ predicts an annual 15% increase in economic activity between 2005 and 2010. There are critical implications for municipal housing, infrastructure, public services, recreational and cultural facilities associated with this prediction.

There are many factors contributing to Aqaba's economy. The strategic location Aqaba occupies between the Arabian Gulf and the Mediterranean, favourable climate, access to recreational and cultural activities and operations of newly established hotels are such factors. The streamlined administrative, customs and fiscal regulations of the Zone further enhance the appeal of investment in the region. In addition, funding is being funneled to Aqaba from international financing to Jordan as a result of its emergence as a regional investment center. It is anticipated that an estimated \$6 billion will be invested in Aqaba between now and the year 2015, shifting the economy from transportation, port activities and manufacturing towards various service industries. There is also a large interest in the region from real estate investors.

The anticipated \$6 billion is expected to be invested in hotels, housing, and construction which in turn will contribute to a 15% (\$1.5 billion) growth rate increase in the GRP. This increase is considered rapid and assumes no shortage of productive factors, such as water or labour.

Based on the 2005 gross product, all of the region's leading sectors are expected to have a higher growth rate than those of the national sectors. The majority of the sectors are

expected to grow at a rate equal to or greater than 10% per year while those related to agriculture, health and education are expected to growth at one in the range of 5-6% per year.

	1995	2000	2005	2010	1015	Avg. Annual Growth Rate (%)		
						1995-05	2005-10	1010-15
Agriculture, forestry and hunting	1.8	2.4	3.1	4.2	5.6	5.6	6.3	5.9
Mining and quarrying	0.3	0.3	1.6	7.1	7.8	18.2	34.7	1.9
Manufacturing	26.0	32.3	54.3	113	135.5	7.6	15.8	3.7
Electricity and water	2.3	6.2	8.3	14.4	25.0	13.7	11.6	11.7
Construction	6.7	32.0	82.2	207.5	394.1	28.5	20.3	13.7
Wholesale/retail trade	12.7	29.2	59.7	123.8	256.7	16.7	15.7	15.7
Hotels and restaurants	10.0	12.9	19.2	46.5	69.7	6.7	19.4	8.4
Transport, storage, communications	42.7	72.7	127.4	202.1	320.8	11.6	9.7	9.7
Finance and insurance	3.0	5.4	11.7	20.9	37.6	14.6	12.3	12.5
Real estate, renting, business activities	13.1	30.0	54.1	120.2	266.7	15.2	17.3	17.3
Public administration, defense, social security	16.5	21.4	24.0	46.3	79.7	3.8	14.0	11.5
Education (private)	0.7	1.0	1.3	1.7	2.2	6.4	5.5	5.3
Health and social services	0.8	1.2	2.0	2.8	3.8	9.6	7.0	6.3
Other community, social, and personal services	2.3	2.7	3.1	4.6	7.3	3.0	8.2	9.7
Private households with employees	0	0.1	0.1	0.1	0.2	--	0.0	14.9
Imputed bank charges	-1.2	-2.9	-6.3	-12.8	-22.5	18.0	15.2	11.9
Gross Regional Product (at basic prices)	137.8	246.6	445.7	902.6	1590.4	12.5	15.3	12.0
Net taxes on products	0	0	3.7	7.5	13.2	5.6	15.2	12.0
Gross Regional Product (at market prices)	137.8	246.6	449.4	910.1	1603.5	12.5	15.2	12.0

Source: Computed from AZEM, Aqaba Regional Economic Development Plan (REDP), Vol. 1 (July 2006), p.11.

Table 4.11 Aqaba Governorate Regional Product Baseline Projections, 1995-2020 (JD 2005 millions)

The Tourism Sector

Despite regional instability, Aqaba still remains a strong touristic destination due to its location, physical amenities and potential cultural attraction. It is clear that the region itself would gain from further developing tourism in Aqaba as it is a high quality international holiday destination and a gateway to Jordan and the region as a whole.

The rapid growth of the tourism sector in Aqaba is estimated to add 7,300 new 4 & 5 star rooms to Aqaba's hospitality facilities within the next 5 years. 11,000 new jobs are expected to be created in Aqaba as a result in the increase in tourism activities. It is also projected that over the period 2007 - 2011, the restaurant sector will require an additional

2,300 new employees annually, with at least 1,000 of these new employees absorbed by the fast food sector each year.

Over the next 5 years, Aqaba will need in excess of 10,000 new hotel & restaurant workers.

The tourism projections for Aqaba are predicted to rise substantially in the medium term future. The above table illustrates the projections, taken from the Aqaba Tourism Marketing Strategy 2005 - 2010 (IS-ASEZA, 2004). The figures illustrate a projected increase of 200% between 2006 and 2010. This will give rise to an additional load on local services and utilities, as well a corresponding increase on the load on the dive sites and beaches along the south coast.

Year	2003*	2006	2008	2010
Unit	'000 bed nights per year	'000 bed nights per year	'000 bed nights per year	'000 bed nights per year
Corporate	88	100	168	260
Wholesale (groups)	244	320	490	720
Individual Leisure	44	60	182	420
Domestic	506	520	560	600
Total	882	1,000	1,400	2,000

Table 4.12 Tourism Targets to 2010 (annual hotel bed nights)

A number of tourism mega projects are underway in Aqaba which have major impacts on the overall economic rate of growth due to their size. These are;

- Tala Bay investing \$65 million per year through 2011
- Aila Island investing \$75 million per year through 2017
- Saraya investing \$300 million per year
- ADC Capital Investment Plan investing totalling JD 2,600 million through 2015
- AlIE-Ceramics factory investing \$100 million per year through 2008

Ports Sector

Imports and exports through the ports, and the associated industrial activity are a major contribution to the economic activity in Aqaba, and in Jordan. A number of studies project significant increase in imports and exports as regional stability improves. The tables below illustrate some of the projected growth in port traffic, expected in the next 3 decades, for dry bulk, liquid bulk, and general cargo.

Data is taken from the Update of Trade and Traffic Forecasts, ADC, July 2007.

Year	2006	2007*	2010	2015	2020	2025	2030	2035
Phosphate rock export (1000 tonnes)	3212	3673	3974	3772	5205	5205	5205	5205
MOP export (1000 tonnes)	1372	1653	1978	2423	2423	2423	2423	2423
Sulphur import (1000 tonnes)	608	567	719	1175	1175	1175	1175	1175
DAP export (1000 tonnes)	608	596	625	674	684	684	684	684
NPK export (1000 tonnes)	236	210	210	210	210	210	210	210
Aluminium hydrate import (1000 tonnes)	14	21	23	24	25	25	25	25

*based on figures up to 20 June 2007

Table 4.13 Summary of Dry Bulk Forecasts Related to the Fertilizer Industry Complex

Year	2006	2007*	2010	2015	2020	2025	2030	2035
PA export (JPMC and IJCC) (1000 tonnes)	363	379	580	1362	1353	1353	1353	1353
Ammonia import (1000 tonnes)	225	217	231	244	246	246	246	246
Vegetable oil (1000 tonnes)	203	45	47	49	51	54	56	58
Mineral oil (1000 tonnes)	28	29	35	45	57	70	85	104
Chemicals (1000 tonnes)	61	56	67	86	110	135	164	200

based on figures up to 20 June 2007

Table 4.14 Summary of Liquid Bulk Forecasts

Year	2006	2007*	2010	2015	2020	2025	2030	2035
RoRo vehicle imports (1000 vehicles)	108	93	115	154	201	241	279	312
RoRo vehicle re-exports (1000 vehicles)	6	5	6	7	10	12	16	20
Logs and wood products import (1000 tonnes)	216	214	282	394	489	576	610	640
Iron and steel products import (1000 tonnes)	99	189	226	284	336	371	410	452
Rice in bags (1000 tonnes)	58	88	73	73	55	32	27	27
Sugar in bags (1000 tonnes)	68	59	62	62	43	20	15	15
Bagged animal feed (1000 tonnes)	117	141	101	82	67	52	36	36
Miscellaneous general cargo imports (1000 tonnes)	34	101	55	59	60	61	63	64
Miscellaneous general cargo exports (1000 tnes)	76	73	80	86	88	89	91	93

based on figures up to 20 June 2007

Table 4.15 Summary of General Cargo Forecasts

5.0 Assessment of Project Alternatives

5.1 Strategic Alternatives

Under ASEZA's Regulation No. 21, an EIA must describe the main investment and technical alternatives of the proposed project which have to be investigated by the Project Owner and the main reasons for the preferred choice, taking the respective likely environmental effects into account.

The development of the South Port Master Plan and its antecedents was discussed in Section 2.1.

This section will briefly outline the 3 main strategic alternatives and summarize their relative economic and environmental merit.

5.1.1 Strategic Option A - The 'no project' option

This is actually not a realistic option for Jordan. The port traffic projections carried out by Royal Haskoning in 2005/6, show that new berth and land facilities at the South Port are required. Also, the desire to relocate the Main Port operations away from the vicinity of the urban center of Aqaba in accordance with the ASEZ Master Plan, requires development of the South Port.

The result of the 'no-project' option would be;

- Continued strategic economic constraints from the limited industrial port capacity
- Continued lack of investment, lack of maintenance and environmental pollution at both the South Port and the Main Port, in particular resulting from phosphate dust emissions.
- Continuing land-use conflicts in Aqaba, resulting in a disincentive to continue investment in downtown and tourist Aqaba

ADC and ASEZA have ruled out the 'no-project' option as strategically unacceptable.

5.1.2 Strategic Option B - Rehabilitation of Main Port Facilities & Development of the South Port with no Relocation of Services

One option is to solve the environmental issues at the Main Port, and the capacity constraints at the South Port separately. This would entail refurbishment and improvements to the Main Port, and a separate development of the South Port, without relocating services. A number of studies and costing assessments have been carried out on the phosphate terminal at the Main Port which states that significant upgrade and refurbishment work is required in order to bring the facilities up to modern performance standards and acceptable environmental management standards. APC has now allocated funds and the tender process is now underway to fit new dust suppression equipment to the rail/road unloading stations and ship loaders. This is expected to be functioning by 2008. However, changes to working practices and management and control systems are also necessary to effect better environmental management

Development of industrial berth capacity at the South Port could be carried out in accordance with the projections for South Port Cargo. The development would focus on

increasing the handling capacity of the industrial berths, resolving the issue of the 'Jerash' by creating land-based storage facilities, improving marine services, and significantly improving efficiency and environmental management throughout the port. This option would be less costly, and would require less coastline construction and dredging.

The main disadvantage of this option is environmental. One of the key concerns of the ASEZ Master Plan 2001 was the constraining influence of the industrial units at the Main Port. With Aqaba being successfully developed and marketed as a tourist destination, and significant inward investment in tourism infrastructure in the area, the facilities at the Main Port are both visually and environmentally pollutive. The inability of the Port to manage dust emissions has led to significantly reduced air quality in the area, as well as the effects of layers of phosphate dust in the area. The marine environment is currently impacted both by settlement of airborne dust and by spillage at the quay.

Despite the rehabilitation of the port and increased dust control, the rail, trucking, and ship- loading operations would remain. The visual statement of the facilities in close proximity to the increasingly developed tourist zones is a contradiction. The Master Plan strongly recommended the resolution of the land use conflict by clustering industrial units, including the port operations, in the South Industrial and Port area, and allowing the urban and commercial center of Aqaba to expand southwards into the Main Port site. None of the studies carried out adequately took into account these longer term economic benefits of the removal of heavy port operations.

This option has also been disregarded by ADC as inadequately addressing the need to remove the pollutive phosphate facilities away from Aqaba town and resolving the conflicts related to clustering the entire town of Aqaba as a residential/commercial and tourism zone.

5.1.3 Strategic Option C - Relocation and Development

The ASEZ Master Plan, produced in 2001, following the creation of the Aqaba Special Economic Zone, recommended that;

- The industrial and pollutive operations at the Main Port to be relocated to a newly developed South Port. Operations to be relocated included phosphate, general cargo, vegetable oil and fuel oil.
- Much of the land at the Main Port should be released for additional tourism/urban waterfront access, including reconfiguring the inner harbour for ferry and cruise ship access, and relocating administrative services to the Container Terminal and South Port.
- The capacity and services at the South Port should be developed, effectively clustering pollutive and intensive operations together in the Southern Industrial Area, segregated from any tourism and urban/community areas and facilities. The new capacity would include a multi-purpose general cargo facility which could handle livestock, a new phosphate terminal, a new grain terminal, and a general upgrade of environmental management at all ports. The Industrial jetty would be upgraded to improve efficiency, health & safety and environmental management.

This option of relocation facilities from the Main Port to the South Port best takes into account the potential impacts on the environment. The proposed project identified in

Section 2 is based on this Master Plan, and follows it with some amendments. All relevant environmental mitigation measures recommended in the Master Plan are reviewed and addressed in this report.

5.1.4 Summary & Conclusions

A relative statement of each of the above strategic options, alongside the proposed option, is presented below in Table 5.1. The reduction of negative environmental impacts across the table from left to right, as the options are refined from the no project option right through to the proposed option is clear. The proposed option is an improvement on the ASEZ Master Plan and will create a significant reduction in negative environmental impacts from the ports. This highlights the fact that one of the drivers for the project is the improvement of the environmental performance of the ports.

The proposed strategic option is therefore the most environmentally acceptable. The one remaining significant negative impact related to the proposed option is the impact on the marine environment at the South Port, particularly the damage to the coral reef. The layout options at the South Port site are examined in more detail in the following Section.

Criteria	No Project Option	Rehabilitate & Develop - No Relocation	ASEZ Master Plan 2001	Proposed Option
Environmental Impacts at Main Port	Continuing damage to air quality and marine environment from phosphate dust, continuing aesthetic impact from Main Port, continuing land use conflicts in Aqaba	Phosphate dust impacts reduced, continuing aesthetic impact, continuing land use conflicts	Phosphate dust impacts eliminated, recovery of marine environment can begin, some port operations remaining at site	Phosphate dust impacts eliminated, recovery of marine environment can begin, removal of general cargo, grain and vegetable oil facilities, removal of aesthetic impacts
Environmental Impacts at South Port	Increasing congestion at South Port	Some damage to corals at South Port, improved environmental management, reduction in spillage and emissions	Damage to corals at South Port, improved environmental management, reduction in spillage and emissions	Some damage to corals at South Port, improved environmental management, reduction spillage and emissions, removal of 'Jerash'
Economic Impacts	Continuing constraint to tourism investment in Aqaba town, increasing congestion and constraint to industrial zone development	Continuing constraint to tourism investment in Aqaba town, increased capacity of South Port, removal of constraint to development of South Industrial Zone	Reduced but continuing land use conflict in Aqaba, some land at Main Port site released, increased capacity of South Port, removal of constraint to development of South Industrial Zone	Increased capacity of South Port, removal of constraint to development of South Industrial Zone

Table 5.1 Relative Impacts of Four Strategic Opinions for Ports Development

5.2 South Port Layout Alternatives

In recent years, two proposed layout alternatives for the South Port have been developed;

ADC South Port Master Plan 2006 – a conceptual layout undertaken without detailed information being available about the location and depth of the corals. The purpose of this layout was to maximize the usage of the available land and coastline, with all the Main Port operations being relocated within the existing constraints. Environmental impacts were not a significant consideration in the development of this concept. **This is the layout which was presented in the Pre-Scoping Report and the Scoping Session held by ASEZA in Aqaba on 12th June 2007.**

ADC South Port Master Plan 2007 – a detailed revision of the 2006 conceptual layout, undertaken to include, amongst other things, revised traffic forecasts, and the results of detailed surveys and measurement of corals in the area. This plan significantly reduces the impact on the corals in Dirreh Bay. This Master Plan will be published fully in December 2007. **This is the option which is now being proposed by ADC and is the subject of this assessment.**

5.2.1 Aqaba South Port Master Plan 2006

The proposals of this report were outlined in the Preliminary Scoping Document of June 2007, which was released to the stakeholders and discussed at the Scoping Session on 12th June 2007. The layout is illustrated in Figure 5.1. The main facilities to be developed in the South Port include;

A. South Port Redevelopment

- A new miscellaneous liquid berth
- New grain berths
- New Industrial Terminal for Bulk Material
- New multi-purpose cargo berths with capacity for RoRo
- A redeveloped Oil Terminal with on-shore storage to replace the Jerash oil tanker
- Marine services including bunkering and an oily waste reception facility
- New ferry terminal and land border crossing

This project could cover around 3 km of coastline, from the border with Saudi Arabia, up to the north of the existing Oil Terminal. The existing areas and infrastructure of the Industrial Jetty, the Timber Berth and the existing Oil Jetty, would all be subsumed in the re-developed South Port. The approach to the southern basin would be an area of relatively high density shipping traffic with passenger ferries berthing at the Ferry Terminal, and general cargo, RoRo ships and bulk carriers turning and maneuvering to berth. Land would be allocated in the Southern Industrial Zone for warehousing, open storage, port administration buildings and future port-related activities requiring land close to the Port.

In the longer term beyond 2030, land is designated for possible construction of a second basin. This would require the gas pipeline and sea water intake to the thermal power station to be relocated. A phased approach to the development will be used, whereby the initial development

of the South Port will focus on upgrading the existing facilities and developing new facilities to allow the transfer of traffic from the Main Port by 2010.

B. Development of Oil Terminal

The development of the oil terminal is also an important part of the Ports Development Project. Currently, oil is stored on the Jerash – a 300,000 tons oil tanker permanently moored at the existing Oil Terminal. It is proposed to upgrade the existing Oil Terminal, and develop facilities for loading/unloading, storage on land, and loading of road tanker trucks. The plans include the jetty, pumping and pipeline routes, the storage tank farm to allow buffer storage of 300,000 m³ of crude oil, 20,000 m³ of diesel and gas, 20,000 m² of gasoline, 3,500 m³ of LPG, and 600,000 m³ of strategic storage of crude oil, and a terminal for loading into road tankers. The Oil Terminal will be used for the import of crude oil for the refinery at Zarqa together with refined petroleum product and LPG, the and export of some heavy fuel oil.

C. Relocation of Ferry Terminal

Relocation of the existing Ferry Terminal was also part of the South Port Master Plan. The location proposed at the Saudi Border in Dirreh Bay, enabled a combined land and sea border crossing to be established.

The main disadvantage of this Master Plan was the impact on the corals in Dirreh Bay. Figure 5.2 illustrates how the proposal would impact the corals. 108,000 m² of coral (including 31,000 m² of live coral) would require to be dredged to provide access to the General Cargo Berths. An Estimated 21,600 m² of corals would be dredged to provide access to the Ferry Terminal. Much of these corals are of high significance, and the stretch known as the Dirreh Bay Wall would be at risk from dredging down to a depth of 15 m to the South of the Industrial Terminal. Stakeholders at the Scoping Session raised concerns at the scope of the coral impact.

5.2.2 Aqaba South Port Master Plan 2007

Following the Scoping Session, and taking into account the concerns raised regarding the impacts of the Port on the coral reefs of the South Port and Dirreh Bay area, a revision of the Master Plan was made. This is illustrated in Figure 5.3. The revision was able to take into account the latest port traffic projections and needs, as well as more up to date information on the location, depths and quality of the corals in the area, based on the Coral Mapping Survey conducted by the MSS, information which was not available when the original layout was devised in 2005/6.

The main improvements to the plan are;

- Establishment of a small harbour for marine services, pilotage and a slipway, close to the Industrial Jetty
- Relocation of the general cargo berths from the shoreline south of the Industrial Jetty, to the inner basin
- Removal of the proposed Ferry Terminal

This revised layout in the 2007 Master Plan is the one which was presented at the final disclosure session held on the 8th of May, 2008. Following the disclosure session the Ferry Terminal has been added to the Master Plan and is the current plan being proposed by ADC and assessed in this EIS, described in more details in Section 2.

5.2.3 Summary & Conclusions

The proposed South Port Master Plan 2007 – the current proposal by ADC – has by far the least impact on the marine environment. The amount of coral destruction is significantly reduced. This is to be expected since the revision was commissioned specifically to reduce the impact on the marine environment, following revised port traffic projections, and survey information on the marine environment. The remaining impacts on the marine environment are discussed in detail in subsequent sections, together with mitigation and compensation recommendations.

5.3 Assessment of Phosphate Transportation Alternatives

Phosphate is currently transported from the Jordan Phosphate Mines Company (JPMC) mines at Al Abiad, Al Hassa and Eshidiya by truck and rail to the phosphate terminal at the Main Port where it is loaded to ships for export. Approximately 60% of the supply is currently by rail and 40% by truck. (RH Strategy Report 06). Once a new phosphate storage and loading facility is established at the South Port, transport of phosphate to the South Port will be required. There is potential to have a negative impact on the environment requiring controls and monitoring systems to be included in the design of the phosphate transportation chain. There are three strategic options for such transportation to be carried out;

- By rail
- By conveyor
- By road

Figure 5.1 summarizes the 3 options.

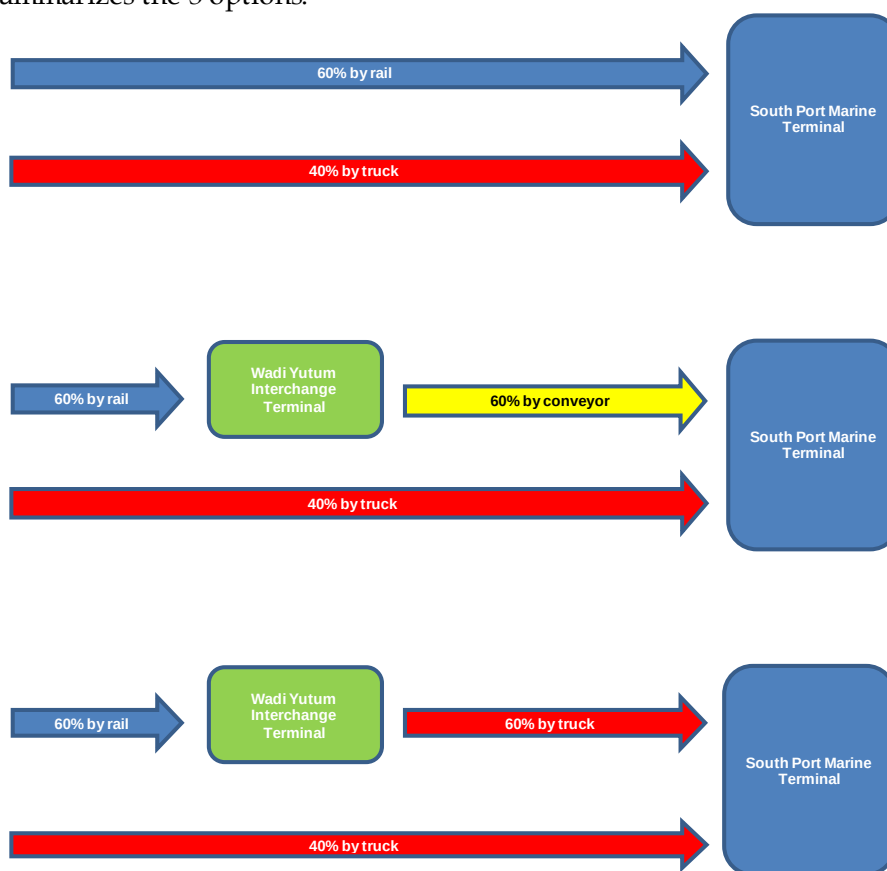


Figure 5.1 Summary of the Three Phosphate Transportation Alternatives

A separate study has been carried out on these options¹². The relative components of each are summarized here, together with the relative environmental implications.

5.3.1 By Rail

The creation of a railway link to the South Port was studied in the report 'Study of the Railway Development Strategy in Jordan, Complementary Services (ADC), Phase 1 Extension Report, Draft 2'. The recommended option in this report – referred to as alignment Option 1/1– would connect directly from the existing narrow gauge line at Wadi Yutum and run directly to a new designated rail head in the Southern Industrial Zone. The proposed route is illustrated in Figure 5.2. The total length of route from the proposed Wadi Yutum junction to the rail head at the Industrial Zone would be 27.2 km. A double track tunnel of 14.3 km length, with forced ventilation and doors, fans and shafts for ventilation would be required.

Provision for a new rail head has been allowed for in the South Industrial Zone Master Plan layout around 4.2 km from the coastline at the proposed port. Phosphate would be discharged from the railway carriages at this location and conveyor to the terminal via a new dual conveyor belt system. As with each of the transport options under consideration the new South Port phosphate terminal will have capacity to hold 360,000 tons of phosphate. JPMC requires the ability to store up to 12 different grades of product and this has been incorporated in the design. The proposed system would be able to handle 5 million tons of phosphate per year.

At present, the cost of developing this railway link is prohibitive, due to the amount of tunneling and re-contouring needed to maintain an acceptable gradient for the railway. As such, this option has been discounted by ADC at this stage.

Information in the above section has been taken from 'Study of the Railway Development Strategy in Jordan, Complementary Services (ADC), Phase 1, Extension Report, Volume 1 of 2, Draft 2', CPCS Transcom, May 2007.

¹² Phosphate Conveyor Study, Final Report, ADC, June 2007.

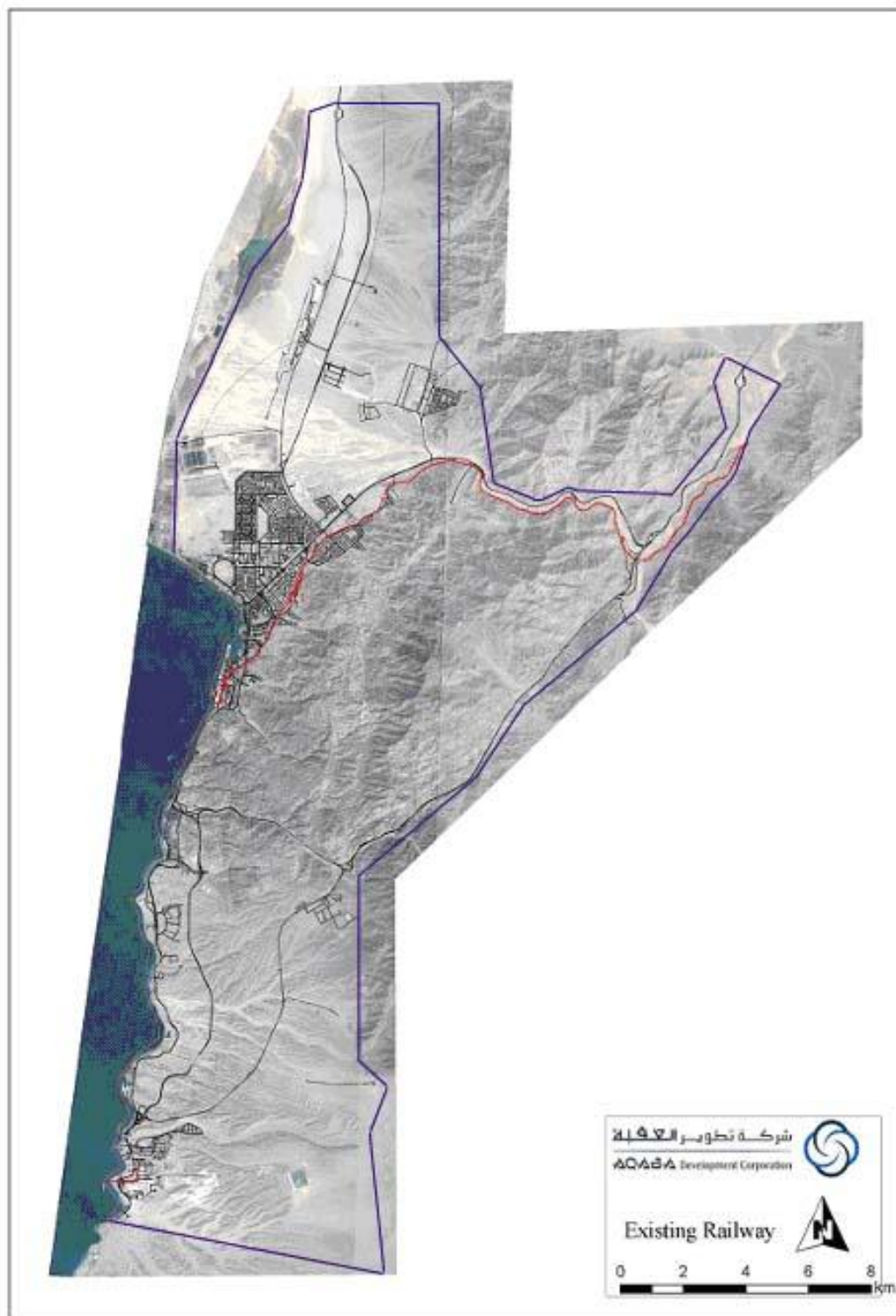


Figure 5.2 Proposed Rail Route

5.3.2 By Conveyor

In this option, phosphate could be delivered by conveyor to the South Port. The following elements would be constructed;

A. A **rail unloading station** would be constructed at the Wadi Yutum interchange comprising two rail wagon unloading points, two sets of reception sidings, locomotive run-round and two sets of departure sidings. Unloading of one train of 34 wagons will normally take approximately 2 hours. There would be an average of 10 trains per day to handle the estimated annual throughput of 4.8 million tons of phosphate by rail. If the throughput by rail is increased to (say) 8.2 million tons per year or 18 trains per day the two rail wagon unloading points will have to be operated on a 24 hours per day basis. A rail wagon loading station comprising two rail wagon unloading points each about 50 m long could be needed. This would provide for simultaneous discharge of two wagons per train.

In order to allow simultaneous operation of the two rail wagon unloading points, two sets of rail sidings would be provided, as well as two departure sidings where safety checks may be carried out on trains prior to departure.

B. A **belt conveyor line** would be constructed from the Wadi Yutum interchange to the proposed location of the phosphate terminal in the South Port. The proposed route for the conveyor – identified following a site survey and study – together with the other main facilities, is identified in the study. Where the Back Road makes a significant horizontal bend, a belt conveyor will need to follow a straighter route.

The line would consist of four separate flights of conventional troughed belt conveyors together with associated transfer towers and conveyor bridges. The long haul conveyor could be a single conveyor line or two parallel conveying lines may be used to avoid stoppage in the event of breakdown or maintenance of one line. Both options were considered. Of the three types of conveyor available, a standard conventional troughed belt conveyor is proposed for this route. This uses idler rollers in the shape of a trough which supports the belt. The return part of the belt is supported by flat idler rollers. The conventional troughed belt conveyors are the most commonly used for long haul conveying.

C. A **stockpile warehouse** of 64,000 tons capacity with six truck loading stations will be constructed to interface with the rail unloading facility. Transfer over the short distance from rail car discharge grid to stockpile warehouse will be by conventional conveyor.

Determination of the number of truck loading stations is based on assumptions (RH report) that maximum forecast requirement will see 3.5 million tons transported direct from mines by truck and the balance interchanged between rail and truck at the Wadi Yutum interchange. The storage/truck transfer equipment at each of the six loading stations would be equipped with state of art dust and noise suppression equipment.

The South Port phosphate terminal would have capacity to hold 360,000 tons of phosphate. JPMC require ability to store up to 12 different grades. To provide for flexibility of transport of different grades (each train carries only one grade at a time) and to avoid any train delays at the planned rail/road interchange the buffer storage is designed to comprise eight bins each having 8,000 tons capacity. The outtake from the stockpile warehouse will be by reclaiming belt conveyors in tunnels underneath the warehouse. Magnetic separators and steel detectors will be installed at the outtake belt conveyors to avoid transfer of any sharp steel materials which might damage the costly belts of the long haul conveyors.

D. **Substations** to provide electrical power to the conveyors

The maximum simultaneous power requirements are estimated at 3,445 kW at 415 V, 5,300 kW at 6.6 kV, giving a total of 8,745 kW. Based on the maximum simultaneous demand and the available 33kV power supply in the area, a medium voltage power distribution system is

required, including 3 transfer towers all transfer points should be completely enclosed and equipped with adequate dust control units. The transfer towers should also include air compressors for the supply of compressed air to the dust filters and basic facilities for maintenance such as hoist beams and hoist units.

Information in the above section has been taken from 'Aqaba Industrial Zone and South Port Projects – Phosphate Conveyor Study', Royal Haskoning, June 2007. However, due to cost and logistical constraints, this option has also been discounted by ADC.

5.3.3 By Truck

This is the option which is being proposed by ADC. Around 40% of the phosphate currently delivered to the Main Port arrives by truck. Under this proposal, all phosphate will be transported to the South Port by truck. One component will be transported directly from the mines to the South Port as in the current situation, except that the transport distance will increase by around 26 km. The component which currently arrives at the Main Port by rail will terminate instead at a newly constructed transfer and unloading station in Wadi Yutum, and be transferred to a truck fleet. Up to 3.5 million tones could be carried directly from the mines by truck.

The transfer/unloading station in Wadi Yutum will have the capacity to deal with the predicted annual throughput in 2025 of 4.8 million tons (see Table 7.5 later). The total truck fleet which will work the direct route from the mines to the Port is undetermined as yet.

The new facilities in Wadi Yutum will include some storage capacity so that trains can be unloaded and stockpiled for loading to trucks. As with each of the transport options under consideration the new system will have capacity to hold 360,000 tons of phosphate. JPMC requires the ability to store up to 12 different grades of product and this has been incorporated in the design. The proposed system would be able to handle 5 million tons of phosphate per year. The stockpile warehouse and road unloading station will be equipped with weighbridges to weigh the phosphate delivered to the terminal. A workshop and an office are also planned at the terminal. This option will require the upgrading of the existing road connection with the Back Road to provide proper access for phosphate trucks. A slip road and flyover may need to be provided to allow incoming loaded trucks to cross the Back Road safely. This is currently being studied by the Ministry of Public Works and Housing.

Due to cost and scheduling needs, the road option is by far the most economically acceptable, and a decision has been made to implement this option. Additionally, the road is in place and is presently an under-utilized asset.

5.3.4 Summary & Conclusions

Table 5.2 summarizes the relative positive and negative impacts of each option. The relative merits are partially based on Royal Haskoning's assessment in the Phosphate Conveyor Study, and are summarized below.

Issue	Rail	Conveyor	Road
Infrastructure	--	-	+
Reliability	+	-	+
Flexibility	0	-	+
Safety	+	+	-
Implementation	--	-	++
Emissions	0	+	-
Dust	+	0	-

Table 5.2 Summary of the Relative Positive and Negative Impacts of the Three Phosphate Transportation Alternatives.

From an environmental perspective, both the rail and conveyor option would reduce both greenhouse gases and the risk of dust emissions, assuming they are well managed. In the proposed road option, emissions from the trucks will be greater, and the risk of dust emissions from the loading, unloading and transportation processes are greatest. Careful mitigation and management of dust and emissions will therefore be required. This is addressed in Section 10.

5.4 Analysis of Alternatives to RoRo Parking

The amount of coral damage at the north of Dirreh Bay is a major concern to ADC and all stakeholders, and the land area and usage must be justified. As mentioned previously, an adjustment to the revetment included within the first Master Plan of the South Port took place to protect and preserve the significant coral in the area as a result of the public concern raised during the first public scoping session held on 12th of June 2007.

In order to preserve the coral banks located off-shore at this location, the General Cargo & RoRo berths at the north-west corner were relocated to the New Port basin and the shore protection bund moved inland, situated approximately on the -10.0 DC depth line. The area between the shore protection bund and the south coastal road, situated between the Marine Service harbour to the north and the General Cargo & RoRo basin to the south provides for two RoRo car parks of respectively 70,000 m² and 29,000 m². The area encloses the seawater intake station of KEMAPCO and it is planned to further include a maintenance workshop. The area is hereafter referred to as 'RoRo area'.

The original design is presented in figure 5.3, the revised design as per Port Master Plan December 2007 is presented in figure 5.4 and the RoRo area in figure 5.5.

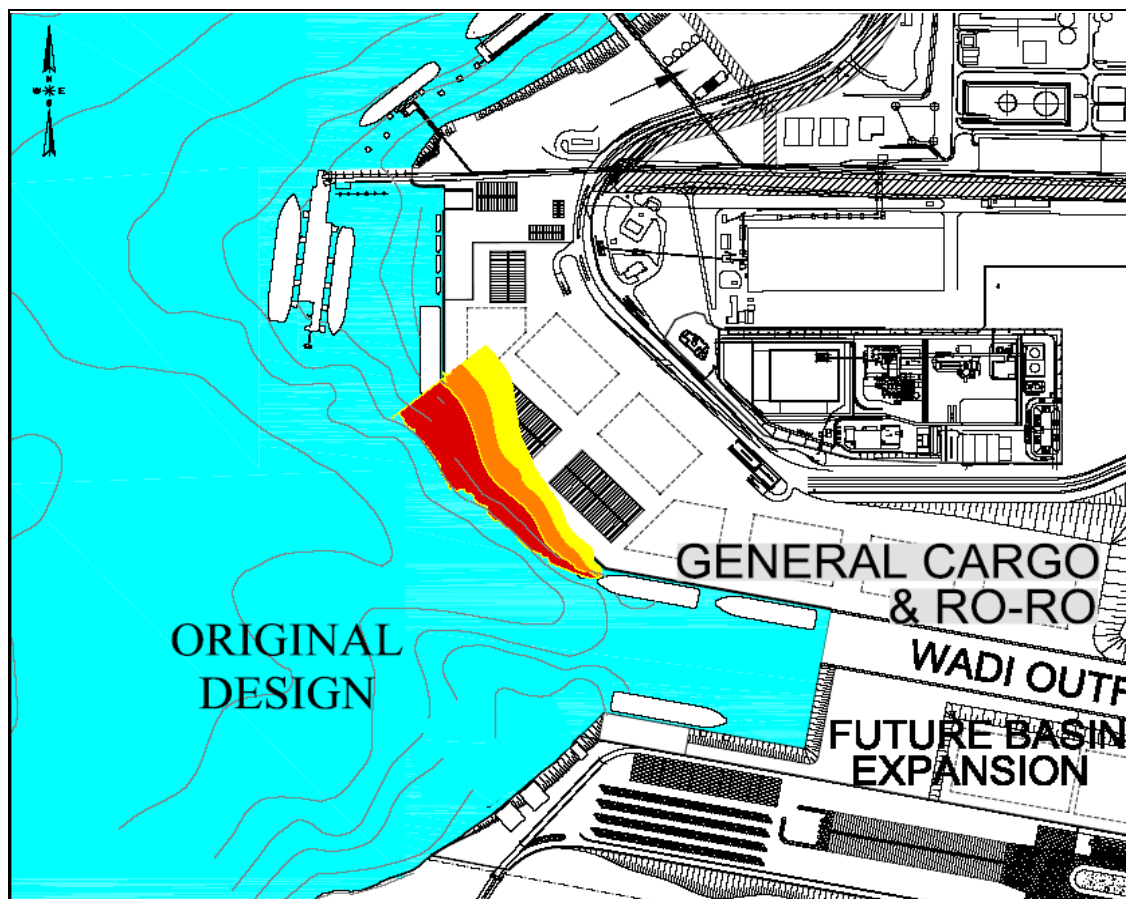


Figure 5.3 Original Design of the General Cargo and RoRo berths

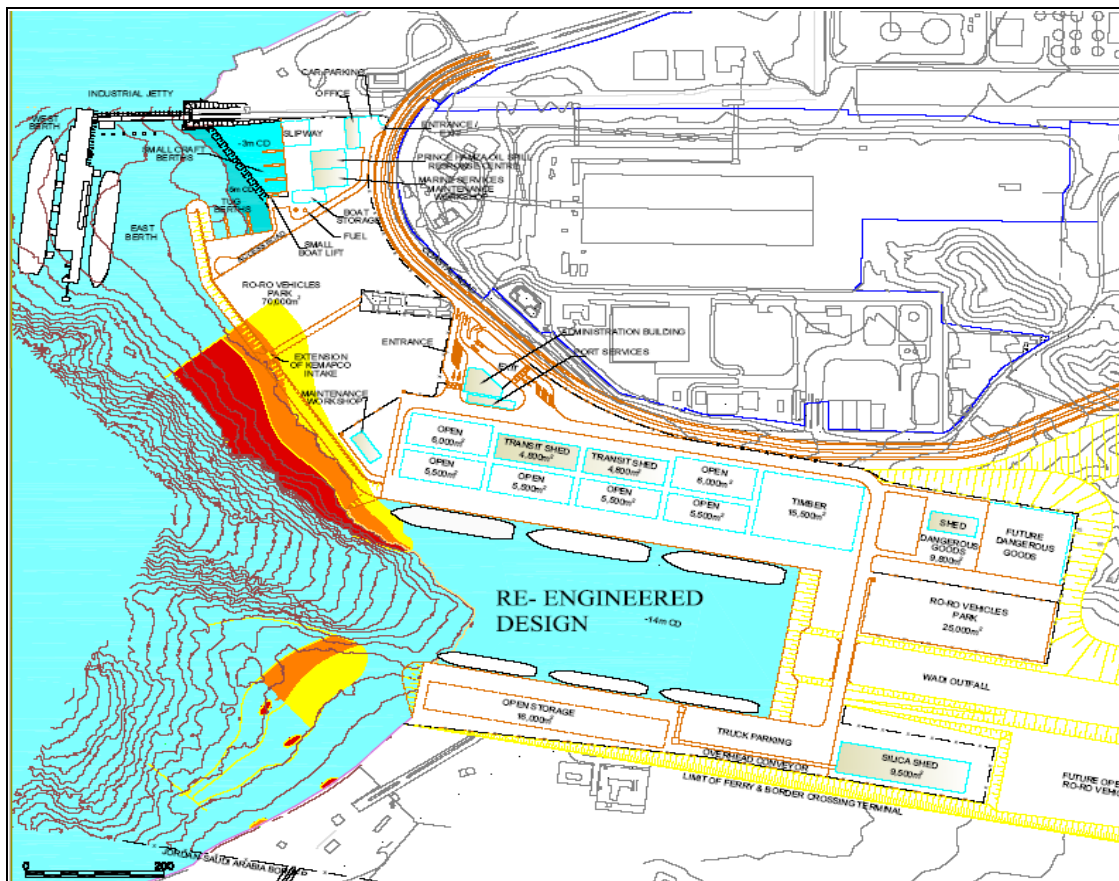


Figure 5.4 Revised Design of the New Port

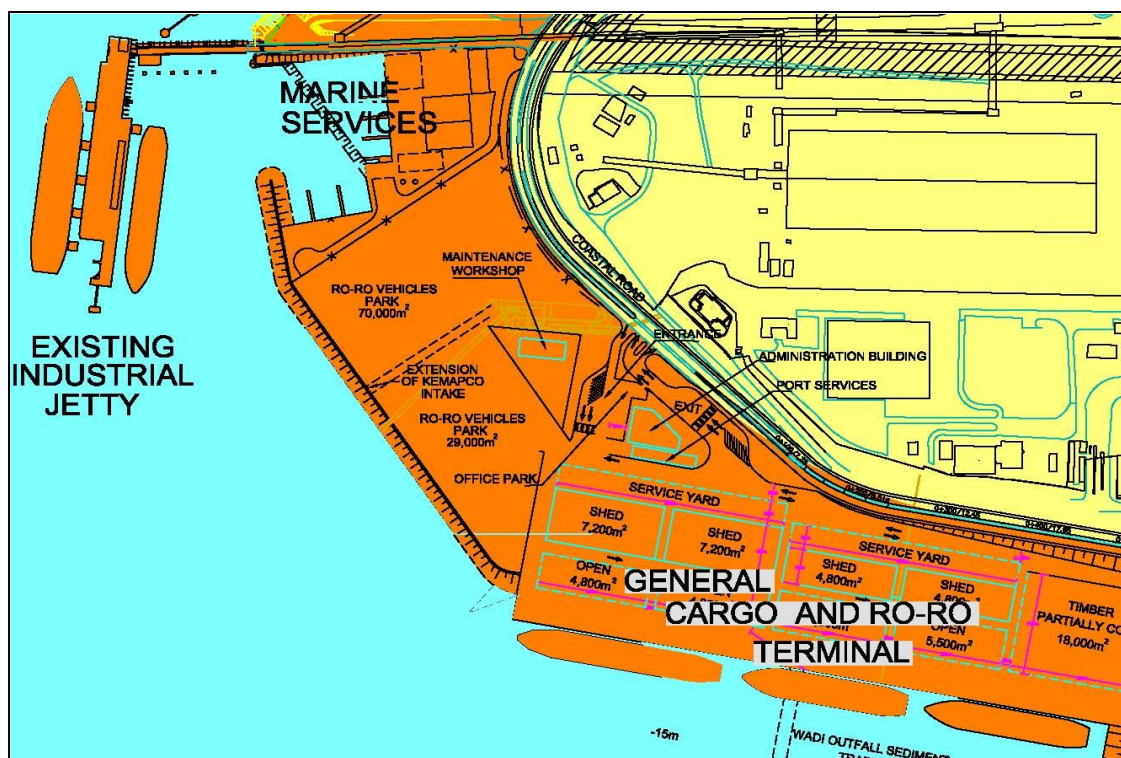


Figure 5.5 Master Plan of the New Port

ASEZA requested further design changes be studied that may result in a reduced area of coral damage. Design suggestions were made such as relocating the intended RoRo storage area to a location north-east of the New Port basin, leaving the area between the Marine Services harbour and the General Cargo & RoRo berths untouched. In order to carry out this study, it was suggested that ADC performs a cost benefit analysis by assessing costs associated with creating RoRo area in the east hills, including access road, creating RoRo area by means of construction of a suspended deck on tubular steel piles, and the reduction in costs involved in the original location, including coral damage compensation costs.

5.4.1 Approach to Assessment

A total of five alternatives were assessed for the cost benefit analysis of the RoRo parking location. The analysis used the proposed Master Plan as a baseline alternative and compared it with redesigned alternatives associated with minimal damage to corals present in the area. The area of coral damage "saved" by the alternative and the cost of implementation of the alternative were then compared between all proposed solutions.

In order to carry out the analysis, the costs associated with different components of the each of the alternative were based on the following;

- Costs of corals were taken from the Coral Compensation Assessment for the Aqaba Port Relocation, 2008 report. According to the report, a total area of 32,509 m² of corals will be directly impacted equivalent to a monetart value USD 7.8 M. It then follows that price per m² of coral is USD 240 (169 JD).
- Costs associated with excavation of storage area from the hill eastern of the project area are estimated to be 3.25 JD/m³
- Cost of filling and compaction were estimated to be 4.00 JD/m³
- Construction of an access road along with its drainage needed to connect the carved out parking on the hill with the rest of the terminal will cost 39.00 JD/m²
- Cost of revetment is estimated at 1600 JD/m
- Cost of deck on piles is estimated to be 62,500 JD/m
- Based on the design requirements, tubular steel piles needed for the construction of a deck on piles will cost 2,000 JD/m²

All costs include an estimated uplift cost adjustment for price increases as well as general and preliminary costs, engineering and contingency costs.

5.4.2 Assessed Alternatives

Alternative 1

This is the baseline alternative which is presented in the Master Plan 2007. The total area damaged is equivalent to 71,000 m² resulting in an area of 14,910 m² of coral damage (based on a 21% hard coral cover) in favour of the RoRo terrain. The remainder area damaged is in favour of the west end of the quay side and the marine services harbour with no impact on the corals.

Alternative 2

For this alternative, the entire RoRo area and RoRo activities are shifted to the hill side requiring no land reclamation and thus resulting in no coral damage. However, a RoRo parking area with a surface area of 71,000 m² needs to be constructed in the east side of the project area and will to be excavated from the hills.

Alternative 3

The revetment located at the -7 m water depth contour line for this alternative avoids the area with high percent coral cover and follows the north east boundary of the 25-40% coral coverage area. The RoRo parking at Dirreh Bay will be reduced to 52,000 m² resulting in an area of 11,025 m² of hard coral damage based on a 21% hard coral cover. Also, a parking area of 18,500 m² will need to be constructed in the east side of the project area and will have to be excavated from the hills.

Alternative 4

This alternative is generally equal to alternative 1, but it that the shore protection bund is replaced by a quay at -10 m water depth.

Alternative 5

Alternative 5 involves the development of a berth between the marine services harbour and the harbour basin by means of constructing a suspended concrete deck on tubular steel piles. Protection of adjacent structures will be required through a bund/revetment at the southeast side of the marine services harbour, a revetment to protect the reclamation to the original shore line and through a bund/revetment at the west side of the general cargo quays. Also, a concrete deck on steel piles will be constructed till the -10 m water depth contour lines.

In the assessment of this alternative, two financial figures were associated with the corals impacted underneath the deck on piles due to uncertainties of the extent of coral damage by shading. The two figures used are:

1. A total area of 14,910 m² of coral is assumed to be impacted by the deck on piles; associated costs are 2.52 million JD.
2. The coral is not impacted by the deck on piles and no costs for coral compensation have to be taken into account.

5.4.3 Summary & Conclusions

Table 5.3 illustrates the total costs as well as the breakdown associated with the different components required with each of the proposed alternatives.

			Cost in million JD									
			Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
Alternative 4Item	Unit	Unit cost (JD)	Quant	Cost	Quant	Cost	Quant	Cost	Quant	Cost	Quant	Cost
RoRo area Durrah Bay	m ²		71,000		0		52,500		71,000		71,000	
RoRo area at east hill	m ²		0		71,000		18,500					
Coral compensation	m ²	169,00	14,910	2.52	0	0	11,025	1.86	14,910	2.52	0 / 14,910	0.00 / 2.52
Add. Bunds Marine Services	m	23,620.00	0	0	170	4.01	60	1.42	0	0	170	4.01
Add. Bund west berth	m	23,620.00	0	0	200	6.56	70	1.65	0	0	200	6.56
Excavation RoRo east hill	m ³	3.25	0	0	710,000	2.31	185,000	0.60	0	0	0	0
Backfill RoRo east hill	m ³	4.00	0	0	710,000	2.84	185,000	0.74	0	0	0	0
Access road RoRo east hill	m ²	39.00	0	0	8,000	0.31	8,000	0.31	0	0	0	0
Backfill RoRo Durrah bay	m ³	4.00	639,000	2.56	0	0	393,750	1.58	639,000	2.56	0	0
Bund RoRo Durrah bay	m	23,620.00	500	11.80	300	1.77	420	6.94	0	0	300	1,77
Quay RoRo Durrah bay	m	71,000.00	0	0	0	0	0	0	500	35.90	0	0
Deck on piles	m ²	2,000.00	0	0	0	0	0	0	0	0	71,000	142.0
Total				16.9		17,8		15.1		41,0		154,4 / 156,9

Table 5.3 Summary of the Cost Analysis of the RoRo Area Alternatives

In order to form a well balanced decision on how to best develop the RoRo area of the New Port, consideration must be made for aspects other than short term financial ones. An identification of such aspects that influence the selection of the best alternative option include;

- A less efficient unloading process of the RoRo carrier will result if the RoRo parking is relocated to the east hill since the parking will be further away from the basin. It will take more time for the RoRo vehicles to reach their parking lot.
- The east hill area is presently outside of the port boundary.
- Damage to vehicle paintwork may result as the east hill area lies immediately down wind of the existing industrial (chemical) plants should any emissions occur from the industrial plants.
- For security reasons, ISPS etc., the natural area retained at the north-west corner of the New Port will not be accessible to the public, tour operators or others, as it lies within the harbour boundary.
- There is a possibility that the shape of the revetment that follows the original shore line, due to the prevailing winds and surface currents, induces an "eddy" attracting suspended material and flotsam.
- The costs of the earthworks that need to be executed at the east hill area are very uncertain. No information is available on the condition of the soil at this particular location and it is uncertain whether the hill can be excavated using standard equipment. Specialised, more expensive equipment might be needed.
- Acquiring soil information to gain insight in the soil quality would take time, which is a scarce item.
- Some security issues might be involved with the construction of the RoRo parking in the east hill. The total length of the South Port border will become longer and it might be difficult to patrol the elevated terrain.
- Reclaiming the north-west corner at Dirrah Bay in a later stage would be more costly in terms of mobilisation and demobilisation of equipment and difficult access to the location, but also in terms of permitting and overcoming environmental and political issues.
- The present design for the north-west corner leaves the option to construct a berthing facility now or in a later stage at relatively small costs, facilitating a water depth of -10CD.
- The creation of a RoRo parking area at the east hill location may pose a negative effect on possible future expansions of the New Port basin to the east.

The layout that was modified after the first public scoping session designated the north western reclamation as RoRo parking area meaning an area where vehicles would be securely held following discharge and prior to delivery. As part of additional studies required by the regulator an analysis of shops presently calling at the existing Main Port showed that 55% have an arrival draft of 9 meters or less. This therefore means that the planned revetment and reclamation will be available for conversion to port operating land adding further two berths for use as volumes grow.

6.0 Consultation and Public Disclosure

6.1 Approach to Consultation

The development of the South Port, including relocating services from the Main Port and developing the Main Port site was a major component of the original ASEZ 2001 Master Plan. The Strategic Environmental Assessment (SEA) for the Master Plan which was carried out in 2001 included extensive public and stakeholder consultation. The Master Plan was approved by ASEZA in the same year. The overall approach of relocation and development has therefore already received significant prior consultation.

ASEZA's Environmental Protection Regulation No 21 requires that a Scoping Session and a post-EIS-submission disclosure session to be held as components of the EIA. A successful Scoping Session was held on the 12th of June 2007 with over 80 attendees that engaged in all day discussions. In addition, there have been several press releases about the project. These included a major interview with the ADC Chairman in Spring 2007. The interview explained the rational behind the project. To further transparency as well as provide the public with information and updates, a brief on the project is being proposed for the ADC and ASEZA websites.

However, due to the importance of the project, ASEZA and ADC felt the need to provide additional opportunities to engage the public. It was agreed that this would take place through a series of Focus Group Discussions (FGDs) and Structured Interviews (SIs) with key stakeholders.

FGDs were held during October 2007 with the following groups;

1. Environmental Non Governmental Organizations
2. Diving Community
3. Local Hotel and Tourism Sector
4. Media
5. Civil Society Organizations

SIs were held with;

1. Appointed representative from the Aqaba Ports Corporation (APC)
2. Appointed representative from Jordan Phosphate Mines Company (JPMC)
3. Appointed representative from Amin Kawar & Sons uses ports services

FGDs were hosted by ASEZA in the Aqaba Marine Park. These were facilitated by an experienced socio-economist. An environmental engineer representing the ADC project team, and an ASEZA-appointed officer were present at all sessions. Each FGD involved a presentation on the project, a review of drawings and a question and answer session. A discussion was then held, based around a structured agenda. Concerns were raised and discussed. Notes and minutes were taken. The FGDs are written up more fully in Appendix VI. Minutes of each FGD and lists of attendees are included. Recommendations for continued disclosure of information on the project, based on the consultations are given at the end of the Section.

6.2 Summary of Consultations

Group 1: Environmental NGOs

The group felt that the increased distance to the port could impact the health and financial situation of residents, due to noise and emissions from the increased traffic and transportation costs. There was a concern that recreational activities in the south coast area will be impacted as

a result of the project. Concerns focused on the glass-boat operators and diving centers, especially since the southern coastline is considered one of the most beautiful areas.

The group also noted that demand on products and services could raise prices, including real estate prices. It was admitted that this could positively impact residents by increasing market activity and revive businesses, although unless incomes increase, there could be a burden on residents.

The group members believe that if there were large numbers of foreign labourers working on the port, this could cause local young men and women to acquire socially unacceptable practices in their conservative community. Drug use and sexual practices were cited as a concern. It was also felt that large numbers of male foreign labourers could create an adverse reaction on women, reducing their mobility. There was also concern that large numbers of workers into Aqaba would place pressure on the infrastructure, requiring new facilities and improving the existing ones.

There was a comment that a restructuring of the port and its staff will be needed, thus requiring a rethinking of recruitment policies by the Ports Cooperation. There was an opinion that this could 1) trigger improved port specific programs at training institutions and 2) increase competitiveness among port employees as 'masked labour'/unqualified staff will no longer be employed. These were felt to be positive impacts.

The group pointed out that the space made available in place of the current port is necessary for the local community and the project would be to their benefit if this space is made available for them. Communicating this information to the public, and the adoption of a Corporate Social Responsibility was suggested to improve the image of the Authority amongst the local community.

Group 2: Diving community

The group accepted that the project overall will attract more investors and residents into Aqaba which in turn will increase tourism in the area. This increase could negatively impact the corals as they will experience more pressure. At the same time, it was thought that prices would rise – especially in Old Town and the Salah al-Din areas – due to their proximity to the Main Port site. This group also raised concern over the distance to the new port, and the additional transportation expenses to port workers.

It was felt that financial compensation to the dive centers for their losses caused by losing divers due to the closure of the south coast site should be considered as well as improving the existing dive sites. However, if the corals in the site of the current port could be revived, this would be excellent boost for diving. It was also felt that wrecks or concrete balls could be sunk in the northern area to create new reefs.

This group noted that the area proposed for the new port is very popular among divers, with some who come specifically to dive off the Dirreh Bay Wall, and that closing access to this site would have a significant impact on the diving industry.

There was agreement that restricting access to the beach at Dirreh Bay was a major disadvantage since this area is popular with local people at weekends. Providing information was considered important, emphasizing the benefits arising from the project.

It was felt that the provision of clear information on the project would allow people to plan their activities to address the new realities. For example, if the diving sector knew the plan for the coming few years, they would be able to advertise about the new dive sites that are going to be

available by 2010. The most suitable way to give out information was felt to be through ASEZA, either through their website, the media, or meetings with the local community.

Group 3: Local hotel and tourism sector

This group felt that although the local people have a good level of education, they lack practical experience. Creating training centers can build a capable workforce as well as act an incentive to engage the locals with the project. During the construction phase, jobs are most likely to be filled up by foreign labour who will reside in Aqaba.

Participants felt that prices could rise due to increased demand, especially on consumer products. However, as the port expands, it could be used as an external hub for the neighboring countries which will increase its use and bring in more revenue to both the port and the businesses in Aqaba.

The group pointed out that people in Aqaba are afraid of instability, and will be very hesitant to leave guaranteed sources of revenue to try their chances in the new project. Familiarization with the project and the opportunities provided will build a positive image. This can be done by providing access to the project locations, arranging fieldtrips, street advertisements and releasing information through NGOs.

Group 4: Media

No one attended this FGD.

Group 5: Civil Society Organizations

It was felt that the distance to the new port in the south is a main factor of concern. There was a concern over increased traffic, transportation costs and reduced market activity, as it will be harder for business persons to make their way down to the new site to buy goods. However, relocating the Main Port will remove many problems associated with it from the local community as well as creating space in that area.

It was agreed that the port workers will be most affected by this move. Many individuals are closely associated with the port but are not employed by the port, such as per diem workers and those who work on the sidelines and by the gates. There was a concern that such employment segments may be restructured and, with the port being so far, might lose their jobs due to transportation difficulties. Creating organized transportation lines should be considered, not just for those employed by the port, but for everyone concerned and providing support services to the port.

It was felt that links and communication between the Ports Corporation and the local community are important. The Corporation needs to appear sensitive to the public through CSR activities and projects, general meetings and presence in the activities of the local community.

Structured Interview 1: Ports Cooperation

It was noted that this project has the potential to break the cycle of low education and the lack of opportunities for workers in Aqaba. It was felt essential that the port provides decent jobs with decent salaries, an incentives system and accessible opportunities to the local residents. The lack in training opportunity in port related jobs can be remediated with provision of training and teaching of them in local institutions. This can improve the quality of living for many families.

It was agreed that, in order to involve residents effectively, benefits needs to be perceived through increased wages, revamped infrastructure and provision of housing. Frequent updates on the project need to reach the residents in order for effective preparation and participation.

Structured Interview 2: Jordan Phosphate Mines Company

There was a concern that the arrival of large numbers of people will disrupt the status quo in Aqaba, and that temporary workers would be inconsiderate of local customs, often bringing with them bad practices and raised living costs. Construction of temporary housing is therefore crucial to reduce their impact on the local community, economy and reduce traffic. There is a need for a serious traffic study as traffic along the coastline is going to increase from both the sudden increase in the population and the establishments along coastline.

In terms of health and the environment, the advantages are that the corals at the location of the current port will be saved and revived; as well as the elimination of the phosphate dust.

There was a suggestion that training institutions can design programs with the port, creating opportunities for the local residents to gain useful skills and qualifications that meet those needed by the port construction and operation.

It was felt that residents need information to be prepared to invest and benefit from the new opportunities. The most effective way for the Authority to do so will be to place announcement boards in the street or a flier in a busy area in the town center.

Structured Interview 3: Amin Kawar and Sons

There was a suggestion that one profitable venture could be the placement of touristic establishments in the site of the current port, but leaving the cruise ship terminal close to town so as not to disturb businesses that target this market.

It was agreed that businesses associated with the port will be affected, with additional costs including transportation of employees between the town center and the port. The new port should assign space for port-related businesses to establish offices with a good number of personnel, due to the increased distance for employees to travel.

There was an impression that the project will create an increased desire to be employed by the Ports Corporation, and that this increased choice of labour would increase the quality of labour on the Ports, and the effectiveness of the workforce.

It was felt that local customs and traditions are going to be impacted by many factors including the large numbers of people (cited by the participant at 5,000 to 6,000) who will be traveling on the external road instead of the town area.

Again, the point was made that businesses and individuals need to know how this project can benefit them and be updated in order to interact with it. Businesses that work at the port can be contacted with new information through their unions.

6.3 Synthesis of Comments

It can be seen that the main stakeholder concerns were;

- Difficulties and costs of transportation to the new port,
- The effects of increased foreign workers on the local communities

- The provision of timely information on the project.

In addition, the dive sector had concerns over the loss of corals in Dirreh Bay, and the potential affect on the Dirreh Bay Wall Dive site.

The key benefits anticipated were;

- Release of the Main Port site for public use
- Removal of the Main Port activity
- Knock on benefits from increased trade through the port.
- Potential for training

The main concerns and comments were listed in Table 6.1 below.

Overall, there was a positive reaction to the idea of closure of the Main Port, and the development of new port facilities in the South. The benefits to the Town of Aqaba – residents and tourists – were clearly appreciated. There were a number of positive comments regarding the restructuring of the Aqaba Container Terminal (ACT) and the positive benefits to ACT workers and employees. There was a feeling that if the new Port could learn from the successes of ACT, and implement similar improvements, all would benefit.

	Concerns/Perceived Benefits	Affected Group	Proposed Solutions
Benefit	Increased port capacity will have knock on benefits for local suppliers, businesses, employees, local communities and increase in economic activities	- Labour force in Aqaba - Businesses in Aqaba	- Provide organized transportation for workers and service providers - Increase safety measures on roads - Provide public transportation to South Port (maybe including a light rail) - Improve road networks (junctions) - Ensure public access to waterfront and beach area at Main Port site - Implement youth programs - Transport corals from Dirreh Bay to another location to preserve them - Improve existing dive sites by cleaning, improving accessibility and provision of services - Provide financial compensation for dive centers - Dedicate additional facilities and access at the south coast for diving - Rehabilitate the reefs at the Main Port phosphate berth - Create artificial reefs by putting down wrecks or concrete artificial reef units - Provide foreign labour with enclosed reasonable incomes and housing for port workers housing away from town centre and - Build a new affordable residential area close to the South Port - Allocate part of the budget for local community development - Merge mega projects to train and employ Aqaba's youth - Creating training centers and programs specific to port skills and needs rather than continued recruitment of managers and workers from abroad - Improve working hours at the port - Change way of dealing with imported goods - Provide office space to navigation and clearance companies - Conduct workshops with the navigation and clearance companies and workers at the port to remove any barriers and promote share of vision
Benefit	Removal of port operations at the Main Port, dust and environmental improvements; aesthetic improvements of commercial and tourism zoning and increased water quality and coral health in Main Port	- Residents and visitors to Aqaba - Diving sector - Tourism sector	
Benefit	Potential development at Main Port site, increasing economic/tourist activity in Aqaba, and access to waterfront and knock on benefits	- Residents of Aqaba - Tourism sector - Businesses in Aqaba	
Benefit	Positive impacts such as training and employment potential; and additional services and amenities	- Youth of Aqaba - Employable residents of Aqaba	
Concern	Social impacts from foreign labour and change in labour practices	- Residents and visitors to Aqaba - Port employees	
Concern	Increased distance	- Port employees - Port service providers	
Concern	Negative impacts on local community such as price rises	Residents and visitors of Aqaba	
Concern	Risk to environment at South Port, including corals and dive sites	- Tourism and diving sector - Glass boat operators	
Concern	Loss of access to Dirreh Bay beach and Dirreh Bay Wall dive site	- Diving and tourism sector - Glass boat operators	

Table 6.1 Synthesis of the Comments

6.4 Recommendations on Monitoring & Continued Disclosure

It is clear that a consistent concern from the stakeholders is for clear and timely information on the project to be made available for local people, so that plans can be made, and that the local communities, residents, workers, affected industries, etc can prepare how to address the new realities. In order to keep interested stakeholders informed on the project as it unfolds, the following recommendations are made;

- A disclosure session to be held with all Scoping Session invitees once the EIA is received and reviewed by ASEZA
- Announcements to be made in local newspapers in English and Arabic to update on the following milestones;
 - Publication of invitation to bidders to express interest
 - Release of RFP to selected bidders
 - Receipt of proposals with bidder's names
 - Selection of winning company and beginning of negotiations
 - Award of contract
- Once the winning company is announced it should be made responsible for further public disclosure by using media outlets (newspapers, radio and TV). Information on the construction and operation schedules should be publicized, including the use of descriptive signage at the Main and South Ports illustrating artists impressions of the design.
- The current employees of APC must receive advance updates of plans and scheduling related to Main Port closure and phasing, including provision of transportation, recruitment and training, labour restructuring plans (if any).
- Once the final details of the port development and operation plans are finalized, a statement should be made by ASEZA/ADC/EPC regarding the projections and opportunities for employment and worker relocation.

Note: It is proposed that a socio-economic study should be carried out on the impact of the project on the local community, particularly on the impact of the potential restructuring of labour under the new operational arrangements. Particular attention should be given to the impacts on the residents of the Old Town, and on the port workers, families and on local service providers. Recommendations can then be made on how best to mitigate the consequences.

It is recognized that the issue of potential labour restructuring has not been addressed in this study, since no details will be available until discussions are opened with the selected bidders. It is also noted that both ADC and ASEZA are aware of the importance and sensitivity of labour employment and local services to the economy and community of Aqaba.

7.0 Project Impacts

In accordance with the requirements of the Environmental Protection Regulation No. 21, this section identifies the likely impacts arising from the project under assessment. These are divided into the various project sub-components.

7.1 Determination of Significance

For negative impacts, a 'significance' has been attributed, in accordance with the regulatory requirements. Significance is the measure used when assessing the environmental impacts associated with a project. It is derived, taking into account the characteristics of the impact and the sensitivity of the surrounding environment. The weighting and balancing of the relative influence of the impact magnitude and receptor sensitivity is takes into account the following parameters;

- Compliance with regulatory policy objectives, regulations and standards
- Reference to criteria such as protected species, protected areas, landscapes, etc
- Type of impact (contamination, degradation, physical alteration, loss of habitat, etc)
- Physical scope of impact (area, quantity of affected resource or habitat)
- Type of contaminant source (concentration, source of contamination, longevity)
- Importance of the resource impacted
- Effect on biodiversity
- Probability of impact
- Ease of management/mitigation of the impact
- Comparison with experience on similar projects elsewhere
- Experience and professional judgment
- Stakeholders concerns

The significance itself is then graded and given a numerical value for ease of comprehension. These numerical values used here are outlined as follows;

Grade	Significance of impact
0	No need for mitigation
1	Issues whose significance is low
2	Issues whose significance is moderate
3	Issues whose significance is high

A negative/positive sign prior to the grade is also assigned to identify whether the significance is a positive or negative one on the surrounding environment.

7.2 Benefits of the Project

The ports of Aqaba are the sole maritime gateway of the Hashemite Kingdom of Jordan and thus are a strategic national asset. The upgrade and maintenance of the ports to meet international standards of efficiency, worker performance, and environmental management – as this project will provide – is a necessity. One particular benefit of the project is the establishment of an oil and oil wastes reception facility, in accordance with Jordan's obligations under the MARPOL treaty.

In addition, Jordan's overall port capacity, in particular for industrial bulk solids and liquids, needs to be increased to facilitate the predicted increased demand coming from proposed expansion of the Southern Industrial Zone. The rationalization of the ports, the relocation of services from the Main Port to the South Port, and the upgrade of the South Ports addresses these problems. In addition, all the sea ports need to be expanded and improved environmental management need to be implemented at all port facilities.

The current Main Port operation is becoming increasingly incompatible with the developing residential and tourism facilities in the town, and is the reason why the ASEZ Master Plan envisaged the relocation of most port operations from this area.

There are both significant environmental and economic benefits anticipated as a result of the Port Development Project.

Environmental Benefits

- Reduction in phosphate dust emissions due to the closure of the phosphate facility at the Main Port
- Reduction of pollutants from town centre due to relocation of Main Port operations, and reduction of truck traffic in the area
- Recovery of the marine environment at the Main Port
- Creation of public space on the rehabilitated site, including irrigated landscaping
- Significant investment in the installation of new environmental protection measures at the South Port
- Provision of an oil waste reception facility as required by MARPOL

Economic Benefits

- Release of 313 dunums at Main Port site for investment, development of residential/tourism/commercial/etc
- Knock on encouragement of increased private investment in tourism and commercial purposes in Aqaba town
- Increased availability of amenities for Aqaba residents and visitors
- Increased public access to waterfront at the Main Port site
- Increased fiscal take as a result of port expansion and more efficient operations
- Increased health and safety and reduced accidents
- Increased environmental security
- Clustering of Aqaba port activities into the Industrial Zone
- Increased employment opportunities in both retail, hospitality, commercial and ports sectors

These long term benefits are of high significant and will positively impact many sectors of the local population of the town of Aqaba. Of the main groups to be impacted are the people of Aqaba who will benefit from increased economic activity, improved availability

of civic amenities, increased job opportunities and an improved environment. The commercial sector will also see benefits, from additional investment opportunities. Overall, the town of Aqaba can continue to improve its identity by developing the port site in harmony with the nearby urban, commercial and residential areas.

7.3 Environmental Impacts from Main Port Site Rehabilitation

This section discusses the impacts from the closure of port operations, the decontamination and demolition of facilities at the Main Port and the rehabilitation of the site. A summary of the impact assessment is presented in Table 7.1.

Improvements to the Marine Environment from the Main Port Rehabilitation

The marine environment within the Main Port vicinity is currently contaminated resulting in restricted coral growth, a polluted sea bed and contaminated water quality. As discussed in Section 4, there is significant phosphate dust settled in the sea, impacting the corals and sea grass in the area. There is also spilled and dumped material in the sea around the general cargo berths and the phosphate jetty. The closure of operations at the Main Port will reduce pressure on the marine environment by reducing/eliminating spills and discharges of materials into the sea. Phosphate settlements will cease and the degree of spillage at the site will be reduced/eliminated. In addition, spilled material at the site – barrels, piles, sunk vessels, discarded ropes, etc, will be removed from the sea bed as part of the site rehabilitation. As a result, the water quality in the area will recover leading to restoration of marine flora and fauna including the regeneration of corals in the area.

Note that at the request of ASEZA, no attempts will be made to remove phosphate dust settled on the sea bed, due to the difficulty and negative impacts this would be present. However, as partial compensation of the habitat damages at the South Port – see later Section 8 – recommendations will be made on establishment of an artificial reef in the area, taking into account the improved water quality.

Direct impacts on the marine environment from the Main Port rehabilitation will include;

- Increase in water quality from the removal of port operations, elimination of dust deposits, removal of spilled material and reduction in turbidity

Indirect impacts on the marine environment from the Main Port rehabilitation will include;

- Long term gradual recovery of marine environment and improved coral growth in the area, including at a proposed artificial reef

These impacts are positive and highly significant, allowing a long term, though reversible, improvement in water quality and general marine environment around the Main Port.

Improvements on the Terrestrial Environment from the Main Port Rehabilitation

The terrestrial environmental context has been described in Section 4. The current operations at the Main Port are detrimental to the surrounding terrestrial environment, due mostly to ineffective dust controls at the phosphate facility. There has also been some past spillage of hydrocarbons on the site, resulting in a small amount of contaminated sub-soil and significant quantities of asbestos on the site, including in buildings. It is evident that the relocation and rehabilitation of the Main Port – including the demolition and removal of all equipment and facilities would result in significant positive impacts allowing recovery and improvement of the surrounding environment.

Direct impacts on the terrestrial environment from the Main Port rehabilitation;

- Improved subsoil conditions due to removal of sub-soil contamination that has arisen from over 30 years of port operations
- Improved surface conditions due to removal of all phosphate dust and asbestos at the Main Port site
- Improved aesthetics due to the removal of port facilities and infrastructure

Indirect impacts on the terrestrial environment from the Main Port rehabilitation include;

- An unquantifiable reduction in risk to human health due to a cleaner environment

These benefits are of high significance and long term, though reversible.

Impacts on Air Quality from Elimination of Phosphate Operations

The air quality in Aqaba is currently greatly impacted by dust emissions from the current transportation and loading of phosphate at the Main Port. The removal of the phosphate loading facility will eliminate phosphate dust emissions from the area and lead to an immediate improvement in air quality and a reduction of air-borne particulates. There will be a knock on though unquantifiable reduction of risk to respiratory health in Aqaba.

Direct impacts on air quality from the elimination of phosphate operations include;

- Improved air quality from reduction in air-borne particulates
- Improvement on the overall aesthetics of the current location of the phosphate loading facility including removal of phosphate dust plume, constantly present during loading operations

Indirect impacts on air quality from the elimination of phosphate operations include;

- Reduced risks to human health, especially respiratory health, from reduced particulates

These benefits are positive and highly significant. Once the phosphate facilities are removed, the improvements will be long term, though reversible.

Impacts on Terrestrial Environment from Disposal of Scrap and Waste

Hazardous material such as asbestos must be disposed of at the hazardous waste facility at Swaqa. Non-hazardous material such as contaminated soil, phosphate, building rubble, etc must be taken to a disposal location approved by ASEZA. However, there remain risks to the ground and groundwater from such disposal.

Direct impacts on the terrestrial environment from disposal of scrap and waste may include;

- Contamination to soil from leachate of contaminants
- Contamination of groundwater from leachate of contaminants

Indirect impacts on the terrestrial environment from disposal of scrap and waste may include;

- Downstream impacts on wells or marine environment
- Health impacts from inappropriate disposal of hazardous material

If not mitigated properly, these impacts could be of moderate significance, long term and irreversible, especially in the case of health-related impacts.

Risk of Migration of Rodents from Main Port Site after Decommissioning

There is a risk that once the grain silos are cleared, the rodent population at the site will migrate into neighbouring areas in search of food. Nearby residential areas will be particularly at risk. There could be resulting health impacts from diseases carried by the rodents. However, no measurement of rodent populations at the site have been made.

Direct impacts from migration of rodents could include;

- Increased populations of rodents in residential areas
- Contamination from the inappropriate disposal of rodent carcasses

Indirect impacts from migration of rodents could include;

- Increased health risks from diseases

These impacts are dependent on mitigation and control, but are likely to be of low significance, short term and reversible.

Impact from Use of Inappropriate Fill at Main Port

There is a risk that fill material used at the Main Port contain pollutants or is otherwise unsuited to use at the shoreline. Such inappropriate fill material include fill that is not inert, contaminated and soluble which will pose a risk to the marine environment by altering water quality and introducing pollutants to the marine ecosystem.

Direct impacts from the use of inappropriate fill at the main port include;

- Reduced water quality
- Contamination of marine environment by introduction of contaminants present in fill material

Indirect impacts from the use of inappropriate fill at the main port include;

- Reduced quality of marine ecosystem
- Increased health risk to marine ecosystem

These impacts are dependent on the use of inappropriate fill and the policies that are followed. In the event they take place, they are likely to be of moderate significance, longterm and reversible.

Health and Safety Impacts from the Demolition of Buildings

Significant demolition work will be required to remove building and facilities. This will entail the use of heavy plant, and perhaps explosives. There will be a risk to workers from plant, falling debris, working at heights, and from the use and storage of explosives.

Direct impacts from the demolition could include;

- Injury or death to workers from demolition activities
- Injury or death from use of explosives or fire

Such impacts are likely to be of significant, but long term and could be irreversible, if not properly mitigated.

Benefits from the Release of the Main Port Site for Commercial/Urban/Tourism Purposes

The removal of Main Port operations will release an area of around 313 hectares of currently industrial land, allowing the development of urban, commercial and tourism facilities. Access to the waterfront will be improved and extended. The potential additional investments should be a significant boost to the local economy, both in terms of tourism revenue and local retail services. The overall aesthetics of Aqaba will also improve

Direct benefits from the release of the Main Port site include;

- Aesthetic improvement of the area
- Removal of industrial complex from tourist/commercial/urban zone
- Improved access to waterfront

Indirect impacts from the release of the Main Port site include;

- Removal of restraints to additional investment in the town

Benefits from the release of a rehabilitated and decontaminated Main Port site are of high significance, long term and likely to be irreversible.

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
Marine Habitat	Increased water quality from the removal of port operations, elimination of dust deposits, removal of spilled material and reduction in turbidity	Reversible	Long Term	+2
	Increased water quality and reduced risk of oil and oil waste spillage due to the establishment of a new oil reception facility	Reversible	Long Term	+2
	Recovery of habitat and restoration of marine flora and fauna	Reversible	Long Term	+2
	Potential contamination due to downstream impacts from leachate from inappropriately disposed contaminants and use of inappropriate fill	Reversible	Long Term	-2
Terrestrial Habitat	Improved subsoil conditions due to removal of subsoil contamination that has arisen from over 30 years of port operations	Reversible	Long Term	+1

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	Improved surface conditions due to removal of all phosphate dust and asbestos at the main port site	Reversible	Long Term	+3
	Risk of contamination of soil and groundwater from leachate of contaminants in the event of inappropriate disposal of waste material	Reversible	Long Term	-2
	Increased rodent displacement from habitat into the surrounding environment causing potential terrestrial community structure change	Irreversible	Long Term	-2
Air Quality	Reduction in airborne particulates	Reversible	Long Term	+3
H&S from Demolition	Injury or death to workers from demolition activities	Irreversible	Long Term	-2
	Injury or death from use of explosives or fire	Irreversible	Long Term	-2
Social Impacts and Benefits	Aesthetic improvement due to removal of all port facilities and infrastructure and dust plumes related with port operation	Reversible	Long Term	+3
	Increased risk to human health due to inappropriate disposal of hazardous and waste material	Reversible	Long Term	-2
	Increased risk to human health associated increased rodents in residential areas	Reversible	Short Term	-2
	Reduced risk of respiratory health impacts	Reversible	Long Term	+3
	Removal of industrial complex from tourist/commercial/urban zone	Reversible	Long Term	+3
	Improved access to waterfront	Reversible	Long Term	+2
	Removal of restraint to additional investment	Reversible	Long Term	+3

Table 7.1 Significance of Impacts during Main Port Rehabilitation

7.4 Environmental Impacts Associated with South Port Construction

This section discusses the potential environmental impacts associated with development of the South Port. A summary of the impacts is presented in Table 7.3.

Impacts on the Marine Habitat from Dredging, Anchoring, Piling and Land Reclamation

Approximately an area of 160,000 m² of beach, shoreline and seabed at Dirreh Bay will be damaged as a result of construction activities such as dredging, piling and land reclamation. There will also be some dredging for the General Cargo entrance channel in Dirreh Bay and at the Industrial Terminal at the location of the proposed Marine Services Basin. There will be additional direct impact from piling and jetty construction for the

liquids berths and phosphate berths north of the container terminal. Hard and soft corals, and other associated marine flora and fauna will be impacted. Additional impacts could result from spillage or rolling of imported fill material and rocks on the sloping shoreline.

Calculations were carried out by ADC and MSS, to estimate the amount of corals impacted. The horizontal area of coral which will be damaged by reclamation of dredging was taken from drawings included in the South Port Master Plan. Figure 7.1 shows this. An assumption of vertical limits was made, although a 10 m buffer zone was included to allow for revetment slopes to the sea bed. The total horizontal area under permanent structures, jetties, berths, etc was taken, on the assumption that healthy coral is not likely to thrive in dim conditions. Additionally, a 3 to 5 m diameter buffer zone of damage was assumed for each pile based on its context.

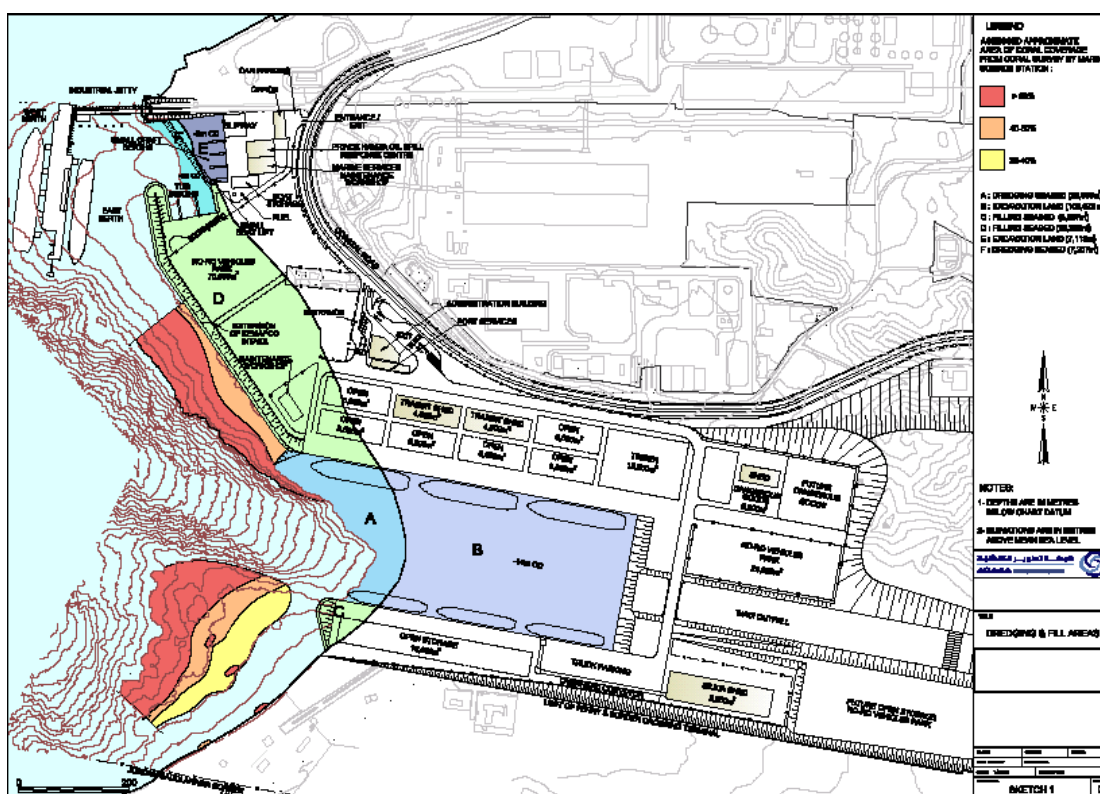


Table 7.1 Coral Damage at the South Port due to Construction Activities

According to these calculations, an approximate total of 32,500 m² of live hard coral will be removed at the South Port. There will also be a risk to corals and benthic communities from ship anchorage. Annex III and Section 7 discuss the significant work undertaken to assess the marine environment which will be impacted. It should be noted that design revisions since the South Port Master Plan 2006 have significantly reduced the area of impacted corals - see Section 2.

A further 5,476 m² of live hard coral will be removed at the South of Dirreh Bay where the Ferry Terminal will be located. The areas of hard corals directly impacted are summarized in the table below.

Zone of Impact	Area of live coral affected m ²	Description
Dirreh Bay South	1,250	Dredging and filling of land removing shallow reef flat
Dirreh Bay North	17,900	
Industrial Jetty	1,500	Dredging of shallow reef flat
Industrial Liquids Berth	500	Dredging and construction of jetty and dolphins in shallow reef flat
Phosphate Berth	3,150	Dredging and construction of jetty and dolphins in shallow reef flat
Grain Berth	700	Reclaiming with fill
Miscellaneous Liquids Berth	7,500	Reclaiming with fill
Ferry Terminal (Dirreh Bay South)	5,476	Landfill, dredging and creating of mooring dolphins
Total	37,976	

Table 7.2 Impact on Corals

As noted above, soft corals will also be impacted, but these were not considered in the above calculations, since their growth is very seasonal, and their recovery rate is much higher than hard corals.

Direct impacts on marine habitat loss associated with development include;

- The physical removal of benthic habitat, including hard and soft coral and other marine flora and fauna.
- The removal of migration and spawning sites for certain fish species.
- Risk to marine fauna from reclamation

Indirect impacts on the marine habitat associated with development include;

- Decreased populations of marine flora and fauna such as certain fish species, due to loss of habitat, migration and spawning sites.
- Disorientation of marine organisms such as fish and coral larvae due to increased levels of noise and vibration
- Beach disturbance, flora and fauna displacement and community structure change due to some species removal, reduction and isolation
- Decreased quality and quantity of corals due to extensive sedimentation caused by dredging and landfilling which may smother the corals

These above impacts are of high significance due to the high biodiversity of corals, particularly in Dirreh Bay. Stakeholders consider these to be one of the most significant impacts from the project. The loss of the reef habitat in Dirreh Bay is of particular significance as the quality of coral is high, and there will be displacement of a number of marine species which use the coral as habitat. The area is also used by the local community as a dive site and recreational spot. The impacts will be long term and irreversible.

Impacts on Marine Water Quality from Dredging, Anchoring, Piling and Land Reclamation

Construction activities such as placing of fill material in the sea, dredging, piling and anchoring can cause disturbance of sediments thus increasing turbidity and suspension of particles in the water column. This in turn can be detrimental to corals and other flora and fauna, even at low levels.

Direct impacts on water quality associated with development include;

- Increased turbidity and particle suspension in the water column
- Risk of contamination from marine or land-based construction plant and equipment

Indirect impacts on water quality associated with development include;

- Reduction in live coral cover and lower depth limit of corals and other benthic habitats by reduction of light availability due to increased sedimentation
- Lowered growth rates, reduced productivity, reduced recruitment, substantial reduction in sexual reproduction and rates of decolonization of coral due to increased levels of sedimentation
- Disturbance to flora and fauna from settlement of sediment particles

Such impacts are of high significance due to the irreversible, long term impacts, the valuable resource, and the effect on marine biodiversity. However, impacts on the water quality from the port construction itself are of moderate significance, reversible and should be short term.

Impacts on Marine Water Quality and Environment from Leakage or Discharge of Solid or Liquid Materials during Construction

There is a risk that construction, solid and/or liquid materials may be released to the marine environment. This could include oil, stored liquid materials (e.g. oil, solvents) solid and liquid waste, from stored material, or from construction plant and equipment. The risk of this is related to the storage and maintenance practices of the contractor

Direct impacts on marine environment associated with leakage/discharge during development could include;

- Reduced water quality due to presence of pollutants in marine environment.
- Increased nutrient levels resulting in eutrophication
- Build up of solid waste on the seabed

Indirect impacts on marine environment associated with leakage/discharge during development include;

- Disturbance of natural marine cycles due to imbalance in species numbers arising from contamination

- Risk of contamination of marine flora and fauna in the event of an accidental fire/explosion due to improper storage and handling of material during construction activities
- Risk of toxicity to algae, marine bacteria, marine invertebrates and fish in the event of an accidental spill of waste material such as oil and/or oil compounds
- Risk of coral suffocation and death in the event of increased solid waste such as plastics, metal, rubber and glass from inappropriate management
- Increased mortality and risk to health of marine flora and fauna due to contaminants.
- Risk of health impacts on swimmers and divers in vicinity

Such impacts would be of moderate significance since they can be regulated to reduce the risk of the impact taking place. The quantity, type of contaminant and its ease of management may change the significance of the impacts. Anticipated impacts on water quality will be reversible and short term whereas those on the marine habitat and fauna could be long term and irreversible.

Impacts on Air Quality and Terrestrial Environment from Land-Based Construction

As described in Section 4, the terrestrial habitat at the South Port is already contaminated and disturbed. No significant flora and fauna is present, although small areas of beach habitat may be lost as a result of land clearances at the coastline. Construction operations may, however, result in increased levels of dust, particle emissions and noise in the surrounding environment.

Direct impacts on air quality and terrestrial environment from land-based construction could include;

- Displacement of any remaining fauna in area
- Increased levels of dust, noise and particle emissions

Indirect impacts on air quality and terrestrial environment from land-based construction;

- Knock on impacts on respiratory health for workers and residents
- Decreased populations of sensitive terrestrial flora and fauna either residing or migratory in the area

These impacts are of low significance, short term and reversible due to the present degraded state of the terrestrial flora and fauna.

Impacts on the Air Quality and Terrestrial Environment from the Transportation of Materials, Equipment and Labour

Increased levels of transportation activity can be anticipated as a consequence of the port development. This will result in elevated levels of noise and dust in off-site areas through which transportation routes pass.

Direct impacts on air quality and terrestrial environment from transportation will include;

- Increased levels of dust, particle emissions and noise.

- Indirect impacts on air quality and terrestrial environment from transportation will include;
- Displacement of and nuisance to terrestrial fauna due to increased levels of noise
- Increased risk of traffic accidents
- Increased levels of GHG emissions

The levels of increase of transportation activity to the South Port and Industrial Zone as a result only of this project, will be marginal related to the current trends, thus the impacts on air quality are of low significance. They will be reversible and short term. However, the cumulative impacts of all the planned development at the South Port and Industrial Zone will be significant and are part of a separate study by the Ministry of Public Works and Housing.

Impacts on Roads and Transportation Infrastructure

The port construction will temporarily increase the traffic to and from the port. This will include the delivery of plant, equipment and materials to and from the site, and the removal of waste. A significant issue will be the delivery of rock armour and fill material to the site. There is a risk of overloading the vehicles resulting in high axle weights which could disturb the road surfaces. This is a known hazard of construction using large amounts of fill and heavy rock armour, and can cause expensive damage to roads infrastructure, if not properly mitigated.

Direct impacts on roads and transportation infrastructure could include;

- Increased traffic on supporting networks and junctions
- Risk of structural impact on road surfaces from heavy trucks

A detailed examination of road and junction capacity has not been carried out in this study. However, this is currently under study by the Ministry of Public Works and Housing, taking into account the forecasted traffic loads.

Impacts on Existing Marine Intakes and Outfalls

Figure 4.4 illustrated the location of the 4 intakes/outfalls along the coastline. The intake and outfall serving the KEMAPCO plant will both be affected by the project. The project design needs to take account of these services, and incorporate them into the design of the facilities, as has already been done. During construction liaison between the contractor and KEMAPCO will be necessary to minimize any disruption to flow.

There is also a risk that excessive turbidity in the water during construction could cause problems for the water intakes of KEMAPCO (in Dirreh Bay), JPMC and the ATPP (to the north of the Industrial Terminal). Strict control of turbidity during construction is addressed in the Performance Requirements section.

Direct impacts on these utilities could include;

- Disruption of the existing infrastructure due to construction and excavation
- Disruption to cooling water flow

- Intake of debris or higher turbidity water to the cooling system causing problems internally in the cooling plant.

If the cooling water system need to be shut down, there could be impacts on production at the plant affected – ie the KEMAPCO and JPMC facilities. If there was a disruption in power generation at the ATPP, this would constitute a significant problem for Jordan, as the Aqaba Plant provides most of Jordan's power. It is imperative that turbidity is controlled in this area, and that the contractor is aware of the consequences. These impacts must be controlled and mitigated, however, the management is straightforward and they are therefore deemed of moderate significance, reversible and short term.

Aesthetic Impacts from Quarrying

Rock armour, underlayer and fill material will be required for the port development. This will likely be sourced from local quarries. Quarrying of rock for construction typically scars the landscape. While this is unavoidable if land-based sources of rock are used, measures should be taken to minimize negative effects, and only quarries approved by ASEZA should be used.

Direct impacts from quarrying include;

- Scarring of landscape

Indirect impacts from quarrying include;

- Reduced value of quarry vicinity for tourism or recreational purposes

In the event that a mitigation plan is not implemented to restore the quarried area, the impacts associated with quarrying would be of moderate significance since the area to be impacted is large. Also, the impacts would be long term and irreversible. Mitigated impact significances will be low.

Health & Safety Impacts from Port Construction

There will be some temporary risks to worker's health and safety associated with port construction activities. Working on construction sites increases risk of injury or death due to accidents such as falls, burns, drowning as well as coming in contact with harmful materials detrimental to health. Proper safety protocols reduce the risk of such accidents.

Direct health and safety impacts of the Port Development may include;

- Increased risk of road traffic accidents as a result of increased road traffic
- Risk of accidents at construction site including, falls and drowning

The impacts to health and safety of workers is of moderate significance since the risk can be reduced by the implementation of a proper health and safety protocols and regulations. In the event and accident does take place these impacts are often irreversible and long term.

Impacts Associated with Damage to the Natural Gas Pipeline

The location of the Natural Gas pipeline from Egypt was described in Section 4. This pipeline lies in the bay to the north of the Industrial Terminal, just north of the proposed Phosphate Berth. Based on a scaling-off from the available drawings, this pipeline is less than 50 m from the closest section of the new jetty, although a more detailed locating of the pipeline in relation of the proposed jetty will be necessary before construction begins.

This owner/operator of the pipeline is required to bury and/or protect the pipeline up to a depth of 70 m, in accordance with the conditions set out in the approved Environmental Impact Assessment. To date, this protection work has not been carried out, and the pipeline remains exposed.

There is a risk that excavations, emergency anchoring, piling, land reclamation, or other activity associated with the construction of the jetty, could damage this unprotected pipeline. The resulting release of gas would be a significant health and safety hazard, as well as releasing emissions to air. There would be a risk of explosion and fire. There would be a break in Jordan's strategic gas supply, which would have major knock-on effects in the country, while supply was suspended. The potential impacts on health and safety, energy supplies, air quality, etc, in the case of explosion would be highly significant, and could be irreversible.

Direct impacts associated with damage to the Natural Gas pipeline include;

- Risk of explosion and fire
- Disruption of Jordan's strategic gas supply, and knock on effects on the generation of energy
- Reduced air quality due to released emissions
- Detrimental impact on the surrounding marine environment

Due to the lack of information on the pipeline location and protection requirements and schedule, additional investigations leading to careful mitigation of this issue are required. An extra-contract action has been identified to be carried out in advance of the contracting process – see Section 9.1.

Impacts from Construction Workers Housing at the Shoreline

If temporary construction workers were to be housed in temporary shelters at the construction site, there would be a risk of wastewater and solid waste being released to the marine environment, since there are no adequate facilities in the area.

For this reason, the establishment of temporary accommodation on the construction site is prohibited. Workers must be housed in properly serviced accommodation elsewhere.

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
Marine Habitat	Physical removal of benthic habitat, including hard and soft coral and other marine flora and fauna	Irreversible	Long Term	-3
	Removal of migration and spawning sites for some fish species	Irreversible	Long Term	-3
	Decreased population of marine flora and fauna due to loss of habitat, migration and spawning sites	Irreversible	Long Term	-3
	Risk of toxicity of algae, marine bacteria, marine invertebrates and fishes in the event of an accident spill of oil and/or oil compounds	Reversible	Short Term	-3
	Risk of coral suffocation and death in the event of increased solid waste such as plastics, metal, rubber and glass	Reversible	Short Term	-2
	Reduction in live coral cover and lower depth limit of corals and other benthic habitats by reduction of sunlight penetration due to increased sedimentation during construction activities	Reversible	Short Long	-2
	Lowered growth rates, reduced productivity, reduced recruitment, substantial reduction in sexual reproduction and rates of re-colonization of coral due to increased levels of sedimentation	Reversible	Short Long	-2
	Risk of contamination of marine flora and fauna in the event of an accidental fire/explosion due to improper storage and handling of materials	Reversible	Short Term	-3
	Disorientation of marine organisms such as fish and coral larvae due to increased levels of noise and vibration	Reversible	Short Term	-2
	Beach disturbance, flora and fauna displacement and community structure change due to some species removal, reduction and isolation	Irreversible	Short Term	-2
	Impacts on restricting diving at the Dirreh Bay wall.	Reversible	Short Term	-1
Water Quality	Increased turbidity and particle suspension in water column due	Reversible	Short Term	-3

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	to dredging, filling and land reclamation			
	Increased risk of contamination from marine and land-based construction plant and equipment	Reversible	Short Term	-2
	Increased nutrient levels resulting in eutrophication conditions	Reversible	Long Term	-1
	Risk of reduced water quality in the event of a leakage of pollutants due to improper storage and handling of materials	Reversible	Long Term	-3
	Reduced water quality in the event of unpermitted and illegal construction of temporary labour housing close to shoreline	Reversible	Short Term	-1
	Reduced water quality in the accidental event of damage to gas pipeline	Reversible	Short Term	-2
	Risk of build up of waste on seabed in the event of improper handling and storage of waste material	Reversible	Long Term	-2
Terrestrial Habitat	Displacement and disturbance of any remaining fauna in area due to land based construction including nuisance from increased noise levels	Reversible	Short Term	-1
	Decreased populations of sensitive terrestrial flora and fauna either residing or migratory in the area	Reversible	Short Term	-1
Air Quality	Reduced air quality due to increased levels of dust, noise and particle emissions	Reversible	Short Term	-2
	Increased levels of GHG emissions	Reversible	Short Term	-2
	Impacts of increased traffic on supporting network and conjunctions	Reversible	Short Term	-2
	Increased risk of structural impacts on road surface from road trucks	Reversible	Short Term	-2
	Decreased air quality due to released emissions in the event of accidental damage to the gas pipeline taking place	Reversible	Short Term	-2
Aesthetic	Scarring of landscape due to quarrying	Irreversible	Long Term	-1

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	Reduced value of quarry vicinity for tourism or recreational purposes	Reversible	Short Term	-1
General	Risk to Jordan's natural gas supply from a breach in the gas pipeline	Reversible	Long Term	-3
Health and Safety	Increases risk of road traffic accidents as a result of increased traffic	Reversible	Short Term	-1
	Increased risk of accidents at construction site	Reversible	Short Term	-2
	Knock on impacts on respiratory health for workers and residents in the event of reduced air quality	Reversible	Long Term	-1
	Risk of health impacts on swimmers and divers due to reduced water quality at the port site	Reversible	Short Term	-1
	Risk to safety and health in the event of explosion of natural gas line releasing gas emissions and fires in the area	Irreversible	Short Term	-2
	Increased risk of explosion and fire in the event of accidental damage to gas pipeline	Reversible	Short Term	-2
Infrastructure and Utilities	Disruption of the existing infrastructure of KEMAPCO's marine water intakes and outfalls	Reversible	Short Term	-2
	Disruption to other cooling water intakes in the area (KEMAPCO, JPMC, ATPP, etc)	Reversible	Short Term	-3
	Disruption to Jordan's gas supply in the accidental event of damage to the gas pipeline	Reversible	Long Term	-3

Table 7.3 Significance of Impacts during the Construction Phase

7.5 Environmental Impacts at the South Port during Operation

This section discusses the environmental impacts which will result from expanded operations at the South Port. The issues are summarized in Table 7.4.

Improvements in Environmental Management

As indicated in Section 4, there are currently significant environmental problems associated with material handling at the Industrial Jetty, including spillages of material to

the sea and emissions to air. Given the strict environmental performance requirements to be placed on the new ports operator, the overall management of the area should be significantly improved. Thus, a reduction of emissions to air and spillages to the sea should result, despite the increased facilities and throughout. This section lists the potential negative impacts and risks from operation of the new South Port, which need to be mitigated. The selected bidder or operator of each berth is required to produce a berth-by-berth assessment of the environmental risks at each berth, and submit to ASEZA in the Detailed Project Description– see Section 10.6.

Impacts on Marine Environment from Storm water Runoff

‘Wadi 2’ with a catchment of 62 km² drains through the Industrial Zone and South Port area. The land at the South Port slopes towards the sea under its natural contours encouraging that any drainage of contaminant from the land, including the port facility, to the sea. During periods of heavy rainfall, the stormwater carrying debris, spilled oils and other materials from the Port will be washed into the groundwater or the sea – contrary to the ‘zero discharge’ policy of ASEZA. Even in the absence of rainfall, spillage of solid material and/or leakage of liquids on the port site or Industrial Zone could find their way to the marine environment via the groundwater or surface runoff.

The design has already taken into stormwater into account, as illustrated in Figure 2.5, with a series of dykes, and channels taking the wadi flow into the Genral Cargo Basin.

Direct impacts on marine environment from storm water runoff include;

- Reduced marine water quality as a result of contaminants washing into the sea
- Damage to marine flora and fauna from contamination

Indirect impacts on marine environment from storm water runoff could include;

- Reduction of population size of sensitive marine species in the immediate area
- Risk of bacterial and/or viral contamination of marine organisms
- Risk of toxicity to algae, marine bacteria, marine invertebrates and fishes
- Risk of bio-accumulation of heavy metals in tissue of marine organisms in the event of accidental introduction of heavy metals/organic/inorganic matter in the sea
- Disruption of marine ecosystem

Impacts from stormwater run off are of deemed to be of moderate significance due the mitigation steps already taken in the design to reduce the risk. However, spillage and leakage risks remain significant given the presence of sensitive, good quality and important coral reef located within the vicinity, and the ever present risks of spillage or leakage from the port. These impacts are long term reversible effects on the water quality and long term, irreversible on the corals.

Impacts on Marine Environment from Spillage and/or Leakage

Table 7.4 below summarizes the commodities which will be handled at each berth, with the spillage risk. Any solid or liquid material being handled at the quayside gives rise to a risk of spillage. The degree of impact will depend on the quantity and type of contamination, and the location, weather conditions, current, etc. Some solid material will dissolve in the

sea water and be carried by currents (most salts), while others will be less soluble and tend to settle (sulphur, phosphate). Liquids such as phosphoric acid and ammonia constitute a particular contamination risk as they are highly reactive and damaging.

Direct impacts on marine environment from spillage and leakage include;

- Reduced marine water quality as a result of contaminants washing into the sea
- Damage to marine flora and fauna from contamination

Indirect impacts on marine environment from leakage and/or storm water runoff could include;

- Reduction of population size of sensitive marine species in the immediate area
- Risk of bacterial and/or viral contamination of marine organisms
- Risk of toxicity to algae, marine bacteria, marine invertebrates and fishes
- Risk of bio-accumulation of heavy metals in tissue of marine organisms in the event of accidental introduction of heavy metals/organic/inorganic matter in the sea
- Disruption of marine ecosystem

Note. A detailed risk assessment of the impacts at each berth is highly dependant upon the types of equipment and environmental controls installed at each facility. Rather than make predictions in advance of the detailed design, the contracted ports operator/design will be required to make a berth by berth assessment of the environmental risks, based on the detailed specifications of each berth, and set against performance requirements. This is discussed further in Sections 8 and 9.

Terminal/Berth	Berth type	Commodities	Length (m)	Depth (m CD)	Capacity (tones/yr)	Environmental Risks/Impacts
Miscellaneous liquids berth	Jetty	Vegetable oils Mineral oils Chemicals	180	-13.0	1.2 million	Spillage of vegetable oils, mineral oils and chemicals
Grain terminal	Marginal quay	Grain	250 (200m quay)	-15.0	2.3 million 3.0 million	Spills of grain to sea Dust emissions
Industrial bulks terminal	Phosphate berth	Phosphate rock	280 (225)	-15.0	8.5 million	Spillage and emissions of phosphate
	Industrial liquids berth	Ammonia Phosphoric acid Fuel oil	250	-13.5	2.2 million	Spills from ammonia, phosphoric acid and fuel oil
	Industrial jetty west berth	Sulphur Potash (MOP)	230	-15.0	3.5 million	Spills of commodities handled at berth such as potash and sulphur
	Industrial jetty east berth	NPK fertilizer Potash (MOP) DAP Salt	190	-11.0	n/a	Spills and emissions from NPK, potash, DAP and salt, KCl
Marine services	Marginal quay slipway	-	160 60	-6.0		Oil and other chemical spills
General cargo terminal	Marginal quay	General cargo Silica RoRo trade vehicles livestock	245	-12.0 -14.0	2.0 million 0.4 million cars 0.1 million heads	Contamination of general cargo basin from spilled material Flies from livestock

Table 7.4 Summary of Berth Characteristics and Materials Handled

Impacts on Marine Environment from Ship Discharges

In addition to the loading and unloading of cargo, consideration should be given to the impacts from ship discharges. These include taking on and discharge of ballast water, discharge of oil or oily wastes, and tank wash water. Annex I of the MARPOL Treaty prohibits any discharge into the sea of oil or oily mixture from the cargo area of an oil tanker while in a Special Area -the Gulf of Aqaba is recognised as one such Special Area. However, the Annex also states that this shall not apply to the discharge of clean or segregated ballast. The inadequately regulated exchange of ballast water has been a leading cause of the introduction of exotic organisms around the world, which has had severe environmental and economic consequences in many countries. The Annex encourages oil tankers that are entering the Red Sea Special Area to ensure that they enter the Special Area with 'only clean ballast on board', but this is not a requirement. There is therefore currently no Jordanian requirement which prohibits discharge of ballast water in Jordanian waters, and no rigorous system to monitor oil - or any other waste - discharges. However, the provision of an oily waste treatment facility in the South Port will reduce the risks of such discharges.

Direct impacts on the marine environment from ship discharges include;

- Decreased marine water quality due to ship ballast, wastewater or oil waste discharge into sea
- Risk of exotic species introduction from ballast discharges

Indirect impacts on the marine environment from ship discharges include;

- Reduction of population size of sensitive marine species
- Potential of increased nutrient levels leading to eutrophication
- Increased risk of local species displacement due to out competition by exotic species

These impacts are of moderate significance given the presence of sensitive, good quality and important coral reef located in the area, and the likely occurrence and lack of enforcement. The impacts on the water quality will be long term and reversible, while effects on corals and other marine life would be long term and irreversible.

Impacts from Ship 's Generators and Cooling Water Discharge

Ships on approach and at dock generate air emissions from their onboard generators and may discharge cooling water against ASEZA's regulations. The air emissions contain particulates and GHGs, and are pollutive, e.g. particulates can settle in the surrounding marine environment. Cooling water discharge from ships can also be damaging if it is contaminated in any way, or if the temperature load is high.

Ports throughout the world are increasingly recommending or regulating against discharges and emissions from ships on approach. Some ports prohibit the use of onboard generators when docked, and require that shore power (main electricity) is to be taken from the port, in order to reduce emissions from ship-board generators.

Some ports also restrict ship speed on approach to reduce engine load and emissions. Neither ASEZA, APC nor the JMA have set any such requirements at Aqaba's ports, although they may introduce future constraints.

Direct impacts could include;

- Particulate and GHG emissions from generators
- Damage to corals from higher temperature water

Indirect impacts could include;

- Settling of particulate hydrocarbons in marine environment
- Increased stress to corals in area

Impacts on Marine Environment from Ship Operations, Anchoring and Berthing

The putting out of anchors over shallow reefs causes irreversible damage, and has happened in Dirreh Bay in the past – see Section 4. However, no anchoring of port-related shipping in Dirreh Bay is envisioned, or should be necessary. In addition, anchoring is prohibited and thus will not be permitted, other than in emergency situations.

However, the increased ship activity in the area increases the risk to the corals from a number of other factors. There are healthy, live corals located in the area which may be impacted by shading from ships and the possibility of emergency anchoring increasing the risk to the corals. In the calculation of coral destruction presented in Section 7.3, only the direct result of the berth construction has been taken into account. Damage as a result of ongoing port operation must be monitored separately, following construction. This is addressed in Section 10 and 11.

Direct impacts on the marine environment from ship operations, emergency anchoring and berthing will include;

- Risk of damage to corals from emergency anchoring
- Increased turbidity from propellers
- Impacts on the corals from shading from parked ships

Indirect impacts on the marine environment from ship operations, emergency anchoring and berthing include;

- Increased risk of ship collision
- Displacement of sensitive marine species due to increased ship and traffic
- Increased sedimentation caused by ferries propelling themselves when mooring and departing.
- Pollution from the ferries (oil, chemicals, etc)
- Ship groundings and emergency anchoring damage on corals
- Reduction in light impacts to corals resulting from ships regularly moored above them.
- Sedimentation from the diverted wadi at the general cargo basin

These impacts are of moderate significance since any damage taking place will affect the corals. The risks to the more pristine corals in the south of Dirreh Bay are markedly lower than the risk to the already impacted corals in the more northerly bay. Impacts on coral will be long term and irreversible.

Impacts on Marine Environment from Spillage and Emissions to Air from Loading and Unloading

The loading and unloading of bulk dry material and liquids present an increased risk, especially to the marine environment. The predicted 2025 figures for bulk material to be handled were listed in Section 2. This includes phosphate and other grains, general cargo, bulk liquids (specifically ammonia), vegetable oil, liquefied petroleum gas (LPG), bulk salts and hydrocarbon oil.

Direct impacts on marine environment from loading could include;

- Settling of spilled dry material and/or material emitted to air, especially bulk chemicals, grains, salts, etc
- Spillage of liquids during loading/unloading
- Reduction of water quality

Indirect impacts on marine environment from increased port activity could include;

- Potential of increased nutrient levels leading to eutrophication
- Risk of toxicity to algae, marine bacteria, marine invertebrates and fishes
- Potential increase or disruption of marine species life cycle patterns, spawning and migrations

These impacts would be of moderate significance due to the risk reduction by implementation of proper spill control protocol and a contingency plan. In the event spillage does take place the impacts on water quality will be reversible, while impacts on marine environment may be irreversible.

Particular Impacts to Water Quality in the General Cargo Basin

The creation of the semi-entrained General Cargo Basin introduces a risk of reduced water quality from increased spillages, and reduced circulation. In this case, the Basin is fully open to the sea, and, because of the low range of the natural tidal cycle in the Gulf of Aqaba, will undergo a natural exchange of water of between only 3 and 6% of its total volume as water enters and leaves the basin each tidal cycle – ie twice per day, even in calm conditions. The action of ships' propellers and any natural wind or wave action will significantly increase the mixing and introduce oxygen into the water, but these effects are intermittent.

The degree of water exchange with the Gulf is an important determinant of how the water quality will be maintained. Such a small, semi-entrained basin with an open mouth would not normally require circulation modelling to determine the water exchange. In fact, such modelling would be inappropriate in this case, since the assumptions on degree and type of contamination at this stage, would be based on conjecture, rather than firm data. Given the open nature of the Basin, and assuming stringent controls on spillages, the likelihood of this Basin retaining good oxygen levels, is high. However, this is entirely dependant on the management of spillage and run off to the basin.

Artificial circulation is one means of increasing water exchange and is used in more strongly entrained basins in the region. However, it is not recommended to induce artificial circulation at this stage, since if there is a problem of contamination in the basin, it is not desirable to export this to Dirreh Bay. The best management method is to reduce or eliminate spillages and leakages, in accordance with the performance requirement developed in Section 10.5.

The operator will be asked to maintain water quality within certain limits, and to produce a Basin Management Plan showing how debris and spillages will be removed from the basin floor and the water column.

Direct impacts could include;

- Retention of contaminated water from spillages or leakages, leading to elevated pollution levels and reduced oxygen levels in the Basin

General Impacts on Marine Flora and Fauna from Creation of General Cargo Basin and Other Structures

The newly constructed jetties, dolphins and the semi- entrained cargo basin will provide shelter and space for certain marine flora and fauna. This space will act as a protection area from predators to these species. The new structures will also provide hard substrate which will provide a foundation for new coral growth – for example at the revetment created along Dirreh Bay, the walls of the General Cargo Basin, and the sides of piles and berthing walls. However, hypoxic condition may occur in the General Cargo basin if water circulation is poor, causing negative impacts on the marine environment in the area.

Direct impacts on marine flora and fauna from newly constructed jetties, dolphins and basins could include;

- Increased shelter and protection areas for some marine species – a benefit
- Increased area of hard substrate available for new coral growth – a benefit
- Hypoxic water conditions due to poor water circulation in general cargo basin

Indirect impacts on marine flora and fauna from newly constructed jetties, dolphins and basins could include;

- Increased population size of species using newly constructed jetties, dolphins and basins as shelter and protection areas – a benefit
- Risk of mortality or short livelihood of smaller surface deposit feeding polychaetes and marine invertebrates such as crustaceans, bivalves and gastropods

Impacts on Air Quality from Cargo Loading, Unloading and Handling at the Port

Increased handling of bulk materials will increase the risk of emissions to air, during loading and unloading from trucks and ships. However, the improved environmental management which will be required from the operator should actually cause a reduction in emissions.

Direct negative impacts on air quality from cargo loading, unloading and handling could include;

- Increased risk of emissions to air

Indirect negative impacts on air quality from cargo loading, unloading and handling include;

- Health impacts from increased particulates
- Settling of particulate material in marine environment
- Transmission of air emissions across the national boundary due to prevailing northerly winds

Impacts on air quality are deemed to be of significance due to the ability to reduce the risks by implementation of proper loading, unloading and handling of cargo protocol. In the event of improper handling, the impacts will be reversible.

However, the port operator will be required to install best practice environmental controls and implement strict procedures. The aim is to actually reduce the amounts of material spilled and air emissions, despite increased throughput.

Impacts on Health & Safety from Port Operations

Increased ports activity will increase the health and safety risks to workers and associated labourers. Risks will accrue from operating plants and machinery, trucks, working at the quays, working on ships, etc.

Direct impacts will include;

- Increased risk of accidents on the port due to increased throughput and workload

In the event that these risks are mitigated with an implementation of proper labour health and safety protocols, the impact would be of low significance. However, impacts could be long term and could be reversible or irreversible.

Impacts on Diving at the Wall Dive Site

As discussed in Section 8.4, ADC envisages no additional restrictions to diving at the Wall site in the near future. Traffic to the Industrial Berth and boat harbour should not be enough to prevent diving, although clear permissions and communications protocols will be required to ensure security and safety. As in the current situation, there are risks to divers from passing ships. Additional traffic will give rise to additional noise impacts on divers.

Direct impacts will include;

- Increased risk of accident to divers from port traffic

- Possible future restrictions on dive numbers, but this is dependant on future port traffic to the industrial berth, and is not predicted to be an issue

These risks will be mitigated with the implementation of an application/approvals and communication process, such as is in place today, both an additional reference to the new port operator. The potential impacts are of moderate significance, long term and reversible.

Impacts on Air Quality from Transportation of Phosphate

The transportation of phosphate 24 km to the South Port, by truck, as opposed to a combination of truck and rail will introduce increased risks to air quality. Estimated round trips by truck to and from the South Port are given in Table 7.5, showing an estimated 217,000 return trips to the port from Wadi Yutum, and 161,000 from the mines. Additional risk points are the transfer station in Wadi Yutum, where around 60 – 70% of total transfer is rail to road, and the unloading sites at the Port, where phosphate will be discharged from trucks onto conveyor systems. The conveyor systems and the loading at the ship will also be risk points. Phosphate movements at the Main Port currently generate significant and unacceptable dust emissions. It is imperative these this does not occur at the South Port. GHG emissions will also result from the additional truck traffic presented in Section 5.3.

Direct impacts on air quality from phosphate transportation could include;

- Increased spillage to the terrestrial environment at the various risk points
- Increased emissions to air at the risk points
- Increased GHG emissions from the additional transportation

Indirect impacts on air quality from phosphate transportation could include;

- Increased risk to health from increased particulates

Such impacts are of moderate significant, long term and reversible.

Route	2006				2015				2025			
	Truck (million tonnes/yr)	No. of Trucks (per yr)	Rail (million tonnes/yr)	No. of Trains (per yr)	Truck (million tonnes/yr)	No. of Trucks (per yr)	Rail (million tonnes/yr)	No. of Trains (per yr)	Truck (million tonnes/yr)	No. of Trucks (per yr)	Rail (million tonnes/yr)	No. of Trains (per yr)
Mine to Main Port	0.9	30,000	2.25	1,697	-	-	-	-	-	-	-	-
Mine to South Port	1.27	42,333	-	-	3.5	116,666	-	-	4.8	161,000	-	-
Mine to Wadi Yutum	-	-	-	-	-	-	4.7	3,615	-	-	6.5	4,988
Wadi Yutum to South Port	-	-	-	-	4.7	156,666	-	-	6.5	217,200	-	-

*note: data based on 30 tonnes/truck capacity and 1,300 tonnes/train capacity

Table 7.5 Predicted Truck and Rail Loads

Other Impacts from Transportation to and from Port

There will be an increase of phosphate trucks travelling between Wadi Yutum and the South Port. There will also be significant addition of transportation of general cargo, liquids, grain, etc to or from the port.

Other impacts from transportation could include;

- Increased risk of accident due to increased road traffic
- Increased impact on road network and junctions

Impacts would be of low significance, long term, and reversible.

Impacts on Utilities and Infrastructure from Increased Demand

The operation of the port will result in increased port and ancillary service activity. These events will place pressure on the existing utilities and infrastructure due to demand. Currently the port is served by Aqaba's main potable water supply. There is no onsite wastewater treatment facility – septic tanks are used. Future utility capacity improvements will be addressed in the Southern Industrial Zone Extension Study, which will attract a separate EIA.

Direct impacts on utilities and infrastructure from increased demand could include;

- Additional demand on potable water resources
- Additional demand on water treatment plant
- Additional demand on electrical energy

Indirect impacts on utilities and infrastructure from increased demand include;

- Increased prices for utilities such as water and power
- Increased competitiveness between service suppliers
- Increased GHGs from Aqaba Thermal Power Plant

These impacts will be managed and therefore be of low significance, long term and irreversible.

Risk of Explosion and/or Health Risk from the Proximity of the Grain Storage Silos to High Tension Power Lines, and Chemical Storage

In Figure 2.2, the location of the grain storage area is shown in close proximity to flammable chemical storage (to the north and west) and to the Aqaba Thermal Power Plant (to the east and south east). There are also high tension lines from the Power Plant crossing close to the silos. These together constitute an explosion risk, since grain dust can cause a build up of static. There is also a risk that emissions and vapours from the chemical storage could contaminate the grain.

Direct impacts could include;

- Explosion caused by static build up of dust

- Chemical fires cause by explosion
- Contamination of grain from chemical leakage or vapour emissions

Such impacts are listed as moderate. However, they can be mitigated by proper design of the facilities, and application of environmental controls. A requirement for a specific study to produce recommendations for the detailed design and management of this area is listed in Section 9.2.

Impacts on Gas Pipeline

Ships manoeuvring close to the new phosphate berth should have no need to use anchors, except in case of emergency. However, any dropping of anchors in this area is a threat to the gas pipeline. At time of report compilation, this pipeline is currently unprotected, although the owner/operator of the pipeline has an obligation to bury/protect it from the shoreline to a water depth of 70 m. There is a significant risk to this pipeline which would result in release of gas - a significant health and safety hazard, as well as releasing emissions to air. There would be a risk of explosion and fire, not to mention disruption of Jordan's gas supply. The potential impacts on health and safety, energy supplies, air quality, etc, in the case of explosion would be highly significant, and could be irreversible.

Direct impacts associated with damage to the Natural Gas pipeline include;

- Risk of explosion and fire
- Disruption of Jordan's gas supply
- Reduced air quality due to released emissions
- Detrimental impacts on the surrounding marine environment

Additional investigations and careful mitigation of this issue is required.

The impact is potentially of high significance, if not mitigated.

Impacts on Aircraft Safety

The South Port is lies under the flight path to the King Hussein International Airport, albeit lying 25 km to the south. As such, there could be a risk to aircraft safety from inappropriate lighting, such as bright sky-ward facing lighting, rows of linear lighting which could be construed as runway-landing lights, fireworks, etc. However, this issue is easily mitigated by preventing the above.

If not mitigated, direct impacts would include;

- Increased risk of confusion to pilots of incoming aircraft

The impact is potentially of moderate significance, if not mitigated.

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
Marine Habitat	Increased potential of sensitive marine species displacement due to increased noise and ship traffic	Reversible	Long Term	-2
	Increased risk of marine flora and fauna contamination	Reversible	Long Term	-2
	Increased damage and stress to corals due to unpermitted cooling water discharge from docking/berthing ships	Irreversible	Long Term	-2
	Increased risk of coral damage in the event of unavoidable emergency anchoring of ships	Irreversible	Long Term	-2
	Risk of viral and/or bacterial contamination of commercial fish and shellfish in the event of accidental spill of waste material into the sea	Reversible	Long Term	-2
	Increased risk of exotic species introduction from ballast water discharge into the sea	Irreversible	Long Term	-2
	Potential positive impact on certain fish species due to increase of shelter and protection areas under newly constructed jetties, along pillars and within general cargo basin	Reversible	Long Term	+2
	Potential of a short lived, smaller surface deposit feeding polychaetes and the absence of marine invertebrates such as crustaceans, bivalves and gastropods in the event hypoxic conditions arise from poor water circulation in general cargo basin	Irreversible	Long Term	-3
	Potential of decrease in population size of sensitive marine species due to ship ballast, wastewater or oily waste discharges into sea.	Reversible	Long Term	-2

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	Increased potential for disruption of marine species life cycle patterns, spawning and migration due to increased port activity, increased risk of contaminant leakage and storm water runoff	Irreversible	Long Term	-2
	Risk of bioaccumulation of heavy metals in tissue of marine organisms in the event of accidental introduction of heavy metals/organic/inorganic matter into the sea	Irreversible	Long Term	-2
	Increased potential for the introduction of exotic species in the event of inadequate regulated exchange of ballast water	Irreversible	Long Term	-2
	Increased risk on marine environment (toxicity to corals and other fauna and flora, change in environmental conditions, or shift in community structure) from chemical and other hazardous liquid spillages during loading and settling of spilled material	Reversible	Long Term	-2
	Settling of particulate material in marine environment	Irreversible	Long Term	-2
Water Quality	Increased turbidity from ship propellers due to increase ship traffic	Reversible	Short Term	-2
	Reduced marine water quality as a result of contaminates washing into the sea in the event of inappropriate storage and handling management and storm water drainage design	Reversible	Long Term	-2
	Increased risk of elevated pollution levels and reduced oxygen levels in the general cargo basin due to retention of contaminated water in the event of spillage/leakage	Reversible	Short Term	-2

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	Reduced water quality due of settling of particulate hydrocarbons in marine environment from docking/berthing ships' cooling water discharge	Reversible	Short Term	-2
Terrestrial Habitat	Increased nuisance from noise and air emissions to surrounding environment from increased ship and port activity	Reversible	Long Term	-2
	Increased risk of contamination of soil and groundwater from spillage or leakage of chemicals, fuels and lubricants	Reversible	Long Term	-2
Air Quality	Increased risk of emissions to air during loading and unloading from trucks and ships due to increased handling of bulk materials	Reversible	Long Term	-2
	Increased air pollution including GHG releases due to increased demand on a new hydrocarbon based electrical power	Reversible	Long Term	-2
	Transmission of air emissions across the national boundary due to prevailing northerly winds	Irreversible	Long Term	-3
	Reduced air quality due to emissions in the accidental event of gas pipeline damage	Reversible	Short Term	-2
	Increased levels of particulates and GHGs from docking/berthing ships' generators	Reversible	Short Term	-2
Utilities and Infrastructure Aesthetic	Increased pressure on road network and junctions	Reversible	Long Term	-1
	Increased pressure on potable water resources	Reversible	Long Term	-2
	Increased pressure on water treatment plant	Reversible	Long Term	-2
	Increased prices for water utilities and power	Reversible	Long Term	-1
	Increased competitiveness between service suppliers	Reversible	Long Term	-1
General	Increased economic activity from clustering of industries which in turn will enhance	Reversible	Long Term	-2

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	economic development			
	Increased employment opportunities	Reversible	Long Term	-2
	Increases competitiveness between service suppliers	Reversible	Short Term	-1
	Increased population size due to influx of national and international migrants	Reversible	Long Term	-1
	Introduction to new culture and ethics	Irreversible	Short Term	-1
	Better quality of life due to increase availability of facilities	Reversible	Long Term	-2
	Increased costs of utilities such as water and power	Reversible	Short Term	-1
	Potential for local community to acquire new traditions and customs	Irreversible	Long Term	-1
	Further diving restrictions on the Dirreh Bay Dive Site	Reversible	Long Term	-2
	Possible disruption of Jordan's gas supply in the event of accidental damage to the gas pipeline	Reversible	Short Term	-3
	Increased risk of confusion to pilots of incoming aircraft	Irreversible	Long Term	-2
Health and Safety	Increased risk of accident due to increase throughput and workload	Reversible	Short Term	-2
	Increased risk to health from increased particulates	Reversible	Long Term	-1
	Increased risk of ship collision due to increased ship traffic	Reversible	Long Term	-2
	Increased risk of accidents due to increased road traffic.	Irreversible	Long Term	-3
	Increased risk of accidental spill/discharge of material into surrounding environment	Reversible	Long Term	-2
	Increased risk of accidents to divers due to increased port traffic	Reversible	Long Term	-2
	Risk of explosion and fire in the accidental event of damage to gas pipeline	Reversible	Short Term	-3

Impact On	Description of Impact	Reversibility	Duration	Significance Before Mitigation
	Risk of explosion and chemical fires due to build of grain dust in close proximity of high tension lines from the power plant	Reversible	Short Term	-2
	Risk of grain contamination in the event of leakage from nearby chemical storage or vapour emissions	Reversible	Short Term	-2

Table 7.6 Significance of Impacts during Operation

7.6 Environmental Impacts Associated with Decommissioning at the South Port

This development of the South Port represents a large scale investment on behalf of both the Government of Jordan, and the private sector. The design life of the new facilities will be more than 20 years, and it is almost inconceivable that decommissioning will occur at any point in the foreseeable future. The development is part of the ASEZ Master Plan which envisages expansion in tourism, infrastructure, ports and utilities spanning over the next 20 years. The most likely scenario for the post-design-life-span of the project is the continued upgrading and modernization of the facilities. No impacts from decommissioning have therefore been considered here.

The development at the Main Port site will attract its own EIA.

8.0 Mitigation and Compensation of Coral Loss

Feedback from the project screening and the scoping stages confirmed that the key environmental impact from this project is the impact on the marine environment at the South Port, particularly the corals in Dirreh Bay. The areas of damage to the coral were discussed in Section 7.3, and a description of the state of the existing corals was given in Section 4.1.

Overall, about 38,000 m² of corals will be removed, either through landfilling or dredging. The bulk of this – 17,900 m² – will occur to the shallow reef flat in Dirreh Bay. Some damage – around 13,370 m² – will also occur to the shallow reefs along the shoreline of the bay to the north of the Industrial Terminal, although these are more degraded and impacted from the port and industrial activities. Damages north of Dirreh Bay will be due to dredging and piling for the creation of new jetties and dolphins, and will include the shading of corals under permanent structures; and damages south of Dirreh Bay will be due to landfill, dredging and creation of the mooring dolphins. Light impact from ship berthing has not been taken as a direct impact in this approach.

Indirect impacts will arise during the construction phase through sedimentation and turbidity as well as from contamination or accidents. Ongoing indirect impacts from operation will depend on how the port is managed. The coral damage due to such indirect impacts is uncertain and dependent on a number of factors and has not been taken into account in this valuation. It is preferred to require the ports operator to maintain a high environmental management performance, and to penalize him under existing legislation for additional post-construction damage.

The direct and indirect impacts were described in Section 7.3. The stakeholder views were described in the Scoping Report, and additional comments and opinion in Section 6.

8.1 Mitigation to Reduce Coral Damage

Mitigation measures already taken, and proposed, to reduce the coral damage were described in Sections 2.1, 7.2 and 7.3. The measures were considered in three phases;

Design Measures – these include the significant design revisions taken in 2007 to reduce the area of land reclamation needed in Dirreh Bay, and also to reduce proximate impacts to the Dirreh Bay Wall Dive Site. These changes resulted in significantly reduced zones of impact, as discussed in Section 5. Bidders will also be invited to consider if other measures can be taken at detailed design stage which could further reduce impacts.

Controls & Monitoring during Construction – several actions were proposed in Section 8.2 to reduce construction impacts. These include the use of a sediment curtain, particular dredging techniques, and monitoring of the operations. It is crucial that the contractor does not cause damage outside the zone of impact.

Controls & Monitoring During Operation – control of ship anchoring, discharges, emissions, spillages, etc, during the operation of the Port were proposed in Section 8.3. In the longer term, these controls will be essential to reduce the long term ongoing impacts of having an industrial port in a sensitive marine environment.

This section now discusses the issue of compensating for the lost coral habitat, as requested by the stakeholders at the Scoping Session.

8.2 Valuation of Damages

An economic valuation of the damage and loss of coral reef, as a result of the construction works was carried out by an independent, international environmental economist with significant experience in coral reef damage valuation. Two full reports were produced for both the South Port and the Ferry Terminal and are included as Annex. The methodology used was a value/habitat/resource equivalency analysis which included 6 stages;

1. confirmation of full extent of predicted damage to corals
2. determine the status of the corals affected
3. determination of the value of the corals affected
4. establish stakeholder views and identify mitigation/remediation measures
5. undertake the equivalency analysis
6. make recommendations

The areas of damage to the coral were discussed in Section 7.4, and a description of the state of the existing corals was given in Section 4.1. The direct and indirect impacts were described in Section 7.4. The stakeholder views were described in the Scoping Report, and additional comments and opinion in Section 6. As noted earlier, only damage to live hard corals was considered here. There is a degree of contaminated and dead coral in the area. In addition, soft coral growth in Aqaba is seasonal, and will recover much faster than hard cover. For this reason, it was excluded from the calculations.

Annex VIII lists various costing approaches, which could be applied. Summary figures are included in the Table below;

Valuation Approach	Value of Damage (Millions USD)
ASEZA Instruction No 37 - 4000 JD/m ²	182.0
Coral Recreation Value Calculation - 90 USD / m ² /year	58.5
Egyptian Approach - 300 USD / m ² /year	195.0
Compensation Payments Elsewhere - average of sample 1,000 USD / m ²	32.5
Compensation Payments Elsewhere - Larger coral areas damaged 84 USD/m ²	2.7

Table 8.1 Damage Valuation Figures

However, none of the above approaches was felt to apply to the situation in Aqaba, for various reasons. Based on the study objectives, and a review of economic concepts and international best practice, it was agreed with ASEZA and ADC, that a combined approach

of value/habitat and resource equivalency analysis would be the preferred approach. The aim of this approach is to determine the overall value of the corals and then use habitat and resource equivalency analysis to identify suitable restoration and resource equivalent schemes. Based on the cost of these compensatory actions, several further measures may then be proposed to ensure that the total compensatory package equals to the overall value of the corals.

The assumptions used in the valuation, and a fuller discussion of the approach, are listed in Appendix VII.

The total valuation of damage, based on the above equivalency analysis is given in the following Table;

Item	Value (USD)
Damage caused by direct destruction of corals during construction north of Dirreh Bay	9.0 M
Damage cause by direct destruction of corals during construction south of Dirreh Bay	5.2 M
Total Value	14.2 M

Table 8.2 Valuation of Direct Loss of Corals at South Port

8.3 Compensation Measures for Direct Damages and Restricted Dive Access

As cited in Appendix VII, measures have been recommended which are '*designed to achieve no net loss of biodiversity where feasible*'. According to the Equator Principles, Performance Standard 6, this may include a combination of actions, such as;

1. Post-operation restoration of habitats
2. Offset of losses through the creation of ecologically comparable area(s) that is managed for biodiversity, and
3. Compensation to direct users of biodiversity

Compensation for Direct Damages

Based on the above, some measures have been proposed which could appropriately compensate for the direct damages;

- An equivalent habitat consistent of artificial reefs with corals transplanted from Dirreh Bay before construction begins. Also including artificial substrate and nursery grown coral nubbins.
- Monitoring of the coral transplanting process
- A contribution to help strengthen the management and enforcement of regulations in the Marine Park, including a financing study, to increase the protection to the bulk of Jordan's coral resource

- Contribution to a public education fund which will help to raise awareness of the importance of the corals and Jordan's marine environment
- Documentary record of the Dirreh Bay coral reef and the Dirreh Bay Wall, to be taken before construction works begin

Proposed Breakdown of Compensation Measures

The following table summarizes the recommended measures. The study also provided recommendations on the distribution of monies between these items. These recommendations have been passed to ASEZA and ADC and will be used to derive an agreed distribution of resources, in association with other stakeholders. To allow for stakeholder involvement in the discussions, the figures are not listed in this draft EIS.

Aspect	Description	Cost (US\$)
Mitigation	Coral transplanting from Dirreh Bay reef flat	-
Monitoring	Monitoring of water quality parameters and coral reef condition during construction and operation	-
	Monitoring of coral transplants and artificial reefs	-
Compensatory measures for direct damages	Create new artificial reefs	-
	Boulders and large rubble for corals to grow on	-
	Strengthen management of MPA - including financing study	-
	MSS fund for relevant scientific research	-
	General environmental & coral awareness fund	-
	Film & record of Dirreh Bay Wall	-
Total	Habitat Damage	9.0 million

Table 8.3 Recommended Balance of Measures and Costs for the South Port

Aspect	Description	Cost (US\$)
Mitigation	Coral Transplanting	-
Monitoring	Monitoring of water quality parameters and coral reef condition during construction and operation	-
	Monitoring of coral transplants and artificial reefs	-
Compensatory measures for direct damages	Place additional boulders and large rubble for corals to grow on	-
	Strengthen management and associated studies of MPA	-
	MSS fund for relevant scientific research	-
	General Jordanian coral awareness and management fund	-
	Film & record of South Dirreh Bay	-
Compensatory measures for restricted dive access	Support diving facilities elsewhere in Jordan.	-
Total	-	5.2 million

Table 8.4 Recommended Balance of Measures and Costs for the Ferry Terminal

The overall compensation package is a combination of the total amount presented above for both the South Port and the Ferry Terminal as well as the following notes;

1. Any compensation fund administrative costs should be extra, and the costs should be allocated according to the itemised costs detailed. In particular, this is the case for the transplanting and construction of artificial reefs, which must be carried out by suitable experienced and qualified people. Associated costs may vary depending on the nature of the approaches adopted
2. If the transplanting, artificial reef and substrate provision are not undertaken as recommended, the compensation should be at a far higher level USD 32 M (i.e. USD 1,000 per m²) to pay for more general coral reef conservation efforts. Furthermore, any fund developed should comprise a mix of representatives to ensure that the money is appropriately spent.
3. The compensation amount for the Ferry Terminal site is higher per m² than for the South Port development because the development of the Ferry Terminal will substantially change the nature of what would otherwise be the most southerly and potentially least disturbed coral reef in Jordan.
4. Any additional indirect damages caused by the construction and/or operation of the ferry terminal and/or the South Port should be compensated for at the Jordanian legal rate for damages of JD 4,000 per m². Such impacts must be

monitored closely and enforced, with the money being re-invested in repairing, restoring or enhancing corals in Jordan.

5. If an Environmental Fund is created as part of this compensation solution, it is important that the monies are allocated only to measures which are related to the protection of the marine environment. Otherwise, the principle of providing compensatory value for marine habitat loss, is lost. Criteria for application, evaluation and award should be set, to ensure that this principle is respected.
6. Given that construction work may begin on site as early as summer 2009, any coral transplanting must be complete before this. Since artificial substrate must be in place before transplanting can be complete, it is imperative that decisions on the commissioning of enabling measures (creation of substrate) and transplanting, are completed urgently, in early 2008, in order to provide sufficient time for an adequate operation.

9.0 Environmental Clearance Process

9.1 Contracting Process for the South Port

ADC has elected to commission the South Port development from the private sector, as a Design – Build – Finance – Operate Contract. Qualified companies or consortia will tender for a Contract to;

- Complete the detailed design for the South Port
- Construct the works, and
- Operate the new port facilities for a period of time

A new legal entity – a Special Purpose Vehicle (SPV) – will be created to contract with ADC for the above. The contracting party will be ADC, the Grantor.

ADC has already prepared an outline design for the port – the South Port Master Plan. The SPV will be contracted to complete this design, and may introduce revisions and additions within the overall framework set out in the Master Plan. The SPV will then develop the detailed layout and makeup of each of the port components, including details on the equipment and technology to be adopted. The actual construction documents will be prepared by the SPV, incorporating the detailed design.

The SPV will then develop a construction approach and methodology, and to construct the works. Details of the construction approach have not been set in the Master Plan and will be left to the SPV to develop. Details of the operation of the port will also be established by the SPV, within the parameters set by ADC.

The tentative timescale is yet to be finalized. However a tentative schedule is given below;

Activity	Date
Publication of tender documents	Early-mid 2008
Receipt of Tenders	Mid 2008
Review of Tenders	Mid-late 2008
Selection of Bidder	Late 2008
Contract Negotiation	Late 2008
Signing of Contract	Late 2008/Early 2009

9.2 Environmental Clearance on the Ports Master Plan

Figure 9.1 illustrates how the process for environmental clearance under ASEZA's Environmental Protection Regulation No 21 fits with the above process. Clearance will be a two stage process. The first stage includes this Environmental Impact Assessment of the South Port Master Plan. In granting environmental clearance on the Master Plan, ASEZA is approving the following;

- the overall project concept, together with the siting and overall layout
- ADC's approach to the key environmental issue of the coral damage and compensation, including ADC's commitments to compensation payments
- that any remaining design issues and studies have been identified
- the overall environmental performance requirements for construction and operation
- the monitoring requirements for construction and operation, as set out the Environmental Monitoring Plan
- the institutional set up required to follow up on the project

In achieving environmental clearance on the Master Plan, in advance of the tendering process, ADC is removing significant project risk from the private sector.

The main outputs from the EIS on the Master Plan are therefore;

- Environmental performance requirements for detailed design, construction and operation
- Environmental Monitoring Plan

9.3 Identification of Detailed Environmental Management and Controls

Many of the detailed environmental mitigation and control measures have not been developed in the EIS on the Master Plan. This is partly 1) to ensure that the overall responsibility for environmental compliance with the various requirements, guidelines and standards, remains with the SPV, and the designer, contractor and operators, and not with ADC, and 2) it is beneficial to allow the private sector to propose their own policies, approaches, methodology, and technologies, and borne out of up to date practical experience and best practice, rather than to have ADC or the ASEZA prescribe certain approaches. Once the tendering process has been completed, the SPV will then be required to achieve environmental clearance on the details of the design, construction approach and methodology, and the approach to operation of the port facilities.

The approach taken in this EIS is therefore to set out the overall environmental performance requirements, based on Jordanian and international regulations, guidelines and standards, and to require the SPV to meet these. The SPV will be required to submit a Detailed Project Description including construction techniques and methods, a Baseline Environment Statement and the EMP and to have ASEZA review them. The OSC, created by ASEZA whose role is to act as an advisory and coordinating body, will review SPV communication and disclosure materials during this phase.

ASEZA might choose to initiate a wider public communication and disclosure process to make environmental documents and reports to the public and provide a forum for review and feedback.

Once ASEZA grants environmental clearance on these documents, the CEMP and OEMP become part of the SPV's licence to operate and the conditions of approval for the project,

as all other economic entities in the Aqaba Special Economic Zone. Details of what the above mentioned documents should include are outlined in Section 9.5

ADC and ASEZA will supervise and monitor contractor performance, including compliance with the stipulated performance requirements and the governance system. ADC might carry this directly through a project management unit (PMU), or by appointing a third party.

In addition, ASEZA is the ultimate responsible body for ensuring that the construction EMP is implemented and that construction activities are in compliance with ASEZA regulations, standards, processes and the approved Construction EMP.

Non-compliances or breaches of the legislation will also be dealt with directly by ASEZA, acting on the SPV.

This process has been summarized in Figure 9.1. Table 9.1 also sets out the responsibility of the private sector, ADC and ASEZA, as well as setting out the key documentation required at each of the 5 stages of the contracting process.

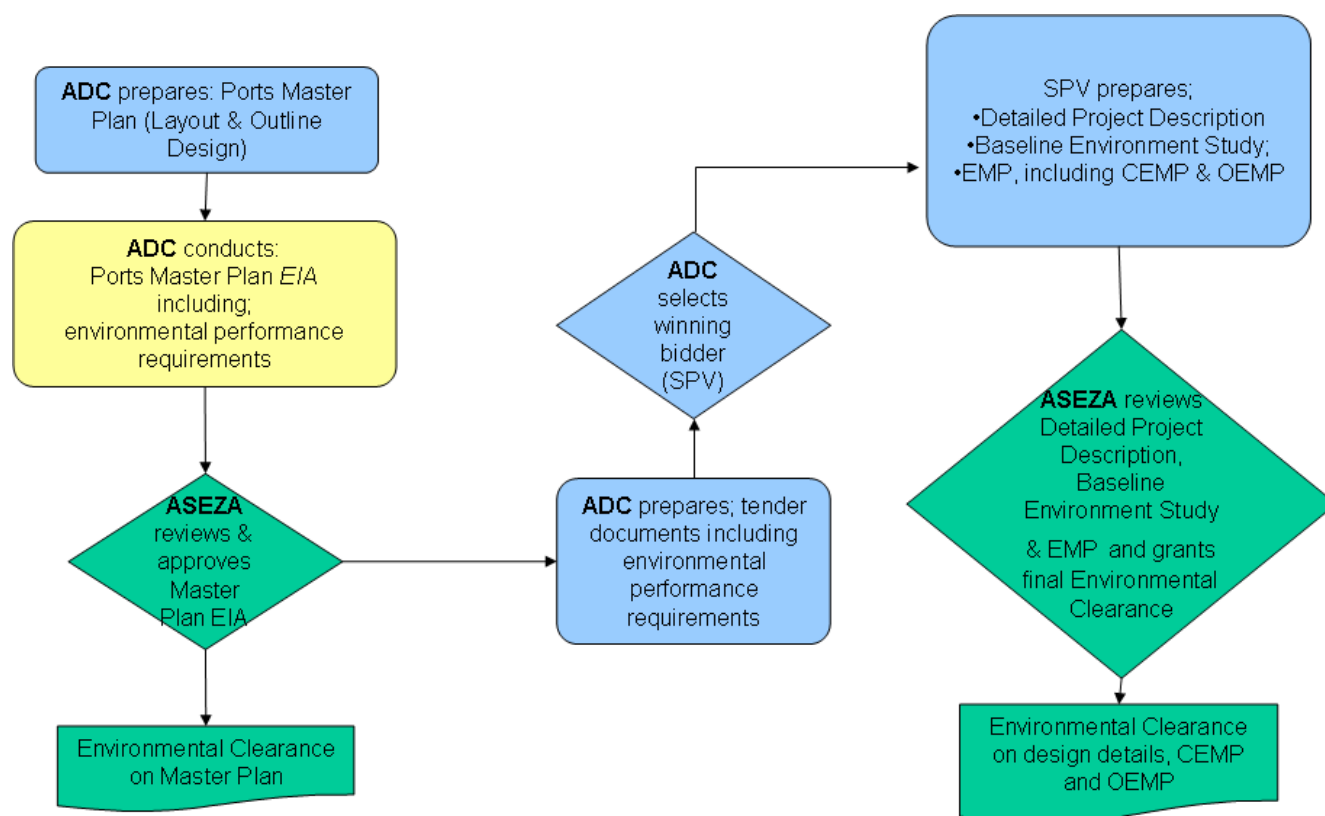


Figure 9.1. Environmental Clearance Flow Chart

	Pre Award Phase		Post Award and Design Phase	Project Implementation Phase	
	Master Plan Design	Tendering	Tendering & Pre-Construction	Construction	Operation
Bidder (SPV)		As part of technical proposals, all bidders are required to submit their proposals illustrating objectives, approaches and allocated resources to meet the Environmental Performance Requirements, Qualifications Documents, and Approaches and Methodologies for Baseline Report and construction and operation EMP	The SPV is required to prepare and submit the following documents to ADC and ASEZA: • Baseline Environment Study, • Detailed Description of the Project including construction and operations activities, • An environmental management plan for construction and operation.	The SPV is required to carry out environmental monitoring and disclosure during the construction phase and in accordance with the EMP, which will be an integral part of the environmental clearance. The results of the monitoring program will be submitted to ADC, ASEZA, and Oversight Committee (which will include ASEZA, ADC, SPV Management, and Related NGO's and Research Institutes).	The SPV is required to carry out environmental monitoring and disclosure during the operation phase and in accordance with the EMP, which will be an integral part of the environmental clearance. The results of the monitoring program will be submitted to ADC, ASEZA, and Oversight Committee (which will include ASEZA, ADC, SPV Management, and Related NGO's and Research Institutes)
ADC	Conducts EIA on Master Plan	Prepares tender documents, including the environmental performance requirements. ADC evaluation committee will review the above items and ensure that bidders qualifications, approaches and plans to develop the baseline environment report, and the construction and	ADC will review the documents to ensure that SPV meets the environmental performance requirements and is in compliance with its contract with ADC.	As part of its contract with the SPV, ADC will carry out review, inspection, and monitoring of construction activities. ADC might elect to do this through appointing a third party or directly by its personnel.	As part of its contract with the SPV, ADC will carry out review, inspection, and monitoring of operation activities. ADC might elect to do this through appointing a third party or directly by its personnel.

	Pre Award Phase		Post Award and Design Phase	Project Implementation Phase	
	Master Plan Design	Tendering	Tendering & Pre-Construction	Construction	Operation
		operation environmental management plan meet the set forth RfP requirements.			
ASEZA	Awards environmental clearance to the EIA on the Master Plan	Approves the environmental performance requirements and the governance framework	ASEZA will review the baseline environment report, the construction and operation EMP, and the detailed project description including method statement of construction, equipments and technologies to be adopted, and pollution control facilities and equipment, and operational aspects.	ASEZA has the ultimate responsibility of ensuring the construction activities meet the clearance conditions including the EMP, and are in compliance with its own standards, regulations, and desired best practices. ASEZA is also responsible for compliance monitoring of all project activities, through its ongoing and new monitoring programs, and/or through contracting with a third party for compliance monitoring.	ASEZA has the ultimate responsibility of ensuring the operation activities meet the clearance conditions including the EMP, and are in compliance with its own standards, regulations, and desired best practices. ASEZA is also responsible for compliance monitoring of all project activities, through its ongoing and new monitoring programs, and/or through contracting with a third party for compliance monitoring.

Table 9.1. Environmental Clearance - Roles & Responsibilities

10.0 Environmental Management Requirements

This chapter sets out the steps and deliverables required from the next stages of the ports' development.

10.1 Additional Tasks to be Carried Out

One outcome of the Environmental Assessment process and due diligence is that ASEZA and ADC have identified areas where additional study or other action is required outside of the contracting process, to support the development of the port. A description of each action is provided below, along with an indication as to which body is responsible.

1. Stability and Protection Study on the Natural Gas Pipeline

The Jordanian Egyptian Natural Gas Pipeline lies just north of the proposed phosphate berth. Based on available information, the distance between this pipeline and the piles at the phosphate berth may be as little as 70 m at some points. It is essential that this pipeline is not damaged or disturbed during construction and operation of the phosphate berth. Under the environmental permitting agreement between ASEZA and the owner/operator of the pipeline, the adequate protection of the pipeline from the shoreline to a water depth of 70 m is the responsibility of the owner/operator, although no protection works have yet been implemented. There are still unknown risks associated with this pipeline, which need to be identified in advance of the contract agreement.

ADC has agreed to commission a study to address this issue. The following components are to be addressed within the study;

- Identification of the location of the pipeline, with respect to the proposed facilities. Locate the pipeline accurately on drawings and charts
- Carry out a pre-construction inspection of the pipeline from the shoreline to a position where the water depth is -50CD
- Establish a buffer zone of 50 m between the pipeline and any piling, berth construction
- Development of a statement of liability to be agreed between ASEZA, ADC, the owner/operator of the pipeline, and the SPV, so that the allocation of risk is clearly understood in advance of the contract signing
- Close communication between contractor and pipeline owner/operator throughout construction
- Marking of pipeline buffer zone on all charts and pilotage operations
- Recommendations for monitoring of the pipeline stability and integrity during construction and operation
- Prohibition of any boat activity, including emergency anchoring in pipeline buffer zone

- Monitoring and follow up of boat activity to ensure compliance with navigation requirements

This recommendations from the study should be reviewed by ADC, ASEZA, Jordan Maritime Authority, the Ministries of Energy and Transport, the owner/operator of the pipeline, and the SPV, before final design and construction begins.

2. Transportation Infrastructure and Safety

Much of the phosphate and other material, which is currently taken to the Main Port, will be transported to the South Port via the Back Road. Although this road system is well established, there are concerns over the safety record of the road with respect to trucks. Estimates on the additional road traffic as a result of the Port Development are set out in Section 7.4. ASEZA has recommended that a review of the road network between the Wadi Yutum Transfer Station and the South Port be made, with particular regard to gradients, speed limits, speed restrictions, warning signs, emergency braking lanes, and other emergency facilities, to determine the adequacy of the road for the purposes of transportation to the new port.

The study would review the road traffic projections based on South Port Master Plan and Southern Industrial Zone Extension, and make recommendations regarding upgrading of the safety features. The road is the responsibility of the Ministry of Works and Public Housing, and it should be them who takes responsibility for this review, and the implementation of the recommendations.

3. Formation of Coral Compensation Committee

ASEZA and ADC have agreed to form a joint committee to oversee the distribution and use of the fund created by ADC to compensate for damage to the marine environment. This compensation is discussed in Section 8.3. The committee will develop a frame of reference to ensure that the distribution of funds reflects the need to compensate for habitat damage in accordance with the Equator Principles' performance standard on biodiversity protection, by providing either;

- Post – operation restoration of habitats
- Offset of losses through the creation of ecologically comparable areas that are managed for biodiversity,
- Compensation to direct users of biodiversity

The formation of this committee is urgent, given that construction in the marine environment could begin in the summer of 2009. If funds are to be used for coral transplanting from Dirreh Bay, then artificial habitats must be commissioned, and the coral transplanting programme begun as a matter of urgency.

4. Film Documentation of Coral Garden in Dirreh Bay

It has been recommended – Section 8 – that ADC should commission a film documentation of the coral garden in Dirreh Bay and the Dirreh Bay Wall before construction begins. This will preserve a record of the area and should be commissioned around 12 months before construction begins.

5. Management of Diving at Dirreh Bay Wall Site

ASEZA should work with ADC, the new ports operator, and the security services, to develop a one-stop approvals process for divers accessing the Dirreh Bay Wall Site. The process should attempt to allow restricted diving where it is safe to do so. The process should set out notification protocols so that all relevant parties know exactly of the timing and location of dives. The protocol should also establish if the diving can take place from the coastline, or by boat, and whether a visible means of marking diving activity should be established. The protocol should take into account the need to inform incoming ships and vessels docked at the Industrial Terminal, of diving activity. Such a clear applications/approvals, notification and communications process will reduce the risk to divers at this site.

This action will not be required until the construction work is complete, since it is likely that particular restrictions will apply during the construction phase.

6. Socio-Economic Impact Study

Although this is not a regulatory requirement, it is recommended that a study be carried out on the impacts to the local community, particularly on the impacts from the relocation of services from the Main Port to the South Port, and from any potential restructuring of labour under the new operational arrangements. Particular attention should be given to the impacts on the residents of Old Town, and on the port workers, families, and on local service providers. These issues were raised by many stakeholders during the consultations – Section 6. ASEZA should decide if and how this study should be carried out, perhaps as part of wider socio-economic considerations being given to the development of Aqaba and the empowerment of the local community.

10.2 Requirements for Final Design of South Port Components

The following recommendations for the detailed design stage are made.

Design for Environmental Management

All detailed designs should be carried out by a competent professional company that will provide a design which reflects best practice in terms of environmental controls, and which will comply with all relevant legislation. The layout of the port, specification of equipment, determination of working practices, etc should all take into account the need to strictly control emissions, spillages, leakages, etc within the site.

Basin Management Plan

A Basin Management Plan should be developed by the operator for the basin. The management plan must illustrate and identify the risks associated with operations on basin contamination and alteration of oxygen levels and the procedures to be implemented in order to prevent these conditions from taking place and in turn complying with ASEZA's requirements. Particular attention should be paid to organic elements such as livestock and grain. It further needs to outline how water quality levels are to be monitored and maintained as well as how spilled material will be removed.

Minimization of Impacts on Marine Habitat

The detailed design of the South Port must be carried out within the framework set out in the Master Plan, particularly regarding the impacts on the marine environment. The amounts of coral damage estimated in this EIS document should be regarded as upper limits. Any design developments which will require additional damages are to be discouraged, must be submitted to ASEZA to receive specific approval. In fact, the designer should review the requirements, and assess whether any reductions in impacts to the corals can be achieved, particularly in Dirreh Bay.

Containment and Drainage

The port should be self contained as far as possible with regards to drainage. The design should take into account ASEZA's policy of zero discharge to the groundwater and marine environment.

The outline design for storm drainage, set out in the South Port Master Plan must be developed to take into account that the land at the South Port slopes towards the sea under its natural contours, and encourages drainage from the land including the port facility, to the sea. The annual average rainfall in Aqaba is only 35 mm, but this tends to occur in flash floods. The catchment area draining towards the port is 62 km², with a 100 year flood peak of 455 m³/s. The designer acquire the figures relevant to the port catchment.

The detailed drainage of all port areas should also be designed to capture spills and wastewater and prevent any contaminated run off to the ground or the sea, taking into account the rainfall characteristics of the area.

No discharge from any tank or sump to the ground or the sea is permitted. If tanks or sumps are constructed, a facility for pumping from the sump to trucks should be included. Emptying of the tanks should only be to trucks properly licensed for this purpose, and records showing the final destination of the trucks should be kept. The port operator remains jointly liable with the pump-out contractor, to ensure that the final destination of any liquid wastes complies with the Jordanian discharge requirements.

Where stormwater is channelled through the port, the design should be detailed in such a way as to prevent the pick up of sediments and pollutants into the sea.

As well as ASEZA's 'zero discharge policy', other wastewater legislation applies. In practice, until other facilities are constructed, wastewater can only be taken to the Aqaba Wastewater Treatment Plant (AWWTP), and can only be discharged there if compliant with the Instruction on the Disposal of Industrial and Commercial Wastewater to the Sewage Network – see Section 3. If the wastewater doesn't comply, then either pre-treatment (preferred but with a cost implication) or dilution (increases water demand) will be necessary.

Design for Seismic Effects

There are a number of active faults in the Aqaba area. The Aqaba Fault lies approximately under Aqaba town, and there is the cross-fault CF- 4 approximately one kilometer to the north –northeast of the northern coastline. The Eilat fault lies approximately 2.5 km to the west –northwest of the northern hotels area. The presence of faulting in the Southern Port area should be further investigated during detailed design.

Infrastructure failures due to seismic effects could induce negative environmental impacts, including destabilization of some of the shoreline structures, breakage of pipes and tanks containing liquids. The marine environment is at particular risk. The project should be designed to withstand seismic impacts in accordance with Jordanian building legislation, and taking into account the additional horizontal and vertical forces induced by the lateral acceleration caused by earthquakes, the strength and stability of the sub-soil under earthquake conditions, and the behaviour and response of the proposed equipment and structures.

The full seismic conditions at the South Port site should be investigated as part of the geotechnical investigations related to the detailed design.

Layout of Port Facilities for Health & Safety

The detailed designers should ensure that the port facilities are laid out so that all port operations can be undertaken with a minimum likelihood of accidents that may result in injury or environmental damage. Clear lines of vision, adequate access and transportation clearances and an absence of overhanging facilities will contribute in this regard. In the event of an accident, environmentally appropriate port layout will minimize the human, financial and environmental consequences of the accident. The prospective designers should be required to demonstrate their experience and commitments to health and safety.

Design for Prevention of Hypoxic Conditions

Hypoxic conditions in the General Cargo Basin are to be avoided. This issue was discussed in Section 7.4.

In addition to the request placed by ASEZA to address the potential occurrence of hypoxic conditions at the general cargo basin, where ADC has to increase the depth to -15CD, monthly oxygen measurements will be made in the Basin, as outlined in the monitoring plan. If the levels fall below 10% of those in the open waters, steps will be required to increase the oxygen levels. These measures could involve removal of oxygen-demanding material from the floor of the basin or the water column, mechanical aeration of the basin, or artificial circulation of water with the open Gulf. The detailed design team should assess the risk of hypoxic conditions, in the light of the proposed operating control processes and procedures, and the material to be loaded and unloaded, and assess what measures (if any) should be provided for in the design. If provision for mechanical aeration or circulation is deemed to be necessary, this should be included in the design. If not, the operator will be required to maintain the oxygen levels by good ports management, and will be responsible to act in the event of reduced O₂ levels.

Design for the KEMAPCO Outfall

The detailed designer must ensure that the extension of the KEMAPCO outfall does not discharge into the General Cargo Basin. This cooling water will be of higher temperature and may contain chemical agents which would lower the marine water quality.

The extension to the KEMAPCO outfall is to be extended at least at the mouth of the general cargo basin, so that discharge occurs into open water.

Boat Yard at General Cargo Basin – Usage Constraints

There is provision for a future boat yard to be developed at the General Cargo Basin as part of the port expansion, although it is outside the project under assessment. However, ASEZA wishes to constrain the activities which can occur in this area. Therefore, ASEZA prohibits all activities pertaining to shipyard type activities near the basin. Those activities to be carried out must be confined to those which will not introduce additional risks to the marine environment, and should not produce wastewater, run off, etc.

No fabrication of boats is to be carried out in this area. Activities can only include bolting and fixing of pre-fabricated equipment. The use of paints, sprays, fibreglass, oils, cleansing fluids, or other liquids which would contaminate the marine environment are completely prohibited. The detailed design of this area should include stringent environmental measures to limit air emissions or run off to the Basin.

Because of the sensitivity of the area, any change of use to this area will require a full environmental impact assessment (EIA)

Design for Explosion Risk in Grain Silos

The location of the grain silos has been changed as requested by ASEZA. The port Master Plan initially had the grain silos connected to the drain berth via conveyors, situated within close proximity to the power station and chemical storage. However, grain will now be handled in the general cargo basin. Grain silos will be constructed at the eastern edge of the general cargo basin. As a result, risks associated with food safety have disappeared.

Nevertheless, there is still a concern linked with grain storage, which is the risk of an explosion taking place within the silos as a result of rapid combustion of grain dust in the air. Three main conditions are required for dust explosions to take place, a combustion cloud with certain concentrations of dust, an ignition source with sufficient energy and sufficient oxygen.

In order to prevent, minimize and eliminate the potential of a dust explosion taking place, the following requirements should be met:

Reduction of Explosion

- Designers to assess the risk of explosion and implement measures to reduce build up of combustible dust cloud in silos, including explosion relief vents and panels at bins, filters, etc
- Silos walls to be designed to contain explosion within
- Explosion suppression systems to be specified and fitted, including effects on the silo roof
- Regularly cleaning of the terminal area and removing of spilled dust and grain piles.

Water and Air Quality

- The detailed designer to assess the risk of spillage to the cargo basin, and to design specific emissions and spillage controls (dust free hoppers, covered conveyor belts, spill plates, etc)

- The detailed designer/operator to develop operational procedures for grain unloading, handling and storage. These should include supervision and monitoring of the process
- Procedures for spillage or emissions clean up should also be developed and implemented, and adequate clean up equipment provided (ie means to remove spilled grain from the bed of the cargo basin in the event of spillage)
- Air and water quality monitoring requirements – as set elsewhere.

Control of Dust Emissions

There are several potential sources of dust emissions into the surrounding environment. There is particular concern about the phosphate transportation chain, which begins with rail unloading and truck loading at the new Wadi Yutum Transfer Station, spillage risk from the trucks, risk from the truck unloading facility at the port, the conveying to the berth, and finally the ship loading.

The spillage and emission risk associated with each activity should be studied and assessed by the designers. The design should develop adequate mitigation measures to be taken to reduce or eliminate emissions to ensure compliance with the various Jordanian Standards – Section 3. Measures will include specifications for equipment (filters, pumps, curtains, etc) and procedures.

ASEZA has a particular concern to see how this is to be addressed in the design, and has asked that the risk assessment and mitigation measure proposals should be submitted for approval. Documentary evidence on the performance of the various equipment should be provided.

Wastewater Treatment

There is currently no wastewater treatment plant in the South Port or Industrial Zone area, although one is anticipated to be built as part of the Industrial Zone Extension. In the meantime, domestic wastewater must drain to septic tanks and then be pumped out by trucks and taken to the Aqaba WWTP.

Therefore, it is required that the detailed design of the port should allow for all domestic wastewater at the port to drain to septic tanks, which can be later pumped by trucks and taken to AWWTP.

There is no alternative for domestic wastewater.

10.3 Performance Requirements for Main Port Rehabilitation

Decommissioning, demolition of equipment and facilities, removal of contamination and site preparation are not part of the forthcoming contract for the South Port. Different arrangements will be made for this work. The following section illustrates the performance requirements which should be applied.

Control of Hazardous Material Removal

An estimated 80,000 – 90,000 m² asbestos containing material, both in buildings and in temporary storage, have been identified on the Main Port site, and there is also the possibility of PCBs in some of the electrical gear. Such hazardous materials should be removed in advance of demolition. The handling of hazardous material should be closely monitored as not to further cause any harm to the surrounding environment and personnel.

The requirements for hazardous material removal include;

- All asbestos removal needs to comply with the Regulation on Hazardous Waste Management and Handling, and the directions based on Article 45 of Public Health Law No. 54 of 2002. The Ministry of Environment, not ASEZA, has jurisdiction over hazardous material management, and must approve all the work.
- In addition, the provisions of the following legislation should also be applied;
 - USA OSHA – Occupational Safety and Health Administration – which regulates worker safety through worker training and personal protection.
 - USA EPA – Environmental Protection Agency – which regulates any adverse health impacts to the environment.
 - NESHAPS – US National Emission Standards of Hazardous Air Pollutants which regulated demolition work that could be released into the atmosphere.
- An experienced and qualified asbestos containing material (ACM) foreman should supervise the work
- All personal protection equipment (PPE) required for protection of the workers and others in the work area, in the above guidelines, should be provided. Items include respiratory protection, disposable paper suits and suitable hand tools for removing the CAB.
- Asbestos must be removed before other demolition works begin.
- Equipment containing PCB's must also be removed before other building demolition, and taken to the hazardous waste facility at Swaqa. Such equipment must be labelled and not mixed with non hazardous equipment. PCB's are highly toxic. It is therefore essential that equipment containing PCB's is handled and transported with extreme care to ensure that damage to equipment does not occur and that PCB's are not spilled.
- The only acceptable disposal site in Jordan for asbestos and other hazardous material is the Ministry of Environment Hazardous Waste Facility at Swaqa, around 200 km north of Aqaba. The disposal contractor should communicate with the Swaqa site to coordinate the arrival and handling of the material.
- The removal of the hazardous waste materials should be in compliance with the Regulation of Hazardous Waste Management and Handling Issued in accordance with paragraph (B) of Article (5) and paragraph (A) of Article (9) from the By-law

of Hazardous Waste Management and Handling Number (43) of 1999, and in accordance with the regulations handbook from the Jordanian Ministry of Environment "Harmful and Hazardous Substances Regulations, 2006". Additional requirements will be given in the Port Due Diligence study. The Ministry of Environment must be consulted upon, and approve all work.

Control of Non-Hazardous Contamination Removal

Significant quantities of phosphate dust at Main Port Site need to be removed, yet no discharge of any contaminated liquid to the sea is permitted. The amount of dust remaining at the site after demolition and clean up will depend on the time for cessation of loading activities, and the weather conditions. The contractor should proposed a methodology for removal of the remaining dust. If the removal of phosphate dust is carried out by hosing with water (this may or not be approved by ASEZA when the time comes), bunds should be created around the area of operations to capture the run off and prevent its discharge to the sea. The recovered run off should be filtered, the water reused or discharged, and the captured phosphate dust disposed of in the Aqaba Landfill Site, or other wise as approved by ASEZA.

Turbidity in the sea water must remain equal to or less than 0.5 NTU above ambient levels.

Excavated sub-soil containing hydrocarbon contamination should be taken off site by trucks, to the destination approved by ASEZA at the appropriate time.

Removal of Material from Sea Bed

Section 4.1 describes the debris which lies on the seabed around the Port. The material includes metal piles, tyres, and other plastic material. The most likely method for removal of this material from sea bed is to float the material using mobile buoyancy equipment – air bags – and to float the material to the quay for disposal, although the contractor will be free to propose an alternative method.

The diving team to remove waste from sea floor should consist of trained and experienced divers using well maintained and checked equipment. All appropriate diving safety procedures should be followed.

Once restored to the land, recovered material should be disposed of at the Aqaba Landfill Site, in accordance with the Solid Waste Management by law 27/2005

Infrastructure Demolition and Removal

A main component of the Main Port rehabilitation process will be the demolition of the current infrastructure and its removal from the site. This process will impact the environment in various ways such as reduced air quality due to increased levels of particles and noise. Also, it creates an increased risk of contaminating the marine environment in the event of improper processing. There are also risks to health and safety of the workers.

All hazardous material, including all identified asbestos, should be removed before demolition.

The contractor should be experienced at demolition of tall buildings and underground facilities. Site to be properly segregated, with appropriate access control during demolition.

Where explosives are to be used, proper precautions on handling of explosive material, based on the relevant MSDS sheets, should be followed. The Jordanian Armed Forces must be informed and their presence requested on site.

The Jordanian Labour Law to be followed, with all its relevant amendments.

Full safety precautions to be taken when working over water and diving. Such precautions are established in the UK Health and Safety Executive Diving at Work Regulation of 1997. However, the contractor can propose equivalent precautions, with justification.

Ownership for material for scrap or reuse should be clearly transferred to the second party, and records kept of contact details of purchaser, to facilitate follow up in the event of downstream dumping of unwanted material.

Rodent Control

In order to prevent the migration of rodents from the vicinity of the port, culling may be required followed by appropriate disposal of carcasses. The means of disposal should be approved by ASEZA at the appropriate time.

10.4 Performance Requirements for South Port Construction

Migration of rodents off the site is to be prevented.

The following requirements have been developed for the South Port Construction. These will be set out in the tender documents, and should become a contractual requirement on the SPV.

Development of Construction Methodology

A Marine Construction Method Statement and Schedule should be prepared by the Contractor and submitted to ASEZA in advance of any marine works. ASEZA should be informed prior to all marine reclamation and dredging activities. The contractor should propose a methodology which will have protection of corals as a priority.

Protection of Marine Water Quality and Marine Habitat during Marine Works

The impacts from the unavoidable loss of coral and sea grass habitat from both dredging and land reclamation were discussed in Section 7. Section 2 described how the scope of impact has been significantly reduced by re-design of the port layout. However, the risks to the corals during construction remain high, and it is imperative that damage is confined to as small a zone of impact as is possible. Steps should be taken during the marine construction stage to control damages, and constant monitoring is required.

The turbidity in the sea water outside the construction (eg outside the sediment curtain, if one is used) should be monitored constantly, and should remain equal to or less than 0.5 NTU above ambient levels.

Excavation of General Cargo Basin should be carried out before break out to Dirreh Bay. Breakout should only be made after a visual inspection of excavation and entrained water, and approval by ASEZA.

Dredging is to be by land-based plant and dredged material taken to a suitable land location and deposited in such a manner as to ensure that fines/sediment do not drain into the water. A minimum 50 metre distance between dredged materials and the high tide line should be maintained.

If blasting is required, a blasting schedule and method statement is to be prepared and sent to ADC and ASEZA for approval, prior to blasting.

No disposal of dredged material at sea is permitted. Material is to be taken to land and should not be deposited close to the shoreline where there is a risk of sediment-laden run off or mobilization and return to the marine environment, e.g. during storms. If excavated material is to be reused on site, it should be stored at locations where it cannot run off back to the sea.

No direct discharge to the sea of sediment laden water from dewatering operations will be permitted. Water must be either filtered or allowed to settle before discharge. ASEZA to approve of all discharge of dewatering water.

Both a contractor's representative and a Client's representative to be present for all marine works.

The establishment of temporary labour accommodation on the construction site, or anywhere at the shoreline, is prohibited. Workers must be housed in properly serviced accommodation elsewhere, approved by ASEZA.

Storage of Materials

The construction works are to be managed to minimize the risk of spillage or leakage of oil or stored chemicals or liquids to marine environment.

Proper storage and related management of materials during the construction works is essential to ensure safety and environmental security. For example;

- In accordance with the 'zero discharge policy' of ASEZA, no materials may be released to the marine environment. Mitigation measures to prevent this include procedures for tracking and accounting for all materials used (in particular, hazardous materials including oils), storing liquid materials (e.g. oil, solvents) in locations where they cannot enter the sea in case of accident or spill and provide adequate containment and clean up procedures, and remove all solid and liquid waste for disposal in approved waste management facilities.
- The Jordanian Standard JS 431, 1985 on Storage of Hazardous Substances should be complied with.
- A record of all hazardous materials should be maintained by the Contractor. Hazardous material requiring storage should be recorded by noting the type and quantity of the material at the time it enters storage, and the MSDS associated with each hazardous material should be filed at a location separate from the storage facility. Materials leaving storage should be recorded so that the record of

hazardous materials actually in storage is always up to date and complete. Emergency services personnel at the site and in the ASEZ should be advised of the location of the MSDS data and hazardous materials storage records, and should have immediate access to this information in the event of an emergency.

- The Contractor should ensure that emergency services organizations possess, and are trained in the use of, any products necessary to combat an emergency caused by a hazardous material. In particular, the Contractor will ensure that emergency services organizations are aware of circumstances in which water should not be used to combat an emergency, and that they are trained in the use of appropriate products to address emergencies in which water should not be used.
- Storage facilities should be accessible only to authorised personnel, and should be locked when not in use. Storage facilities for hazardous materials should be flame-proof. Hazardous materials should be clearly labelled. Hazardous materials should be stored so that incompatible materials cannot come into contact with each other, and should be stored separately from non-hazardous materials.
- Criteria should be established for a minimum buffer distance – 50 metres is recommended – between the sea and land-based storage facilities containing liquids. Storage facilities for liquid materials should be equipped with adequate spill containment, and storage facilities should be located only in areas where there is no risk of flooding.
- Storage of liquid materials on-board vessels should not be undertaken beyond what is required to undertake specific tasks.
- So that emergency services can respond quickly and effectively, access roads should be kept free of obstructions, and emergency services staff should have access to information regarding the types of hazardous materials that may be involved in the fire. Notification responsibilities of emergency services staff by on-site personnel should be established. The Prince Hamzeh Center for Oil Spill Response should be informed of the construction schedule and any particular spill risks.
- Under the Environmental Protection Regulation, ASEZA has the right to inspect any facility at any time, and to commission an external audit if necessary.

Spill Management

Discharge/release of solid and/or liquid materials to the groundwater and the sea are prohibited in order to conform with the 'zero discharge' policy of ASEZA.

Where spillages or accidental discharges of liquid material occur, prompt steps should be taken to clean up the spill/discharge and to minimise impacts.

Every effort should be made to prevent spillage of oil and fuel from construction machinery. The contractor should only supply well maintained equipment, inspected prior to operation. Daily visual inspection must be carried out by the contractor. Maintenance and refuelling of machinery should be carried out at a suitable location, away from the area of operation, and where there is a paved or hard surface. Measures to trap spilling oil and fuel should be in place during refuelling. If spills occur, spill

substances will be recovered and disposed of appropriately. Sand or soil contaminated as a result of spillage should be removed from the site. Spills to water should be contained where possible, and the contaminated water separated and pumped off for appropriate disposal.

A minimum of 1,000 litres of general purpose spill absorbent should be maintained at each hazardous materials storage facility on-site, and should be replaced as it is used. Appropriate absorbents include zeolite, clay, peat and other products manufactured for this purpose.

Spilled materials should be tracked and accounted for, spills should be reported and corrective action taken to prevent a recurrence of the spill.

Control of Noise

Although the construction site is far from residential areas and lies in an industrial zone, noise should be controlled to minimise impacts on birds and marine fauna in the area. The contractor should meet the Jordanian Instruction for Limitation and Control of Noise, which regulates noise outside the construction site.

Control of Emissions to Air

Dust emissions will settle in the sea and impact the marine flora and fauna, particularly the sensitive corals. It is imperative that particular attention is paid to dust control. Dust suppression practices should be used, with the aid of non-toxic and non-chemical materials (e.g. water) where necessary.

The contractor should comply with the Jordanian Standard JS 1189 for air pollutants emitted from stationary sources. All construction plant and equipment should be inspected for particulate emissions before arrival at site and be well maintained. Plant with higher than acceptable emissions should not be used.

Waste Management

Construction waste - rubble, scrap, and excavated material is to be managed properly to avoid impacts on the surrounding terrestrial or marine environment.

All construction waste to be disposed of at Aqaba Landfill Site or other site licensed approved by ASEZA. No illegal fly-dumping in non-licensed areas is allowed. The final destination of trucks leaving the site is to be verified by the Contractor on a daily basis.

No dumping at sea of any material is to be allowed, either from land or sea.

Because of the proximity of a sensitive marine environment, a Waste Management Plan - showing approximate quantities of waste and disposal locations - should be developed by the contractor and approved by ASEZA before construction begins.

Impacts on Infrastructure

As noted in Section 7, the likely impacts on road and transportation infrastructure are likely to be low. However, the usual controls relevant to construction and transportation operations should be maintained.

The Ministry of Transport's requirements on vehicle weights should be adhered to.

Management of Marine Construction Plant

The Main Contractor is responsible for the management of all plant including that of sub-contractors. Marine plant must be fully surveyed, certified, licensed for the specific purpose, and insured. Marine plant to be strictly controlled and supervised so as not to accidentally cause damage to the corals.

Anchoring at the South Port site must be kept to a strict minimum, as any anchoring will directly impact the coral reefs in the area.

Anchoring in Dirreh Bay should only be for the purpose of marine excavation or piling.

No anchoring of craft in Dirreh Bay is to be permitted.

No boat activity at all within Dirreh Bay, south of a line extending from the southern wall of the General Cargo Basin, is to be permitted.

Anchoring of barges, e.g. for piling or dredging, must be approved by the SPV

No discharges of any kind from construction plant - oil waste, tank cleaning - are permitted in the Gulf of Aqaba.

Health and Safety

A Health and Safety Plan should be developed by the contractor and submitted to the Client before construction begins. This Plan will address the likely hazards, and provide guidance and warning to workers, visitors, emergency response procedures, provision of protective clothing, adequate safety management, and the appointment of a safety officer, who will be present during construction activities. The requirements of the Jordanian Labour Law (No 8, 1996) and its amendments, regulations and instructions, should be considered in the Health and Safety Plan, and adhered to at all times.

In particular,

- A Health and Safety officer should be appointed from the Contractor's side.
- Emergency services should be notified of all hazardous materials used on the construction site. MSDS's should be available and emergency personnel should be trained in response to chemical (including oil) emergencies.

Aesthetic Impacts from Supply of Rock

Visual scarring to the landscape from quarrying should be minimized.

A plan for sourcing quarried materials should be prepared by the Contractor, and approved by ASEZA prior to construction. Quarried rock should be sourced only from regulated and approved quarries. No quarrying from unlicensed sites or from wadis or other areas will be permitted.

Prevention of Damage to KEMAPCO Intake during Construction

The contractor is to make means to prevent any blockage from taking place to the KEMAPCO intake. The consequences of such a blockage is detrimental as it will impair the cooling process in the KEMAPCO plant, and could require a shut down of some of the processes.

The contractor is also required to liaise with the KEMAPCO facility on a regular basis during the construction phase, regarding the diversion and relocation of this pipe.

10.5 Performance Requirements for South Port Operation

This section describes the overall environmental performance requirements for the long term operation of the ports. ASEZA's Environmental Protection Regulation No 21 is the governing legislation which must be adhered to at all times. This Regulation prohibits damage to the environment, and permits no discharges to the marine environment. The Regulation authorizes ASEZA to inspect the facilities to verify compliance with all environmental legislation. Section 12 addresses compliance.

Ship Management

This sub-section addresses aspects of ship management that relate to the environmental performance of vessels, including relevant aspects of docking and anchoring, ship-to-shore reporting and communication, and ship movements. These aspects of ship management are addressed in SOLAS, and extensive materials are available from IMO to support the implementation of recommendations and requirements. Table 10.1 summarizes these aspects of ship management, and additional detail is provided below.

General Framework – SOLAS and MARPOL

The SOLAS Convention and the MARPOL Convention address many aspects of environmental management associated with port operations. In many cases, port operations must be undertaken in strict compliance with these Conventions. In other cases, codes or guidance have been issued under one of these Conventions that elaborates in detail how port operations must be conducted; in some cases, these codes or guidance documents are mandatory for parties to the Convention, while in other cases they are advisory. However, many codes and guidance documents that IMO has prepared on an advisory basis in the past have later been adopted on a regulatory basis.

While the SOLAS convention focuses on 'safety of life at sea', many of the issues it addresses are central to the environmentally safe performance of ships. Thus, for example, standards and procedures have been developed under SOLAS in order to ensure the safety of ships during voyages. These standards and procedures, however, serve not only to protect "life at sea" but also to prevent accidents, foundering and other poor management that would result in the release of pollutants as well as result in unsafe working conditions.

Both Conventions must necessarily address the interface between ships and land in order to ensure that requirements and recommendations for activities on ships are in fact feasible. The MARPOL Convention, for example, addresses the release of pollutants from ships to the sea, but this is only feasible if there are adequate facilities on shore to receive the wastes that would otherwise be discharged – and MARPOL therefore addresses the need for shore-based facilities to receive wastes. Likewise, SOLAS requires standards and procedures to be met by ships while at sea but these require actions while vessels are in port to ensure that standards and procedures are met during a voyage; for example, stowage of cargo that ensures safety (and proper environmental security) during a voyage requires that the cargo is properly stowed while the vessel is in port.

Many aspects of SOLAS and MARPOL require local authorities to monitor and inspect vessels to ensure that the requirements of Conventions are met. Both Conventions make provision for Port State control; that is, the right of the State in which a ship is at port to ensure that the ship meets the requirements of the Conventions. This is an important

aspect of ensuring the protection of the marine environment, since it provides the Port State with the ability to ensure that vessels using its ports are equipped and operated to provide proper protection of environmental resources.

The new ports operator must be fully conversant with the requirements of all relevant international treaties, including how they apply to Jordan. Ports operators will be required to demonstrate their knowledge and compliance of such relevant international legislation, during the bidding process.

Docking and Emergency Anchoring

The IMO BLU Code identifies the conditions that should prevail in order to ensure safe docking and the technical aspects of ensuring that it is securely undertaken when appropriate conditions prevail. Assurance of proper docking requires that ships provide proper information to port authorities and terminal operators, see Section 4.1.2 of the code. The BLU Code is not mandatory for parties to SOLAS, but provides a sound basis for developing regulatory requirements to ensure proper berthing of ships.

In addition to the guidance provided by the IMO Code, requirements in Jordan include a buffer zone between coral and areas where vessels berth. A buffer zone helps ensure that coral is protected and that will minimize the risk of grounding or damage to ships – and resultant environmental damage – as a result of accidents associated with berthing.

No anchoring is permitted along Jordan's coastline, including in the area of the South Ports, except in an emergency.

All ships docking at the South Port are to be brought in to dock by tug boats, with appropriate pilotage, in accordance with the requirements of the Port.

Ship-to-Shore Communication and Reporting

The interface between ship-side and shore-side operations has frequently been characterised in the past by poor communication that has resulted in potential and actual accidents and environmental impacts. In order to correct this situation, the IMO BLU Code details the communications responsibilities of a ship's master, and the responsibilities of the terminal operator/port authority. Table 10.1 below sets out these communications responsibilities.

The Ports operator must be fully conversant with these requirements, including how they apply to Jordan. Aqaba Marine Services can provide the procedures for arrival, pilotage, and berthing.

BASIS FOR RECOMMENDED PRACTICE	RECOMMENDED PRACTICE
DOCKING AND ANCHORING	
IMO Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code)	Ships should be accepted by port authorities only if the following conditions are met: (i) sufficient water depth; (ii) adequate mooring arrangements; (iii) adequate fendering to protect shore-side facilities; (iv) safe access to berth; (v) absence of obstructions to loading/unloading operations; (vi) vessel size in relation to items (i) – (v) Provision to be made for emergency unberthing of ships Establish a buffer zone between coral and berthing/emergency anchoring off locations for ships (Note 2)
SHIP-TO-SHORE COMMUNICATION AND REPORTING	
IMO Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code)	Ship master should report and communicate to terminal operator: (i) estimated time of arrival and relevant information to identify the ship; (ii) a loading/unloading plan (as appropriate); (iii) arrival and departure draughts; (iv) confirmation of ballasting/de-ballasting in accordance with IMO criteria; (v) ship dimensions; (vi) details of ship's loading/unloading (as appropriate) facilities and equipment; (vii) previous loading/unloading port; (viii) details of cargo to be loaded/unloaded and berthing displacements/draughts; (ix) confirmation that holds are ready to accept cargo; (x) other information requested by the terminal operator. Communication/reporting to also be in accordance with IMO Resolution A.851(20), see Table 3. Terminal should report and communicate to ship's master: (i) name of berth to be used and timing for berthing and loading/unloading; (ii) details of loading/unloading equipment and berthing facilities; (iii) details related to distance between water level and hatches/coamings, and air draft; (iv) berthing and gangway access, including tug availability; (v) details on loading; (vi) details on mooring; (vii) restrictions on de-ballasting; (viii) maximum sailing draught permitted; (ix) other information requested by the ship's master. Information should be updated as appropriate and necessary <i>Loading</i> Communication arrangements between the ship and terminal should be capable of responding to requests for information on the loading process and of prompt compliance in the event that the master or terminal representative orders loading to be suspended. Consideration should be given to the disposition of cargo on the conveyor systems and to the response time in the event of an emergency stop. <i>Unloading</i> communication arrangements between ship and terminal should be capable of responding to requests for information on the unloading process, and of prompt compliance in the event that the master orders unloading to be suspended. Contact person at the terminal and on board the ship should be established and recorded.
SOLAS Chapt. V IMO Assembly Resolution A.851 (20)	Establishes role of Governments of Contracting Parties to establish reporting systems Coordination of reporting systems between Governments with a common interest in a particular area Sets out principles and guidelines for reporting systems and reports

BASIS FOR RECOMMENDED PRACTICE	RECOMMENDED PRACTICE
	made by ships. Safety and pollution-related reports to be made without delay,.
SHIP MOVEMENTS	
SOLAS Chapt. V	Voyage data recorders (VDR's) required on ships An automatic identification system (AIS) to be fitted on all ships Vessel Traffic Services (VTS) to be established by the Government of Contracting States where volume of traffic or degree of risk justifies a VTS; VTS established by a Government takes effect only in its territorial sea area. IMO "Guidelines on Vessel Traffic Services" provide a framework for VTS (and refer to the VTS Guidelines of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)).

Table 10.2: Aspects of Ship Management Related to Environmental Management

Note 1: The BLU Code is references in SOLAS Chapter VI

Note 2: The need for a buffer zone is not included in the BLU code, but is a recommended practice to protect coral.

Generally, IMO encourages flexibility with respect to the timing of reports between a ship and the port authority/terminal operator. However, IMO Resolution A.851(20) recognizes that information relating to safety or pollution incidents and threats should be made immediately. Additionally, the timing of reports regarding arrival and departure in/from port and the nature of the cargo on board should be undertaken consistent with timing shown in Table 3.

The operator must comply with the IMO BLU Code (SOLAS Chapter VI), and any other relevant international legislation.

Ship Movements

Ship movements are generally regulated through shipping lanes approved and communicated by IMO. Governments of contracting parties to the IMO Convention may apply to IMO to have a shipping lane moved, however, for reasons that may include protection of natural or environmental resources. Shipping lanes in the Gulf of Aqaba may therefore be delineated to reflect the conservation of these resources through the mechanisms provided by the IMO.

In recent years, IMO has placed priority on not only the maintenance of shipping lanes, but also on coordination of the location of ships themselves in order to enhance safety and to ensure rapid response to safety and environmental emergencies. Three actions are relevant:

1. *Voyage Data Recorders (VDR's)* VDR's are required on all ships with a gross tonnage of greater than 3,000, constructed on or after 1st July 2002. VDR's enable accident investigators to review procedures and instructions in the moments before an incident and help to identify the cause of any accident. Performance standards for VDR's were adopted in 1997 and give details on data to be recorded and VDR specifications. They state that the VDR should continuously maintain sequential records of preselected data items relating to status and

output of the ship's equipment and command and control of the ship. The VDR should be installed in a protective capsule that is brightly coloured and fitted with an appropriate device to aid location. It should be entirely automatic in normal operation. All vessels are required to be equipped with a VDR by 1 July 2010; however, IMO provides that a flag state Administration may exempt ships, other than roll on-roll off passenger ships constructed before 1 July 2002, from being fitted with a VDR where it can be demonstrated that interfacing a VDR with the existing equipment on the ship is unreasonable and impracticable.

2. *Automatic Identification Systems (AIS's)* SOLAS Chapter V requires the carriage of automatic identification systems (AISs) capable of providing information about the ship to other ships and to coastal authorities automatically. SOLAS requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size built on or after 1 July 2002. It also applies to ships engaged on international voyages constructed before 1 July 2002, according to the following timetable:

- Passenger ships, not later than 1 July 2003;
- Tankers, not later than the first survey for safety equipment on or after 1 July 2003;
- Ships, other than passenger ships and tankers, of 50,000 gross tonnage and upwards, not later than 1 July 2004;
- Ships, other than passenger ships and tankers, of 10,000 gross tonnage and upwards but less than 50,000 gross tonnage, not later than 1 July 2005;
- Ships, other than passenger ships and tankers, of 3,000 gross tonnage and upwards but less than 10,000 gross tonnage, not later than 1 July 2006.
- Ships, other than passenger ships and tankers, of 300 gross tonnage and upwards but less than 3,000 gross tonnage, not later than 1 July 2007;
- Ships not engaged on international voyages constructed before 1 July 2002, will have to fit AISs not later than 1 July 2008.

A flag State may exempt ships from carrying an AIS when ships will be taken permanently out of service within two years after the implementation date. Performance standards for AIS were adopted in 1998. SOLAS requires that AIS shall:

- Provide information - including the ship's identity, type, position, course, speed, navigational status and other safety-related information - automatically to appropriately equipped shore stations, other ships and aircraft;
 - Receive automatically such information from similarly fitted ships;
 - Monitor and track ships;
 - Exchange data with shore-based facilities.
3. *Vessel Traffic Services (VTS)* A VTS is a marine traffic monitoring system established by a harbour or port authority to keep track of vessel movements and provide navigational safety in a limited geographical area; it is similar in a marine context to air traffic control in an aviation context. Aqaba Marine Services operates such a system at the South Port. SOLAS recognizes the value of establishment of a VTS where the volume of traffic or degree of risk associated

with shipping traffic in an area justifies the service. The establishment of a VTS is a State responsibility and has effect only within the territorial waters of the State. IMO has issued guidelines related to the establishment of a VTS, and other organizations (notably the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)) have played important roles in the implementation of VTS.

The Jordanian regulator with respect to shipping and port traffic is the Jordan Maritime Authority, although ASEZA is the relevant authority in the case of an environmental incident. The ports operators should review and be familiar with all current Jordanian and international legislation on navigation and ship movements and comply with same.

Cargo Loading, Unloading and Handling - Emissions and Spillages

This section addresses port loading and unloading operations, dry bulk and liquid bulk handling. Specific reference is made to the major materials that will be managed through the South Port at Aqaba; general cargo, grain, bulk liquids (including ammonia and phosphoric acid), vegetable oil, liquefied petroleum gas (LPG), potash, sulphur, phosphate and hydrocarbon oil.

The Port operator should aim towards zero spillage and emissions. The Jordanian Standards on air quality – JS 1140 and JS 1189 – should be adhered to at all times. The operator is required to conduct a berth-by-berth risk assessment of the spillage and emissions risk, based on the detailed design of the berth and environmental proposed controls, - see Section 10.6.

Based on the risk assessment, appropriate equipment and dust/spillage control equipment should be provided and implemented, and maintained. Constant visual monitoring of port operations should be carried out by the Ports operator, and any spillage or emissions should be noted, and immediate action taken. Any operation which gives rise to significant spillage or emission should be immediately suspended until adequate remedial measures are taken. The operator should develop a Spills Management Procedure. All spills should be recorded in a log.

Table 8.2 summarises environmental issues with respect to port operations related to loading and unloading. IMO has established general procedures for the loading and unloading of cargo, and these should be followed with respect to all loading and unloading operations. Primarily, these procedures relate to the responsibilities of the ship's master and the port (terminal) operator, and the clarification of their respective roles and communication between them. Timely notification of the port authority of the arrival of a vessel is also important to ensure that the port is in a position to properly receive the vessel and provide for its loading/unloading in an environmentally appropriate manner.

Table 8.2 also identifies specific cargo loading and unloading requirements and for specific cargoes that are a priority in Aqaba. There are relevant SOLAS or MARPOL requirements associated with each of these cargoes, except for phosphate rock; recommendations for management of phosphate have been developed from good practice guidelines issued by the United Nations Commission on Trade and Development (UNCTAD). The following recommendations for specific cargo loading and unloading requirements should be applied:

RECOMMENDED GENERAL MEASURES		
BASIS FOR RECOMMENDED PRACTICES	RECOMMENDED PROCEDURAL PRACTICES	RECOMMENDED OPERATIONAL PRACTICES
IMO Code of Practice for the Safe Loading and Unloading of Bulk Carriers (BLU Code)	Terminal operator required to comply with the relevant IMO codes and recommendations on ship/port co-operation; Terminal operator required to appoint a "terminal representative"; Ship master is responsible for the safe loading and unloading of the ship according to details that have been confirmed with the terminal operator in the form of an agreed loading/unloading plan; In case of non-compliance with the agreed loading or unloading plan the master has the right to stop the loading or unloading operation. Port authorities have the right to stop the loading or unloading of cargoes when the safety of the ship is endangered; Port to establish a Quality Management System.	<i>General</i> "Manual on loading and unloading of solid bulk cargoes for terminal representatives" (published by IMO) to be utilised <u>Loading</u> Loading conveyors to be enclosed in order to minimise losses caused by wind, spillage etc. Ventilation of enclosed loading areas to be adequate to prevent explosions caused by dust. <u>Unloading</u> Grabs and other unloading equipment to be utilised only when ship is berthed alongside a wharf. Grabs and other unloading equipment not to operate over open water. Curtains, nets, water misting or other techniques to be used to catch spilled materials
IMO Resolution A.851(20)	All vessels to notify port authority/terminal of arrival at least 24 hours before arrival, or at time of departure from a port where voyage is less than 24 hours. Port of departure/port of arrival to be notified of polluting/hazardous materials before departure from port.	Compliance with IMO Resolution A.851(20)
RECOMMENDED CARGO-SPECIFIC OPERATIONAL PRACTICES		
CARGO	RECOMMENDED PROCEDURAL PRACTICES	RECOMMENDED OPERATIONAL PRACTICES
Grain	Monitoring and inspection of ships for compliance with relevant IMO guidelines and requirements; Procedures to be in accordance with International Grain Code and SOLAS Chapter VI Part C	Ships to be loaded/unloaded in accordance with International Grain Code and SOLAS Chapter VI Part C
Phosphate and other bulk dry chemicals (potash, sulphur, etc)	Procedures to be in accordance with IMO <i>BLU Code</i> .	Transport, transfer and stowage of phosphate using totally enclosed systems, negative pressure buildings/storage, and dust suppression/ management techniques

RECOMMENDED GENERAL MEASURES		
BASIS FOR RECOMMENDED PRACTICES	RECOMMENDED PROCEDURAL PRACTICES	RECOMMENDED OPERATIONAL PRACTICES
Ammonia	Monitoring and inspection of ships for compliance with relevant IMO guidelines and requirements; Procedures in accordance with <i>Procedures and Arrangements Manual</i> issued under MARPOL Annex II	Management in accordance with IBC Code issued by IMO under MARPOL Annex II for Global Harmonized System (GHS) Class Y substance (Liquid ammonia (28% or less)) under MARPOL Annex II
Vegetable Oil	Monitoring and inspection of ships for compliance with relevant IMO guidelines and requirements.	As appropriate, management of vegetable oils to be in accordance with "Guidelines For The Transport Of Vegetable Oils In Deep Tanks Or In Independent Tanks Specially Designed For The Carriage Of Such Vegetable Oils On Board Dry Cargo Ships", issued by IMO under MARPOL Annex II and with "International Bulk Chemical (IBC) Code" issued by IMO under MARPOL Annex II
Liquefied Petroleum Gas (LPG)	Monitoring and inspection for compliance with MARPOL Annex II and International Gas Carrier Code (SOLAS Chapt. VII Part C), as appropriate	Management in accordance with MARPOL Annex II and, as appropriate, International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) (SOLAS Chapt. VII Part C); Establish ship traffic restrictions during navigation of vessels carrying LPG, such as limited times and tidal windows for entering and leaving port, or one-lane traffic; Establish separate traffic lanes for LPG/petroleum vessels and other traffic.
Hydrocarbon Oil	Monitoring and inspection for compliance with IMO Revised Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers	IMO Revised Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers; Establish ship traffic restrictions during navigation of vessels carrying oil, such as limited times and tidal windows for entering and leaving port, or one-lane traffic; Establish separate traffic lanes for LPG/petroleum vessels and other traffic; Equipment specified in MARPOL Annex I, Chapt. 4 Part B to be operational.

Note 1: "General principles for ship reporting systems and ship reporting requirements, including guidelines for reporting incidents involving dangerous goods, harmful substances and/or marine pollutants".

Table 10.3: Recommended Practices for Cargo Loading, Unloading and Handling

Grain Management requirements for grain are set out in the International Grain Code, published by IMO. On-shore storage and handling should be designed to minimise the creation of dust which can result in an explosive accident.

Phosphate Phosphate is exported from Aqaba in bulk solid form. Phosphate is very dusty, and may create a significant nuisance in and adjacent to the port unless it is carefully handled and transferred to ships. The entire handling operation should confine phosphate so that dust cannot escape. In event of the failure of dust suppression systems during ship loading operations then, regardless of other circumstances, the cargo operations must stop until the dust suppression equipment is reinstated.

Sulphur Sulphur is imported as a bulk solid, taken from ships onto conveyors at the Industrial Terminal. Sulphur spillages and emissions are a current problem, with sulphur deposits at the sea bed at the Terminal. The entire handling operation should confine sulphur that dust cannot escape, and consideration should be given to requiring a minimum grain size for imports.

Ammonia Liquid ammonia (28% or less ammonia) is subject to management as a Class Y pollutant under MARPOL Annex II, and this dictates the types of ship that may be used to transport ammonia as a bulk liquid. IMO has issued the "International Bulk Chemical (IBC) Code" that details management requirements for materials regulated under Annex II, and a "Procedures and Arrangements Manual" that provides guidance for management of materials regulated under MARPOL Annex II. These documents should be used as the basis for management of ammonia as a bulk liquid on ships and in the port.

Vegetable Oil Vegetable oils are regulated under MARPOL Annex II. IMO has prepared "Guidelines For The Transport Of Vegetable Oils In Deep Tanks Or In Independent Tanks Specially Designed For The Carriage Of Such Vegetable Oils On Board Dry Cargo Ships". The "International Bulk Chemical (IBC) Code" issued by IMO under MARPOL Annex II, and the "Procedures and Arrangements Manual" mentioned above should also be used in the management of vegetable oils.

Liquefied Petroleum Gas (LPG) LPG is a mixture of petroleum and natural gases that exist in a liquid state at ambient temperatures when under moderate pressures (less than 1.5 MPa or 200 psi). In petroleum refining, LPG is collected during distillation, from lighter compounds dissolved in the crude oil, as well as generated in the "cracking" of heavy hydrocarbons. Therefore, LPG can be considered a by-product and its exact composition and properties will vary greatly with the source, but in all cases LPG is highly flammable or explosive. Management of LPG should be in accordance with MARPOL Annex II and, as appropriate, International Gas Carrier Code (SOLAS Chapt. VII Part C). LPG should be managed through dedicated and separate traffic lanes and port facilities in order to minimize the likelihood of fire or explosion.

Hydrocarbon Oil Oil is subject to management under MARPOL Annex I and IMO has additionally published "Revised Guidelines and Specifications for Oil Discharge Monitoring and Control Systems for Oil Tankers". Additionally, oil tankers should enter and exit the port using dedicated traffic lanes in order to minimize the risk of accident and associated pollution.

Phosphoric Acid PA is currently exported by both IJCC and JPMC as an aqueous solution containing 54% P₂O₅. The transportation management of this chemical falls within MARPOL Annex I and the GESAMP/EHS. Furthermore, the vessels transporting

hazardous chemicals as such are subject to IMO's International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk (IBC).

Ballast Water In addition to the loading and unloading of cargo, consideration should be given to the taking on and discharge of ballast water. The inadequately regulated exchange of ballast water has been a leading cause of the introduction of exotic organisms around the world, which has had severe environmental and economic consequences in many countries. The International Convention for the Control and Management of Ship's Ballast Water and Sediments recommends that ballast water exchange should be as far from the nearest land as possible, and in all cases at least 50 nautical miles from the nearest land and in water at least 200 metres in depth. When these requirements cannot be met, the Convention allows that areas may be designated where ships can conduct ballast water exchange. All ships should remove and dispose of sediments from spaces designated to carry ballast water in accordance with the provisions of the ships' ballast water management plan, and in no cases should sediments be discharged in port.

Although Jordan is not a party to this Convention, the maritime regulator should implement the above requirements on an internationally-agreed "good practice" basis in collaboration with adjacent Governments, as appropriate, and bearing in mind the priority need to ensure the protection of coral.¹³

The Red Sea is recognized as a Special Area under MARPOL, which recommends that ships entering a Special Area take on board clean ballast water. However, there is no prohibition on ballast water discharge under MARPOL, or on Jordanian legislation. MARPOL does prohibit the discharge of waste (especially of oily waste) into the sea.

Washing of ship cargo working areas should not be permitted until ships are underway, in deeper water, away from coral areas.

The recommendations listed in Table 8.2 and above, and in other legislation should be followed.

Phosphate Transportation

Phosphate will be transported to the South Port from a) the mines, and b) a rail-road unloading station in Wadi Yutum – see Section 5.3 for details. The risk points for dust are;

- Loading the trucks and trains at the mines – not the subject of this assessment
- Emissions from the trucks during transport
- Emissions at the Transfer Station in Wadi Yutum
- Emissions at the Unloading Facility at the South Port
- Conveying from the Unloading/Storage to the Quay

¹³ Additional guidance on this subject is provided in Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens (1997), published by IMO.

- Loading at the Ship

The operator(s) are required to comply at all times with the Jordanian Standards on air quality - JS 1140 and JS 1189. The annual maximum allowable concentration for PM₁₀ is 70 µg/m³. However, zero emissions to air should be the target of the operations.

The operator is required to conduct a risk assessment for spillages and emissions, - Section 10.6. Appropriate dust control measures (dust free hoppers, curtains, filters, etc) should be purchased, installed, implemented, monitored and maintained throughout operations.

Conveyors should be constructed in such a way as to avoid spillage, including any wind effect.

Drainage and Spills Management

A target performance of zero spills should be strived for in accordance with ASEZA's zero discharge policy. However, the Ports Operator should be prepared immediately to contain and manage any spillages which occur.

The SPV will be required to develop and submit policies and procedure for spill management, for review and approval. Policies, procedures and practices should include training and staffing, design of facilities, containment and response equipment, and operational procedures for dealing with spills. Monitoring and reporting procedures should also be documented. These should reflect best practice in advanced ports in Europe and Asia.

Oxygen levels will be monitored in the General Cargo Basin – see Section 10. Dissolved oxygen levels must remain with 10% of the ambient levels in the Gulf. If they fall below this, actions must be taken by the operator to reduce oxygen depletion to acceptable levels. A Basin Management Plan should be developed for the General Cargo Basin, illustrating how water quality levels are to be monitored and maintained, and how spilled material is to be removed.

Thermal Discharges

It is unlikely that the port itself will require to discharge cooling water, although developments in the Southern Industrial Zone may give rise to additional applications for discharge cooling water. However ships alongside the port may wish to discharge cooling water. Any thermal discharges must meet ASEZA's thermal discharge limits, as follows;

- The total flow rate must be acceptable to ASEZA
- The water is originally taken from the Gulf of Aqaba, in close vicinity to the discharge,
- It contains no additives and is of the same quality as the sea water,
- The temperature at the discharge point does not exceed 3 degrees above the ambient water temperature.

As noted earlier – Section 7.4 - more stringent conditions might be applied by ASEZA in the future.

Management of Diving at Dirreh Bay Wall Site

A clear applications/approvals, notification and communications process will reduce the risk to divers at this site. The SPV Operator should follow the approvals and communications process that will be developed, and to cooperate with ASEZA and other agencies regarding dive access – see Section 10.1.

Storage of Materials

No discharge, leakage or leaching to the groundwater or the sea is permitted.

The storage of hazardous materials must be properly managed, in accordance with JS 431 and JS 4371. Storage should be in appropriate facilities (secured in respect of hazardous material) and tracking with accountability systems maintained for dangerous materials to prevent unauthorised use of materials and use of materials by individuals who are not properly trained.

Storage of bulk dry or liquid material for loading/unloading must be in conditions to prevent stormwater ingress, leachate or run off, leakage, etc. Stormwater drainage should be such as to prevent rainwater from reaching the stored material.

Secondary containment is required for all liquid material. Storage facilities for liquid materials should be equipped with adequate spill containment, and all storage facilities should be located in areas where there is no risk of flooding.

Storage facilities accessible only to authorised personnel, and should be locked when not in use. Storage facilities for hazardous materials should be flame-proof. Hazardous materials should be clearly labelled and MSDS's should be available for them in an easily accessible location in case of emergency. Hazardous materials should be stored so that incompatible materials cannot come into contact with each other, and should be stored separately from non-hazardous materials.

Protection of Gas Pipeline

All necessary steps are to be taken to prevent damage to the gas pipeline during operation of the port and berths.

Flight path-related Lighting Restrictions

The Jordanian Civil Aviation Authority (CAA) has no regulations or guidance related to land use or activity restrictions under flight paths. However, the following are to be prohibited at the South Port;

- No bright sky-ward facing lighting or spotlights
- No laser lighting or laser shows without prior approval from the CAA
- No lighting in a linear line, which could be construed as runway landing lights

Wastewater Treatment

The operator should ensure that all domestic wastewater drains to the septic tanks, that these are monitored, and pumped out by truck at the appropriate time.

No discharge to the sea as permitted. This is a requirement until a new plant is constructed in the SIZ.

10.6 Environment Clearance Documents

The purpose of this EIS is to provide environmental clearance to the Master Plan, which includes approvals of the layout, mitigation of the coral and marine environment issues, and the approval of the performance requirements under which the construction and operation of the port facilities will be carried out. However, no detailed mitigation measures are prescribed at this stage. Instead, the SPV will be required to make their own risk assessment, and to develop proposals for environmental mitigation, for review and approval by ASEZA. The SPV is required to submit three documents to ASEZA as the vehicle for this proposal and review process. The documents – *Detailed Project Description, Baseline Environment Study, and EMP including CEMP and OEMP* – should be submitted during the planning and detailed design process, and before any construction work commences. The post clearance documents will be derive from this EIS, and will provide the Environmental Mitigation Plans which an EIS should provide in accordance with the Environmental Protection Regulation. The required contents of the environmental clearance documents are outlined below.

Design Elements

- Berth design details – plans for the detailed layout and makeup of each berth, including dimensions, sections showing how the berth is fixed and anchored, details of the ancillary equipment such as cranes, loaders, hoppers, conveyors, etc.
- Details of handling capacity of each berth, loader, conveyor, storage facility, etc.
- Environmental risk assessment for all likely points of spillage or air emissions
- Details of the mitigation measures to be applied at each risk point, including equipment, controls, procedures, monitoring, etc.

Construction

- A Construction Method Statement showing the approach to construction of all elements, including the approach to meeting the performance requirements, and schedule
- A Marine Construction Method Statement and schedule, showing methodology for construction of each element, type of plant and equipment to be used, approach to dredging and marine excavation, storage of materials, etc, illustrating the proposed approach to meet each the construction stage performance requirements
- A health and safety plan showing how the Contractor will control health and safety risk

- Staffing, communications and reporting plans relating to environmental management, emergency response to spillages, health and safety
- Details of the environmental management approach, capability and policies of the main companies concerned
- A Construction Environmental Management Plan (CEMP) which summarizes all the above, and lists how each potential environmental impact and risk will be mitigated, and how it will be monitored. This should be in tabular form.

Port Operations

- Operating procedures for environmental management, outlining the routine means for monitoring loading, material handling, conveying, storage, etc, and setting out the approach to emergency response for emissions, spillages, etc.
- Details of any Environmental Management Systems proposed
- Organizational structure and staffing for environmental management, outlining how routine reporting and emergency response is handled.
- Details of the environmental management approach, capability and policies of the main companies concerned.
- A Port Operations Environmental Management Plan (OEMP) which summarizes all the above, and lists how each potential environmental impact and risk will be mitigated, and how it will be monitored. This should be in tabular form.

11.0 Environment Monitoring Plan

The purpose of the Environmental Monitoring Plan is to set out how the environmental impacts of the project will be monitored in the short and long term. Monitoring will be carried out by the different entities outlined in the governance system during the different phases of the project. An overview of the responsibilities given for each of the entities is as follows;

SPV

- Monitor construction activities and performance to ensure that identified and appropriate control measures are being effective and ensure compliance with the CEMP including monitoring and reporting.
- Monitor all port activities and performance to ensure that identified and appropriate control measures are being effective and ensure compliance with the OEMP.
- Liaise and coordinate with ASEZA regarding environmental monitoring and compliance

ADC

- During construction, ADC will monitor contractor performance, including compliance with the stipulated performance requirements and the governance system. ADC might carry this directly through a project management unit (PMU), or by appointing a third party
- During operation, ADC will monitor SPV performance, including compliance with the stipulated performance requirements and the governance system. ADC might carry this directly through a project management unit (PMU), or by appointing a third party.

ASEZA

- During both construction and operation, ASEZA will carry out compliance monitoring in addition to the self monitoring by the SPV and contract monitoring by the ADC and its representatives.

11.1 Monitoring for Main Port Rehabilitation Works

The following section outlines the Environmental Monitoring Plan that should be carried out during the rehabilitation of the Main Port. This includes decommissioning, demolition of equipment and facilities, removal of contamination and preparation for site development.

Control of Hazardous Material Removal

- Air quality should be monitored during asbestos removal, in accordance with the requirements of NESHAPS – the US National Emission Standards of Hazardous Air Pollutants which regulate demolition work that could be released into the atmosphere. A project monitor should be present during asbestos abatement to ascertain that NESHAPS requirements are adhered to. During this process the

project monitor should collect daily area samples to access airborne asbestos concentrations during the removal phase.

- For hazardous material transportation, a Vehicle Log Feedback System for vehicle logs should be adopted to verify that each load of material reaches the appropriate destination and is not disposed of in unsuitable locations.

Control of Non-Hazardous Contamination Removal

- Visual monitoring of the sea water at the Main Port should be carried out during hosing of phosphate deposits. If there is noticeable turbidity, then the run off locations should be identified and sealed. Turbidity levels in the sea adjacent to the Main Port should be monitored during any activity which gives rise to run off, for example phosphate dust removal. The levels should be equal to or less than 0.5 NTU above ambient levels at all times.
- Monitoring of PM₁₀ should be carried out at the northern and southern edges of the Main Port site, daily during removal of phosphate dust. The Jordanian Standard JS 1140/2006 on Ambient Air Quality is applicable, which requires that PM₁₀ levels do not exceed 70 µg/m³ annually.
- A *Vehicle Log Feedback System* for vehicle logs should be adopted to verify that each load of material taken off site reaches the appropriate destination and is not disposed of in unsuitable locations.

Removal of Material from Sea Bed

- A log of all material removed from the sea bed should be made for comparison against ADC's survey log, taken from the Aqaba Ports Development Project, Contamination Cleanup and Assessment Report, ADC, 2008.
- A visual inspection of the sea bed should be made by ADC following the work, to determine that all significant material has been removed.

11.2 Pre-Construction Monitoring of South Port

Pre-construction documentation of the baseline environment at the Ports is necessary in order to understand the future impacts the ports construction or operation might have. The existing environmental conditions at the South Port have been documented based on a series of studies already conducted in advance or in conjunction with the EIA. These were conducted as part of the baseline study to complete this EIA as well as to provide a control for future identification of positive and negative impacts to the environment. The following monitoring results are available as baseline data;

- A noise study conducted in October 2007 by REEC at three sites at the South Port; Civil Defense/Adderra, al-Fajr Natural Gas Company and Prince Rahsed Marine Club;. Continuous monitoring was carried out and converted to hourly data in order to compare with Jordanian standards. The results are outlined in Appendix V. No further pre-construction noise assessment is envisaged.
- An air quality study was carried out in October and November of 2007. The study was conducted at three sites at the South Port; Civil Defense/Adderra, al-

Fajr Natural Gas Company and Prince Rahsed Marine Club. The air quality parameters that were monitored included pollutants and meteorological characteristics such as: SO_x, CO, O₃, NH₃, HF, VOCs, PM₁₀, nitrogen oxides, wind speed and direction, temperature, humidity, rainfall amount, atmospheric temperature and solar radiation. Results are presented in Appendix IV. No additional pre-construction air quality monitoring is envisaged, unless requested by ASEZA.

- A coral survey conducted by MSS in February - May 2007 at the South Port used different methodologies to assess coral species, diversity, abundance, and distribution. This can act as a pre-construction baseline. No additional pre-construction assessment of corals is envisaged.
- Water quality – this is measured monthly at a number of locations as part of the MSS Water Quality Monitoring Programme. Recent results from this are listed in Section 4.2.2. It is recommended that additional results are taken immediately before construction and circulated to all related actors as an agreed baseline. Parameters to be measured should include;

Temperature, salinity, sigma-t, pH, alkalinity, oxygen, ammonium, nitrate, nitrite, phosphate, silicate, chlorophyll a, hydrocarbon, particulate matter, zooplankton biomass.

Measurements should be taken at the following locations;

- Oil Terminal
- Timber Berth
- Industrial Jetty
- Dirreh Bay

Air Monitoring at Wadi Yutum Transfer Station and Back Road

Pre-construction baseline air monitoring of the site for the Wadi Yutum Transfer Station, and at one agreed location along the Back Road – the Back Road Sampling Location - around half way between the transfer station and the port. This monitoring should focus on TSP and PM₁₀ levels. This will provide a comparison with the dust levels during construction, and during operation.

Given the time delay before the construction work will begin, ASEZA may request an updated baseline characterization closer to the time of construction.

11.3 Monitoring during Construction of South Port

It is essential to ascertain that the environmental resources are not harmed any more than necessary during the construction of the South Port. The following section lists monitoring activities that must be followed in order to minimize and prevent further environmental adverse effects from taking place.

Control of Emissions to Air

Air quality of the following parameters should be monitored at least once monthly;

- TSP, PM₁₀, SO_x, NO_x, HF, NH₃, phosphate dust, volatile organic compounds (VOCs), air temperature and humidity, wind speed and direction

Sampling should be downwind of the construction works. Monitoring points should include;

- the Dirreh Bay shoreline,
- one point to the south of the Industrial Terminal,
- one point north of the Industrial Terminal.
- Wadi Yutum Transfer Station site
- Back Road Sampling Location

Sampling should be undertaken during normal working hours.

Air monitoring should be carried out during construction to ensure that the JS 1140/2006 on ambient air conditions is met. Non-compliances in terms of TSP and PM₁₀ will be assumed to emanate from the port construction works.

Air monitoring of dust emissions north and south of the Industrial Jetty need to be carried regularly during the construction phase

In addition, visual monitoring of the works should be carried out at all times. If dust emissions are found to be excessive, the works should be stopped until adequate control measures can be implemented. If particulate emissions from particular plant or equipment in question shall be shut down until repair can be affected.

Control of Noise

Noise monitoring during the construction shall only be required if complaints are received by ASEZA, or if ASEZA has reason to suspect that noise levels are excessive. Noise monitoring locations and frequencies will be decided on a reactive case by case basis, and results compared with the baseline data

Protection of Marine Water Quality and Marine Habitat during Marine Works

Visual monitoring of the sediment curtain should be maintained at all times during marine works, and work stopped if visible breaches of the curtain occur. This is crucial to the sustainability of the adjacent coral fields and will have long term significant impact if not complied with.

Visual monitoring of turbidity should be carried out constantly during marine works, dredging, anchoring, etc. Turbidity should be physically measured daily during excavation and reclamation works. Monitoring should occur within 50 m of the sediment curtain wall or boundary of the works, and should not be up-current from the works. The locations of turbidity monitoring should reflect the work being carried out.

Particular attention should be paid to the coral reef flats, the Dirreh Bay Wall, and the cooling water intakes of the JPMC, Thermal Power Plant, and KEMAPCO plants. Turbidity levels should be maintained equal to or below 0.5 NTU above the ambient levels. If levels exceed this deviation, marine works should cease until the situation is rectified.

Inspection of the excavated General Cargo Basin to be made before breakout to Gulf, to establish that the entrained water will not detrimentally impact the Gulf. If the entrained water is too turbid, additional settling time should be allowed before breakout.

Visual inspection of excavated material should be made to determine if there are any conditions which would trigger further testing of the material before disposal.

A new marine monitoring station should be established in Dirreh Bay, to measure the following parameters and report to ASEZA, weekly during marine construction. Parameters to be measured should include;

Temperature, salinity, sigma-t, pH, alkalinity, oxygen, ammonium, nitrate, nitrite, phosphate, silicate, chlorophyll-*a*, hydrocarbon, particulate matter, zooplankton biomass.

Prevention of Hypoxic conditions in the General Cargo Basin

As mentioned before, following a request by ASEZA to address the potential occurrence of hypoxic conditions at the general cargo basin, ADC increased the depth to -15CD.

Additionally, in order to ensure that oxygen levels remain within 10% of those in the open water and prevent contamination from taking place, the operator is required to regularly monitor the water quality of the basin. In the event that oxygen levels drop, remedial steps, such as increased circulation, must be carried out to increase the oxygen levels. If contamination takes place, corrective actions must take place to remove the contaminant.

Waste Management

- The final destination of waste trucks leaving the site is to be verified by the Contractor, on a daily basis.
- Visual observations of waste management on site need to be made .
- Confirmation of the destination of all waste/scrap/spoil taken offsite

Impacts on Infrastructure

- The current Ministry of Transport requirements on inspection of truck weights is applicable to all construction traffic.
- If visual monitoring of the trucks gives rise to suspicions of overloading, or if impacts to the road surfaces become obvious, proof of loading weight should be retrieved from the Contractor.

Management of Marine Construction Plant

- inspection of all marine plant before commencement of work.

- Visual observation of ships locations and movements on a continuous basis
- Weekly inspection of ship oil logs.

Health and Safety

- There should be reporting on any health and safety violations.

Aesthetic Impacts from Supply of Rock

- Verification of the source of all truck loads of incoming rock fill or armour should be made.
- Periodic inspections at the quarry should be carried out to determine continuing compliance.

Security of the Gas Pipeline

- Verification should be made that the protection of the pipeline has been carried out to the satisfaction of ASEZA, the owner/operator of the pipeline and the marine contractor.
- Verification of the pipeline location should be made to the satisfaction of ASEZA, the owner/operator of the pipeline, and the marine contractor, especially where it is closest to the phosphate berth or other planned construction works.
- All construction work close to the buffer zone should be approved on a daily basis, including re-verification of the buffer zone, if there is any doubt as to the pipeline's exact route.
- Constant liaison with the pipeline operator during excavations close to the pipeline should be made.

Storage of Materials

- Visual inspection and monitoring of the storage of materials should be carried out along with lookout for spillages or leakages during inspections of the site

Spill Management

- Visual inspection and monitoring the storage of materials should be carried out along with lookout for spillages or leakages during inspections of the site

11.4 Monitoring of Post-Construction Coral Health

In order to differentiate between the damage to the marine environment caused by the port construction, and the operation of the port, it is recommended that an assessment of the located in the South Port vicinity should be carried out, by visual inspection by divers, once all construction works have been completed, but before use of the new berths begins. This may have to be carried out in stages to meet with the staged construction and handover of the various components. This survey should assess the

diversity, abundance and health of the corals present and should include an extensive photographic record. The data collected will serve as a baseline for the South Port operation phase.

11.5 Monitoring during Operation of South Port

The monitoring of operations and environmental performance for the new port will be a crucial component of environmental management, and one which is absent from the current ports operations. It is envisaged that ongoing monitoring will consist of the following components;

- Visual and operational monitoring of port operations and activities
- Monitoring of air quality at port, back road, and Wadi Yutum
- Monitoring of water quality
- Monitoring of impact on corals
- Monitoring of port reception facilities
- Monitoring of environmental emergency response capability

These are discussed below;

Visual and operational monitoring of port operations and activities

Visual and operational monitoring of port operations and activities will be undertaken. Specifically, these monitoring actions include;

- Ensuring that the ports are operated in accordance with the OEMP and all environmental regulatory requirements.
- Review and update the OEMP as required based on evaluation of monitoring data and changing operations at the port.
- Implement the Monitoring Plan, including the regular air and noise quality monitoring programme.
- Liaise with ASEZA and MSS and other entities regarding the Monitoring Plan including the marine water quality programme and the annual coral health assessment.
- Daily visual inspection of the port area, including all storage, conveyors, loading and unloading operations.
- Recording an environmental infringement log book, and preparing monthly environmental reports.
- Liaise and coordinate with the various other companies and agents using the port land and facilities regarding environmental management.

Air Quality

Air quality parameters are a necessity to be monitored to ensure the South Port is not operating at unacceptable levels. The prescribed international and national standards and regulations need to be abided by at all times as to avoid risk of polluting the surrounding environment. The Monitoring Plan requires air quality monitoring, of the following parameters;

- TSP, PM10, SO_x, NO_x, HF, NH₃, Phosphate dust, Volatile Organic Compounds (VOCs), Air Temperature and Humidity, Wind Speed and Direction

Monitoring points should include;

- the Dirreh Bay shoreline,
- one point at the property boundary to the south of the Industrial Terminal,
- one point north of the Industrial Terminal.
- Wadi Yutum Transfer Station site
- Back Road Sampling Location

Ideally, permanent onsite stations should be developed.

Under ASEZA's risk-based 'polluter pays principle', sampling is the responsibility of the Operator. However, this could be outsourced by the Operator to a private company, or to ASEZA's Laboratories, which operate an ambient air quality monitoring programme.

Marine Water Quality

The Monitoring Plan requires a monthly monitoring of marine water quality from a point in Dirreh Bay, to be finally decided by ASEZA. The marine water quality parameters to be monitored need to be in accordance with standards and policies prescribed. In specific, monitoring needs to ensure that the South Port is operating in accordance with the ASEZ 'zero discharge' policy. The marine water parameters to be monitored include;

- Dissolved Oxygen, pH, Temperature, Nitrate, Nitrite, Ammonia, Phosphate, Transparency, Colour and Odour, Salinity, Silicate, Phytoplankton, Zooplankton, Chlorophyll a

It is recommended that the MSS be contracted to provide this additional water quality monitoring point, as an extension of its ongoing programme for ASEZA.

Coral Health

The damage valuation – Section 8 – takes into account the damage during construction of the port only. Any damages which occur during operation will constitute infringements which will be dealt with by ASEZA via its normal industrial inspections programme, and may incur costs from the Ports Operator.

We are recommending that a post-construction survey of the corals in Dirreh Bay, and in the bay north of the Industrial Terminal is conducted. This need not be a detailed

mapping survey like the MSS 2006 work, but could be a fast visual inspection and photographic record, perhaps of 10 specific indicator points. The post-construction inspection would then act as a baseline state of the corals against which annual surveys could be compared.

We recommend an annual – 1 day – inspection to be carried out in order to build up a picture of the coral health during operation of the port. Given that the corals need to be monitored monthly by a scientifically qualified diving team to access their status, it is recommended that MSS be contracted for this.

Port Reception Facilities

The monitoring of port reception facilities includes three tasks:

- Monitoring the ability of the port reception capability to receive wastes. Inspections of port reception facilities should be undertaken daily or as often as necessary to ensure that there is sufficient capacity to receive the wastes from ships that are scheduled to arrive in port over the following 24 hours or before the next inspection in the case of inspections that are less frequent than daily.
- Monitoring that each type of reception facility is used only for the wastes that it is intended to receive. In the event that reception facilities receive wastes other than the wastes that they are intended to receive, follow-up actions should be taken – as feasible – to identify who is responsible for the misuse of the facility and to educate them regarding proper use of the facility; continued misuse of a port reception facility may result in more severe compliance measures (e.g. fines).
- Monitoring the fate of wastes placed in port reception facilities ensuring that wastes placed in port reception facilities are transported from the port on a regular basis and are disposed of in an environmentally appropriate manner. For hazardous materials, the Vehicle Log Feedback system identified in Section 8.1 should be used for ensuring proper management of these wastes; this system may be also be applied to the tracking of other wastes if there is evidence that other wastes are not being properly managed after they leave the port.

Environmental Emergency Response Capability

The monitoring of environmental emergency response capability includes the following tasks:

- Verification and inspection of emergency response equipment. Each month, the following should be verified:
 - Absorbents for shore-side spills are located in each hazardous materials storage location, in the proper amount and in proper condition.
 - Booms, dispersants and related equipment for addressing marine spills and discharges are properly located and are available in the proper amount and in the proper working condition.
 - Records of hazardous materials in storage match hazardous materials that are in fact in storage.
 - MSDS information is properly available for all hazardous materials.

In addition, there should be constant liaison with off-site emergency services to ensure that they are properly equipped to respond to emergencies at the port that involve hazardous materials, and that they possess appropriate materials for addressing emergencies at the port that should not be addressed using water.

- Once per year, coordination should be carried out to simulate a response to the following:
 - A marine spill
 - A spill and fire of shore-side hazardous materials.

The simulated responses should involve the full range of staff and entities (including off-site emergency services) and the full range of communications, interfaces and subsequent reporting that would be required in the event that the response was not a simulation.

Phosphate Transportation

- Each truck leaving the loading facility (i.e. the mines or Wadi Yutum) should be visually inspected for spillage. If dust deposits are visible on the truck, the loading facility should be inspected to determine the source of spillage, and the leak repaired.
- Visual observations should be made at the Wadi Yutum Transfer Station during each loading/unloading operation. If any emission to air is observed, the facility should be inspected to determine the source, and steps taken to repair. If the leak is significant the operations using the equipment in question should cease until repairs are made.
- Visual observations at unloading facility at Port during each truck unloading operation. If any emission to air is observed, the facility should be inspected to determine the source, and steps taken to repair. If the leak is significant the operations using the equipment in question should cease until repairs are made.
- Visual observations at conveying in South Port during operation. If any emission to air is observed, the facility should be inspected to determine the source, and steps taken to repair. If the leak is significant the operations using the equipment in question should cease until repairs are made.
- Jetty during loading of ships. If any emission to air is observed, loading should cease, the equipment should be inspected to determine the source, and steps taken to repair. Use of the equipment in question should cease until repairs are made.

Spills Management

Visual observations should be made at each jetty during loading or unloading of ships. If any spillage or leakage is observed, loading should cease, the equipment should be inspected to determine the source, and steps taken to repair. Use of the equipment in question should cease until repairs are made.

Thermal Discharges

If the port is obliged to discharge cooling water in the future, it must monitor in accordance with ASEZA's requirements. Water temperature outside the mixing zone should remain within 3 degrees of the ambient temperature. The MSS has agreements to monitor the outlet temperature from a number of private sector facilities.

Storage of Materials

Normal visual inspection of the port should occur, to pick up any leakage or spillage.

12.0 Institutional and Procedural Arrangements for Environmental Compliance

12.1 Institutional Framework for Environmental Compliance

As part of the Environmental Management Plan (EMP), the detailed layout of institutional framework for environmental management actions during construction and operation will be developed to include the responsible institution and department for implementation of each action, along with reporting structure and frequency, and the final sign-off responsibility for successful implementation of that action.

However, as the name indicates, the governance framework report provides the overall skeleton for delineation of responsibilities of the main parties during the various phases of the project.

The institutional entities that will take on responsibilities are the following:

- **ADC** - the Grantor, responsible for the South Port Development

ADC, as the mandated corporation to develop and manage the strategic assets of the zone, has led the Ports Master Plan Development and the transaction. As such, ADC has designed the master plan, structured the transaction, drafted the TOR, and other related documents. It will manage the transaction process and sign the contract with the SPV.

ADC will continue to be engaged in the subsequent stages of award, namely, the design phase, and the implementation phase. As per its contract with the SPV, ADC will supervise and monitor contractor performance, including compliance with the stipulated performance requirements and the governance system. The nature of contract inspection, supervision, and monitoring will change over the phases and subsequently the related items related to environmental performance.

For contract compliance, inspection, supervision, and monitoring, ADC might carry this directly through a project management unit (PMU), or by appointing a third party.

- **SPV** – the Special Purpose Vehicle representing the successful bidder, who will design, build, finance and operate the new port facilities. The SPV will act as the Client for the subsequent design and construction work. This entity will be selected and created to design, build and operate the project, and will be responsible for:
 - Advancing the design to contract drawings and specifications stage,
 - Preparation of baseline environment report, project description for construction and operation phases, and the construction and operation environmental management plan,
 - Implementing the construction contract(s),
 - For the supervision of the construction contract(s),
 - For the environmental management of the project,
 - For the ongoing management of the port, including all tenants, suppliers, sub-contractors, etc, and

- Communication, reporting, and disclosure during the design and implementation phases, including performance indicators and environmental performance requirements, and EMP implementation.
- **ASEZA** – Planning and Environmental Regulator, is responsible for the approval of the SPV Baseline Environment Study, Construction Method Statement and Detailed Project Description making sure they comply with the Environmental Protection Regulation No. 21/2001 and in particular the provisions contained within the Master Plan Clearance and its EIA. During the implementation phase, and in its regulator capacity, ASEZA will have the ultimate responsibility to ensure environmental compliance of the SPV, as per ASEZA regulations, project clearance requirements and accompanying documents – detailed project description, baseline environment report, and construction and operation EMP. In addition, ASEZA:
 - Will exercise their right to stop work at any time if they believe that the provisions of the EIA are not being met. Work can only resume once ASEZA is convinced mitigation is satisfactory.
 - Is accountable for addressing any applications for approval in a quick and efficient manner, and according to their laws and regulations, so that at no time are they held responsible for holding up the work.
- **Oversight Committee OSC** – As part of project facilitation and coordination, and its commitment to communication and disclosure with stakeholders, ASEZA has decided to form an OSC a committee comprised of representative from ASEZA, ADC, Client Representative, SPV and other required expertise and research institutions as deemed necessary to carry out its mandate. The OSC will act as an advisory and coordinating body during design, construction and operation of the project.

The OSC will act as:

- Resource group on environmental issues and challenges during design, construction, and operation and ways to address these challenges,
- A coordination body to ensure common understanding on SPV performance in meeting the environmental requirements, the construction and operation EMP,
- Review SPV communication and disclosure materials.

Figure 12.1 illustrates the relationship of these parties, with respect to environmental compliance.

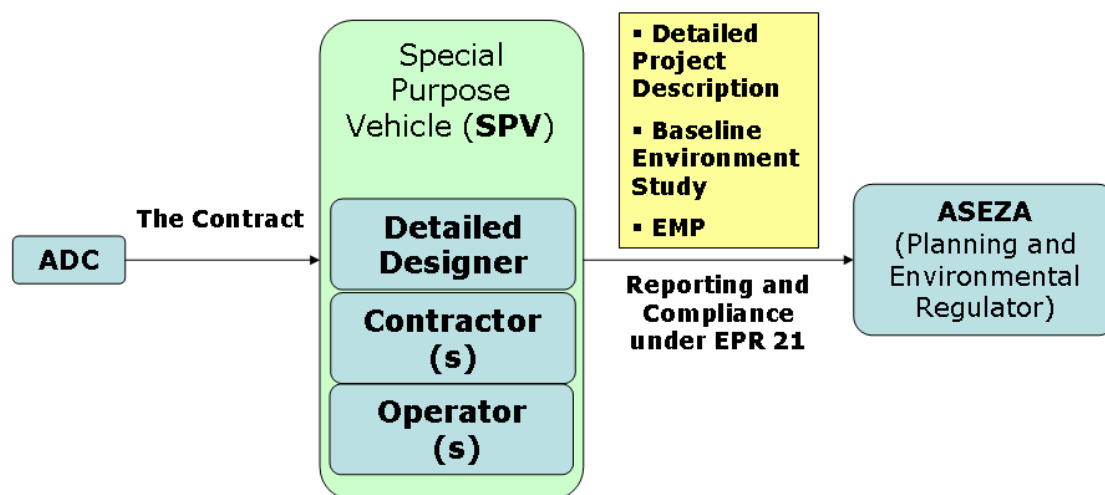


Figure 12.1 Relationship Between ADC, SPV and ASEZA

Clearance (Permitting)

As explained in Section 9, the SPV will act as the umbrella body, and will act on ADC's behalf as the investor, or project developer, in terms of ASEZA's Environmental Clearance requirements. The SPV will submit the Detailed Project Description, the Baseline Environment Statement and the EMP to ASEZA, and will communicate directly with ASEZA regarding clarifications and additional details regarding environmental clearance.

Post Clearance (Post-Permitting)

The SPV will also be the legal entity with which ASEZA communicates with regard to environmental management, reporting, compliance and infringements during the construction and operation phases. The SPV may choose to delegate this responsibility to its agents (contractor, operator(s)) or sub-contractors, but will remain directly responsible to ASEZA for environmental performance.

12.2 Staffing

This section sets out one suitable approach to staffing, with respect to environmental management. However, a refined staffing plan will be required to be submitted by the SPV as part of the Detailed Project Description and the EMP.

12.2.1 Environmental Management Officer (EMO)

The SPV should appoint an individual or team to be responsible for all environmental performance on behalf of the SPV. This individual should be a qualified and experienced engineer, with environmental management experience.

Set Up, Design, Pre-Construction

During the set up period, the EMO will have the following responsibilities;

- Review the environmental performance requirements included in the Contract

- Liaise with all sub-contractors (designer, contractor(s), operator(s)) to develop the Detailed Project Description, a Baseline Environment Statement and the EMP required under the Contract, including;
 - Environmental risk assessments
 - Development of management controls
 - Construction methodology
 - Staffing plan
 - CEMP
 - OEMP
- Submit the Detailed Project Description, a Baseline Environment Statement and the EMP to ASEZA, and liaise with ASEZA to develop them as required

During Construction

During the construction period, the EMO will have the following responsibilities;

- Review the approved CEMP with the relevant responsible individual(s) from the Contractor(s) side.
- Identify the environmental competence requirements for all Contractor(s) staff working on the Project and ensure delivery of environmental training to personnel within the Contractor(s) team. Identify the environmental competence of all contractors working on the Project and advise the SPV senior management as to their suitability.
- Work with the Contractor to develop detailed method statements on environmental management and controls prior to work starting.
- Monitor construction activities and performance to ensure that identified and appropriate control measures are being effective and ensure compliance with the CEMP including monitoring and reporting.
- Recommend actions to ensure non-compliances are fully addressed and corrected in a timely manner.
- Act as main point of contact with ASEZA on environmental issues during construction contract

The Contractor retains overall day-to-day responsibility for Health and Safety, Environmental and Quality performance throughout the construction period. The Contractor must ensure that appropriate resources are made available, and any necessary environmental controls or mitigation measures are implemented.

All construction and installation activities including those carried out by subcontractors and suppliers should be supervised, or regularly checked through the completion of site inspections by the EMO and the Contractor. The Contractor remains responsible for environmental management of all subcontractors and for compliance with all environmental requirements including the CEMP.

Environmental deliverables required by the CEMP should be subject to regular inspections by the EMO. These inspections would be used to confirm that:

- Construction works are progressing in accordance with the agreed method statements.
- Hazards and risks have been identified and appropriate protection or mitigation measures are in place, prior to during the implementation of construction activities.
- Construction works have been completed in accordance with the design.

During Operation

During operation, the responsibilities and functions of the EMO should include;

- Prepare the Operator's response to the OEMP, including policies and procedures for environmental management.
- Identify environmental competence requirements for all port staff and user entities and ensure delivery of environmental training to personnel within the Project team.
- Ensure that all sub-tenants and users of the port are familiar with the OEMP and the regulatory requirements.
- Develop detailed method statements on environmental management and controls.
- Work with relevant staff of tenants and commercial entities to implement OEMP actions.
- Provision of advice and liaison with the various actors on the port site to ensure that environmental risks are identified and appropriate controls are developed and implemented.
- Monitor all port activities and performance to ensure that identified and appropriate control measures are being effective and ensure compliance with the OEMP.
- Liaise and coordinate with ASEZA regarding environmental monitoring and compliance

The EMO or his/her staff should be located in an office close to the South Port berths, and be present on site during all loading and unloading operations and other potentially pollutive operations.

Monitoring of noise, vibration, dust and water quality must be carried out in accordance with the CEMP. The Contractor's Environmental Manager must maintain a register of all environmental monitoring and submit monthly monitoring data to the CR as part of the monthly reporting.

12.2.2 ASEZA Representative

As the environmental regulator, ASEZA should have a permanent presence on the South Port site, during both construction and operation.

During Construction

An ASEZA representative should inspect the construction works each week during construction activities. Particular attention should be paid to the marine construction activities, when daily site visits may be required. ASEZA's observations of the process should be designed on a risk basis, based on the method statement and schedule to be developed by the SPV and submitted to ASEZA.

During Operation

It is recommended that ASEZA occupies a small office space on the Port itself, and that one or more individuals from the Environmental Inspection and Compliance Division are present there at regular intervals. Their tasks should include;

- Observing the operations
- Receiving regular reports from the EMO
- Making specific inspections of operations and equipment which are regarded as particular risk points for emissions, leakage or spillage
- Noting non-compliances and reporting these to both the EMO and ASEZA

12.3 Environmental Communications & Reporting During Construction

12.3.1 Monthly Environmental Appraisal & Report

The SPV should carry out a Monthly Environmental Appraisal of the Contractor's environmental performance. A Monthly Environmental Report should be prepared, which would assess compliance with the CEMP. The Report should detail environmental performance for the period, and should include a summary of inspections completed, audits undertaken, complaints and incidents, response measures undertaken to remedy complaints and incidents, and actions underway or to be undertaken to address complaints and incidents, together with timing for achieving compliance with the CEMP with respect to complaints and incidents. Monitoring undertaken for the CEMPs should also be reported.

The SPV should hold a monthly Project Environmental Review Meeting attended by the Contractor and relevant sub-contractors. The Project Environmental Review would;

- Consider the Monthly Environmental Appraisal
- Consider past performance from inspections, audit reports and monitoring data.
- Plan actions required to mitigate forthcoming risks
- Disseminate best practice

12.3.2 Non-Compliances Reporting

Non-compliance products or processes should initiate a Non-Compliance Report from the SPV. The report would identify the nature of the problem, the proposed corrective action, action taken to prevent recurrence of the problem and verification that the agreed actions have been carried out. Normally, a Non-Compliance Report should be submitted within 24 hours of the identification of the non-compliance. However, in cases that demand an immediate response to address the non-compliance incident the SPV should verbally notify the Contractor of the non-compliance. The Contractor should then take all necessary measures to address the non-compliance.

12.3.3 Communication During Marine Works

Because of the sensitivity of the marine environment, the SPV and Contractor are expected to maintain good communications with the marine contractors and emphasise the importance of environmental management throughout the works. Constant visual observation of the marine works is to be maintained, and an agreement and procedures should be in place to stop works in the event of a spillage or excessive sedimentation or other incident.

ASEZA, and possibly the Marine Science Station should be invited to participate in monitoring activities during marine works.

12.4 Developing an Environmental Management System for Operations

Once the port becomes operational, organizational development at the South Port should be undertaken within the context of achieving the implementation of an Environmental Management System (EMS). An EMS has two key components, Environmental Management Plan and Environmental Appraisal.

There are no regulatory requirements for EMS in Jordan. However, the International Organization for Standardization (ISO), in which Jordan is a member, has established international certification standards for the design and implementation of an EMS, referred to as ISO 14000 after the catalogue number of the standard within the ISO system¹⁴. Also JISM has developed a series of standards that address EMS and EA.

ISO 14000 sets out requirements for achieving an EMS. Environmental benchmarks associated with specific ports operations are established through regulatory requirements as reflected in the environmental legal framework for Jordan, and in international treaties to which Jordan is signatory. Specific regulatory requirements are referenced below.

Environmental best practice at ports is achieved by:

- Policy that integrates environment with the business objectives of the port.
- A regulatory framework that provides the necessary allocation of roles, responsibilities and powers to stakeholders to undertake actions to achieve the policy goals.

¹⁴ ISO 14000 encompasses a series of standards on different aspects of EMS; ISO 14001 is the most immediately relevant standard that may be considered for application at ports in Jordan, see www.iso.org

- Development of an EMS that clarifies all aspects of environmental management.
- Clearly articulated environmental performance criteria and objectives for all operational aspects of the port.
- Monitoring and follow up to ensure that objectives are met.

The Ports Operator should be appropriately supported with administrative and information technology (IT) staff and equipment at a level to ensure that the Operator is able to efficiently and effectively carry out its duties, submit timely reports to senior management, monitor environmental performance and follow-up where necessary to ensure proper environmental performance. The mainstreaming of environmental performance into port operations will also require internal and external communications to ensure that corporate, regulatory and public stakeholders are properly informed of the environmental performance of the port.

The SPV may be supported by an administrative staff person who will be responsible, under the direction of the SPV, for the administrative tasks. Specifically, he/she will be responsible for setting up and maintaining a filing and records management system, including filing and records management of internal departmental data and information, correspondence, and information/data transmitted to or received from other Ports departments, port tenants and commercial entities, ship operators, regulatory and government entities, and the public.

The SPV should also be responsible for coordinating efficient and effective communication of environmental data and information to appropriate stakeholders on a routine and regular basis. Specifically, the SPV will ensure the following:

- The preparation and submission to ASEZA of quarterly Environmental Performance Reports that briefly summarize activities during the reporting quarter, deviations from environmental requirements or planned/agreed performance by the Operator, ship operators or by tenants or commercial companies operating on the port property, actions and follow-up monitoring undertaken to ensure that identified deviations are corrected, and the results of corrective actions.
- The preparation and submission to ASEZA of an Annual Environmental Performance Report (AEPR) that summarizes:
 - (i) the environmental performance of port and related operations with reference to the OEMP and environmental requirements and goals;
 - (ii) communications actions taken by the SPV with external audiences;
 - (iii) priorities (including capacity building) for the coming year;
 - (iv) environmental expenditures (capital, operating and personnel) and benefits as a result of actions taken to implement the EMP;
 - (v) identification of projected capital, operating and personnel costs for the coming year; and
 - (vi) specific senior management decisions or support requested to facilitate achievement of priorities for the coming year.

12.5 Training and Skills Building

12.5.1 Training of Construction Staff

The raising of environmental awareness is viewed as a crucial element in the appreciation and implementation of the CEMP. As a consequence, all key staff should undergo environmental awareness training. A project specific training plan that identifies the competency requirements for all personnel allocated with environmental responsibilities should be produced by the SPV.

12.5.2 Training for Operation

The Ports Operator should retain specialist expertise to work with the SPV to prepare a Training and Skills Building Program which includes training and skills building with respect to monitoring the environmental performance of port tenants and commercial entities as well as those of the port operator.

Training relevant to all environmental supervision personnel should be identified in the training plan. The scope of the training should encompass technical, administrative, reporting and budgeting aspects of environmental management, as appropriate to the individuals to receive training and skills development. The definition of specific training and skills development should be based on a needs assessment and should avoid duplication of knowledge and skills that staff already possess.

The Training and Skills Development Program will be presented to identify the capacity development modules that will be delivered in support of the training and skills development of each individual. The core content of each module will be summarized, the existing level of competency of the individual will be summarized based on the needs assessment, and the results to be achieved from delivery of each module will be identified. The Training and Skills Development Program will organize the recommended initiatives into an implementation framework over a 3 year period and will recommend the delivery mechanisms for the Program and the costs of its implementation.

A study tour by senior managers within the Port should be organized as an early initiative of the Training and Skills Development Program. The Study Tour should visit an appropriately sized port with an effective EMS and should have as its overall objective the gaining of first-hand experience regarding the application of environmental management initiatives in a well-managed port setting.

12.6 Compliance

12.6.1 Introduction

This Section sets out a recommended compliance framework associated with the development and operation of the South Port. It is recommended that this is reflected in the tender documents and the eventual contract with the ports contractor and operator. The framework presents;

- Requirements to ensure proper environmental management associated with port development, port operation and ships using the port.

- Communications are identified that will ensure that entities with environmental responsibilities are aware of their responsibilities.
- A strategy for achieving compliance with the required environmental actions. The strategy is pragmatic:
 - It builds on – and adopts the compliance frameworks of – existing legislation (e.g. ASEZA Environmental Protection Regulation No. 21 of the year 2001 and a range of international legislation to which Jordan is a party and that is generally administered through the International Maritime Organization - IMO) and environmental management mechanisms that are already in place (e.g. operating permits that are required by ASEZA).
 - It incentivizes compliance in the port construction phase by linking proper environmental performance by the contractor (and by contractor staff, sub-contractors and suppliers) to the payment of the contractor for the performance of the contract; i.e. the contractor is required to perform the identified environmental actions in order to be paid.
 - Where appropriate, it provides for the ports construction contractor to be notified of non-compliance in a manner that allows the contractor to address infractions without penalty. However, repeated infractions of a similar nature will result in stronger compliance measures.
 - It provides for a range of ‘guidelines’ issued by IMO over the past several years with respect to environmental management of shipping to be integrated into the Jordanian legal framework and, in so doing, provide them with the force of law
- Key legal strengthening and capacity development requirements in order to achieve effective environmental management, particularly with respect to the shipping and the shipside/landside interface.

Key aspects of the compliance strategy are as follows:

12.6.2 Construction & Port Development

General Requirements and Compliance

The environmental requirements for the port development will be specified in the tender documents. The contractor will then propose overall methodologies and accountable staff to ensure compliance with these requirements, which will be agreed with the port developer and with ASEZA. Payments to the contractor under the construction contract should be linked to performance of the specified environmental requirements. The contractor will also have responsibilities for the environmental performance of its staff, sub-contractors and suppliers – specifically, to ensure that they are aware of their environmental obligations and are capable of meeting those obligations.

Marine Works and Sediment Management

Measures that require one-time actions by the contractor should be linked to payment under the construction contract: performance of these actions is required in support of payment. Provision is made for notifying the contractor of minor infractions that are not actually causing environmental damages (but which may if they remain unaddressed).

However, the compliance framework provides that more serious infractions that are causing damage - or which are likely to cause damage - should be addressed immediately. The nature of marine works is such that serious damage may be caused inadvertently in a short period of time. Accordingly, provision is made for the application of stop work orders in order to ensure that damages are minimized¹⁵

Materials Storage, Management and Spill Prevention

Generally, a notice of a compliance infraction should first be sent to the contractor regarding materials storage, management and spills. Adequate contractor response to a notice of infraction will be required as a condition of contract payment.

Waste Storage and Management

The contractor will be required to ensure proper storage and management of waste. The contractor will be responsible for establishing a tracking system in cooperation with ASEZA and the Ministry of the Environment. Wastes that are not properly managed in accordance with Jordanian law will be subject to action by ASEZA or its agent(s) to provide proper management of wastes; the contractor will be liable for costs plus a penalty plus the cost of environmental damages where the contractor has failed to ensure proper waste management and actions are taken by ASEZA or its agent to provide proper management. However, the contractor will not be liable for costs associated with improper management of waste by ASEZA or its agent(s).

Environmental Emergency Response

The responsibility of the contractor to prevent environmental emergency situations (including spills) should be set out in the tender documents. The contractor will be required to contractually comply with specific measures to address spills and emergency response, and compliance in these regards will be linked to payment under the construction contract. The contractor will be financially liable for spills/discharges caused by it or its sub-contractors or suppliers.

12.6.3 Port and Vessel Operations

General Port and Vessel Operations

Generally, environmental management associated with land-based port activities may be addressed through existing ASEZA legislation and environmental management associated with ship-based activities may be addressed through various international treaties to which Jordan is a party (particularly MARPOL 73/78 and the SOLAS Convention). However:

- Clarification of roles, responsibilities and accountabilities are required at the ship/port interface. IMO has prepared extensive guidelines in this regard and these are now widely used in the shipping industry and by ports. However, key provisions of these guidelines should be introduced into the domestic legal framework so that ASEZA has a basis to ensure their application.

¹⁵ Alternatives to this approach, such as fines, require longer to implement and do not necessarily stop the damages that are being caused. In many cases, companies view fines as a license to pollute.

- Proper environmental management at ports requires effective actions by terminal operators as well as by the port operator, and legal strengthening and capacity development recommendations are therefore made to enhance the ability of ASEZA to supervise the environmental performance of these operations.

Environmental Management of Marine Vessels

The MARPOL 73/78 and SOLAS Conventions provide a detailed basis for the environmental management of marine vessels. Compliance frameworks are identified in these Conventions and, as outline above, should be strengthened in the Jordanian context by integrating the provisions of guidelines in support of these Conventions into the national legal framework; among other things, this will clarify the Port State authority of Jordan to ensure proper environmental management. In addition, instances of non-compliance should be reported to the IMO and to the Flag State of the vessel.

Environmental Management of Land-side Operations, Including Loading and Unloading

Land-side operations relate to the activities of terminal operators. Generally, environmental compliance associated with these activities can be achieved through application of measures already undertaken by ASEZA through its existing legislation (e.g. through monitoring compliance with conditions set out in operating permits).

Marine Environmental Emergencies, Discharges and Spills

MARPOL 73/76 addresses emergencies, discharges and spills and sets out a rigorous regulatory framework for “special areas” as defined under Annex I and Annex V of the Convention; the Gulf of Aqaba is a “special area” under both Annexes. ASEZA *Environmental Protection Regulation (No. 21 of the year 2001)* provides for actions that ASEZA may take with respect to infractions of “special area” requirements under MARPOL Annex I, but not Annex V. Accordingly, the Regulation should be reviewed and strengthened to fully reflect compliance with all aspects of MARPOL, and penalties for non-compliance should be reviewed in light of current costs and liabilities for addressing environmental emergencies and damages in “special areas”. Compliance in these regards should be a high priority.

Cargo-Specific Requirements

Different cargoes have different environmental management requirements. These can be addressed by ASEZA through its existing permitting and operational review mechanisms. In addition, specific requirements should be integrated into the domestic legal framework from international guidance on the management of these materials; this will provide ASEZA with a stronger and more effective basis for ensuring compliance.

Other Requirements

Effective supervision of the shipside, landside and interface operations of a major port are complex and requires dedicated expertise. ASEZA should codify the regulatory framework for the environmental management of these operations into a set of “*Port State Merchant Shipping and Port Management Environment Regulations*”, consistent with its existing environmental regulation, and should further develop its specialist expertise to address these issues.

¹ “Unsecured storage” is defined to mean storage or placement of materials in a manner that allows them to escape into the environment or to come into contact with each other in normal working conditions, accidental conditions, as a consequence of natural events or any other circumstance. Mechanisms for secure storage to be identified to ASEZA by the contractor to ASEZA’s satisfaction before construction (construction phase) and before port operation commences (operational phase) and these to be monitored.

¹ In addition to the compliance items noted for *Waste Storage and Management*, ASEZA or its agent(s) may at any time contain, remove or otherwise manage any waste materials associated with the project that have not been properly managed on or off the construction site if ASEZA deems that the failure of the contractor to manage waste presents a threat to the environment or to economic activities off-site or to local amenities, and the contractor will be liable for two times the actual cost of the actions undertaken by ASEZA or its agent(s) as well as the cost of any environmental damages that occur directly or indirectly as a consequence of the failure of the contractor or its staff, sub-contractors or service contractors to properly manage waste. The contractor will not be liable for the failure of ASEZA or its agents to properly manage waste.

¹ This provision is in compliance with the *International Convention on Oil Pollution Preparedness, Response and Co-operation*, which defines “oil” to include any form of oil in either its crude state or in a processed/refined state, including LPG, or as a waste.

¹ In addition to the compliance actions identified in *Environmental Management of Marine Vessels*, all instances of vessel or crew non-compliance or of pollution incidents should be reported to the International Maritime Organization and to the flag-state of the vessel(s) in question.

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