

SHAMSUNA 10 MW SOLAR PV POWER PLANT PROJECT
IN
AQABA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
(ESIA)

FINAL

07 August 2014

REV – 1



Document title	SHAMSUNA 10 MW Solar PV POWER PLANT PROJECT IN AQABA – ESIA REPORT
Document short title	Shamsuna 10 MW PV Project in Aqaba – ESIA
Status	REV 1
Date	07 August 2014
Project name	Providing Consultancy Services for Conducting the Environmental and Social Impact Assessment Study for the Shamsuna 10 MW PV Project in Aqaba
Client	Shamsuna Power Company

REVISION RECORD						
Rev. No.	Created By	Internal Review	Date	Submission Status	Reviewed By	Date
Rev 0	Lana Zu'bi	Ra'ed Daoud	18 June 2014	Draft ESIA	Lori Anna Conzo	02 July 2014
Rev 1	Lana Zu'bi	Ra'ed Daoud	07 August 2014	Final ESIA		

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ABBREVIATIONS

AC	Alternating Current
ACES	Arab Centre for Engineering Studies
ADC	Aqaba Development Company
ASEZ	Aqaba Special Economic Zone
ASEZA	Aqaba Special Economic Zone Authority
ATCCO	Arab Towers Contracting Company
ATPS	Aqaba Thermal Power Station
BOO	Build, Own and Operate
CARC	Civil Aviation Regulatory Commission
CdTe	Cadmium Telluride
CEGCo	Central Electricity Generating Company
CO	Carbon Monoxide
CPV	Concentrated Photovoltaic
CSP	Concentrated Solar Power
DBOM	Design, Build, Operate, and Maintain
DC	Direct Current
DoA	Department of Antiquities
DoS	Department of Statistics
E&S	Environmental & Social
EDCO	Electricity Distribution Company
EHS	Environment, Health, and Safety
EHSS	Environmental, Health, Safety and Social
EIA	Environmental Impacts Assessment
EMP	Environmental Management Plan
EOI	Expressions of Interest
EPC	Engineering, Procurement, and Construction
EPGE	EP Global Energy Ltd
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
H&S	Health and Safety
HR	Human Resources
HSE	Health, Safety, and Environment
IBA	Important Bird Area
ICP	Informed Consultation and Participation
IFC	International Finance Corporation
IFIs	International Financial Institutions
IFIs	International Financial Institutions
IUCN	International Union for Conservation of Nature
JPMC	Jordan Phosphate Mines Company
JPRC	Jordan Petroleum Refinery Company
JS	Jordanian Standard
KEMAPCO	Arab Fertilizers & Chemicals Industries Ltd
LLA	Land Lease Agreement
LV	Low Voltage
MCM	Million Cubic Meter
MEMR	Ministry of Energy and Mineral Resources
MoA	Ministry of Agriculture
MoEnv	Ministry of Environment
MoH	Ministry of Health
MoL	Ministry of Labour
MOM	Minutes of Meeting
MOU	Memorandum of Understanding
MV	Medium Voltage
MW	Mega Watt
MWI	Ministry of Water and Irrigation
NEPCO	National Electric Power Company
NO ₂	Nitrogen Dioxide
NTS	Non-Technical Summary

O&M	Operation and Maintenance
OHL	Over-head Line
OHS	Occupational Health and Safety
OHSM	Occupational Health and Safety Manual
OSHA	Occupational Safety and Health Administration
PEA	Preliminary Environmental Assessment
PM ₁₀	Particulate Matter smaller than 10.0 microns in diameter
PM _{2.5}	Particulate Matter smaller than 2.5 microns in diameter
PPA	Power Purchase Agreement
PS	Performance Standard
PV	photovoltaic
RE	Renewable Energy
REOI	Request for Expressions of Interest
RJAF	Royal Jordanian Air Force
RSCN	Royal Society for the Conservation of Nature
SIZ	Southern Industrial Zone
SO ₂	Sulphur Dioxide
SZ	South Zone
TOR	Terms of Reference
TSP	Total Suspended Solids
VTC	Vocational Training Centre
WAJ	Water Authority of Jordan
WWTP	Wastewater Treatment Plant

NON-TECHNICAL SUMMARY IN ARABIC

ملخص غير فني

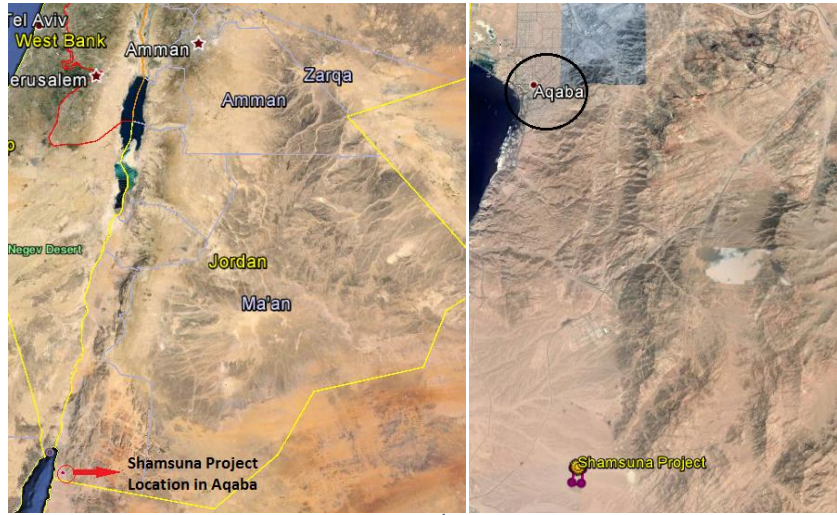
خلفية المشروع

1. عهد صاحب الجلالة الهاشمية الملك عبد الله الثاني ابن الحسين المعظم إلى صاحب السمو الملكي الأمير حمزة بن الحسين المعظم برئاسة لجنة ملكية تعمل على مراجعة وتحديث الإستراتيجية الوطنية الشاملة لقطاع الطاقة بهدف مواجهة التحديات التي تواجه قطاع الطاقة في الأردن.
2. في عام 2007، قامت اللجنة الملكية بتحديث الإستراتيجية وتقديم رؤية تصورية للتطورات في قطاع الطاقة حتى عام 2020، حيث كانت إحدى النتائج الرئيسية الحاجة إلى تنويع مصادر الطاقة وزيادة حصة الطاقة المتجددة إلى 7% في عام 2015 وإلى 10% في عام 2020 – معتمدة بشكل رئيسي على طاقة الرياح والطاقة الشمسية.
3. ازداد قطاع الطاقة المتجددة في الأردن تقدماً منذ دخول " قانون الطاقة المتجددة وترشيد الطاقة رقم (13) لعام 2012" حيز التنفيذ، وذلك وفقاً للإستراتيجية الوطنية المحدثة. لقد أنشأ هذا القانون الأسس التي مكنت القطاع الخاص من تقديم مقترحات مشاريع في مجال الطاقة المتجددة في الأردن إلى وزارة الطاقة والثروة المعدنية.
4. وإلى هذه المرحلة، فقد وقع الإختيار على شركة شمسن لتوليد الطاقة (والمشار إليه بإسم المطور) من قبل وزارة الطاقة والثروة المعدنية لتطوير مشروع طاقة شمسية باستطاعة مقدارها 10 ميغاواط، والمزمع إنشاؤه في الشاطئ الجنوبي في العقبة.
5. وبالرجوع إلى وزارة البيئة، ووفقاً لنظام "تقييم الأثر البيئي رقم 37 لعام 2005"، يتطلب مشروع بهذا الحجم والطبيعة إلى إجراء عملية تقييم الأثر البيئي والاجتماعي من أجل الحصول على التصريح البيئي اللازم للبدء بأعمال الإنشاءات والتشغيل. بالإضافة إلى ذلك، سيسعى المطور إلى الحصول على التمويل اللازم لإقامة المشروع من المؤسسات المالية الدولية - كمؤسسة التمويل الدولية (IFC). لذا سيقوم المطور بتصميم وإدارة مشروعه من خلال تطبيق الممارسات الدولية الجيدة، وكذلك اتباع المواصفات القياسية ذات العلاقة.
6. تعرض هذه الوثيقة النتائج الرئيسية لعملية تقييم الأثر البيئي والاجتماعي للمشروع.

وصف المشروع

(1) موقع المشروع

7. يقع المشروع ضمن منطقة العقبة الاقتصادية الخاصة وتحديداً في الشاطئ الجنوبي والواقع في الجزء الجنوبي من منطقة العقبة الاقتصادية الخاصة بمحاذاة حدود الأردن مع السعودية.
8. يقع أقرب تجمع سكاني إلى الشمال من موقع المشروع على مسافة أكثر من 14 كم ضمن مدينة العقبة ضمن الشاطئ الشمالي. هذا وتوجد بعض الفنادق والمرافق الترفيهية الخاصة بالسباحة والغوص وغير ذلك ضمن مناطق الشاطئ الأوسط والشاطئ الجنوبي مثل تالا باي وشاليهات دائرة المخابرات العامة والواقعة على مسافة 5 كم إلى الغرب من موقع المشروع.



الشكل أ: موقع المشروع

9. تم إعداد مخطط شمولي للشاطئ الجنوبي في 2006 وصنفت هذه المنطقة كمنطقة صناعية (SZ) وهي منطقة ذات تضاريس وعرة مع حوالي 3.5 كم من الساحل في أقصى الجنوب من منطقة العقبة الاقتصادية الخاصة وتقطعها عدة أودية عميقة وواسعة جافة تمتد من الجبال إلى الساحل. يحدها في الجنوب وادي (1) والحدود مع المملكة العربية السعودية، ومن الشرق خليج العقبة، في الغرب من الحدود منطقة العقبة الاقتصادية الخاصة وفي الشمال منطقة عازلة تمتد على طول وادي 2.
10. تعمل عدة منشآت صناعية ضمن المنطقة الصناعية في الشاطئ الجنوبي بما في ذلك: الموانئ الصناعية، وصناعات الأسمدة، ومرافق تخزين المواد السائلة، ومحطة كهرباء العقبة الحرارية. بالإضافة إلى ذلك، تؤوي الميناء الرئيسي كجزء من خطة نقل الميناء الرئيسي من الشاطئ الشمالي إلى الجنوبي في العقبة بالقرب من الحدود الأردنية السعودية. الميناء الرئيسي هو قيد البناء حالياً، ومن المتوقع أن يكتمل بحلول نهاية العام 2014.
11. الموقع المخصص للمشروع هو عبارة عن قطعة أرض بمساحة 180 دونم والتي هي جزء من مجموعة أراضي بمساحة إجمالية 1308 دونم مخصصة لمشاريع الطاقة الشمسية. المشروع الوحيد الذي تم الاتفاق عليه رسمياً مع وزارة الطاقة ومن المخطط تنفيذه هو مشروع شمسنا مدار البحث. وقد حصلت مباحثات سابقة مع مطورين آخرين ولكن حتى الآن لا يوجد شيء مؤكد ورسمي على أرض الواقع.

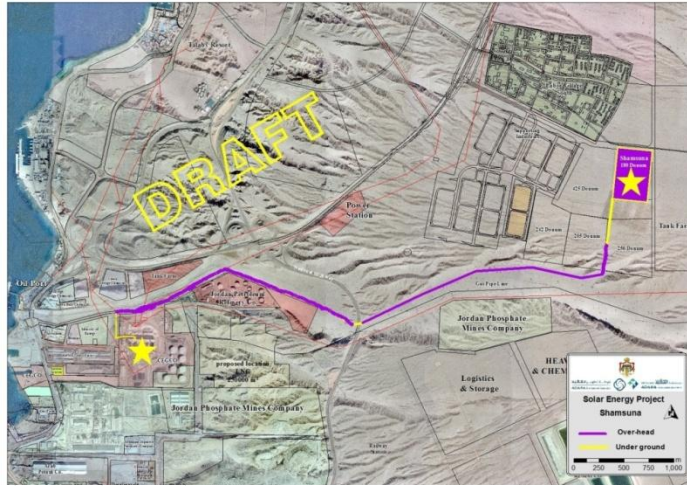
(2) مكونات المشروع

12. مكونات المشروع في الموقع: يتألف المشروع بشكل رئيسي من مصفوفات الطاقة (كما هو مبين في الشكل ب أدناه). بحيث تتكون هذه المصفوفات من عدة ألواح للطاقة الشمسية والتي بدورها تعمل على تحويل الطاقة الشمسية (الأشعة المنبعثة من الشمس) إلى طاقة كهربائية. البنية التحتية والمرافق الأخرى في الموقع وتشمل: منطقة صغيرة للتخزين، سياج حول المنشأة والحماية الأمنية، وشبكة الطرق الداخلية، وخزانات المياه المستخدمة في تخزين المياه لتغطية حاجة المشروع.



الشكل ب: الشكل المثالي لمصفوفات الطاقة والتي تتألف من الألواح الكهروضوئية

13. مكونات المشروع خارج الموقع: خط كهرباء عبارة عن كابلات نقل متصلة من خلال كابل 30 كيلو فولت، مع المحطة التحويلية التي تقع ضمن محطة كهرباء العقبة الحرارية (ATPS). الكابلات سوف تكون خط علوي هوائي مع بعض المقاطع القصيرة تحت الأرض. طول الكابل تقريباً ستة (6) كم. من المهم أن نلاحظ أن مسار هذا الخط هو مبدئي من الممكن تعديله قبل البناء على أساس تقييم الموقع والمسوحات اللازمة ولكن المسار العام هو من خلال المنطقة العازلة في وادي 2.



الشكل ج: الخطة المبدئية لمسار كابل الكهرباء والذي يمتد من موقع المشروع وحتى المحطة التحويلية في محطة كهرباء العقبة الحرارية (شركة تطوير العقبة، 2014)

14. ومن المتوقع البدء بعطاءات هذا المشروع والبناء في أيلول من عام 2014 ومرحلة التشغيل في نيسان من العام 2015 ولمدة 20 عاماً بحسب ما تم الإتفاق عليه مع وزارة الطاقة والثروة المعدنية.

15. يشتمل المشروع على مدار فترات إنشائه وتشغيله على القوى العاملة التالية:

الجدول أ: فرص العمالة المحلية والأجنبية خلال مرحلة إنشاء وتشغيل المشروع (مقاول الهندسة والتزويد والبناء، 2014)

مرحلة الإنشاء	مرحلة التشغيل – دوام جزئي	مقاول الهندسة والتزويد والبناء - ترينا	عمالة أجنبية مهرة
4	1		عمالة أجنبية غير مهرة
0	0		عمالة محلية مهرة
30	1		عمالة محلية غير مهرة
70	5		

(3) مراحل المشروع

16. من المحتمل أن تمر الأنشطة خلال عملية تطوير المشروع في ثلاث مراحل منفصلة: (1) التخطيط والإنشاء، (2) التشغيل و(3) التفكيك. وفي ما يلي عرض ملخص لهذه المراحل:

- **التخطيط والإنشاء:** ويتضمن ذلك إعداد تصميم تفصيلي للمشروع، ونقل مختلف مكونات المشروع إلى الموقع (مثل وحدات الألواح الشمسية)، بالإضافة إلى العمليات التحضيرية لتركيب المصفوفات ومكونات المشروع الأخرى. حيث تشمل أنشطة إعداد الموقع كلاً من الحفريات وتسوية الأرض وتنظيف الموقع وإزالة الطمم (إن وجد) وغيرها؛
- **التشغيل:** يتطلب هذا النوع من المشاريع، العدد المحدود من الأنشطة التشغيلية، حيث تشمل هذه الأنشطة بشكل رئيسي على صيانة المصفوفات ومختلف المعدات الكهربائية بهدف المحافظة على فعالية النظام ضمن الحياة الافتراضية له. وهذا يشمل على سبيل المثال، تنظيف الألواح الشمسية من الغبار والأتربة المتراكمة، والتي إذا ما بقيت ستؤثر على الأداء؛
- **التفكيك:** لم يتم تحديد ما إن كان سيتم نقل ملكية المشروع إلى وزارة الطاقة والثروة المعدنية في نهاية عمر المشروع (وهي 20 عاماً بحسب الاتفاق المبرم بين المطور والوزارة) أم إن كان سيتم تفكيك المشروع بالكامل، حيث أن الوزارة من الممكن

أن تواصل تشغيل المشروع لمدة 5 سنوات أخرى. وفي حال تم الإتفاق على تفكيك المشروع وإزالته، فقد تتضمن عملية التفكيك القيام بفصل وحدات المشروع عن بعضها البعض بهدف التخلص منها نهائياً.

تقييم الآثار البيئية والاجتماعية للمشروع

17. سينتج عن المشروع آثار بيئية وإقتصادية إيجابية مهمة، على المستويين الاستراتيجي والوطني، في ظل التحديات الراهنة التي تواجه قطاع الطاقة في الاردن. من الضروري الأخذ بعين الإعتبار هذه الآثار الإيجابية والتي تتضمن ما يلي:
- يسمح هذا المشروع بالقيام بالمزيد من التنمية المستدامة والتي من شأنها أن تؤكد إلزام الحكومة الأردنية تجاه الاقرار بالاستراتيجية الأردنية للطاقة؛
 - سيساهم هذا المشروع في تأمين المزيد من مصادر الطاقة، من خلال الاعتماد على مصادر طاقة أصيلة والأهم من ذلك أنها مصادر مستقلة في معظمها. حيث أن توليد الكهرباء المتوقع من هذا المشروع سيخدم احتياجات الكهرباء السنوية لأكثر من 10,000 فدر أو يغطي استهلاك ثلاثة فنادق خمس نجوم؛
 - كما سيساهم المشروع في خفض تكاليف توليد الكهرباء بالنسبة إلى كلفة الوقود السائل المستخدم في الطرق التقليدية حالياً. مما يؤدي إلى تقليص في عجز ميزانية الحكومة الاردنية؛
 - تعتبر عملية توليد الكهرباء عبر الخلايا الشمسية عند تشغيلها خالية تماماً من التلوث، مقارنة بالطرق التقليدية المتبعة في إنتاج الكهرباء في الأردن. حيث يُتوقع أن تعمل الطاقة النظيفة المنتجة على التقليل من استهلاك الوقود السائل المستخدم في توليد الكهرباء في الأردن وبالتالي المساعدة في تقليل انبعاث غازات الدفينة وكذلك الملوثات الهوائية الأخرى.
18. ومن ناحية أخرى، سينتج عن إقامة المشروع بعض الآثار البيئية السلبية. وعلى الرغم من ذلك، تشير نتائج دراسة تقييم الآثار البيئية والاجتماعية إلى أن هذه الآثار على درجة ضئيلة من الأهمية ويمكن التخفيف منها، كما هو موضح أدناه.
19. وتطال هذه التأثيرات المحتملة كلاً من الجوانب التالية: المنظر الطبيعي والجوانب المرئية؛ استخدامات الأرض؛ جيولوجية وهيدروجيولوجية المنطقة؛ التنوع الحيوي؛ المواقع الأثرية؛ نوعية الهواء والضجيج؛ البنية التحتية والمرافق؛ الظروف الإجتماعية – الاقتصادية؛ الصحة والسلامة المهنية؛ بالإضافة إلى الصحة المجتمعية، والسلامة والأمن.

(1) المنظر الطبيعي والجوانب المرئية

وصف للوضع الحالي

20. توصف منطقة المشروع بأنها تقع على جرف تتخلله بعض مجاري الأنهار الجافة تتميز بوجود آثار للرسوبيات. موقع المشروع نفسه يتميز بأنه ذا أسطح مستوية مع ارتفاع نحو 360 متر فوق مستوى سطح البحر. يقع الوادي الرئيسي (وادي 2) على مسافة أقل من واحد (1) كم إلى الجنوب من موقع المشروع ويمتد من الجبال الشرقية باتجاه ساحل العقبة إلى الغرب من موقع المشروع.
21. منطقة المشروع تعتبر متدهورة بسبب الأنشطة البشرية السابقة، وهي سمة نموذجية في جبال العقبة حيث تستخدم على أنها مواقع إلقاء عشوائي للنفايات لأنها تعتبر مناطق قاحلة لا يستفاد منها بشكل عام. وقد لوحظ وجود أنقاض بناء، ومرافق مهجورة، وأكياس بلاستيك، وأثاث قديم في موقع المشروع. هذا لا ينطبق تماماً على مسار خط الكهرباء المقترح ضمن وادي 2 حيث تم ملاحظة وجود نسبة وكميات أقل من النفايات.
22. الشكل د و ه أدناه يعرضان التضاريس العامه والمناظر الطبيعية في موقع المشروع بالإضافة إلى الوادي الذي يقع الى الجنوب من موقع المشروع بما في ذلك الغطاء النباتي المحدود.



الشكل د: التضاريس العامة والمناظر الطبيعية حول موقع المشروع (تقرير الوضع الحالي لآثار والتراث في موقع مشروع شمسنا، 2014)



الشكل هـ: أشجار الأكاشيا راديانا المتناثرة ضمن مسار خط الكهرباء ضمن وادي 2 (ECO Consult, 2014)

23. يقع موقع المشروع على جرف وهو على ارتفاع أعلى من الطريق الرئيسي المؤدي إلى حدود السعودية، فضلاً عن الأنشطة الصناعية الحالية والتي تعمل ضمن المنطقة الصناعية الجنوبية.
24. المسار المقترح للكابل الكهربائي والذي يربط موقع المشروع بالمحطة التحويلية الموجودة داخل محطة كهرباء العقبة الحرارية يمتد ضمن وادي 2 والمصنف كمنطقة عازلة حسب خطة استعمال الأراضي للمنطقة الصناعية الجنوبية (الشكل ج). لا توجد أنشطة أو مرافق داخل هذه المنطقة العازلة ويجري حالياً استخدامها لمد خطوط الخدمات والمرافق العامة مثل أنبوب خط الغاز فجر و خط نقل الكهرباء ذا الجهد العالي والذي يمتد إلى شمال الأردن.
25. من الأهمية بمكان ذكر أنه لا توجد مستقبلات حساسة رئيسية في منطقة المشروع والمناطق المحيطة (مثل الأنشطة الترفيهية والمحميات البيئية والمواقع التاريخية أو الثقافية، وغيرها)، وهو يقع ضمن منطقة صناعية ت حيث يوجد العديد من المنشآت الصناعية العاملة، مما يؤدي إلى فقدان القيمة الجمالية والصربية للمنطقة.

تقييم الآثار المحتملة وتحديد الإجراءات التخفيفية

26. تقتصر الآثار الرئيسية المحتملة من إقامة المشروع على المرحلة التشغيلية، والتي تشمل الآثار الناتجة عن رؤية المشروع والوهج، حيث تمت مناقشة كليهما تالياً.
27. إذا ما أخذنا بالإعتبار أعلى إرتفاع للألواح الشمسية (وهو 2 – 3.5 متر فقط)، فيتوقع أن يكون المشروع مرئياً في المنطقة المجاورة، وقد تصل امكانية رؤية المشروع إلى عدة كيلومترات ضمن محيط المشروع فقط، وبالتالي من الممكن ظهور آثار

بصرية. ولكن إذا أخذنا بعين الاعتبار إلى عدم وجود مستقبلات بصرية حساسة في محيط منطقة المشروع، فإن هذه الآثار تكون على درجة ضئيلة من الأهمية. المسار المقترح للكابلات الكهربائي يمتد ضمن وادي 2 والمصنف كمنطقة عازلة حسب خطة استعمالات الأراضي للمنطقة الصناعية الجنوبية ويمر فيه خطوط الخدمات والمرافق العامة مثل أنبوب خط الغاز فجر وخط نقل الكهرباء ذا الجهد العالي والذي يمتد إلى شمال الأردن وبالتالي فلا توجد آثار ذات أهمية متوقعة من جراء تغيير المناظر في وادي 2. المستقبلات الحساسة المحتملة حول منطقة المشروع والأكثر أهمية هي أن المشروع سيكون مرئياً من قبل الأشخاص الذين يستخدمون الطريق الثانوي إلى الشمال من المشروع، ولكن ذلك سيكون مؤقتاً ومحدوداً بوقت المرور في الشارع.

28. ومع ذلك، نظراً لعدم وجود مستقبلات بصرية حساسة رئيسية في المنطقة المجاورة المحيطة بموقع المشروع، تعتبر هذه الآثار ذات أهمية ثانوية.

29. كما ذكر سابقاً، تتمثل وظيفة الألواح الشمسية في تحويل الطاقة الشمسية إلى طاقة كهربائية (عبر امتصاص الإشعاع الشمسي). وعلى الرغم من ذلك، لا يتم امتصاص جميع هذه الأشعة، حيث يتم عكس الجزء اليسير منها، وما يصحب ذلك من احتمالية حدوث وهج، ليس على درجة كبيرة من الأهمية (انظر الشكل و). إن الألواح الشمسية تعكس ضوء الشمس بشكل أقل، واحتمالية حدوث الوهج هي أقل إذا ما قورنت بمواد أخرى مستخدمة على نطاق أوسع، مثل الفولاذ، والزجاج، والبلاستيك، وحتى إذا ما قورنت بسطح الثلج والأسطح المائية. إن التأثيرات على المستقبلات الحساسة التي من الممكن أن تتأثر بالوهج هي تأثيرات مؤقتة، وتتضمن مستخدمي الطريق الثانوي إلى الشمال من المشروع. على الرغم من ذلك، تعتبر هذه التأثيرات ضئيلة ومؤقتة.



الشكل و: صورة توضيحية للوهج الناجم عن الألواح الشمسية

(2) استخدام الأراضي

وصف للوضع الحالي

30. لقد بحثت دراسة تقييم الآثار البيئية والاجتماعية الإستخدامات الرسمية وغير الرسمية (أو الفعلية) لمنطقة المشروع كما هو مذكور أدناه.

31. بحثت الدراسة في الخطط الرسمية الموضوعية لاستخدامات الأراضي في المنطقة، كما هو مقرر من قبل الجهات المختلفة ذات العلاقة (مثل سلطة منطقة العقبة الاقتصادية الخاصة، وشركة تطوير العقبة)، حيث خلصت الدراسة إلى عدم وجود أي تعارض مع تلك الخطط.

32. علاوةً على ذلك، واستناداً إلى المناقشات ذات الصلة مع المؤسسات والحكومية المحلية (مثل سلطة منطقة العقبة الاقتصادية الخاصة، وشركة تطوير العقبة) والمشاورات مع الأشخاص ذوي العلاقة خلال الحلقة التشاورية، فقد اتضح بأن موقع المشروع ليس ذا قيمة لدى المجتمع المحلي ولا يستخدم لأي غرض مثل الأنشطة الزراعية.

تقييم الآثار المحتملة وتحديد الإجراءات التخفيفية

33. وفقاً لما ذكر أعلاه، لا توجد آثار متوقعة من المشروع فيما يتعلق باستخدام الأرض.

(3) جيولوجية وهيدرولوجية المنطقة

وصف للوضع الحالي

34. تبعد حود منطقة المشروع حوالي 600 متر عن نظام تصريف المياه السطحية الرئيسي مما يعطي حماية جيدة من خطر الفيضانات الرئيسي ولكن لا يزال المشروع يقع على مروحة رسوبية بمساحة 4 كم² متصلة بشكل مباشر مع النظام التصريف الجبلي مما يؤدي إلى الحاجة إلى تقييم احتمالية حصول الفيضانات في موقع المشروع. وبالتالي، لا بد من دراسة مفصلة للمخاطر الهيدرولوجية والفيضانات التي يتعين على المطور/المقاول القيام بها من أجل ضمان حماية المشروع ومكوناته من أي خطر محتمل للفيضانات تحديد الإجراءات التخفيفية والاحترازية المناسبة (قنوات التصريف، والعبارات، والحواجز، إلخ).

35. بالإضافة إلى ذلك، بالنسبة لمكونات المشروع خارج الموقع فهي خطوط الكهرباء العلوية/الهوائية والتي تمر ضمن منطقة وادي 2. ستكون المسافة ما بين العمود والآخر هي 100 إلى 120م وهي بارتفاع 5م وبالتالي ليس من المتوقع للفيضانات أن تؤدي إلى تدمير هذه الخطوط إذا ما تم تنفيذها وفقاً لأفضل الممارسات الهندسية. وينبغي أن يكون أساس الأعمدة مدعمة بطريقة فعالة لتجنب تعرية التربة. وجود قاعدة خرسانية أو استخدام عمود مصنوع من الخرسانة سيزيد تحمل الأعمدة لهذه الفيضانات.

تقييم الآثار المحتملة وتحديد الإجراءات التخفيفية

36. وبأخذ ما سبق بعين الاعتبار، وبما أنه لم تتم دراسة خطر الفيضانات على الموقع فإنه ليس من الممكن تحديد المخاطر المحتملة من احتمالية حدوث الفيضانات المحلية خلال موسم الأمطار والفيضانات، وبالتالي فإنه لأغراض هذا التقييم فقد اعتمد التصور أو الإحتمال الأسوأ وهو وجود خطر الفيضانات. ويعتبر مثل هذا التأثير ذا أهمية عالية إلى متوسطة الأهمية.

37. من أجل إعلام المطور والمقاول بخصوص مخاطر الفيضانات في موقع المشروع بهدف الحصول على المعلومات الكافية لتخفيفها من خلال تصميم المشروع، يجب على المطور/المقاول إجراء دراسة المخاطر الهيدرولوجية والفيضانات لموقع المشروع بهدف تحديد كميات الفيضانات ضمن موقع المشروع والتقدير في وقت الذروة، والتي بدورها ستحدد هيكل التصميم الهيدروليكي المطلوبة التي من شأنها أن تكون قادرة على نقل هذه التدفقات بأمان ومنع مخاطر الفيضانات. عند القيام بهذه الدراسة وإدراج مخرجاتها ضمن التصميم، فإنه من المتوقع أن تكون الآثار المتبقية بعد تطبيق الإجراءات الاحترازية لها تأثير ضئيل ذا أهمية قليلة أو معدومة.

38. هنالك بعض الآثار السلبية المحتملة أثناء مرحلتي إنشاء وتشغيل المشروع، والناجمة عن ممارسات غير سليمة (مثل الإدارة غير السليمة لطرح النفايات، عدم تخزين المواد الخطرة بالطريقة الملائمة، إلخ)، والتي قد تؤدي بدورها إلى تلويث التربة ومن ثم تلويث المياه الجوفية. إلا أن دراسة تقييم الآثار البيئية والاجتماعية قامت بوضع الإجراءات التخفيفية الكافية للسيطرة على هذه الآثار، ولضمان اتباع ممارسات التوظيف السليمة على مدار مراحل الإنشاء والتشغيل للمشروع.

(4) التنوع الحيوي

وصف للوضع الحالي

39. تعتبر هذه المنطقة عينة نموذجية من الموائل الموجودة في جبال العقبة والأودية الموسمية. الموقع لديه الحد الأدنى من الغطاء النباتي وهناك تدهور ملحوظ لمنطقة المشروع وللغطاء النباتي بسبب الأنشطة البشرية السابقة، وهي سمة نموذجية في جبال العقبة. وقد لوحظ وجود أنقاض بناء، ومرافق مهجورة، وأكياس البلاستيك، وحتى الأثاث القديم في الموقع. هناك تغطية منخفضة جداً للنباتات في موقع المشروع (أقل من 1٪)، بما فيها النباتات الخشبية وغير الخشبية المعمره مثل (*Ochradenus baccatus*), (*Lycium shawii* and *Acacia raddiana*).

40. أما في مسار خط الكهرباء فإن الوضع الحالي للتنوع الحيوي مختلف حيث أن المسار يقع على طول واحد من الأودية الجافة والتي تتدفق غرباً إلى خليج العقبة، حيث تبين وجود كميات قليلة من النفايات في منطقة وادي 2 والتأثير البشري محدود. التنوع الحيوي في الجزء العلوي من مسار خط الكهرباء مشابه له في الأودية الجانبية والتي تصب في خليج العقبة مع وجود غطاء نباتي محدود من أشجار الأكاسيا. بالإضافة إلى ذلك توجد نسبة تغطية عالية من النباتات الحولية والسبب في وجودها خلال وقت الدراسة هو أحدث السيول التي نتجت عن الأمطار الغزيرة الأخيرة في جنوب الأردن.
41. وبالإضافة إلى ذلك فإن جميع النباتات والحيوانات والطيور التي من الممكن أن تتواجد في هذا الموقع لا تحظى باهتمام كبير، وهي من الأصناف الشائعة في مثل هذه الموائل.
42. ويقع موقع المشروع وخط الكهرباء داخل منطقة مهمة للطيور في العقبة (IBA) بناءً على المناطق التي حددتها الجمعية الملكية لحماية الطبيعة (RSCN). استناداً إلى الأداة التي أعدتها حياة الطيور الدولية (BirdLife International) والتي هي عبارة عن خريطة حساسية الطيور المحلقة المهاجرة، أفاد التحليل أن المنطقة لديها "مكانة عالية جداً" فيما يتعلق بالحساسية للطيور المحلقة المهاجرة بما يخص طاقة الرياح.
43. بغض النظر عن موقع المشروع ضمن منطقة مهمة للطيور (IBA)، فعلى الأغلب أن الموقع لا يوفر قيم خاصة مميزة للطيور المقيمة أو المهاجرة وذلك بسبب عدم وجود الغطاء النباتي ومصادر المياه. من ناحية أخرى، فإن الموقع المقترح لمسار خط الكهرباء والذي يمتد على طول وادي 2 هو منطقة نموذجية للعصفوريات التي تستخدم المنطقة للبحث عن الطعام، والإستراحة، والمبيت أثناء مواسم الهجرة وأيضاً لبعض أنواع الطيور المقيمة. هذا يرجع أساساً إلى تغطية أشجار الأكاسيا الذي يوفر تغطية مثالية ويوفر مواقع للإستراحة بشكل عام. كما توفر الأشجار مصدر كبير للغذاء لأنها توفر الحشرات اللاقاريات والزواحف لعدة أنواع من الطيور، مثل الصرد. باختصار، فإن تواجد أشجار الأكاسيا على طول هذه الوديان يوفر ممر ومحطة إستراحة مثالية لبعض أنواع الطيور المهاجرة لقضاء بعض الوقت في الموقع للتزود بالغذاء والراحة قبل مواصلة رحلة هجرتها.
44. أما فيما يتعلق بوجود الموقع ضمن منطقة مهمة للطيور (IBA)، تجدر الإشارة إلى أن السبب الرئيسي لذلك هو الطيور المحلقة التي تم تسجيلها في المنطقة بشكل عام وليس بالقرب من الموقع. وسجلت معظمها إلى الشمال من موقع المشروع بالقرب من مدينة العقبة وعلى طول وادي عربة. الدراسات الوحيدة التي غطت منطقة الدراسة هي التي تمت من قبل الجمعية الملكية لحماية الطبيعة (RSCN) في عام 2002 والتي لم تسفر عن أرقام عالية من الطيور المحلقة في موقع المشروع وبينت الدراسة السابقة أن معظم الأنواع التي تم تسجيلها هي طيور على درجة أقل من الأهمية ولكن سجل نوع واحد فقط مصنّف على أنه مهدد بالانقراض.
45. وبالإضافة إلى ذلك، فإنه واستناداً إلى المسح الذي تم في موقع المشروع فقد تم تسجيل عدد قليل من أنواع الطيور المقيمة خلال الزيارة الميدانية. وتعتبر كافة الأنواع المسجلة على درجة أقل من الأهمية وذلك وفقاً لقائمة IUCN الحمراء للأنواع المهددة، وتعتبر هذه الأنواع شائعة لهذه الموائل في المنطقة بشكل عام. لم تسجل أية علامات لوجود أعشاش أو أنشطة تكاثر ضمن موقع المشروع نفسه على الرغم من إجراء المسح في نهاية موسم التكاثر (والذي يستمر في الفترة من لآذار حتى منتصف أيار). ولكن نظراً لبيئته، هناك احتمال أن المسار المقترح لخط الكهرباء قد يستخدم لأنشطة تكاثر.
46. بناءً على مناقشات مع الجمعية الملكية لحماية الطبيعة (RSCN) لأغراض دراسة تقييم الأثر البيئي للمشروع مدار البحث، تم التوصل إلى أن تراجع حالة البيئة بشكل عام في موقع المشروع بسبب الأنشطة الصناعية ضمن المنطقة الصناعية الجنوبية مما أثر سلباً على التنوع الحيوي في موقع المشروع. بالإضافة إلى ذلك، فإن تعيين منطقة مهمة للطيور (IBA) في الأردن كان قد تم من قبل الجمعية في عام 1998 وهو يحتاج إلى تحديث بسبب التغيرات الكثيرة التي حدثت في البيئات والموائل الطبيعية منذ عام 1998، وبالتالي فإن العديد من المناطق لم تعد تعكس أهميتها كمناطق مهمة للطيور (IBA). بينت الجمعية أنها لا تمنع إقامة مثل

هذا النوع من المشاريع كون أن منطقة العقبة الاقتصادية الخاصة وشركة تطوير العقبة كانت قد خصصت موقع المشروع لمشاريع توليد الطاقة وأنها ليس لديها متطلبات إضافية يجب أن تؤخذ في الاعتبار.

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47. تتركز الآثار الرئيسية المتوقعة على التنوع الحيوي في المنطقة خلال المرحلة الإنشائية. حيث يتضمن ذلك، الآثار المترتبة جراء القيام بأنشطة تحضير الموقع بهدف تركيب مصفوفات الألواح الشمسية حيث أن الأنشطة الإنشائية قد تؤدي إلى تغيير موائل الموقع و أن تكون سبب في اختلالها. ولكن بسبب كون الموقع ذات أهمية بيئية المنخفضة فتعتبر هذه الآثار ضئيلة الأهمية.
48. الموقع المقترح لمسار خط الكهرباء يتميز بتوفر بيئة صحية وأشجار الأكاسيا والتي توفر تغطية مثالية ومواقع للإستراحة بشكل عام وقد تستخدم لأنشطة تكاثر. هناك خطر بأن هذه الموائل قد تتأثر سلباً أثناء مرحلة البناء.
49. المشروع ومسار خط الكهرباء يقعان ضمن منطقة مهمة للطيور ولكن لا يقعان ضمن مناطق محمية أو بالقرب منها. تم تسجيل وجود بعض أنواع الطيور المهددة بالإنقراض ضمن المنطقة المهمة للطيور ولكن على الأغلب أنها لا تستعمل موقع المشروع بالتحديد ومسار خط الكهرباء.
50. تعتبر كل أنواع النباتات والحيوانات والطيور المسجلة ضمن موقع المشروع على درجة قليلة من الأهمية وشائعة في هذه الموائل. واستناداً إلى ما نشر في أبحاث ودراسات سابقة في المنطقة فقد تبين وجود نوعين من الحيوانات الرئيسية الهامة على المستوى الوطني والمهددة بالإنقراض. ومع ذلك، لم يتم تسجيل هذه الأنواع خلال المسح الميداني.
51. بناءً على ما سبق تعتبر الآثار المحتملة على التنوع الحيوي أثناء الإنشاء في موقع المشروع على درجة قليلة من الأهمية وفي مسار خط الكهرباء على درجة متوسطة من الأهمية.
52. هنالك آثار أخرى على التنوع الحيوي أثناء المرحلة الإنشائية والتشغيلية، تلك التي تنطوي على سوء التصرف وممارسات توظيفية غير سليمة من قبل العمال (مثل صيد الحيوانات، والطرح العشوائي للنفايات في الموقع، الخ). لقد وضعت دراسة تقييم الآثار البيئية والاجتماعية الإجراءات التخفيفية الكافية، والهادفة إلى السيطرة على هذه الآثار وضمان حسن التصرف، واتباع الممارسات التوظيفية المناسبة على مدار العمليات الإنشائية والتشغيلية للمشروع.
53. يحدد ما يلي إجراءات التخفيف ليتم تطبيقها من قبل المقاول خلال مرحلة البناء والتي تشمل: إجراء دراسة استقصائية للحيوانات (من خلال خبير تنوع حيوي) قبل بدء البناء لتحديد وجود أي نوع من أنواع الحيوانات الرئيسية ذات الأهمية (الزواحف والثدييات) في الموقع وعلى طول مسار خط الكهرباء المقترح؛ بالإضافة إلى القيام بمسح ميداني في مسار خط الكهرباء قبل الإنشاء للتأكد من عدم وجود أعشاش في منطقة وادي 2، والقيام بعملية بناء المشروع على قدر الإمكان خارج موسم تكاثر الطيور وتجنب أي تدمير لأشجار الأكاسيا على طول ممر وادي 2؛ وتنفيذ تدابير الإدارة السليمة لمنع الأضرار التي لحقت بالتنوع الحيوي.

(5) المواقع الأثرية

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- تخلو منطقة المشروع من أية مواقع أثرية أو أماكن تراثية هامة.

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54. بناءً على ما سبق فإنه لا توجد آثار متوقعة من المشروع على المواقع الأثرية.

55. تتركز الآثار الرئيسية المتوقعة خلال المرحلة الإنشائية. حيث يتضمن ذلك، الآثار المترتبة جراء القيام بأنشطة تحضير الموقع بهدف تركيب مصفوفات الألواح الشمسية. قد تؤدي الإدارة غير السليمة للأنشطة الإنشائية إلى تدمير تلك المواقع المسجلة – يتضمن ذلك على سبيل المثال، الحركة غير المناسبة من قبل الآليات من وإلى الموقع، بالإضافة إلى سوء التصرف من قبل عمال الإنشاءات وما إلى ذلك.
56. إلا أن دراسة تقييم الآثار البيئية والاجتماعية قامت بوضع الإجراءات التخفيفية الكافية بهدف السيطرة على هذه الآثار وضمان إدارة سليمة أثناء العمليات الإنشائية للمشروع لمنع حدوث أي ضرر بتلك المواقع، وكذلك لضمان التصرف السليم من قبل عمال الإنشاءات.
57. وعلاوة على ذلك، فلا تزال هناك فرصة لاكتشاف آثار مدفونة تحت الأرض خلال المرحلة الإنشائية. قد تؤدي الإدارة غير السليمة لهذه المكتشفات (إذا ما تم اكتشافها) إلى تدمير مواقع أثرية قد تكون ذات أهمية تاريخية. على الرغم من ذلك، فقد وضعت دراسة تقييم الآثار البيئية والاجتماعية الإجراءات المناسبة التي يجدر تطبيقها في حال اكتشاف أية آثار تاريخية مدفونة خلال عملية إنشاء المشروع.

(6) نوعية الهواء والضجيج

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58. لقد تم رصد نوعية الهواء ومستويات الضجيج في منطقة المشروع، ولقد أظهرت النتائج بأن نوعية الهواء ضمن الحدود المسموحة للملوثات في الهواء المحيط (كما نصت عليه المواصفة القياسية الأردنية رقم 1140/2006). بالإضافة إلى ذلك، فإن مستويات الضجيج في موقع المشروع هي أيضاً ضمن الحدود المسموحة لهذه المنطقة (كما نصت عليه تعليمات الحد والوقاية من الضجيج لعام 2003).

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59. تتركز الآثار الرئيسية المتوقعة على نوعية الهواء ومستويات الضجيج خلال المرحلة الإنشائية. ويتضمن ذلك الآثار الناتجة عن تنفيذ الأنشطة التحضيرية للموقع. حيث يتضمن ذلك، الآثار المترتبة جراء القيام بأنشطة تحضير الموقع بهدف تركيب مصفوفات الألواح الشمسية. من المحتمل أن ينتج عن هذه الأنشطة انبعاث الغبار، حين سيكون لذلك تأثير مؤقت على نوعية الهواء المحيط. بالإضافة إلى ذلك، يتوقع جراء استخدام الآليات والمعدات حدوث ارتفاع في مستويات الضجيج في كل من موقع المشروع ومحيطه.
60. إلا أن دراسة تقييم الآثار البيئية والاجتماعية قامت بوضع الإجراءات الكافية الهادفة إلى السيطرة على انبعاث الغبار وإخماده، وكذلك إخماد مستويات الضجيج للتخفيف من حدة الآثار المترتبة على ذلك.

(7) البنية التحتية والمرافق العامة

61. يناقش هذا البند البنية التحتية ومرافق العامة وإيصال الخدمات إلى موقع المشروع، ويتضمن ذلك: (1) الموارد المائية والمرافق، و(2) الصرف الصحي، ومرافق طرح النفايات الصلبة والخطرة، و(3) شبكات الطرق، و(4) شبكة الكهرباء.

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- أ. المصادر المائية والمرافق: خدمات إمدادات المياه عن طريق شركة مياه العقبة (AWC) تغطي جميع أجزاء محافظة العقبة بما في ذلك المنطقة الصناعية الجنوبية. ووفقاً للمناقشة مع شركة مياه العقبة، يتم تزويد المنطقة الصناعية الجنوبية بالاحتياجات المائية من خلال اثنين وعشرين (22) بئراً تقع في منطقة الديسي التي تمتد أيضاً مدينة العقبة. هناك شبكة توزيع للمياه تمتد المنطقة الصناعية الجنوبية بالمياه وتخدم مختلف المنشآت الصناعية في المنطقة ولكن لا تصل هذه الشبكة حتى موقع مشروع شمسنا.

- هناك خطة قيد الدراسة حالياً من قبل شركة تطوير العقبة لتوسيع شبكة المياه لخدمة المنطقة في محيط المشروع. وفقاً لشركة تطوير العقبة، فإن تاريخ التنفيذ لا يزال غير مؤكد ولكن من المتوقع خلال السنوات 2014-2015.
- ب. مرافق الصرف الصحي، والنفايات الصلبة، والنفايات الخطرة:
- سيتم في الأغلب التخلص من مياه الصرف الناتجة من هذا المشروع وطرحها في محطة العقبة لمعالجة مياه الصرف الصحي الواقعة في منطقة العقبة الاقتصادية الخاصة؛
 - من المرجح أن يتم التخلص من النفايات الصلبة الناتجة من المشروع إلى مكب العقبة للنفايات البلدية الصلبة ومخلفات البناء إلى مكب العقبة للطمر؛
 - كما سيتم على الأغلب طرح النفايات الخطرة الناتجة من المشروع في مكب سواقه للنفايات الخطرة.
- ج. شبكات الطرق: يتم الوصول إلى المنطقة الصناعية الجنوبية من خلال الطريق الساحلي وهو الطريق الرئيسي الساحلي الذي يربط مدينة العقبة مع مناطق الجذب السياحية ويخصص فقط لاستخدام السيارات الصغيرة؛ والطريق الساحلي الموازي؛ وطريق العقبة الخلفي. يتم الوصول إلى موقع المشروع من خلال طريق ثانوي يربط مباشرة مع طريق العقبة الخلفي.

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- أ. مصادر المياه والمرافق: تتركز الآثار على مصادر المياه ومرافقها بشكل رئيسي خلال مرحلة التشغيل. حيث يمكن لاحتياجات المشروع من المياه أن تؤثر على المستخدمين الحاليين في المنطقة الصناعية الجنوبية. ومع ذلك، فإن احتياجات المشروع للمياه خلال مرحلة التشغيل ضئيلة جداً بما أن الخطة هي استخدام آلية التنظيف الجاف لتنظيف الألواح الشمسية.
- ب. مياه الصرف الصحي، والنفايات البلدية الصلبة: من المتوقع أن تكون كميات الصرف الصحي والنفايات الصلبة الناتجة عن مرحلة الإنشاء والتشغيل ضئيلة جداً ويمكن استيعابها بالشكل الكافي من خلال محطة معالجة مياه الصرف الصحي ومكب النفايات في العقبة.
- ج. شبكات الطرق: سيتم نقل مكونات المشروع إلى ميناء العقبة ومن ثم برأ إلى موقع المشروع. وقد تم تخصيص الطريق الساحلي الموازي وطريق العقبة الخلفي للشاحنات الصناعية الثقيلة وللشحن ولربط موقع المشروع مع العقبة. تم تخصيص طرق أخرى لسيارات الركوب الصغيرة.

(8) الظروف الاجتماعية – الاقتصادية

وصف للوضع الحالي

62. يقع أقرب مجتمع محلي ضمن مدينة العقبة الواقعة على مسافة 14 كم إلى الشمال من موقع المشروع. تتلخص الظروف الاجتماعية والاقتصادية الرئيسية على النحو التالي:
- بناءً على الأرقام الموثقة من قبل دائرة الإحصاءات العامة، بلغ عدد سكان منطقة العقبة الاقتصادية الخاصة تقريباً 103000 نسمة في عام 2010. وفقاً لدائرة الإحصاءات العامة بلغ عدد سكان مدينة العقبة بحلول نهاية عام 2007 الـ 98750 منها 56.1% من الذكور. على الرغم من النمو الواضح في عدد سكان العقبة على مدى العقد الماضي، فإنها لا تزال من أصغر ثلاث مدن في الأردن
 - على الرغم من التطورات الإيجابية عموماً في المجال الاقتصادي على المستوى الوطني، هناك نوعان من التحديات التي تواجه الأردن ومنطقة العقبة الاقتصادية الخاصة بما فيها آثار اجتماعية واقتصادية خطيرة. الأول هو البطالة التي لا تزال مرتفعة في عام 2009، وتقف عند 12.4%. وكانت البطالة بين الإناث الشباب حول ضعف المعدلات الوطنية. بينما تراجع معدل البطالة للرجال في العقبة بين عامي 2003 و 2009 - من 13.3% إلى 10.0%، فقد ارتفع بالنسبة للإناث من 18.0% إلى 23.0%

(ACED، 2010). تضمنت أسباب البطالة عدم التوافق بين المهارات ومستوى التعليم بين أولئك الذين يبحثون عن فرص عمل ومتطلبات سوق العمل. بالإضافة إلى ذلك، معايير العمل للعمالة الأردنية منعتهم من قبول فرص عمل في مجالات معينة وتجنب الوظائف ذات الأجر والأمان الوظيفي المتدنيين أو ذات ظروف العمل غير المرغوب بها (ACED، 2010).

■ يتميز سوق العمالة في العقبة على وجود طلب كبير على العمالة في قطاع النقل والاتصالات تليها البناء والإنشاءات، والتجارة، والإدارة العامة والتعدين / التصنيع. وبين أصحاب العمل وجود صعوبة في ملئ المناصب العليا الإدارية، والوظائف الفنية والمهنية الماهرة، وغير الماهرة في بعض الصناعات (مثل الضيافة والسياحة والبناء) مما اضطرهم إلى التوجه نحو العمالة الأجنبية لملئ بعض المناصب حيث كان أكثر من ربع العمال المحليين من العمالة الأجنبية في العقبة في عام 2007 (ACED، 2010).

■ لا تغطي أي من البرامج التدريبية أو التعليمية القائمة في العقبة أي من التخصصات المتعلقة بالطاقة المتجددة أو مشاريع الطاقة الشمسية. ويرجع ذلك جزئياً لمحدودية متطلبات سوق العمل في العقبة لمثل هذه التخصصات. عادة يتم التنسيق بين الطلب على العمالة وبرامج التعليم والتدريب في العقبة. هذا ويجدر الذكر أنه لا تتوفر الخبرات والمدرسين والمعلمين المتخصصين في العقبة لتلبية الطلب المستقبلي على تنفيذ البرامج التدريبية اللازمة في هذا القطاع.

تقييم الآثار المحتملة وتحديد الإجراءات التخفيفية

63. يتوقع على أقل تقدير أن يتم من خلال المرحلة الإنشائية للمشروع توفير فرص عمل للمجتمعات المحلية في العقبة. حيث سيتم المشروع توفير نحو 100 فرصة عمل خلال المرحلة الإنشائية لمدة ستة أشهر ونحو سبع فرص عمل خلال المرحلة التشغيلية لمدة 20 سنة. كما أبدى المطور التزامه بتوظيف أكبر عدد ممكن من أبناء المجتمع المحلي. هذا، إلى حد ما، يمكن أن يساهم في تحسين البيئة المعيشية لسكانها ورفع مستوى معيشتهم.

64. وعلى الرغم مما ذكر، فقد قدمت دراسة تقييم الآثار البيئية والاجتماعية توصيات للمطور هدفت إلى تعزيز الآثار الإيجابية في المشروع. كما أوصت الدراسة أيضاً باعتماد و تنفيذ خطة عمل مع أبناء المجتمع المحلي بحيث تحتوي كحد أدنى على ما يلي (من خلال سلطة منطقة العقبة الاقتصادية الخاصة، وشركة تطوير العقبة):

■ تحديد عدد فرص العمل التي تستهدف المجتمع المحلي في مرحلة الإنشاء والتشغيل. بحيث تشمل كلاً من العمالة الماهرة وغير الماهرة وتقديم تفاصيل عن المؤهلات والمهارات المطلوبة لكل فرصة عمل وكيفية معالجتها (التدريب، رفع القدرات والكفاءات... إلخ).

■ وضع إجراءات توظيف قائمة على الشفافية وتكافؤ الفرص في إنتقاء الأيدي العاملة من المجتمع المحلي ويشمل ذلك فئة الإناث.

■ تبيان المجالات الإضافية التي يمكن لأبناء المجتمع المحلي الاستفادة منها في المشروع علاوة على الوظائف المتاحة، بشرط توفر الخبرات/المهارات المطلوبة لذلك، مثل التعاقد مع مقاولين محليين، وشراء المواد والمستلزمات من السوق المحلي، إلخ.

■ ومن المهم أيضاً أن ينخرط المطور بشكل مباشر ويساهم في برامج التدريب وبناء القدرات لضمان إمتلاك المجتمع المحلي للمهارات والمؤهلات المطلوبة للمشاركة في فرص العمل في المشروع. وبالإضافة إلى ذلك، الإلتزام بتوظيف الأيدي العاملة الماهرة خلال مرحلتي الإنشاء والتشغيل.

■ أخذ بعين الإعتبار المجالات الإضافية التي تساهم في تعزيز المسؤولية الاجتماعية. وقد يشمل ذلك: (1) تركيب أنظمة شمسية لإنتاج الكهرباء في مرافق المجتمع المحلي (مثل المباني الحكومية، والمساجد، والمدارس، وما إلى ذلك)، (2) توفير برامج المنح الدراسية للطلاب، (3) دعم المؤسسات الأكاديمية المحلية في تطوير برامج أكاديمية في مجال الطاقة المتجددة والطاقة الشمسية.

- ضمان استمرار التواصل بين المطور و أفراد المجتمع المحلي لغايات إلغاء الشعور بالتهميش وتحسين مدى فهمهم للفوائد المجنية من خلال قيام المشروع. كما ينبغي أن تحتوي الإتصالات بين المطور و أفراد المجتمع على المعلومات والتحديثات التي تطرأ على المشروع، مثل فرص العمل، والعطاءات، والخطط الإنشائية، الخ.

(9) الصحة والسلامة المهنية

وصف للوضع الحالي

65. وفيما يتعلق بالصحة والسلامة المهنية، لا يعتبر الوصف للوضع الحالي ذي صلة بالموضوع.

تقييم الآثار المحتملة وتحديد الإجراءات التخفيفية

66. تتخلل المرحلة الإنشائية والتشغيلية من المشروع مخاطر عامة على صحة وسلامة العمال. كذلك المخاطر المرتبطة بطبيعة الأعمال الإنشائية، ومخاطر التعرض لصدمة كهربائية خلال أنشطة الصيانة، وما إلى ذلك.
67. ومع ذلك، فقد تم إعداد دليل إرشادي مفصل في موضوع الصحة والسلامة المهنية للسيطرة على مثل هذه الآثار في مرحلتي الإنشاء والتشغيل. حيث تهدف هذه الإرشادات بشكل عام إلى ضمان صحة وسلامة جميع الموظفين من أجل الحفاظ على سير العمل على نحو مناسب في الموقع وتجنب أي حادث قد يصيب الموظفين.

(10) الصحة المجتمعية، والسلامة، والأمن

وصف للوضع الحالي

68. وفيما يتعلق بالصحة المجتمعية والسلامة والأمن، لا يعتبر الوصف للوضع الحالي ذي صلة بالموضوع.

تقييم الآثار المحتملة وتحديد الإجراءات التخفيفية

69. تقتصر بعض الآثار المحتملة خلال المرحلة التشغيلية على دخول أشخاص غير مرخص لهم بالدخول إلى موقع المشروع. وما قد ينتج عن ذلك من مخاطر محتملة متأتية من مختلف مكونات المشروع (مثل الصدمة الكهربائية، التعرض للمواد الكيماوية والمواد الخطرة، وما إلى ذلك).
70. ومع ذلك، سيعمل المطور على إقامة سياج حول المنشأة بأكملها للتحكم بعبور الأشخاص غير المرخص لهم بالدخول، للسيطرة على هذه الآثار. وبالإضافة إلى ذلك، سيتم توفير موظفي أمن في الموقع على مدار 24 ساعة طوال أيام الأسبوع خلال مرحلة التشغيل.

NON-TECHNICAL SUMMARY IN ENGLISH

NON TECHNICAL SUMMARY IN ENGLISH

Background to the Project

1. His Majesty King Abdullah Ibn Al Hussein II has charged His Royal Highness Prince Hamza Ibn Al Hussein with the presidency of a Royal Commission to update the “Master Strategy of Energy Sector in Jordan”, in order to meet the energy demands and challenges facing the energy sector in Jordan.
2. In 2007, the Royal Commission updated the Strategy and provided a vision for the development of the energy sector till the year 2020, where one of its main outcomes was the need to diversify energy resources and increase the share of renewable energy to 7% in 2015 and 10% in 2020 – with the major share coming from wind and solar power.
3. In accordance with the above, the renewable energy sector in Jordan is gaining momentum since the “Renewable Energy and Energy Efficiency Law No. (13) of the year 2012” entered into force. This law established the basis in Jordan for the submission of renewable energy project proposals by the private sector to the Ministry of Energy and Mineral Resources (MEMR).
4. To this extent, Shamsuna Power Company (hereafter referred to as ‘the Developer’) has been selected by MEMR for the development of a 10 Mega Watt (MW) Solar Power project in the Aqaba Special Economic Zone (ASEZ) in the South of Jordan.
5. In accordance with the ‘Regulation for the Protection of the Environment in the ASEZ No.(21) for the year 2001’, any Energy Generation Industry is categorized as a category two (2) project which require Preliminary Environmental Assessment (PEA). The PEA as required by ASEZA includes all components of a comprehensive Environmental Impacts Assessment (EIA) except for the scoping and disclosure phases.
6. The Developer will be seeking financing for the Project from prospective lenders, including International Financial Institutions (IFIs) – such as the International Finance Corporation (IFC). Therefore the Developer wishes to design and manage the project in accordance with good international industry practice and standards. For the purpose of the ESIA this has therefore been developed in accordance with:
 - IFC Environmental and Social Sustainability Performance Standards (2012);
 - IFC General Environment, Health, and Safety (EHS) Guidelines; and
 - Applicable IFC Industry Sector EHS Guidelines.
7. Additionally, as per the IFC requirements, a consultation process (i.e. scoping and disclosure phase as well as other stakeholder consultations as needed) is also required as part of the ESIA and project development process. Consequently, since this ESIA study includes all constituents of a comprehensive ESIA, it will be referred to as such in all requirements for environmental permitting process.
8. This document provides the main outcomes of the ESIA that was undertaken for the Project and which was prepared in accordance with the ‘Regulation for the Protection of the Environment in the ASEZ No.(21) for the year 2001’ and the IFC “Performance Standards in Environmental & Social Sustainability” and “Environment, Health, and Safety (EHS) Guidelines”.

Project Description

(i) **Project Location**

9. The Project is located within the ASEZ, specifically in the South Port (or the South Zone - SZ- as referred to in the ASEZ Master Plan) of Aqaba which is located at the southern end of the ASEZ adjacent to the border with Saudi Arabia and encompasses the South Port.
10. The closest community is located in the City of Aqaba with the Main Port Area at a distance of more than 14 km north of the Project site. There are a few hotels and recreational facilities used for touristic purposes (i.e. swimming, diving, and other recreational and holiday use) within the Middle and Southern Port Areas (e.g. Tala Bay, and the chalets of the General Intelligence Department) located on the coastline

of the Aqaba Sea at a distance of around 5 km to the west of the Project site. However, these were mainly set up after the establishment of the SZ and the SIZ.

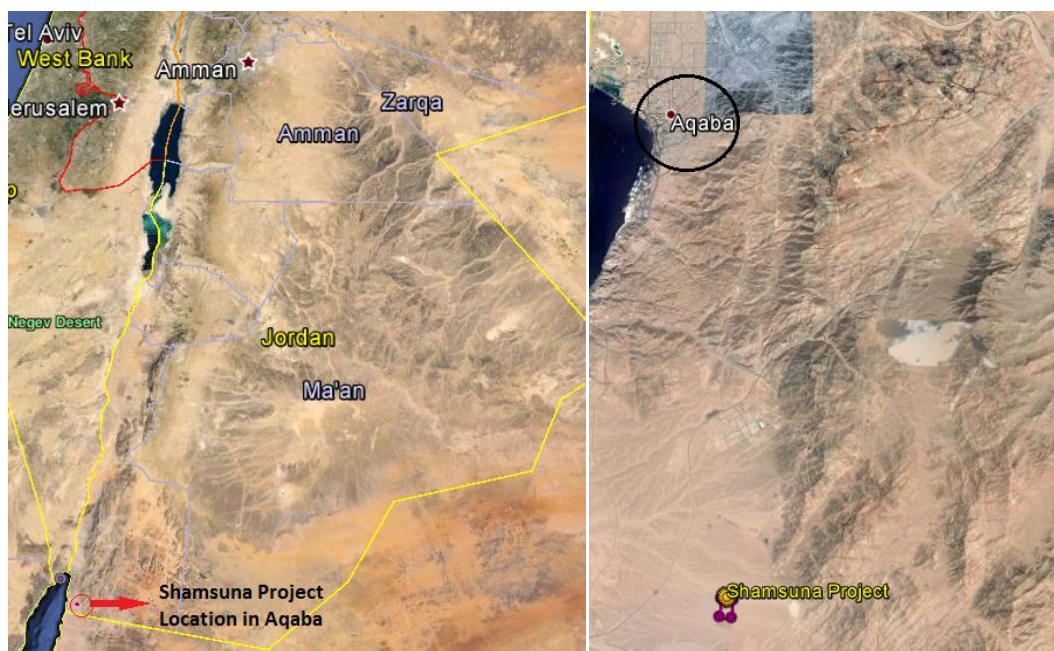


Figure A: Project Location

11. The Master Plan prepared for the South Port (or the South Zone as referred to in the Master Plan) in 2006 officially designated the South Zone (SZ) as an industrial area. The SZ covers 28 km² of rugged terrain with about 3.5 km of coastline in the extreme south of ASEZ. The Zone is crossed by deep and wide wadis (dry river beds) running from the mountains to the coast. It is bounded in the south by Wadi 1 the border with Saudi Arabia, in the east by the Gulf of Aqaba, in the west by the ASEZ boundary and in the north by a designated buffer zone running along Wadi 2.
12. Various industrial establishments operate within the SZ, including: industrial ports and terminals, fertilizer industries, bulk liquid storage facilities and the Aqaba Thermal Power Station. The SZ also harbours the main port which as part of the Port Relocation Plan has been relocated from the Main Port area in the north of the ASEZA area to the southernmost part of the SZ near the Jordan-Saudi Arabia border. The Main Port is currently under construction and is expected to be completed by end of year 2014.
13. The project area for the development of the Project will be around 180 dunums¹ which is part of a 1,308 dunums² land allocated for solar energy projects. The only project currently being planned and implemented is the Shamsuna 10MW PV Project. Discussions with others have been ongoing but to date nothing is definite.

(ii) Project Components

14. Onsite project components: The key onsite project component of the Project includes the power arrays – shown in Figure B below. Power arrays are composed of several Photovoltaic (PV) panels which convert solar energy (radiation from the sun) into electricity. Other onsite infrastructure and utilities include: a small storage area, fencing around the entire facility and security, and internal road network.

¹ 18 hectares

² 130.8 hectares



Figure B: Typical PV Power Arrays Composed of PV Panels

15. Offsite Infrastructure and Utilities: Transmission Cables connected through a 30 kV cable, with the substation located at the Aqaba Thermal Power Station (ATPS). Cables will mainly be overhead with some short underground sections. The length of the transmission cable/line is around six (6) km. It is important to note that this is a provisional transmission line route and could be modified before construction based on site-specific assessment and surveys but will still go through Wadi 2.

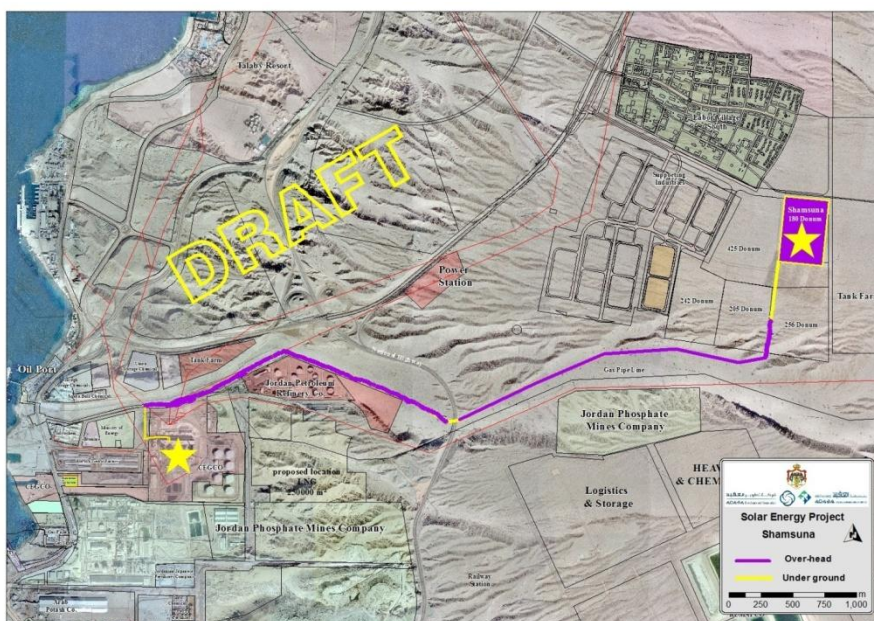


Figure C: Provisional plan for transmission line from the Project site to the substation located at the ATPS (ADC, 2014)

16. The procurement and construction of the PV Project is anticipated to commence in September 2014 and operation of the Project is anticipated to commence from April 2015 for a period of 20 years as agreed with MEMR.
17. The Project will require the following workforce throughout the construction and operation phase:

Table A: Workforce opportunities for local and foreign labour during the construction and operation phases of the Project (EPC Contractor, 2014)

		Construction Period	Operations Period part time- not based on the site
TRINA	Expat / Foreign Skilled Labour	4	1
	Expat / Foreign Unskilled Labour	0	0
TRINA SUBCONTRACTORS	Local Skilled Labour	30	1
	Local Unskilled Labour	70	5

(iii) Project Phases

18. The likely activities to take place during the Project development include three distinct phases: (i) planning and construction, (ii) operation and (iii) decommissioning each of which is summarized below.
- Planning and Construction: this mainly includes preparing a detailed design for the Project, transportation of the various Project components to the site (e.g. PV modules), and onsite preparation

activities for installation of the PV arrays and various other components. Site preparation activities include excavations, grading, levelling, and land clearing activities;

- **Operation:** such a Project requires limited operational activities which mainly include maintenance of the arrays and the various electrical equipment to optimise the energy yield and the life of the system. This includes, for example, regular PV module cleaning to prevent dust build-up which in turn could affect their performance; and
- **Decommissioning:** it is unclear at this point whether at the end of the lifetime of the Project (where according to the agreement between the Developer and MEMR is set for 20 years) MEMR would take ownership of the Project and continue operating it or whether the Project will be completely decommissioned. Anyhow, in the case of the complete decommissioning of the Project, decommissioning activities could include the disconnection of the various Project components for final disposal.

The Environmental and Social Impact Assessment of the Project

19. The Project will result in crucial positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Jordan is facing. Such positive impacts are important to consider and take into account. Such strategic positive impacts include the following:
 - The Project allows for more sustainable development and shows the commitment of the Government of Jordan to realizing its Energy Strategy and meeting the set targets for renewable energy sources;
 - The Project will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The expected electricity generation from the Project is 20GW hours per year, on average; which will serve the annual electricity needs of more than 10,000 individuals or of three (3) large five (5) star hotels;
 - The Project will produce clean energy which will contribute to lowering electricity generation costs when compared to the current costs associated with liquid fuels, and thus leads to a substantial decrease in the Government of Jordan's fiscal deficit; and
 - Generating electricity through PV power is rather pollution-free during operation. Compared with the conventional way of producing electricity in Jordan, the clean energy produced is expected to reduce consumption of liquid fuels for electricity generation in Jordan, and will thus help in reducing greenhouse gas emissions as well as air pollutant emissions.
20. On the other hand, the Project will result in certain negative environmental impacts. Nevertheless, the ESIA concludes that such impacts are generally minor in nature and do not pose any issue of concern and can be adequately controlled and mitigated as presented in details below.
21. Such potential impacts mainly include the following receptors: landscape and visual; land use; geology, hydrogeology, and hydrology; biodiversity; archaeology and cultural heritage; air quality and noise; infrastructure and utilities; socio-economic conditions; occupational health and safety; and community health, safety, and security.

(i) Landscape and Visual

Description of Baseline Environment

22. The Project area can be characterised as being located on an escarpment deeply incised by dry river courses and marked by extensive alluvial deposits. The Project site itself is dominantly of fairly flat surfaces, although it is considered as a very low relief area with an elevation around 360 meters above sea level (m asl). A major wadi (Wadi 2) is located at a distance of less than one (1) km to the south of the Project site and runs from the eastern mountains to the coast of Aqaba to the west of the Project site.
23. The area is severely degraded due to previous human activities, which is a typical feature in the Aqaba Mountains where they are used as dumping sites since they are wrongfully considered as wastelands.

Construction rubble, deserted facilities, plastic bags and even old furniture was observed on site. This was not the same at the proposed transmission line route, where garbage was minimal, still present though, and the only human impact that could be seen was an off-road track.

24. Figure D and Figure E below presents the general topography and landscape of the Project site and the wadi system located south of the Project site along with the limited vegetation coverage, respectively.



Figure D: General view and landscape around the Project site (Shamsuna Cultural Heritage Draft Report, 2014)



Figure E: Acacia raddiana trees across the wadi of the transmission line (ECO Consult, 2014)

25. The Project site is located on the escarpment and is at a higher elevation from the national highway leading to the Saudi Border as well as the existing industrial activities operating within the SIZ.
26. The proposed transmission line connecting the Project to the substation in the ATPS runs within the Wadi 2 which is designated as a buffer zone within the SIZ Land Use Plan (Figure C). No activities or facilities are located within this buffer zone and it is currently being used for extending utilities and service lines such as the Fajr gas pipeline and the HV electricity transmission line extending to the north of Jordan.
27. More importantly, the Project area in general is not known for any key sensitive visual receptors (such as recreational activities, environmental reserves, remarkable historical or cultural sites, etc.) within the surrounding vicinity, and in fact is considered within an Industrial zone in which several industrial establishments are operating; for what its aesthetical value loses some importance.

Assessment of Potential Impacts and Identification of Mitigation Measures

28. The key impacts from the Project development are limited to the operation phase and which include impacts from project visibility and impacts from glare, both of which are discussed below.

29. Given the maximum height of the PV arrays (2 - 3.5m only), the Project is expected to be visible within the immediate vicinity and up to some kilometers around the Project site only, and thus is likely to create visual impacts. The transmission line connecting the project with the substation at the ATPS will run through Wadi 2 which already has the existing infrastructure of a 400 kV transmission line and the Fajr gas pipeline running through it and will therefore not significantly change any views of the Wadi. The most important receptor to which this Project would be visible would be to those using the secondary road to the north of the Project, where such views would be temporary and limited to the time of passage within the area.
30. However, given that there are no key sensitive visual receptors within the surrounding vicinity of the Project site, such impacts are considered to be of minor significance.
31. PV modules, as discussed earlier, convert solar energy (through absorbing radiation from the sun) into electricity. Nevertheless, not all of the incoming sunlight is absorbed and thus a minimal amount of incoming sunlight is reflected, which could be associated with insignificant potential for glare – shown in Figure F below. PV modules reflect much less light and have a lower potential for glare when compared to other materials widely used in other human developments such as steel, standard glass, plastic and even when compared to snow and smooth water. The sensitive receptors which could be affected by glare will be temporarily and include the Secondary road which runs to the north of the Project site. In certain conditions, road users could be temporarily affected by glare as they pass through the area. However, such impacts are minimal and temporary.

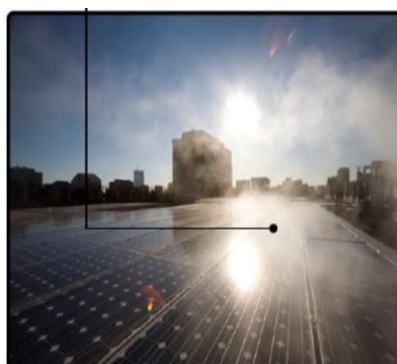


Figure F: Typical Glare from PV Panels

(ii) Land Use

Description of Baseline Environment

32. The ESIA investigated the formal and informal (or 'actual') land use of the Project site area as discussed below.
33. The ESIA investigated the formal land use planning as set by the various institutions (such as the ASEZA and the ADC) and concluded that there is no conflict with such set land use plans.
34. In addition, based on discussions with the relevant local governmental institutions (mainly ASEZA and ADC), it was concluded that the Project site is not considered of any value to the local community and is not utilized for any purpose (such as agricultural activities). Furthermore, the Project area in general is not known for nomadic or semi-nomadic settlements given the natural characteristics of the site and the absence of water resources.

Assessment of Potential Impacts and Identification of Mitigation Measures

35. In accordance with the above, there are no anticipated impacts from the Project in relation to land use.

(iii) Geology, Hydrology, and Hydrogeology

Description of Baseline Environment

36. The project area is around 600 meters from the main drainage system giving a good protection from the main flash flood hazard but still the Project is located on 4km² alluvial fan that is directly connected to the mountainous system giving a need to evaluate the potential runoff for this alluvial fan. Hence, a detailed hydrological and flood risk study is required to be undertaken by the EPC Contractor for the Project in order to ensure that the Project and its components are protected from any potential flood risk and decide whether proper mitigation actions (culverts, gabions ...etc) should be installed to protect the onsite facilities and project components.
37. Additionally, the only offsite components going through the Wadi 2 are the overhead lines. The distance will be 100 to 120m between each pole and these poles are 5m high. It is not normal for floods to destroy the OH transmission line if they are implemented according to best engineering practices. The foundation should have a reinforcement to avoid undercutting and erosion. A concrete foundation or a pole made out of concrete will stand it.

Assessment of Potential Impacts and Identification of Mitigation Measures

38. Taking the above into account and as no flood risk study has been carried out, it is not possible to determine the potential risk of local flood hazards during the rainy season and flash flood events, and so a worst-case scenario of flash flooding has been assumed for this assessment. Such an impact is considered to be of moderate-major significance.
39. In order to inform the Developer and EPC Contractor of any flood risks at the Project site (which will then be able to be mitigated through project design), the Developer shall undertake a hydrological and flood risk study for the Project site with the aim of determining flood quantities within the Project site and peak flood estimates, which in turn will determine the required hydraulic design structure which would be able to convey these flows safely and prevent flood risks. The study will inform the detailed design of the Project and will mitigate the risk of flash floods and therefore it is considered that there will be minimal impact of a minor significance, if not insignificant residual effects.
40. In addition, there are additional potential impacts during the construction and operation phase from improper housekeeping practices (e.g. improper management of waste streams, improper storage of hazardous materials, etc.) which could contaminate and pollute soil which in turn could pollute groundwater resources. However, the ESIA has identified adequate mitigation measures which aim to control such impacts and ensure proper housekeeping practices are implemented throughout the construction and operation phase of the Project.

(iv) Biodiversity

Description of Baseline Environment

41. The area is a typical sample of the habitats of Aqaba Mountains and seasonal wadis. The site has minimal vegetation cover and degraded vegetation cover and the area is severely degraded due to previous human activities, which is a typical feature in the Aqaba Mountains. Construction rubble, deserted facilities, plastic bags and even old furniture was observed on site. The coverage of plants in the Project site was very low (less than 1%), including woody and non-woody perennials, such as *Ochradenus baccatus*, *Lycium shawii* and *Acacia raddiana*.
42. This was not the same at the transmission line route, which is located along one of the dry wadis flowing west into the Gulf of Aqaba, where garbage was minimal (still present though) and the only human impact that could be seen was an off-road track. The upstream part of the transmission line was typical of Aqaba side-wadis that flow into the sea with its healthy coverage of Acacia trees. There was a relatively high coverage of annuals which is mainly due to the latest flash flood that has resulted from the latest heavy rain in southern Jordan.
43. In addition, all fauna species within the Project site are considered of least concern and common to such habitat areas.

44. The Project and the transmission line are located within an Important Bird Area (the Aqaba IBA) as designated by the Royal Society for the Conservation of Nature (RSCN). Based on BirdLife International's Migratory Soaring Bird Sensitivity Map Tool, the analysis reported that the area has a very high status in regard to sensitivity to soaring birds to wind energy.
45. Notwithstanding the Project location within an IBA, the Project probably site does not provide special values for resident or migrant species due to its scarce vegetation and absence of water sources. On the other hand, the transmission line location, which runs along a wadi, is a typical area for passerines that use it for foraging, resting and roosting while on migration and also for resident species. This is mainly due to the Acacia trees cover, which provides perfect cover and roosting spots for passerines in general. The trees also provide a great food source since they provide insects for insect-feeding birds and perching areas for birds that feed on macro-invertebrates and reptiles, such as shrikes. In brief, Acacia trees along these corridor-like wadis provide perfect station for migratory passerine species to spend some time to refuel and rest before continuing their migration journeys.
46. Regarding the location of the site in an IBA, it should be noted that the main reason for the status of the IBA is the soaring birds that were recorded in the area in general and not near the site. Most of these records were recorded to the north of the project site close to the town of Aqaba and along Wadi Araba. The only studies that covered the study area were the studies that were carried out by RSCN in 2002, which did not produce high figures of soaring birds in the project site and most of the species recorded by RSCN in 2002 are considered of Least Concern; but, one (1) recorded species is considered to be Near Threatened.
47. In addition, based on the site survey undertaken for the Project site, few resident bird species were recorded during the field visit. All the recorded species are considered of Least Concern according to the IUCN Red List of Threatened Species, and are considered common to such area habitats. No signs of nests or breeding activities were recorded within the Project site itself although the survey was undertaken generally at the end of the breeding season (which lasts from March till mid May). However, due to its habitat, there is a potential that the proposed transmission line route could be used for breeding activities.
48. Based on discussions with RSCN for the purpose of this ESIA, it has been concluded that the Project site in general is heavily disturbed by the industrial activities within the SIZ and which affects the biodiversity of the Project site; the IBA mapping of Jordan that was done in 1998 needs to be updated due to the many changes that occurred in the natural settings since 1998 and thus many areas no longer reflect their importance as an IBA area; the RSCN does not have any issues of concern in relation to the Project development; and given that ASEZA and ADC have zoned the Project site for PV project developments there are no additional requirements to be taken into account, and such a development is allowed within an IBA.

Assessment of Potential Impacts and Identification of Mitigation Measures

49. The key impact anticipated is during the construction phase. This includes impacts from site preparation activities which are to take place for installation of PV arrays. Such construction activities could result in the alteration of the site's habitat and thus potentially disturb existing habitats. However, given that the Project site is considered of low ecological significance such impacts are considered of minor significance.
50. The proposed transmission line route is less disturbed and has a healthy coverage of Acacia trees which support a number of passerines and are likely to be used for breeding by birds. There is a risk that this habitat may be disturbed during construction.
51. The Project site and proposed transmission line route are located within an IBA, however they are not located within or near areas of critical environment concern (to include environmental reserves and protected areas). The near threatened sooty falcon (*Flaco concolor*) has been recorded in the IBA as have a further 17 soaring bird species, however it is unlikely that they are using the project site and proposed transmission line route.

52. Generally, all recorded flora/fauna/avi-fauna species within the Project site are considered of least concern and common to such habitat areas. However, based on the literature review, two key species are considered important at the national level. This includes the Arabian Hare - which is considered threatened due to hunting activities, and the Spiny Tailed Lizard – which is considered threatened due to hunting activities and extensive harvesting (for collection and selling purposes). However, those species in particular have not been recorded throughout the field survey.
53. Given all of the above, the potential impacts on biodiversity created during the construction phase at the main project site would be of minor significance and along the proposed transmission line route would be of moderate significance.
54. Other impacts on the biodiversity of the site during the construction and operation phase are mainly from improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc). The ESIA has identified adequate mitigation measures which aim to control such impacts and ensure proper conduct and housekeeping practices are implemented throughout the construction and operation phase of the Project.
55. The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include: undertake a fauna survey (through an ecological expert) before construction commences to identify the presence of any key faunal species of importance (reptiles and mammals) onsite and along the proposed transmission line route; Undertake avifauna species (migratory, resident and breeding) prior to construction during fall season 2014 within the proposed transmission line only to ensure that there are no indications of breeding taking place within Wadi 2; undertake construction of the proposed transmission line route outside of the bird breeding season and avoid any destruction of Acacia trees along the wadi corridor; and implement proper management measures to prevent damage to the biodiversity of the site.

(v) Archaeology and Cultural Heritage

Description of Baseline Environment

56. The Project site is devoid of any important or significant archeological or cultural remains.

Assessment of Potential Impacts and Identification of Mitigation Measures

57. Based on the above, there are no anticipated impacts on surface archaeological remains within the site.
58. The main impact anticipated is during the construction phase. This includes impacts from site preparation activities which are to take place for installation of PV arrays. Improper management of construction activities could potentially disturb or damage those sites recorded – this could include for example improper movement of vehicles and machinery into/out of the site, improper conduct by construction workers, etc.
59. However, the ESIA has identified adequate mitigation measures which aim to control such impacts and ensure proper management of construction activities to prevent damage to those sites as well as ensuring appropriate code of conduct by construction workers.
60. Even though highly unlikely, there is a chance that throughout such construction activities, archaeological remains buried in the ground are discovered. Improper management (if such sites are discovered) could potentially disturb or damage such sites which could potentially be of archeological importance. Nevertheless, the ESIA identifies appropriate procedures which should be implemented should such remains in the ground be discovered throughout the construction phase.

(vi) Air Quality and Noise

Description of Baseline Environment

61. Air quality and noise monitoring was undertaken within the Project site to establish baseline conditions. Monitoring concludes that parameters monitored for air quality are within the maximum allowable limits for air quality pollutants in ambient air (as stipulated within the Jordan Standard 1140/2006 - Ambient Air Quality). In addition, noise levels within the Project site are within the maximum allowable limits for noise set for the area (as stipulated within the Instruction for Reduction and Prevention of Noise of 2003).

Assessment of Potential Impacts and Identification of Mitigation Measures

62. The main impact anticipated is during the construction phase. This includes impacts from site preparation activities which are to take place for installation of PV arrays. Such construction activities will likely result in an increased level of dust and particulate matter emissions, which will temporarily impact ambient air quality. In addition, the use of machinery and equipment are expected to be a source of noise and vibration within the Project site and its surrounding.
63. However, the ESIA has identified adequate dust control and suppression measures as well as noise suppression measures to control such impacts.

(vii) Infrastructures and Utilities

64. This section discusses utility and service supply infrastructure to include: (i) water resources and utilities, (ii) wastewater, solid waste, and hazardous waste utilities, (iii) road networks, and (iv) electricity network.

Description of Baseline Environment

- a. Water resources and utilities: Water supply services by Aqaba Water Company (AWC) cover all parts of the Aqaba Governorate including the Southern Industrial Zone. According to discussion with AWC, the SIZ is supplied with its water requirements through twenty two (22) wells located at the Disi area which also supplies Aqaba city. There is a dedicated distribution water network which runs to the SIZ and serves the various industrial establishments within the area. The Project site itself is not served with a direct water connection. There is a plan currently being studied by ADC to expand the water network to serve the area in the vicinity of the Project. According to ADC, the date of the implementation is still uncertain but is expected within years 2014-2015.
- b. Wastewater, Solid waste, and Hazardous waste facilities
- Wastewater from the Project will most likely be disposed at the Aqaba wastewater treatment plant (WWTP) located within the ASEZ;
 - Solid waste from the Project will most likely be disposed at the Aqaba Landfill for municipal solid waste and the Aqaba Debris landfill for construction waste; and
 - Hazardous waste from the Project will likely be disposed at the Swaqa Hazardous Waste Treatment Facility.
 - Road networks: the SIZ is accessed through the Coastal road which is the main coastal road that links the Aqaba City with the touristic attractions and is only allocated for use for small cars; the Parallel Coastal Road (or the National Highway as named by ADC); or the Aqaba Back Road (or the Escape Lane Highway as named by ADC). The Project site is accessed through a direct secondary road which is directly connecting with the Aqaba Back Road.

Assessment of Potential Impacts and Identification of Mitigation Measures

- a. Water Resources and Utilities: Aqaba Water Company will provide water to the site and as the water requirements for the Project during construction and operation (dry cleaning of panels) are minimal it is not considered that the Project will put any constraints on other existing users supplied by Aqaba Water Company.
- b. Wastewater and solid waste facilities: Wastewater and solid waste quantities generated during the construction and operation phase will be minimal and expected to be adequately handled by the WWTP and both landfills in Aqaba.

- c. Road Networks: Project components will be transported to the port of Aqaba and then transported by road to the Project site. The Parallel Coastal Road (or the National Highway) and the Aqaba Back Road (or Escape Lane Highway) are allocated for heavy industrial and shipment trucks and connect the Project site with Aqaba. Domestic traffic uses different roads.
- d. Electricity Network: The Project is expected to entail positive impacts on the electricity network as it will contribute to supplying electricity to the National Grid for end users and help meet the increasing electricity demands throughout the Kingdom. The Project is expected to provide 20 GWh of electricity per year, which is enough to cover annual electricity consumption of 10,000 individuals or three large 5 star hotels.

(viii) Socio-economic Conditions

Description of Baseline Environment

65. The closest community is that within the Aqaba City located at a distance of 14 km to the north of the Project site. The main socio-economic conditions of those local communities can be summarized as follows:

- ASEZ had an estimated population by the DOS of about 103,000 in the year 2010. According to DOS, by the end of 2007, Aqaba city population was 98,750; of which 56.1% are male. In spite of clear growth in the population of Aqaba over the last decade, it is still of the smallest three cities in Jordan.
- In spite of the generally positive developments in the economic sphere at the national level, there are two challenges that face Jordan and ASEZ with serious socio-economic implications. The first is unemployment which remained high in 2009, standing at 12.4%. Unemployment among youth women was about double the national rates. While unemployment declined for men in Aqaba between 2003 and 2009 – from 13.3% to 10.0%, it increased for women, from 18.0% to 23.0% (ACED, 2010). According to ACED (2010), the reasons for unemployment included a mismatch between the skills and education level of those seeking work and the requirements for job openings. In addition, job preferences of Jordanians have discouraged them from accepting positions in certain fields and avoiding jobs with poor wages, poor job security or undesirable working conditions.
- Labour demand in Aqaba is marked by large numbers of employees in transportation and communication followed by construction, trade, public administration and mining/manufacturing. Employers have had difficulty filling senior management positions, professional and skilled technical positions, and unskilled positions in certain industries (e.g. hospitality/tourism, construction). To fill some positions, employers have turned to foreign labour – especially in the construction, hospitality, public services (refuse disposal), and trade areas. More than one-quarter of local workers were foreign in 2007 (ACED, 2010).
- None of the existing training or education programmes within Aqaba cover disciplines related to renewable energy or solar energy projects. This is partly due to the limited requirement in the Aqaba market for such disciplines. Generally, there is a match between labour demand and education and training programs in Aqaba. However, the future demand for engineering and specialists in education cannot be met locally.

Assessment of Potential Impacts and Identification of Mitigation Measures

66. During the construction and operation phases, the Project is expected at a minimum to provide job opportunities for local communities of Aqaba. The Project will create around 100 job opportunities during the construction phase for a duration of approximately 6 months (to include skilled and unskilled labour) ; and around 7 job opportunities during the operation phase to include skilled labour (such as a plant manager,) and unskilled labour (such as module cleaners and security personnel) for a duration of 20 years. The Developer/EPC Contractor has shown commitment to hire to the greatest extent possible local community members. This, to some extent, could contribute to enhancing the living environment for its inhabitants and elevate their standards of living.

67. Nevertheless, the ESIA has provided recommendations to the Developer which aim to enhance such positive impacts. The ESIA recommends that the Developer adopt and implement an action Plan for working with the local community members. The Plan, at a minimum, must consider undertaking the following (through ASEZA and ADC):

- Identify the number of job opportunities targeted to the local community throughout the construction and operation phase, to include skilled and unskilled job opportunities. The developer is expected to provide in details the qualifications and skills required for each job opportunity as well as limitations and constraints of local community members and how they could be addressed (to the extent possible through training, capacity building, etc);
- Present a transparent recruitment procedure for the local community members which should be specified and encouraged in the various construction/operation contracting arrangements. Such recruitment procedures must provide equal opportunity for all, including females;
- Detail additional areas where local community members can benefit or be involved besides job opportunities provided they have the required skills and expertise needed to meet the development standards. For example, during construction the Project shall consider the appointment of local contractors, local sourcing of materials and supplies, etc;
- Consider additional areas where the Developer could implement social reasonability programs. This could include but not limited to the following: (i) installation of residential PV systems for local community facilities such as governmental buildings, mosques, schools, hospitals and health centres, etc (ii) provide scholarship programs for students, and (iii) support local academic institutions in developing academic programs and degrees in PV and renewable energy, (iv) provide educational benefits and attracting visits by local schools, universities and colleges, etc; and
- Ensure timely and continuous communication and dissemination of information between the Developer and the local community members to alleviate potential sense of social marginalization and improve their understanding and perception of the benefits associated with development. Communication should also include information and updates on the Project development, number of employment opportunities, the bidding process for Project components, construction plans, etc.

(ix) Occupational Health and Safety

Description of Baseline Environment

68. With regards to occupational health and safety, a description of baseline environment is considered irrelevant.

Assessment of Potential Impacts and Identification of Mitigation Measures

69. During the construction and operation phase there will be generic occupational health and safety risks to workers, such as working on construction sites, exposure electric shock hazards during maintenance activities, etc.

70. Nevertheless, to control such impacts, a detailed Occupational Health and Safety Manual (OHSM) shall be prepared for the construction and operation phase. Such Manuals aim to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel.

(x) Community Health, Safety, and Security

Description of Baseline Environment

71. With regards to community health, safety, and security, a description of baseline environment is considered irrelevant.

Assessment of Potential Impacts and Identification of Mitigation Measures

- 72.** There is a risk that some construction workers will come from outside Aqaba looking for work which could put pressure on local community services and pose a risk to community health from an increased incidence in communicable diseases. Nevertheless, the EPC Contractor will consider undertaking worker health screening in order to minimise the spread of communicable disease and develop a Code of Conduct for workers to follow.
- 73.** During the operation phase there could be potential impacts mainly limited to trespassing of unauthorized personnel into the Project site and which could result in potential risks from several hazards of the various Project components (e.g. electric shock, exposure to chemicals and hazardous materials, etc).
- 74.** Nevertheless, to control such impacts, the EPC Contractor (Operator) will be installing a fence around the entire facility to control trespassing of unauthorized personnel. In addition, he will ensure onsite guards are adequately trained to deal with trespassing incidents and guards must refrain from using excessive force, unless situation extremely requires so.

1. INTRODUCTION

1.1 Project Background

His Majesty King Abdullah Ibn Al Hussein II has charged His Royal Highness Prince Hamza Ibn Al Hussein with the presidency of a Royal Commission to review and update the “Master Strategy of Energy Sector in Jordan”, in order to meet the energy demands and challenges facing the energy sector in Jordan. In 2007, the Royal Commission updated the Strategy and provided a vision for the development of the energy sector till the year 2020 to become the “Updated Master Strategy of Energy Sector in Jordan for the period (2007-2020)”. One of the main outcomes was the need to diversify energy resources and increase the share of renewable energy to 7% in 2015 and 10% in 2020 – with the major share coming from wind and solar power.

To this extent, and in accordance with “Updated Master Strategy”, the renewable energy sector in Jordan is gaining momentum since a temporary Renewable Energy and Energy Efficiency Law was approved in March 2010 and officially entered into force in April 2012, known as the “Renewable Energy and Energy Efficiency Law No. (13) of the year 2012”. The Ministry of Energy and Mineral Resources (MEMR) is fully committed to substantially progress the development of renewable energy in order to make energy from the sun, wind and other renewable resources an important contribution to the energy supply system of the Kingdom.

This law established the basis in Jordan for the submission of renewable energy project proposals to MEMR. In May 2011, MEMR issued a Request for Submission of Expression of Interest under the Direct Proposal Submission Process (Phase I) by qualified investors interested in investment in renewable energy projects for power generation on build, own and operate (BOO) basis.

Developers have responded at the end of July 2011 by submitting Expressions of Interest (EOI) to MEMR. Following the evaluation of such EOI, MEMR invited the shortlisted developers to enter into a Memorandum of Understanding (MOU) with the objective to undertake all due diligence needed in order to submit a Proposal for the proposed projects.

Only those solar power projects will be selected for further development which offers the greatest benefits to the country. The selection of the solar power projects will be in accordance with the criteria and procedures developed by MEMR and set out in the “Instruction and Requirements for Proposal Preparation and Submission for Solar Power Projects”. Recently, and based on the “Proposal Submission Procedure”, twelve (12) solar photovoltaic (PV) development projects were selected by MEMR for a total capacity of 200 Mega Watt (MW).

Within this context, Shamsuna Power Company has participated in submitting an EOI to MEMR as part of the “Proposal Submission Procedure” for the development of a Solar PV Project within the Aqaba Special Economic Zone (ASEZ). Shamsuna Power Company was selected by MEMR, as part of the twelve (12) solar PV development projects, for the development of a 10 MW PV project, and signed a Power Purchase Agreement (PPA) in March 2014.

Shamsuna Power Company (hereafter referred to as ‘the Developer’) propose to develop a solar PV project of 10MW capacity (hereafter referred to as ‘the Project’). The ESIA is being carried out in accordance with the ASEZA Regulation No. 21 for the Year 2001 ‘Regulation for the Protection of the Environment in the Aqaba Special Economic Zone’ and the IFC Performance Standards (2012)³ and EHS Guidelines.

ECO Consult was commissioned by the Developer to prepare the Environmental and Social Impact Assessment (ESIA) for the Project in order to apply for the necessary environmental permit.

1.2 Project Location& Setting

The Project is located within the ASEZ, specifically in the South Port (or the South Zone - SZ- as referred to in the ASEZ Master Plan of 2001) of Aqaba which is located at the southern end of the ASEZ adjacent to the border with Saudi Arabia and encompasses the South Port.

³International Finance Corporation (IFC) Performance Standards in Environmental & Social Sustainability (January 1, 2012)

The port of Aqaba is located at the north end of the Gulf of Aqaba which connects to the Red Sea through the Tiran Strait. The port comprises the Main Port in the north adjacent to the town of Aqaba, the Middle Port and the South Port which is located just north of the border with Saudi Arabia (Figure 1). The port is the sole maritime gateway to the Hashemite Kingdom of Jordan.

The Master Plan prepared for the South Port (or the South Zone as referred to in the Master Plan) in 2006 officially designated the South Zone (SZ) as an industrial area. The South Zone has been used as an industrial area by ASEZA even before the adoption of the 2006 Master Plan.

The SZ covers 28 km² of rugged terrain with about 3.5 km of coastline in the extreme south of ASEZ. The SZ is backed by land which slopes upward from the shoreline in a series of rugged rock and sand hills to mountains approximately 9 km back from the coast. The Zone is crossed by deep and wide wadis (dry river beds) running from the mountains to the coast. It is bounded in the south by Wadi 1 the border with Saudi Arabia, in the east by the Gulf of Aqaba, in the west by the ASEZ boundary and in the north by a designated buffer zone running along Wadi 2 (Figure 2).

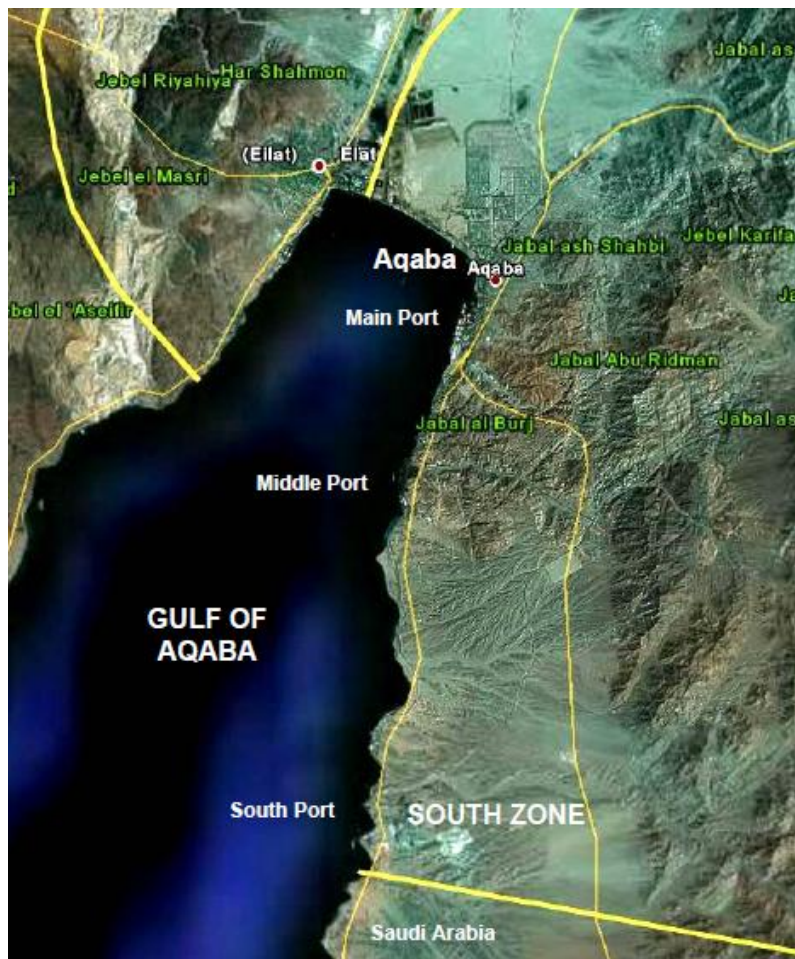


Figure 1: ASEZ Port areas (Royal Haskoning, 2006)

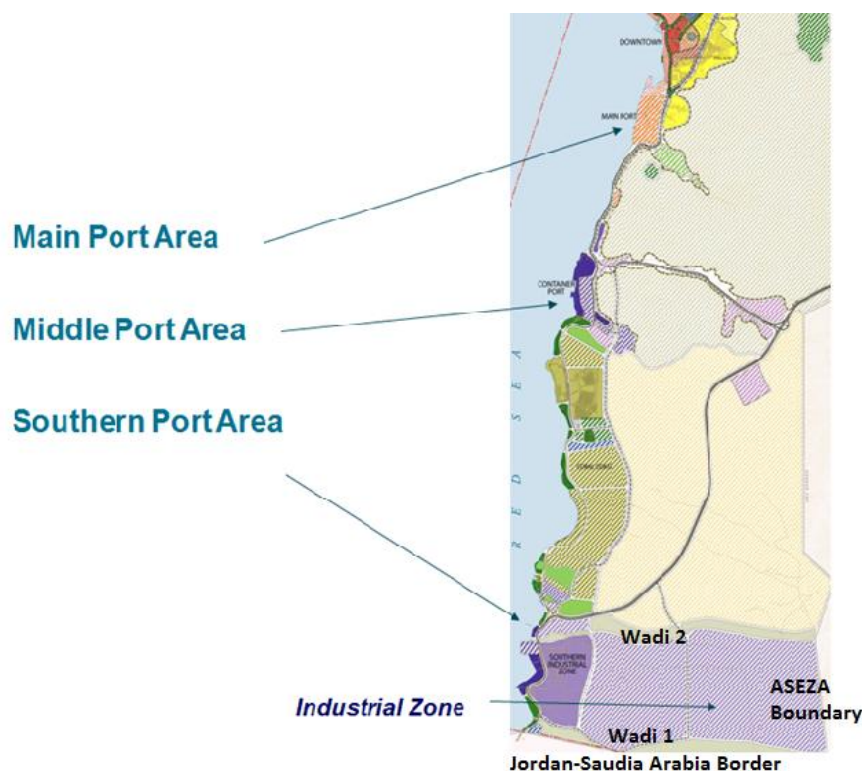


Figure 2: ASEZ Port areas (Aqaba Development Corporation, 2006)

The SZ area is comprised of the land area which is referred to as the Southern Industrial Zone (SIZ) and the coastal area which is the Ports area (or the South Port Community as currently named by ADC). Various industrial establishments operate within the SZ, including: industrial ports and terminals, fertilizer industries, bulk liquid storage facilities and the Aqaba Thermal Power Station. The SZ also harbours the main port which as part of the Port Relocation Plan has been relocated from the Main Port area in the north of the ASEZA area to the southernmost part of the SZ near the Jordan-Saudi Arabia border. The Main Port is currently under construction and is expected to be completed by end of year 2013.

The Project is specifically located within the SIZ. The project area for the development of the Project will be around 180 dunums⁴ (Chapter 2 provides a detailed description of the Project, the Site and its surroundings).

The closest community is located in the City of Aqaba with the Main Port Area at a distance of more than 14 km north of the Project site. There are a few hotels and recreational facilities used for touristic purposes (i.e. swimming, diving, and other recreational and holiday use) within the Middle and Southern Port Areas (e.g. Tala Bay, and the chalets of the General Intelligence Department) located on the coastline of the Aqaba Sea at a distance of around 5 km to the west of the Project site. However, these were mainly set up after the establishment of the SZ and the SIZ.

The Project location and the SZ in addition to the closest community, touristic attractions, and main operating industries in the vicinity of the Project site are presented Figure 3, Figure 4, and Figure 5 below.

⁴ 18 hectares

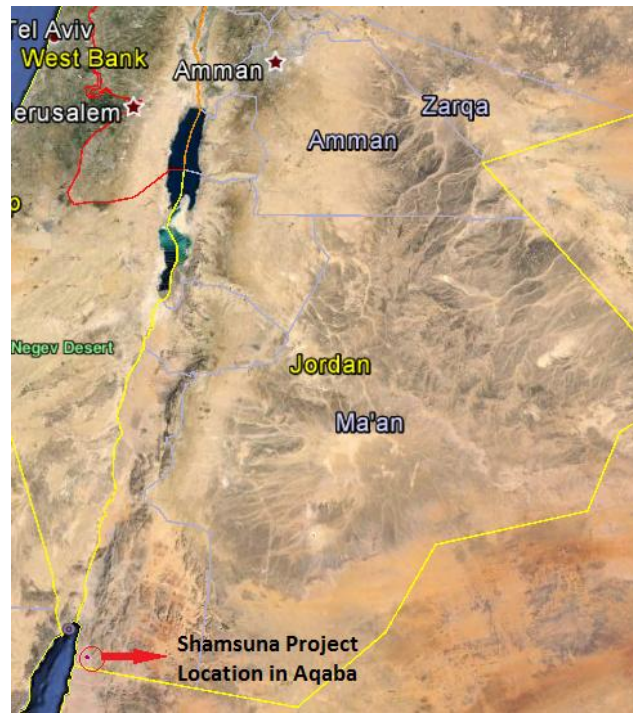


Figure 3: Overview of general Project location within Jordan (ECO Consult, 2014)



Figure 4: Closest Local Communities (ECO Consult. 2014)



Figure 5: Specific Project location within the SIZ - Jordan (ECO Consult, 2014)

1.3 Project Proponent & Key Contributors

Different entities are involved in the planning and implementation of the Project. Responsibilities of each entity are summarized below:

- Shamsuna Power Company: is the Project owner and developer;
- Forsan: partner with the developer;
- EP Global Energy Ltd (EPGE): is a privately owned company specializing in developing renewable energy projects. EPGE are advising Shamsuna Power Company in the development of the project until the financial close phase;
- International Finance Corporation (IFC): Lead Lender
- National Electric Power Company (NEPCO): is the National Electricity Company of Jordan, the Power Off-taker as counter party to the PPA, and, responsible for the high voltage electric grid in Jordan. NEPCO will be responsible for facilitating the connection to the existing grid including all required arrangements (e.g. upgrading existing substation in the Aqaba Thermal Power Station (ATPS);
- Aqaba Development Company (ADC): is the Landlord for Shamsuna Project site. A Land Lease Agreement (LLA) has been signed between ADC and Shamsuna Power Company for leasing the project site for a period of 30 years and are also coordinating the offsite infrastructure and the selected route for the transmission line with all involved parties;
- Aqaba Special Economic Zone Authority (ASEZA): is the statutory institution empowered with regulatory, administrative, fiscal and economic responsibilities within The Aqaba Special Economic Zone (ASEZ). Within the Project, ASEZA is the Planning and Environmental Regulator, responsible for the approval of the Environmental Statement making sure it complies with the Environmental Protection Regulation No.21/2001 and also responsible for granting environmental clearance to developments taking place within the ASEZ;
- Cube Engineering: Owner's Engineer responsible for the following:
 - Design review, tender support, and technical advisory for planning and project development until financial close.
 - EPC management including supervision during construction phase which starts after financial close and lasts till commercial operation date.

- Trina Solar: is the Engineering, Procurement, and Construction (EPC) Contractor as well as the Operation and Maintenance Provider for Project. A Design, Build, Operate, and Maintain (DBOM) Contract is under negotiation between Shamsuna and Trina and accordingly Trina is responsible for preparing the detailed design and layout of the Project; supply of the material and equipment (panels, inverters, etc); construction of the Project and its various components (PV arrays, switchgear, internal access roads, building infrastructure, and medium voltage connections); in addition to Operation and Maintenance for the 20 years operation period. Trina Solar will commission a local subcontractor to do all the civil works and construction on their behalf. Arab Towers Contracting Company (ATCCO) is a potential sub-contractor for the Medium Voltage (MV) cables and full scope of the project;
- ABB: is an international company working in the power and automation technologies sector. ABB is commissioned by Shamsuna to prepare the grid impact study;
- Arab Centre for Engineering Studies (ACES): commissioned by Shamsuna to undertake all required geotechnical studies; and
- Nabarro: Is the international Legal advisors, working with Hadidiand Co as local counsel.
- ECO Consult: hereafter referred to as the 'ESIA Team' who is the ESIA Practitioner and the consultant commissioned by the Developer to prepare the EIA for the Project in accordance with the requirements of the ASEZA and its Environmental Protection Regulation No.21/2001.

1.4 Environmental Clearance Requirements

The ASEZ was launched in 2001 as a duty-free, low tax multi-sectoral development zone encompassing the entire Jordanian coastline (27 km), the seaports of Jordan, an international airport and the historical city of Aqaba. The ASEZ is administratively under the responsibility of ASEZA which is the financially and administratively autonomous institution responsible for the management, regulation, providing municipal services within the ASEZ, and the development of the ASEZ, including issuing environmental permits and granting environmental clearances for projects.

All projects to be established within the ASEZ go through a structured screening process where ASEZA decides whether the projects requires a comprehensive EIA, a preliminary EIA, or does not require neither studies.

The Project must comply with the existing legal context in Jordan, and particularly in the ASEZ, within which it is located.

According to 'Regulation for the Protection of the Environment in the ASEZ No.(21) for the year 2001', any Energy Generation Industry is categorized as a category two (2) project which require Preliminary Environmental Assessment (PEA). The PEA as required by ASEZA includes all components of a comprehensive Environmental Impacts Assessment (EIA) except for the scoping and disclosure phases.

The Developer will be seeking financing for the Project from prospective lenders, including International Financial Institutions (IFIs) – such as the International Finance Corporation (IFC). Therefore the Developer wishes to design and manage the project in accordance with good international industry practice and standards. For the purpose of the ESIA this has therefore been developed in accordance with:

- IFC Environmental and Social Sustainability Performance Standards (2012);
- IFC General Environment, Health, and Safety (EHS) Guidelines; and
- Applicable IFC Industry Sector EHS Guidelines.

Additionally, as per the IFC requirements, a consultation process (i.e. scoping and disclosure phase as well as other stakeholder consultations as needed) is also required as part of the ESIA and project development process. Consequently, since this ESIA study includes all constituents of a comprehensive ESIA, it will be referred to as such in all requirements for environmental permitting process.

This approach has been well received by ASEZA and they provided full support to the Developer and the ESIA Team in holding and arranging for the scoping session. ASEZA invited all relevant stakeholders (to include government and private entities as well as civil society organisations) to participate in the process of scoping of environmental impacts related to the Project. The invitation letters were dispatched to the stakeholders by

ASEZA along with a project brief (prepared and submitted to ASEZA by the ESIA Team) within an appropriate period before the Scoping Session (held on the 20th of May 2014) in order to facilitate the process and ensure an informed discussion during the session. Further details on the scoping session and its proceedings are provided in Chapter 6.

Shamsuna Power Company, as the Developer, is responsible for the preparation of the ESIA. The ESIA is needed to evaluate the environmental and socioeconomic impacts of project-related activities during the construction and operation of the Project.

Shamsuna Power Company commissioned ECO Consult to prepare the ESIA for the Project in order to apply for the necessary environmental permit. This report is the ESIA report to be submitted to ASEZA. This ESIA is undertaken in accordance with ASEZA's environmental permitting requirements and the IFC Performance Standards and EHS Guidelines.

1.5 The Environmental and Social Impact Assessment (ESIA) for the Project

This ESIA report is the third deliverable to be provided to ASEZA as part of the ESIA process. The first two documents included the Pre-Scoping Report in May 2014, prior to a Scoping Presentation held on 20th May 2014 to a range of statutory and non-statutory consultees, and the second, the Scoping Report and Terms of Reference (ToR) for the EIA delivered in June 2014.

This report is the ESIA report that has been prepared and submitted by ECO Consult for the 'Shamsuna 10MW Solar PV Power Plant Project in Aqaba ESIA' – the Project - and presents the results of the assessment of the potential environmental, social and economic impacts of the Project. This report comprises a full detailed ESIA for the 'onsite Solar Power Plant' and a higher level assessment for the proposed corridor for the transmission line to the substation with additional performance requirements identified for the EPC contractor in this regard.⁵

The ESIA report will be submitted to ASEZA as part of an application for acquiring environmental clearance and to the IFC to ensure compliance with their Performance Standards and EHS Guidelines. ASEZA and the IFC will provide comments, and once the ESIA report has been revised and approved, the outcome of this ESIA will be an environmental clearance for the Project in the SIZ.

This ESIA report describes the Project, presents the likely sources of impact, discusses the significance of likely economic, environmental, and social impacts, identifies mitigation and management measures to avoid, minimize or mitigate and compensate for any potential negative impacts and the environmental and social performance requirements for the EPC contractor. The ESIA report also identifies the benefits or the potential positive effects of the Project at the national level in Jordan. The ESIA represents the culmination of a number of technical studies, baseline assessment, evaluation of Project alternatives, and consultation with relevant stakeholders that were based on the 'Scoping and ToR' submitted to ASEZA in June 2014.

1.6 Scope of this ESIA Study

The purpose of the ESIA is to:

- Ensure compliance with the ASEZA regulatory requirements for impact assessment; and relevant international standards and guidelines including those of the IFC;
- Deliver a bankable ESIA to comply with the IFC Principles, identifying and agreeing the relevant applicable Performance Standards and EHS Guidelines;
- Present a description of the Project as a whole, outline the alternatives to the proposed Project, and why the chosen Project option has been taken forward – taking into consideration the environmental effects;
- Assess and analyse available baseline data;

⁵ Should the proposed corridor for the transmission line alter substantially additional studies and assessment may be required.

- Identify gaps and carry out additional field studies;
- Assess the impacts of the Project and its footprint at the National Level in Jordan and at the site specific level in the SIz;
- Identify mitigation measures as well as performance requirements applicable for all phases of the Project (construction, operation, and decommissioning) to minimise/mitigate potential effects;
- Create an Environmental and Social Management Plan (ESMP) to describe the mitigation measures proposed to be implemented to avoid, reduce, remedy, and compensate any significant adverse impacts of the proposed Project and any monitoring requirements. The ESMP also establishes effective interfaces with the regulatory authorities in the region responsible for Project sanction and between the entities involved in the Project; and
- Engage and inform stakeholders of the Project and its potential effects.

This ESIA report is a product of the Project ESIA study. The Report contains a good amount of information and data on the Project components and baseline environment available to date that will allow an understanding of the impacts of the Project on social and environmental parameters, so as to justify the mitigation measures and performance requirements included as part of the ESMP for the Project.

The impact assessment process needs a common understanding of the likely effects of the development. It needs to understand the physical, biological and human dynamics (environmental baseline) in the area in which the Project is to be located and finally to determine the likely significance of the effects (impact assessment). Out of the process come documented decisions on how best to take the Project forward in terms of mitigations and performance requirements to enhance the benefits (an ESMP). The ESMP will form the basis of the Project's management system, to be integrated with detailed design, construction, operation, and ultimately decommissioning.

1.7 Structure of the Environmental Impact Statement

The following table provides an overview of the Chapters within this ESIA document.

Table 1: Summary of the ESIA Content

Chapter	Description of Content
Chapter 2 – Project Description	Provides a detailed description of the Project in relation to its location, the key project components and an overview of the proposed activities that are to take place during the various Project phases.
Chapter 3 – Regulatory & Policy Framework	Provides an overview of the environmental and social regulatory and policy framework applicable to the Project.
Chapter 4 – ESIA Approach & Methodology	Presents the assessment methodology and approach.
Chapter 5 – Project Justification and Analysis of Alternatives	Investigates several alternatives to the Project development in relation to the Project site, chosen technology, Project design, and finally investigates the 'no action alternative' - which assumes that the Project development does not take place.
Chapter 6 – Stakeholder Consultation and Engagement	Discusses the stakeholder consultation and engagement plans which were undertaken as part of the ESIA process for the Project and provides an overview of the findings.
Chapter 7 – Environmental and Social Baseline Conditions	Presents the environmental and social baseline conditions within the Project site and its surroundings in relation to: landscape and visual, land use, geology and hydrology, biodiversity, archaeology, air quality and noise, infrastructure and utilities, and socio-economic conditions.
Chapter 8 – Assessment of Environmental and Social Impacts and Identification of Mitigation Measures	Identifies and assesses the potential impacts from the Project on the various environmental and social receptors. In addition, for each impact a set of mitigation measures have been identified to eliminate or reduce the impacts to acceptable levels.
Chapter 9 – Environmental and Social Management Plan (ESMP) and Compliance Program	Presents the Environmental and Social Management Plan (ESMP) for the Project; which mainly summaries the impacts identified as well as the mitigation measures and monitoring requirements to be implemented throughout the various Project phases. In addition, this Chapter describes the institutional framework and procedural arrangement

	for the ESMP implementation.
Chapter 10 – EPC Contractor Environmental & Social Performance Requirements	The EPC Contractor (Trina Solar) is responsible for connecting the Project to the existing substation within the ATPS. EPC contractor will be responsible for facilitating the connection to the existing Substation in ATPS. This Chapter presents the key Environmental & Social Performance Requirements which must be implemented by the EPC Contractor, and which aim to ensure that environmental and social issues are taken into account and adequately considered during the development of these facilities connected to the Project’s development.

The ESIA includes a standalone Non-Technical Summary (NTS) in Arabic and English and supporting Annexes.

2. PROJECT DESCRIPTION

This section provides a detailed description of the Project in relation to its location, the key project components and an overview of the proposed activities that are to take place during the planning and construction, operation, and decommissioning phase.

2.1 Administrative Setup and Land Use within the Vicinity of the Project Location

The Aqaba Special Economic Zone Authority (ASEZA)

As indicated in Section 1.2, the Project is located within the ASEZ and specifically within the eastern part of the Southern Industrial Zone (SIZ) within which various industrial establishments are operating and which mainly includes: fertilizer industries, bulk liquid storage facilities, and the Aqaba Thermal Power Station.

The ASEZ is one of the districts that form the Aqaba Region. The Aqaba Region consists of Quweira District, Aqaba District, Disi Sub-District, and the Aqaba Special Economic Zone (ASEZ). The Aqaba Region is under the authority of the Aqaba Special Economic Zone Authority (ASEZA).

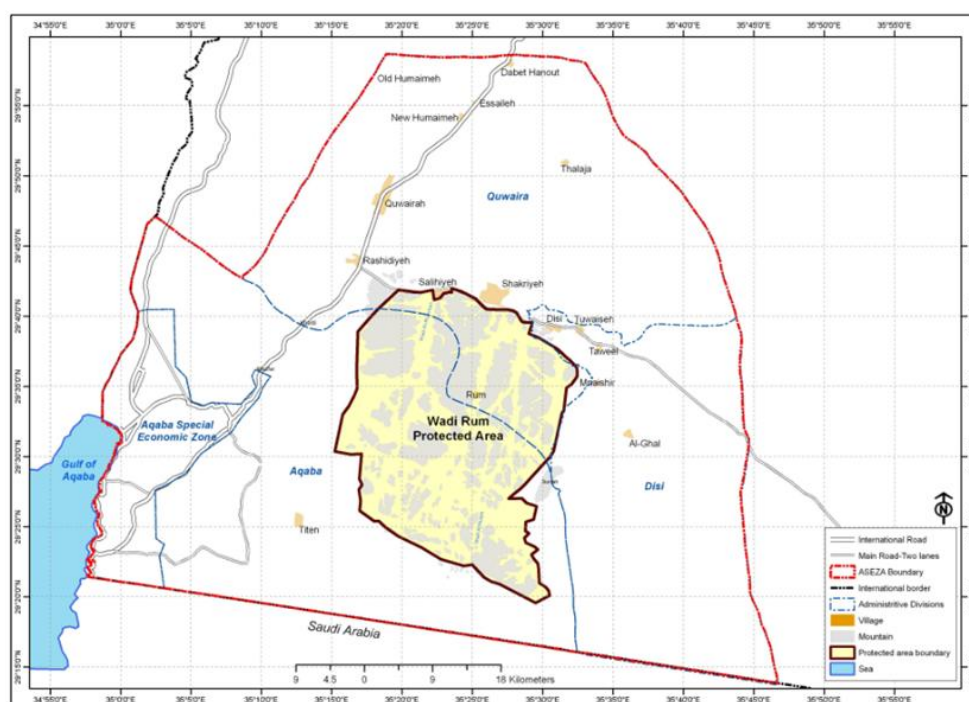


Figure 6: Map of the Aqaba Region (ASEZA, 2013)

ASEZA is the regulatory authority in charge of the ASEZ (as well as the Aqaba Region); and is a financially and administratively autonomous institution responsible for the management, regulation, and the development of the ASEZ, including issuing environmental permits and granting environmental clearances for projects.

In accordance with the ASEZA Regulation No. 21 for the Year 2001 'Regulation for the Protection of the Environmental in the Aqaba Special Economic Zone'; ASEZA has the overall authority and responsibility for protection of the environment within the ASEZ.

The Aqaba Development Corporation (ADC)

Aqaba Development Corporation (ADC) was launched in 2004 with the objective of unlocking the potential of the ASEZ by accelerating its economic growth and development. Launched by ASEZA and the Government of Jordan, ADC owns Aqaba's seaport, airport and strategic parcels of land as well as the development and management rights for these assets in addition to key infrastructure and utilities.

ADC is mandated to develop ASEZ through building new or expanding existing infrastructure and the required superstructure, creating business enablers for ASEZ, and managing or operating its key facilities. This is

envisaged to be achieved through maximizing the attraction of private sector developers and operators. ADC also has the responsibility to implement the ASEZ Master Plan of 2001 in a manner that ensures integrated development and transforms Aqaba into a leading business and leisure hub on the Red Sea.

2.2 Project Location

The Project is located within the Governorate of Aqaba in the South of Jordan approximately 300 km south of the capital city of Amman. More specifically, the Project site is located within the South Port of Aqaba (or the SIZ) which hosts several industrial facilities and operations and which is located around 14 km from the city of Aqaba and less than 5 km north of the Jordanian borders with the Kingdom of Saudi Arabia.

The Project site is rectangular in shape and is referenced by the following UTM coordinates for each corner (Figure 5 - Specific Project location within the SIZ - Jordan).

Table 2: UTM coordinates for each corner of the Project Site (Cube Engineering, 2014)

North West	South West	South East	North East
X 696578	X 696544	X 696893	X 696927
Y 3253651	Y 3253137	Y 3253115	Y 3253628

The site is part of the Wadi Aqaba-Dead Sea-Jordan Rift valley system. It lies 2km to the east of the Gulf of Aqaba; it is largely flat at an elevation of 318 metres and slopes gently towards the Gulf of Aqaba. To the west it is bounded by the escarpment of the Western Highland (Arabian Highlands). This escarpment has been deeply incised by dry river courses marked by extensive alluvial deposits, and the Project is located entirely on such deposits (Figure 7).

Wadi 2 is a deep and wide wadi crossing the area 1 km south of the Project location from the mountains and running to the coast. Although Wadi 2 is large, in terms of the drainage of the Zone it does not have a huge impact partly because it is already controlled along its lower reaches by containment revetments. Although the region is mainly dry there are periodically short intensive rainstorms which produce flash floods in the wadi system which crosses the Zone. The 2006 Master Plan for the SZ and the SIZ studied drainage and flood management within the SIZ and recommended containment structures and channels to protect infrastructure investments within the catchment area of Wadi 2 against flooding, erosion and sediment deposition. However, according to ADC, the already existing containment revetments have been functioning adequately and ADC only had to construct a culvert to protect the road networks downstream of Wadi 2. ADC is already using Wadi 2 as a buffer zone area and as a corridor zone for extending utilities and infrastructure (e.g. Fajr Gas Pipeline and the High Voltage Electricity Transmission Line). According to ADC, to date, there have been no issues caused by any floods within Wadi 2.



Figure 7: Specific Project location within the south Port of Aqaba – Jordan (Shamsuna Cultural Heritage Draft Report, 2014)

Figure 8 below presents the view of the surrounding environment around the Project site:



Figure 8: General view and landscape around the Project site (Shamsuna Cultural Heritage Draft Report, 2014)

According to ADC (2014), more than 10 years ago, part of the site was used for sheep and cattle farm but the operations were stopped and facilities dismantled about five (5) years ago. However, this left the site in a bad and deteriorated shape with some remaining infrastructure and demolition debris scattered around some parts of the land.

The following main facilities are currently operating in the vicinity of the Project site (Figure 9):

- Sulphur handling and operations - Jordan Phosphate Mines Company (JPMC): 1.6 km east of the Project site;
- Evaporation ponds – Arab Fertilizers & Chemicals Industries Ltd (KEMAPCO): 2 km south of the Project site;
- Tank Farm - Jordan Petroleum Refinery Company: 3.7 km south-west of the Project site;
- Aqaba Thermal Power Station operated by Central Electricity Generating Company (CEGCo): 4.8 km south-west of the Project site; and
- Industrial Complex – JPMC: 5.4 Km south-west of the Project site.

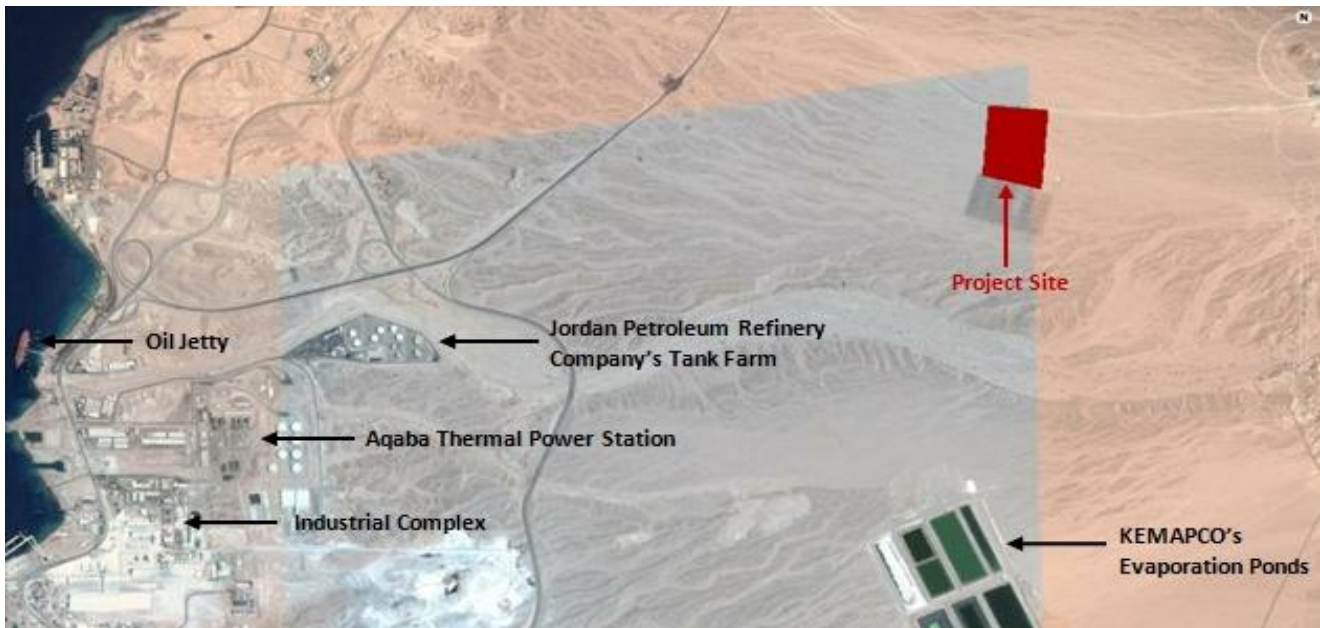


Figure 9: Main existing operations in the vicinity of the Project site (ECO Consult, 2014)

Other existing utilities and infrastructure in the vicinity of the Project site are as follows (Figure 12):

- The Fajr Gas Pipeline (Figure 10): East Gas operates a 36" sub-sea pipeline supplying natural gas from Egypt to Jordan. The landfall of this pipe is on the coast of the South Zone and up to this point it is the responsibility of East Gas Company. From there onwards the pipeline runs towards the eastern mountains of the SIZ and is the responsibility of the Fajr Company. Its route is located at a distance of around 1 km south of the Project site.



Legend

- Shamsuna Project
- Gas Pipeline
- Landfill
- Railway

Figure 10: The Fajr Gas Pipeline running south of the Project site (ECO Consult based on data provided by ADC, 2014)

- High voltage electricity transmission line (Figure 11): this transmission line runs from the ATPS to the north of Jordan and is located at a distance of around 1 km south of the Project site.

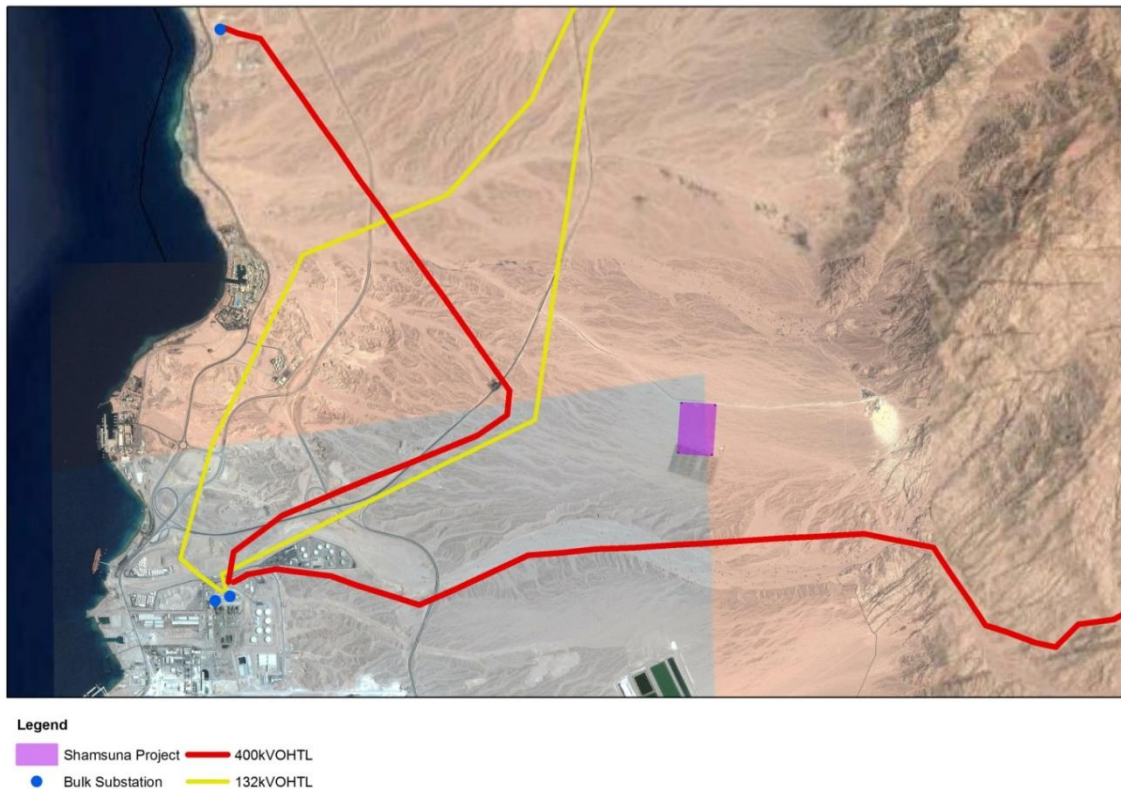


Figure 11: 132 kV and 400 kV Over-Head Transmission lines within the vicinity of the Project site (ECO Consult based on data provided by ADC, 2014)

As shown in Figure 12 the Shamsuna project will be connected to the existing substation. The offsite infrastructure up to the substation will be delivered by the EPC contractor. Additional works to support the off-take from the substation are the responsibility of NEPCO and are not assessed within the remit of this ESIA. Both main utility and infrastructure components listed above run within Wadi 2 or the buffer zone as indicated in the SIZ Land Use (Figure 14).

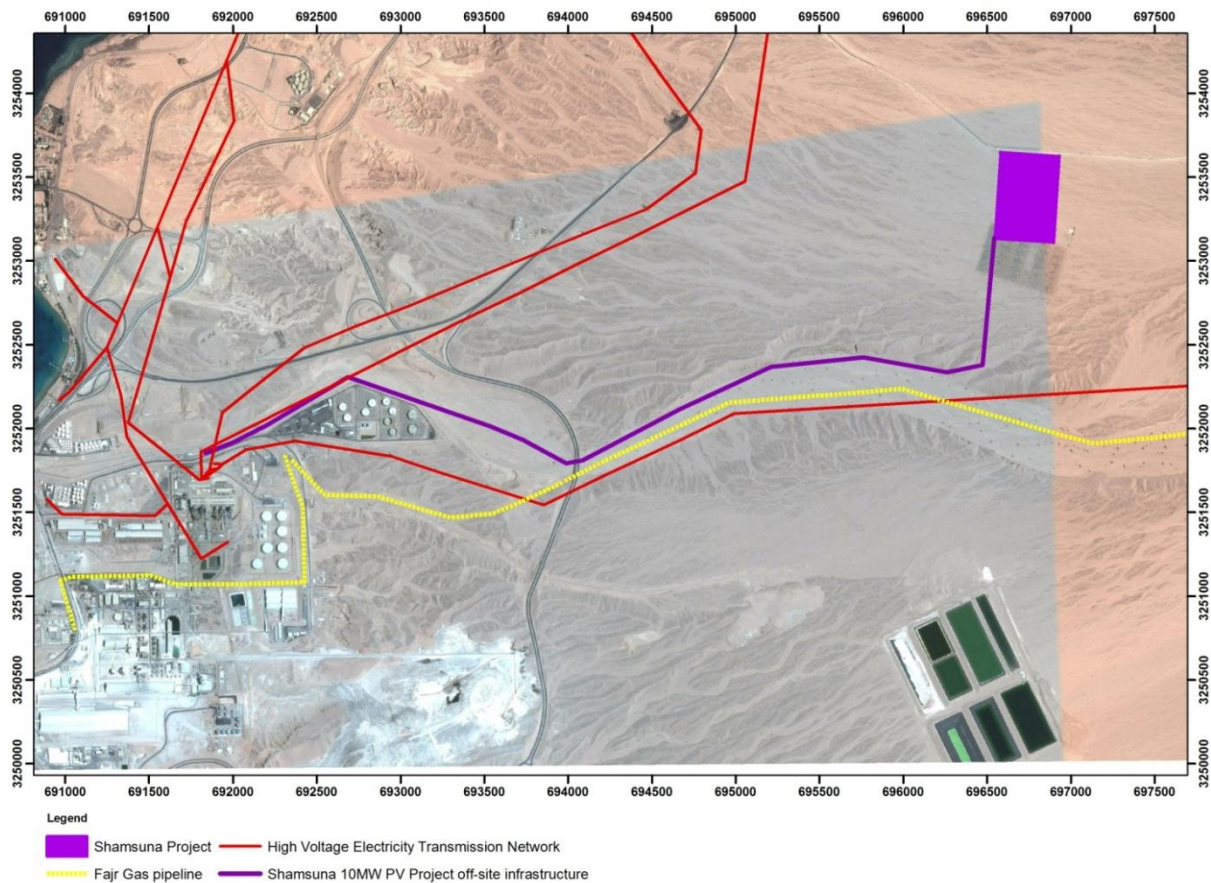


Figure 12: Existing utilities in the vicinity of the Project site (ECO Consult based on data provided by ADC, 2014)

2.3 Land Use and Planned Developments within the Vicinity of the Project Location

A general land use plan has been developed in coordination between ADC and ASEZA for the whole of the ASEZ and this has been approved and formally adopted by the Board of Commissioners in 2012 (Figure 13).

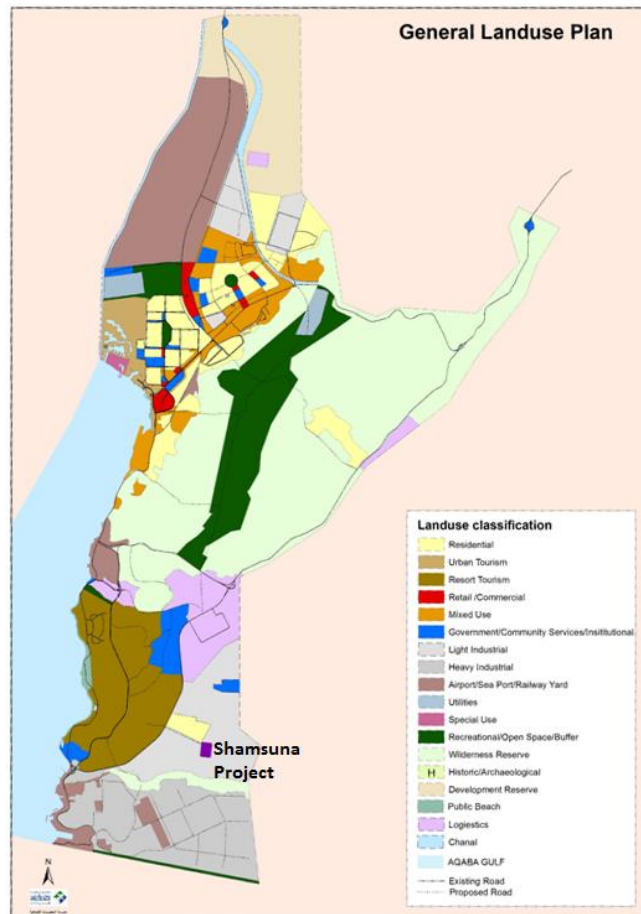


Figure 13: General Land Use for the ASEZ (ASEZA, 2013)

A specific Master Plan and Land Use for the immediate and longer term developments within the South Zone (SZ) in the ASEZ has been developed and formally adopted in 2006. This master plan forms a strategic element of the economic development of ASEZ and it comprises a physical plan for the phased development of both port and industrial zone within the South Zone for the period 2006-2030 (Figure 14).

The main ASEZA goals behind this 2006 SZ Master Plan was to allow the relocation of many of the industrial operations from the Aqaba main port to an area already classified for industrial uses which is the SZ and subsequently enable expansion of the Aqaba's waterfront tourism sector in the main port.

According to the 2006 SZ Master Plan (Figure 14), the eastern part of the SZ (i.e. the Southern Industrial Zone or SIZ), which is the area surrounding the land for the Project, was allocated for several uses and developments including:

- Housing/residential uses (Labour housing for Zone workers – single labour and possibly families);
- Supporting industries (All types of light industry and suppliers);
- Chemical industry cluster (Fertiliser, chemical and other medium/heavy industries);
- Fertiliser cluster and gypsum storage;
- Logistics and Storage (Warehousing, processing, and packaging);
- A new railway corridor extending into the Zone to allow future rail connection between the Zone and the national rail network to transport bulk phosphate for export and other cargo;

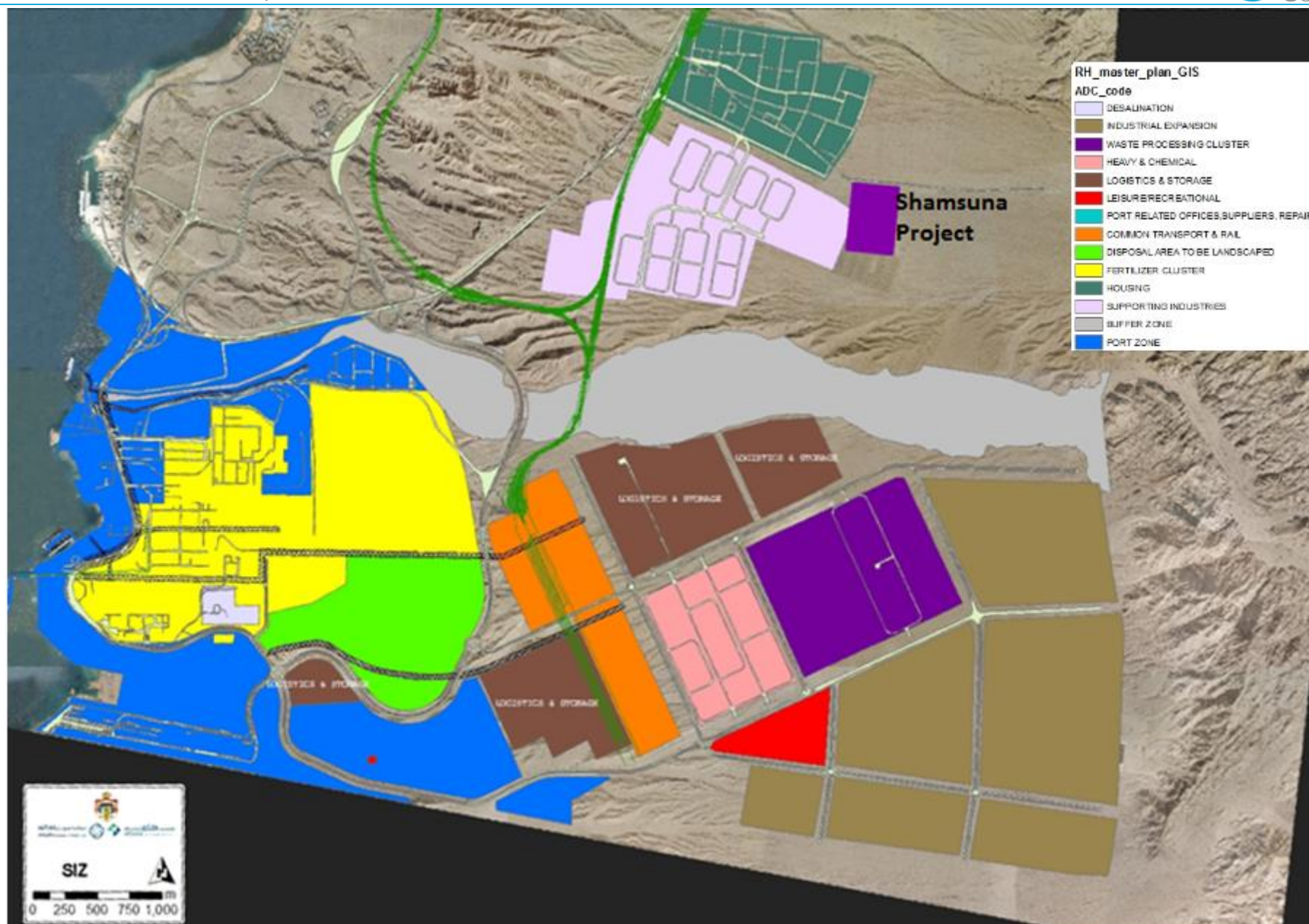


Figure 14: Specific Land Use for the Southern Industrial Zone (ADC, 2014)

- A future industrial waste disposal cluster was proposed adjacent to the existing 420 dunums⁶ of large evaporation ponds used by Kemira Arab Potash Company Ltd (KEMAPCO); and
- Associated utilities and infrastructure were also planned as part of the Master Plan.

A Strategic Environmental Assessment accompanied the 2006 Master Plan, which included stakeholder engagement and consultation, provided comprehensive performance requirements to ensure environmental protection and a structured a road map for environmental permitting for any project planned as part of the 2006 Master Plan. The spatial scope of the Strategic Environmental Assessment was the whole SZ area including the SIZ.

Most recently, and due to the energy security risks that the Country has been facing for a long period of time and the interruption of the gas supply from Egypt, the ADC and the Ministry of Energy and Mineral Resources (MEMR) decided to find a long term solution for this issue and thus established the Energy Ports Master Plan in 2012. The Energy Ports Master Plan was approved by the Board or Commissioners it included an array of energy ports (e.g. Liquefied Natural Gas Terminal, Liquefied Petroleum Gas Terminal, New Oil Terminal...etc) to be established at the coastal part of the SZ at specific locations designated based on a strategic assessment of the proposed energy ports and a detailed safety study.

Based on discussions with ADC, it has been understood that the planned developments within the vicinity of the Project as shown in Figure 14 are still in the planning and negotiations phase. Discussions with some investors progressed more than others, however, to date there are no actual development on the ground. The priority is currently being given by ASEZA and ADC to the implementation of the south port community to include the main port, the industrial ports, and the energy ports. The implementation of any of the Projects planned in 2006 is dependent on the availability of investors willing to invest in such projects. ADC performs its own business development to attract investments but according to ADC, as it stands, there are no eminent plants for the Projects planned within the vicinity of the Project.

Recently, a formal decision was made by the joint committee of ADC and ASEZA to allocate part of the land within the SIZ for solar energy projects. The total area for this land is 1,308 dunums⁷ including the 180 dunums⁸ allocated for the Project, shown in Figure 15 below. The solar energy projects are considered to be part of the supporting industries development. According to ADC, the only project currently being planned and implemented is the Shamsuna 10MW PV Project. Discussions with others have been ongoing but to date nothing is definite.

The Shamsuna Power Company discussed the possibility of submitting a direct proposal for developing a hybrid (solar PV & Wind Farm) in the land adjacent to Shamsuna Project site to MEMR as part of the Request for Submission of Expression of Interest under the Direct Proposal Submission Process (Phase II) which is currently being processed by the MEMR and proposals from interested developers are due first week of July 2014. However, MEMR has not been eager to develop hybrid projects and according to MEMR this is not within the scope for development within this Request for Expression of Interest. Shamsuna Power Company cannot proceed with the Project without the approval of MEMR as the soul entity with the mandate to regulate projects that generate energy within Jordan. Shamsuna Power Company signed an MOU with ADC to lease the land, but since the MOU with MEMR has not been signed yet, hence the MOU is not binding and accordingly the hybrid project is excluded at this stage and it is unclear whether it will be approved by MEMR at all.

⁶ 42 hectares

⁷ 130.8 hectares

⁸ 18 hectares

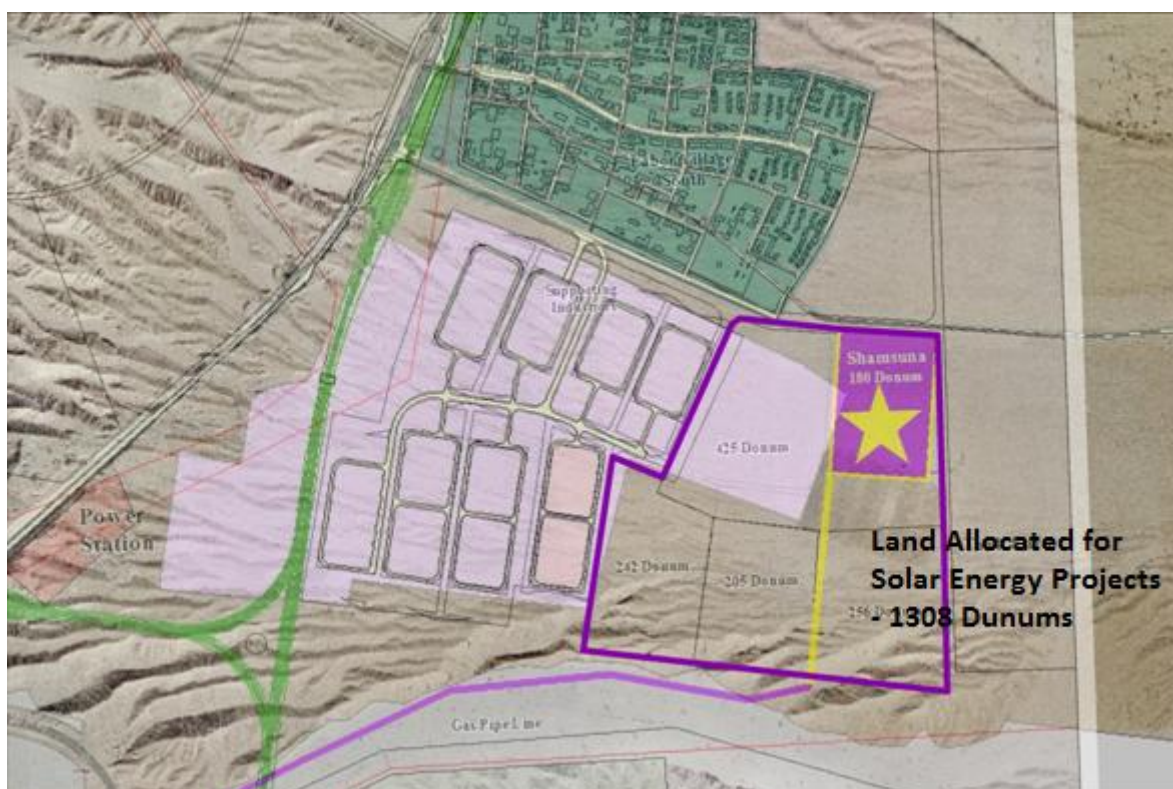


Figure 15: Land allocated within the SIZ for solar energy projects (ADC, 2014)

2.4 Outline of Photovoltaic (PV) Technology

PV is a method of generating electricity through solar panels which are composed of a number of solar cells. Such cells convert solar energy (radiation from the sun) into electricity using semiconductors (photovoltaic material that exhibit the photovoltaic effect); following the exposure of the PV panel to light, voltage is created in the material as photons from sunlight excite electrons in those materials into a higher state of energy, allowing them to act as charge carriers for an electric current.

Solar cells produce Direct Current (DC) electricity from sun light, which can be used for grid connected power generation. However, electricity at the grid is usually in a different form (known as Alternating Current (AC) and thus inverters are used to convert the DC current to AC current. In addition, cells produce electricity at a certain voltage which must be matched to the grid it connects to. Therefore, transformers are used to convert the output from the panels to a higher voltage that matches the grid.

2.5 Project Components

Table 3 below provides a summary of the key project components for the Project, along with a detailed description of each of those components to follow. Such information is based on preliminary information and designs provided by the Project Proponent (i.e. Developer) and Key Contributors (Section 1.3) of the Project.

In addition, Figure 16 presents the preliminary layout of each of those components within the Project site.

Table 3: Summary of Key Project Components (ECO Consult- based on information from Project Proponent and Key Contributors, 2014)

Component	Description
Project Generation Capacity	10 MW
Technology Type	PV (photovoltaic)
Number of Power Arrays	814 (for a total of 40,300 PV panels)
Capacity per Array	12.2 kWp
PV Panel Type	Multi-crystalline technology

Project area to be covered	180 dunum ⁹
Infrastructure and Utilities	This includes: (i) internal track network (ii) underground cables, (iii) storage room, (iii) switchgear, and other.

2.5.1 PV Power Arrays

The Project site will be divided into seven (7) zones each consisting of a number of arrays (for a total number of 814 Power Arrays each with a capacity of 12.2 kWp). Each Array consists of the following components (Figure 16, and Figure 17 below presents the planned layout for the Project and the general components of a PV farm, respectively):

- **PV Panels:** each array will consist of around 10 PV panels where each panel is of 250 Wp capacity with a dimension of 1,640mm length, 992mm width, 40mm thickness and weighs around 19kg. Each panel is covered with high transparency solar glass of 4mm thickness and a silver anodized aluminium alloy frame. The panel is a multi-crystalline technology which used silicon as a semiconductor material to generate electricity. The silicon is considered a non-hazardous material.
- **Mounting structure (metal supporting structure):** the PV modules will be installed on a fixed tilt mounting structure with steel and aluminium
- **Transformers:** The arrays will connect with the inverter through underground Low Voltage (LV) DC cables. In addition, each inverter will connect with a Medium Voltage (MV) transformer that converts the output from the arrays to a higher voltage (from 360 V to 33,000 V) that is appropriate for connection with NEPCO's Substation as discussed in detail below; and
- **DC-AC Inverters:** Each Zone will include an inverter station (for a total of 7 inverter stations) which will convert the current produced from the arrays from DC current to AC current.

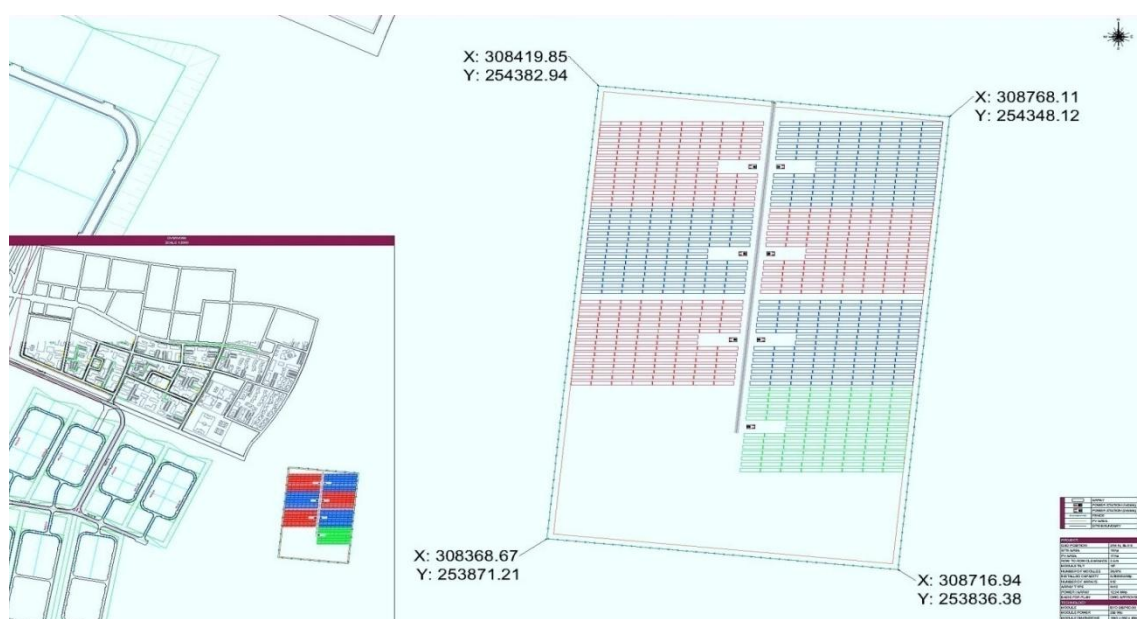


Figure 16: Planned layout for the Project (Cube Engineering, 2014)

⁹ 18 hectares

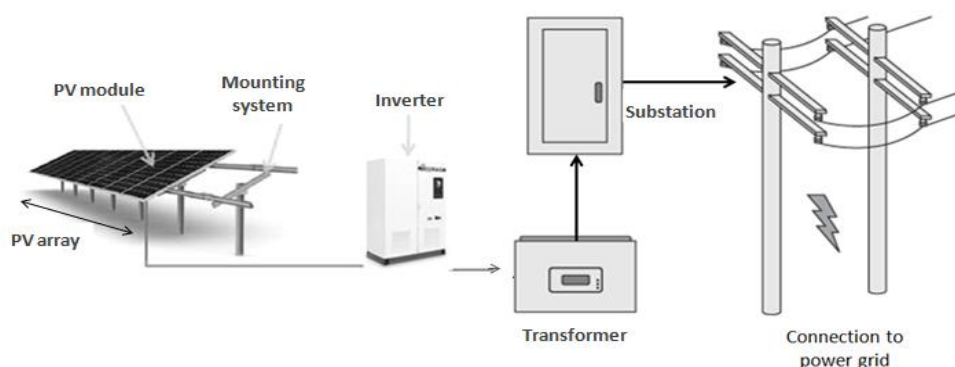


Figure 17: Main Project Components of any PV Farm

2.5.2 'Onsite' Infrastructure and Utilities within Shamsuna ESIA Scope

Other infrastructure and utilities in the Project site and assessed within the ESIA include the following:

- A small storage area of around 16m² for storage of various equipment and machinery to be used throughout the operation and maintenance of the project;
- Fencing around the entire facility and security will be required to ensure safety from criminal activity and trespassing of unauthorized personnel;
- Internal road network: It is likely that tracks will be established between the power arrays for ease of access to the modules for operation and maintenance purposes.

2.5.3 'Offsite' Infrastructure and Utilities with Shamsuna ESIA Scope

The Project will require the following offsite infrastructure and utilities related components which have been subject to a high-level assessment in this ESIA. Within Chapter 8 - 10 mitigation measures, monitoring requirements and performance requirements are identified in order to do a further detailed assessment of impacts and inform construction:

- Transmission Cables and Collector/Switchgear:
 - a. All the power arrays are connected through underground MV AC cables to a MV switchgear.
 - b. The switchgear will connect, through a 30 kV cable, with the substation located at the Aqaba Thermal Power Station (ATPS). Cables will many be overhead with some short underground sections Figure 18.
 - c. The length of the transmission cable/line is around six (6) km.
- Transmission Line Route:
 - a. It is important to note that this is only a provisional transmission line route (Shown in Figure 18)
 - b. assessment and surveys. It is most probable that the whole cable will be Over-head Line (OHL) except under the bridge on the main coastal highway that runs from Aqaba City till the SZ in addition to the last section of the route "entry to NEPCO Substation in the ATPS".
 - c. The selection of this provisional route through the area of current overhead lines which also cross the wadi (Photos below). The provisional route selection process is discussed in Chapter 5.

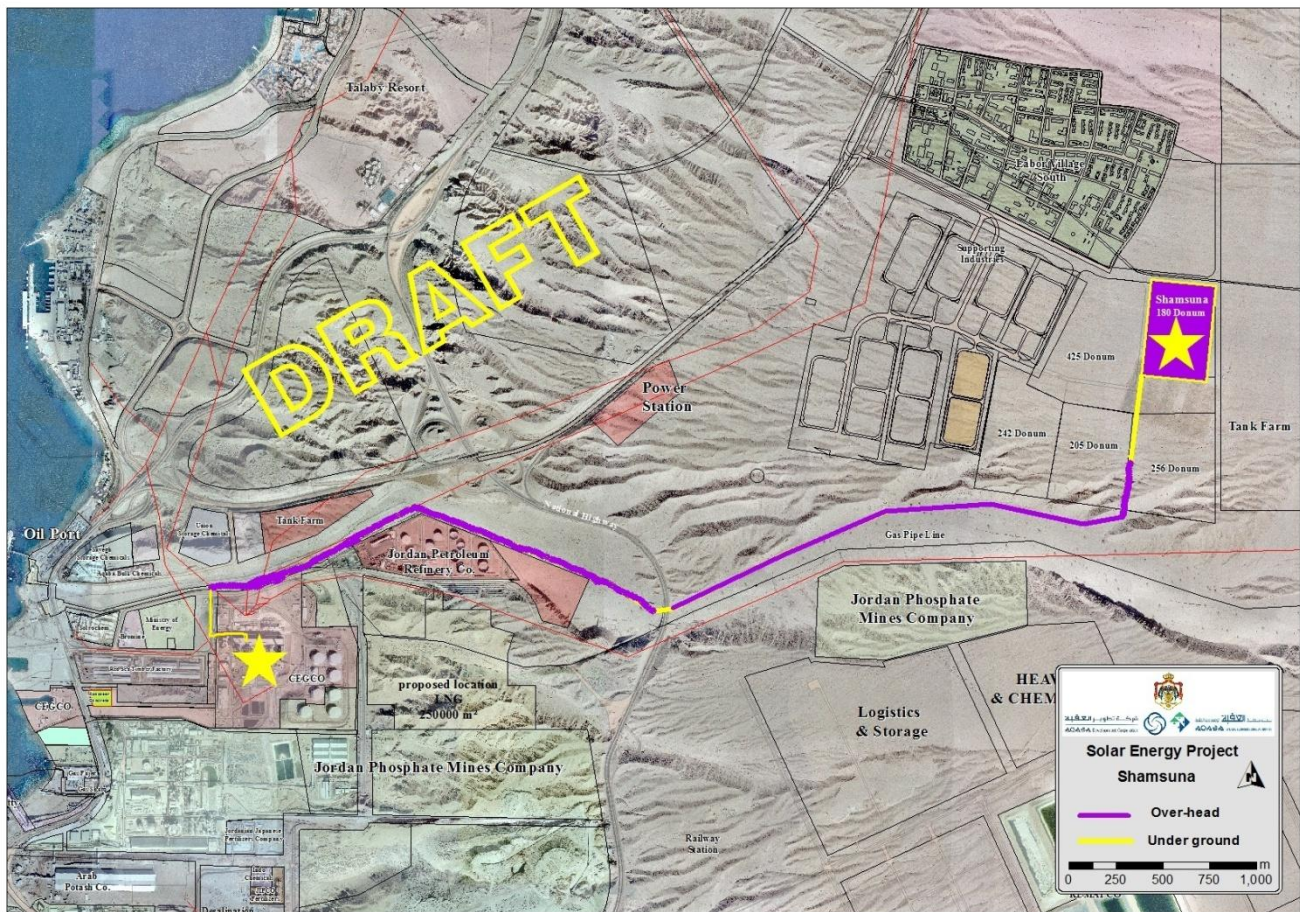


Figure 18: Provisional plan for transmission line from the Project site to the substation located at the ATPS (ADC, 2014)



Figure 19: Photos of Existing Wadi 2 Overhead lines (Cube Engineering, 2014)

2.5.4 'Offsite' Infrastructure and Utilities outside Shamsuna ESIA Scope

The existing NEPCO substation located at the ATPS is a high voltage transformer substation that converts the output from the collector to a higher voltage (from 33 kV to 132 kV) that is appropriate for connection with the High Voltage National Grid (132 kV). The substation is connected with the national grid through High Voltage power lines (132kV transmission line). The substation is operated by NEPCO and is located outside of the Project site (approximately 5 km 4 south-west of the Project). Upgrades to the substation have not been covered within the scope of this ESIA therefore.

2.6 Land Take Requirements & Land Use Context

Since its establishment in 2004, ADC has been working on accelerating and facilitating development and private sector investments within the ASEZ. ADC acts as the landlord of Aqaba's seaport, airport and strategic

parcels of land including the South zone of Aqaba. ADC also has the responsibility to implement the ASEZ and the SIZ Master Plans in a manner that ensures integrated development and transforms Aqaba into a leading business and leisure hub on the Red Sea.

The Project will be developed within the SIZ of Aqaba. As indicated in Section 2.3, an area of 1,308 dunums¹⁰ has been recently formally allocated to be used to solar energy projects (Figure 15)

As described in Section 2.2 and Section 2.3, the formal land use as allocated by the ADC and ASEZA of the whole SZ and SIZ coincides with the existing developments and use of the area as an industrial zone. Since the formal adoption of the SIZ Master Plan in 2006, ADC has been working on implementing the components of the Plan. As the Regulator, ASEZA does not allow the permitting or implementation of any project within the SZ and the SIZ that does not match the provisions of the Master Plan.

In terms of historical use of the land, discussion with the ADC revealed that part of the Project Site was occupied by a sheep and cattle farm. However, the farm stopped its operation about 10 years ago and its infrastructure dismantled around five (5) years ago. The reasons that made the farm stop its operations and dismantle its structure are unknown to ADC. The site has been uninhabited and unused since then (Figure 8).

For the purpose of this ESIA, further investigation on land use of the current project site is provided in Section 7.2.

The outcomes of such consultations reconfirm that the current Project site is uninhabited and unused, and is considered of no value to the local community.

The ESIA Team discussed the presence of any nomadic and semi-nomadic settlements in the SZ area and according to ADC and ASEZA, the Project area is not known for nomadic/semi-nomadic settlements given the natural characteristics of the site (being desert area that is arid and barren with no water resources) and the use of the Zone as an industrial area.

To this extent, a Land Lease Agreement (LLA) has been signed between ADC as the landlord and Shamsuna Power Company as the developer for leasing the project site for a period of 30 years. ADC are also coordinating the offsite infrastructure and assisting in selecting the corridor for the transmission line between the Project site and the substation in ATPS.

2.7 Workforce & Training

According to information provided by the EPC Contractor, the Project will require the following workforce throughout the construction and operation phase as shown in Table 4:

Table 4: Workforce opportunities for local and foreign labour during the construction and operation phases of the Project (EPC Contractor, 2014)

		Construction Period	Operations Period part time- not based on the site
TRINA	Expat / Foreign Skilled Labour	4	1
	Expat / Foreign Unskilled Labour	0	0
TRINA	Local Skilled Labour	30	1
SUBCONTRACTORS	Local Unskilled Labour	70	5

Based on Table 4 above, the total number of local labour required during the construction phase for a period of approximately six (6) months is 100 (to include skilled and unskilled labour) ; and during operation on a part time basis (not based on the site) for a period of 20 years is six (6) to include skilled labour (such as a plant manager, production manager, control engineer, , etc) and unskilled labour (such as module cleaners and security personnel). The EPC Contractor aims to bring in all local labour from the ASEZ and does not plan include any construction camps within its Project.

¹⁰ 130.8 hectares

Shamsuna have prepared Health, Safety, and Environment (HSE) and Labour policies for the construction and operation phase. The ESIA includes a draft structure of the Environmental, Health, Safety and Social system for the Project (Shamsuna EHSS system – Policies and Plans – Structure). This comprises the following:

- Environmental Policy;
- Health & Safety Policy;
- Social & Community Policy;
- Human Resources Policy;
- Social & Communities Policy;
- E&S Management Plan - *this is the commitments/mitigation contained in this ESIA report; and*
- OHS Management Systems - *this is referred to in the ESIA report and **prepared by the EPC Contractor/Operator***

Once finalised and agreed with the Shamsuna Power Company, the Developer shall identify the personnel to be termed the HR manager and the H&S manager.

2.8 Overview of Project Phases

This section presents the likely activities to take place during the Project development and which will include three distinct phases: (i) planning and construction, (ii) operation and (iii) decommissioning each of which is summarized below.

2.8.1 Planning and Construction Phase

Typical activities during the planning and construction phase for the Project include the following (Figure 20):

- Detailed and final planning and design for the project and its components by the EPC Contractor;
- Transportation of Project components to the Project site which mainly includes the PV panels. The components are expected to be transported to the Port of Aqaba and then transported by road to the Project site;
- Site preparation activities as the Project requires a flat physical land area for installation of the PV arrays and the various Project components. Such activities could include excavations, grading, levelling, and land clearing activities;
- In addition to the installation of the panels, there is additional construction work (which could include excavations, land clearing activities, etc) that must be conducted to connect each array to the power grid. This could include the installation and laying of transmission cables, switchgear, and any required upgrades in the substation;
- Additional construction works (which could include excavations, land clearing activities, etc.) for the access road and internal road network; and
- Additional construction works (which could include excavations, land clearing activities, etc.) for the construction of the building infrastructure such as administrative buildings and warehouses.



Figure 20: Typical activities during the construction phase for PV farms (Cube Engineering, 2014)

2.8.2 Operation Phase

The Project shall generally require limited operational activities which mainly includes the following:

- Commissioning tests which usually involve standard electrical tests for the electrical infrastructure as well as the panels, and inspection of routine civil engineering quality records. Careful testing at this stage is vital if a good quality PV farm is to be delivered and maintained.
- Operation and Maintenance (O&M) of the PV farm. This mainly includes maintenance activities which can be divided into the preventive and corrective maintenance. The preventive maintenance follows a routine service schedule aimed at preventing faults from occurring and keeping the plant operating at its optimum level. The frequency of the preventive maintenance depends on a number of factors such as the technology selected, environmental conditions of the site, warranty terms and seasonal variances. It contains for example activities like PV module cleaning, inverter servicing, checks on structural integrity of

the mounting structure. The corrective maintenance is carried out in response to failures for example the repair/ exchange of damaged equipment or inverter faults.

Of particular importance in relation to the O&M activities is the PV module cleaning. It is important to note that the PV modules will be cleaned on a regular basis to prevent dust build-up which could affect their performance. Cleaning will be undertaken through a dry brush cleaning program which does not entail the use of water (Figure 21). Every module will be cleaned at least once a month. It's a rotating process- a team of cleaners start in one section and move on with cleaning. Cleaning will be done per module string/ per inverter. After 14 to 20 days the team is back at the first section to clean. In case of much dust additional workers will join the team. Normal team constitutes of four (4) people.



Figure 21: Cleaning of Shamsuna PV modules will be done through a dry brush cleaning programme (Cube, 2014)

2.8.3 Decommissioning Phase

It is not clear at this point whether at the end of the lifetime of the Project (where according to the agreement between the Developer and MEMR is set for 20 years) MEMR would take ownership of the Project and continue operating it or whether the Project will be completely decommissioned. Should MEMR decide to continue to operate the Project, then in this case, the Project is expected to operate for an additional five to ten years (given that the PV modules lifetime is 25-30 years), and after that MEMR could continue operation through repowering it by replacing older PV modules with more modern and efficient modules, or could decide to completely decommission the Project.

Nevertheless, in the case of the complete decommissioning of the PV farm, decommissioning activities could include the disconnection of the various Project components (PV array, transformer/inverter stations, switchgear, etc) for final disposal. In addition, internal track network will be restored and gates and fences will be removed.

It is important to note that the EPC Contractor (Trina Solar which is also the provider of the PV modules for the Project) is member of PV Cycle which offers a collection and recycling programme for their end-of-life PV modules where most parts of the solar modules can be recycled, including glass, semiconductor materials, ferrous and non-ferrous metals (Figure 22). The recycling program is a comprehensive recycling process which recovers the semiconductor material (up to 95% yield) for reuse in new modules and the glass (with 90% yield) for reuse in new glass products.



Figure 22: PV Cycle collection and recycling programme for PV modules (Cube Engineering, 2014)

2.8.4 Project Schedule

The Project implementation schedule is illustrated in Figure 23 where the schedule shows that the procurement and construction of the PV Project is anticipated to commence in September 2014. The Project is anticipated to be fully operational in April 2015 and operate for not less than 20 years.



Figure 23: Implementation Schedule for the Project (Shamsuna Power Company, 2014)

2.9 Resource Use Efficiency

The objective of this section is to demonstrate how the Project design has endeavoured to optimise the use of all natural resources involved in the Project processes.

One of the key positive impacts of the Project, as far as resource efficiency, is that it will be utilising solar energy to produce electricity. The Project is expected to be of an installed capacity of 10 MW and will contribute to supplying electricity to the National Grid for end users and help meet the increasing electricity demands throughout the Kingdom – as opposed to meeting such increasing demands through conventional electricity production from thermal power plants and also, a 10MW Project will also reduce Jordan's energy bill by 0.5%.

The CO₂ emission reduction is 16,500 t/a (according to IEA 0,64kg CO₂/kWh in Jordan) and the Project is expected to provide circa 20 GWh of electricity per year, which is enough to cover annual electricity consumption of 10,000 individuals or three large 5 star hotels.

In addition, as discussed earlier, the PV modules will be cleaned on a regular basis through a dry brush cleaning program; as opposed to the other option usually used for cleaning of modules through the use of water which would result in higher water consumption for the Project throughout the operation phase. However, the 'dry' cleaning mechanism which will be utilized for this Project optimises the use of water resources and maximizes water use efficiency.

Finally, the resource use efficiency of the proposed technology has been considered within the recycling plan for the PV modules which will probably be carried out within the programme the EPC Contractor is a member of. The EPC Contractor (Trina Solar which is also the provider of the PV modules for the Project) is member of PV Cycle which offers a collection and recycling programme for their end-of-life PV modules where most parts of the solar modules can be recycled, including glass, semiconductor materials, ferrous and non-ferrous metals (Figure 22). The recycling program is a comprehensive recycling process which recovers the semiconductor material (up to 95% yield) for reuse in new modules and the glass (with 90% yield) for reuse in new glass products. Summarised below is an overview of the recycling programme (Source: Executive Summary Life Cycle Assessment (LCA) screening of the Maltha recycling process for Si-PV modules Fraunhofer IBP; Department Life Cycle Engineering (GaBi); June 2012)

Further treatment and recycling of PV modules could significantly influence the environmental profile of PV modules. The location of the recycling plant is Belgium. An environmental assessment of the PV module recycling process applied at Maltha Recycling (Lommel) has been carried out by using a screening life cycle assessment. Goal of the study was the environmental assessment of the current recycling process of silicon based PV modules applied at Maltha Glass recycling in Belgium. The study was conducted in cooperation with PV CYCLE and Maltha Glass Recycling, Lommel, Belgium.

Based on the results of the study the environmental impacts due to the processing of spent Si PV modules as well as the relative share of the recycling to the whole life cycle of mono and multi crystalline PV modules were evaluated. In addition, the potential benefits from the recycling of recovered valuable materials from spent Si-PV modules were identified.

All datasets concerning energy production and end-of-life processes like material recycling or disposal on landfill are chosen to match country representative boundary conditions. To identify the potential environmental benefits of the module recycling, environmental credits have been accounted for the recycling of valuable materials (aluminium frames, copper cables, glass cullet) and thermal recovery from plastic wastes. To this, all caused expenses and emissions related to the whole recycling process of materials, e.g. for the re-melting, as these are applied to produce the recycled materials are accounted for. In terms of waste incineration processes the recovered energy from materials (e.g. plastics) is considered as credit by substituting energy production from conventional energy production. Since the laminate from broken cells and polymer foil are currently stored and not further processed, the recycling of these materials is not accounted for.

Considered recycling processes

The recycling of spent silicon PV modules is based on the processes of a flat glass recycling line. In the first step, aluminium frames and junction boxes are removed in a manual process. The prepared PV module waste is then fed into a shredder by using a wheel loader. The shred PV modules enter the glass recycling line which includes a manual pre-sorting, crushing of the laminates, separation and extraction of materials. The output materials of the glass recycling line are separated according to their material fractions like ferro metals, plastics, PV-cell/polymer foil laminate and glass cullet. The glass recycling line mainly requires electricity for running the processes (shredder, conveyors, hammer mill, compressor). The required electric power is provided by the local power grid and an on-site power PV generation. The PV power plant provides around 50% of the consumed electrical power. Furthermore small amounts of organic foam soap are used to reduce dust generation in the crushing processes.

Results

Based on the defined boundary conditions and collected data, the results show that the PV module recycling process as applied at Maltha Recycling has the potential to contribute to a further reduction of the environmental profile of the life cycle of crystalline silicon PV modules (around 4% -11% depending on the module technology and considered impact category).

The main impacts of the recycling processes at Maltha Recycling are related to the transports of spent modules to the recycling site and the electricity demand for running the processes. The Maltha recycling plant is equipped with an on-site PV power plant, which provides around 50% of the electricity demand at Maltha recycling. This leads to a significant reduction of the environmental profile of the used electricity mix.

The recovered valuable materials, like glass cullet, aluminium frames and copper wires are sent to respective recyclers. The recycling credits given for the substitution of primary materials and thermal recovery of plastic wastes account significantly outweigh the caused impacts of the processing of spent modules. Scaled to the mass of a cSi-PV module with a mass from around 22,4 kg/module, the application of the presented recycling process leads to a reduction of the environmental profile of the module life cycle from around 16kg CO₂-equiv. and around 190 MJ of primary energy from non-renewable resources. In other words, recycling 1t of silicon based PV modules saves approx. 800 kg of

CO₂-equiv. and up to 1.200 kg of CO₂-equiv. in the case that the module is 100% manufactured from primary materials.

The results show, that especially the recycling of aluminium frames and glass cullet lead to a significant reduction of the environmental profile of the recycling process, whereas the assumed secondary material content of aluminium frames plays a decisive role. Since the bandwidth of recycling credits is calculated according to the primary material content of aluminium frames and copper wires, different cases with varying secondary material shares have been investigated. For the evaluation of the reference case, a secondary material share of 50% for the aluminium frames and 45.7% for the copper wires has been chosen which stated as average for the European material production mix (see EC12, EAA3).

An additional scenario investigated the significance of varying transport distances from the collection points to the recycling site. To this, distances from 50 to 500km (200km for the reference case) were evaluated. The results show, that higher transport distances would mainly influence the environmental profile of the whole PV module recycling in the eutrophication and photochem ozone creation potential (POCP). For all other considered impact categories only minor changes have been observed.

3. REGULATORY & POLICY FRAMEWORK

This chapter first provides an overview of the environmental permit process for the Project as governed by the Aqaba Special Economic Zone Authority (ASEZA). The Chapter then discusses the regulatory context which is directly related to environmental compliance which must be adhered to by all parties involved in the Project throughout the planning and construction, operation, and decommissioning. The Chapter goes on to summarise the relevant international agreements and conventions to which Jordan is a signatory. Finally, as the Project is seeking financing from prospective lenders such as the International Finance Corporation (IFC), the Chapter highlights the environmental and social policies and requirements of the IFC which must be adhered to by the Developer.

3.1 Regional Environmental Permit Process

Parallel to the creation of the Ministry of Environment, the ASEZ was established in January 2001 to create a regional focal point for investment and tourism around the southern port city of Aqaba. The ASEZ - Law No 32 for the year 2000 - established the ASEZA to administer the Zone. According to Article 52 of Law No. 32, the ASEZ Board of Commissioners shall be responsible for protecting and maintaining the environment in the Zone. As a result of this law all existing and potential investors within the Zone are required to satisfy ASEZA with regard to the environmental impacts of their investment, and their ability to comply with all the relevant environmental requirements, rules and regulations in force within the Zone.

The process for obtaining the environmental permit for this Project as required by ASEZA is stipulated by Regulation No. 21 for the Year 2001 'Regulation for the Protection of the Environmental in the Aqaba Special Economic Zone'.

3.1.1 Screening Process and Environmental Assessment Requirements

All projects to be established within the ASEZ or projects already established but undergoing modification and expansion submit to ASEZA an application for acquiring environmental permit accompanied with necessary information, data, maps, designs, and specifications. Upon receiving the application, ASEZA studies the projects and based on Regulation No. 21 for the Year 2001, decides if the project requires a comprehensive EIA, a preliminary EIA, or does not require neither of the studies. The purpose of this process is to eventually get the environmental permit and the, subsequently, the construction and operation permits.

As explained in Section 1.3, based on the applicable legislations in the ASEZ, the Project requires the preparation of a Preliminary Environmental Assessment (PEA) before permission to operate (or license to begin construction) can be given.

However, since the Developer will be seeking financing for the Project from prospective lenders such as the International Finance Corporation (IFC), it is required that the national environmental permit requirements in the form of a PEA are complemented by a rigorous consultation process with the involved stakeholders including a scoping session, disclosure session, and other unilateral and bilateral consultations in-between with the primary stakeholders identified within the Stakeholder Engagement Plan (SEP). This transforms the environmental permit requirements for the Project from a PEA study to a comprehensive ESIA study.

3.1.2 ESIA Process and Environmental Permit

In 2006, ADC prepared a long term Master Plan for the development of the overall Port of Aqaba including the South Port area. Given that the Project was not part of the Projects planned within the Aqaba Ports Master Plan; it is not subject to the environmental permit process presented within the 'EIS for the South Ports Relocation and Development Project' (ECO Consult, 2008) conducted on the Master Plan, which was approved by ASEZA in 2008.

As explained in Section 3.1.1, a project of this nature and scale is required to undertake a PEA. However, due to financing requirements, the Project is undertaking a comprehensive ESIA study. Therefore, an ESIA study in addition to that undertaken for the Master Plan is to be conducted on the Project. The application to ASEZA for Environmental permit is provided by the Project Developer

- EIA Study Phases: In summary, three successive phases of activities are involved in the completion of a comprehensive EIA study in ASEZA:
 - Scoping Phase: this includes the submission of a Pre-Scoping Report, undertaking a scoping session, and submission of a Scoping Report/Terms of Reference (ToR) approved by ASEZA for the Study;
 - (ii) Assessment Phase: this includes undertaking the baseline studies, evaluation and assessment of impacts, and the development of an environmental management plan; and
 - (iii) Disclosure Phase: this includes undertaking a disclosure session and presenting the findings of the ESIA to the stakeholders.
- Scoping Phase: The scoping phase proceeds with the submission of a Pre-scoping report to ASEZA. This provides the ASEZA with all available information about the Project as well as the nature of impacts expected to result from the Project and the relevant persons affected in order to initiate the ESIA process by calling for a Scoping and Consultation Session. Then a scoping session is undertaken and following this a Scoping Report/ToR is submitted to the ASEZA which includes the issues addressed in the Pre-scoping Report in addition to other valid comments raised by the stakeholders during the scoping session. The report also includes a detailed Terms of Reference (ToR) that presents the methodology to be adopted for the EIA study. This report must be approved by ASEZA, prior to undertaking the ESIA study.
- Assessment Phase: The assessment phase is carried out in accordance with the approved ToR by the ASEZA and involves undertaking the baseline studies, impact assessment and development of management plans for various components that are expected to be impacted by the project and its activities. The EIA (or in this case termed the ESIA) document is the output of the assessment, prepared in accordance with the ToR.
- Disclosure Phase: This phase is carried out post the submission of the Draft ESIA Report to ASEZA and before the issue of comments and/or approval on the ESIA. ASEZA invited stakeholders to attend a disclosure meeting for the Project where all main findings of the ESIA are presented to the stakeholders including their comments made during the scoping session. ASEZA shall, within five working days from the date the consultative meeting or within twenty working days at most from the date of receiving the ESIS, issue their decision regarding any of the following:
 - Approving the draft ESIS as the final copy, if such document fulfils all requirement; or
 - Asking the Project Owner/developer to provide further information and analyses in areas which are deemed to be unfulfilling of their requirements. ; and
 - Approval of EIA: Upon submission of the final ESIA document (could be revised in case substantial comments were made during the disclosure phase, otherwise, the same submitted draft ESIA report is revised by ASEZA.

ASEZA reviews the report and either approves the study and grants the environmental permit for the Project or rejects the Project if the study indicates that the implementation of the Project would cause significant impacts on the environment and/or the EIA fails to identify plans for reducing adverse impacts. Upon approving the draft ESIS, ASEZA's environmental commissioner shall issue an official decision regarding the environmental permit within seven days receipt of the recommendation from the Environmental Directorate, concerning one of the following:

- Issuing the environmental permit for the Project if the adverse environmental impacts resulting there from are properly managed in the ESIA study including the mitigation and management plan. Such environmental permit shall be valid for one year from the date of issuance;
- Not issuing the environmental permit if it is evident that the establishment of the Project will result in unaccepted significant environmental impacts, or if the mitigation and management plan is not sufficient to manage such; or
- Assigning experts to re-examine the ESIS for final opinion thereon and at the expense of the Project Owner.

As a summary, the official decision from ASEZA regarding the ESIA clearance requires around 40 days to be issued from the date of the Draft ESIS submission, if no further information and analysis were required from ASEZA.

Once Environmental permit is granted, the ESIA report, together with the proposed mitigation and monitoring plans is to be implemented through all Project phases, and shall be considered an integral and binding part of the clearance agreement.

3.2 Summary of Environmental and Social Regulatory Context

This section provides a preliminary summary of those legislations applicable in Aqaba that are directly related to environmental and social compliance that must be adhered to by all parties involved in the Project throughout the planning and construction, operation, and decommissioning phase. These legislations include:

- Relevant international conventions: The Government of Jordan is signatory to a number of important international agreements which relate to the topics addressed in this ESIA, and has already incorporated many of the provisions in national legislation, often indicating that where the national law is inconsistent with international agreements to which Jordan is a signatory, the requirements of the international agreement will prevail. Accordingly, the terms of international agreements to which Jordan is a party are an important part of the legal framework within which the Project operates. Key Treaties and obligations are provided in Table 5; and
- Relevant national legislation and institutional framework (Laws, Regulations, Instructions, and Standards) issued by ASEZA, MoEnv, and other line ministries. Table 5 below lists the key legislation and regulator/entity relevant to each of the environmental and social parameter being studied and assessed within this ESIA.

Table 5: A preliminary list of relevant international treaties and conventions ratified by Jordan

International Agreements on Biodiversity, Flora and Fauna
- Convention on Biological Diversity (1993) - signed by Jordan in 1993. Under this agreement, signatories are required to develop plans and policies for the protection and monitoring of biodiversity and to integrate these into national plans for development
- Convention on Migratory Species (1979) - signed by Jordan in 2000. Signatories are required to protect migratory species throughout the migration range by coordinated efforts and research
- Agreement on the Conservation of African-Eurasian Migratory Water birds (1995): came into force in 1999 after it required number of at least fourteen Range States, comprising seven from Africa and seven from Eurasia, had ratified. The AEWA covers 255 species of birds ecologically dependent on wetlands for at least part of their annual cycle
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973): objective of this convention is to save many and varied forms of wild fauna and flora by regulating trade in specimens of species of wild fauna and flora
- International Plant Protection Convention (1970): the objective of this convention is to prevent the international spread of pests and plant diseases
- UN Convention to Combat Desertification: the objective is to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification through effective action at all levels
- Stockholm Convention on Persistent Organic Pollutants (POP) (2004): The objective of this Convention is to protect human health and the environment from persistent organic pollutants
International Agreements on Energy and Climate Change
- UN Framework Convention on Climate Change (UNFCCC) 1992: The UNFCCC was established so as to begin to consider what can be done to reduce global warming and to cope with whatever temperature increases are inevitable - aiming to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- Kyoto Protocol to the UN Framework Convention on Climate Change (1997): The Kyoto Protocol establishes a legally binding commitment for the reduction of four greenhouse gases produced by industrialized nations, as well as general commitments for all member countries. As of January 2009, 183 parties have ratified the protocol
- UNEP Montreal Protocol on Substances that Deplete the Ozone Layer (1987): is an international treaty designed to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion

International Agreements on Cultural Heritage	
- Convention Concerning the Protection of the World Cultural and Natural Heritage, (World Heritage Convention, 1972): The primary mission of the Convention is to identify and protect the world's natural and cultural heritage considered to be of outstanding universal value	
Other International Agreements Relating to Environmental Protection in the ASEZ	
- 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 - Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention 72) - International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) - International Convention for the Safety of Life at Sea (SOLAS) 1974, and amendments - International Convention on Civil Liability for Oil Pollution Damage, 1969 - Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment 1982, and Protocol 1982	
Other International Agreements Relating to Environmental Protection	
- Basel Convention on the Transboundary Movements of Hazardous Wastes and Their Disposal: designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries	
Obligations Relating to Membership of the International Labour Organisation (ILO)	
- C 29 Forced Labour Convention, 1930 (No.29) ratified 06:06:1966 - C 81 Labour Inspection Convention, 1947 (No. 81) ratified 27:03:1969 - C 98 Right to Organize and Collective Bargaining Convention, 1949 (No.98) ratified 12:12:1968 - C100 Equal Remuneration Convention, 1951 (No.100) ratified 22:09:1966 - C105 Abolition of Forced Labour Convention, 1957 (No.105) ratified 31:03:1958 - C 106 Weekly Rest (Commerce and Offices) Convention, 1957 (No.106) ratified 23:07:1979 - C 116 Final Articles Revision Convention, 1961 (No.116) ratified 04:07:1963 - C 117 Social Policy (Basic Aims and Standards) Convention, 1962 (No. 117) ratified 07:03:1963 - C 118 Equality of Treatment (Social Security) Convention, 1962 (No. 118) ratified 07:03:1963 - C 119 Guarding of Machinery Convention, 1963 (No.119) ratified 04:05:1964 - C 120 Hygiene (Commerce and Offices) Convention, 1964 (No. 120) ratified 11:03:1965 - C 122 Employment Policy Convention, 1964 (No. 122) ratified 10:03:1966 - C 124 Medical Examination of Young Persons Convention, 1965 (No.124) ratified 06:06:1966 - C135 Workers' Representatives Convention, 1971 (No.135) ratified 23:07:1979 - C 142 Human Resources Development Convention, 1975 (No.142) ratified 23:07:1979 - C 144 Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144) ratified 05:08:2003 - C 147 Merchant Shipping (Minimum Standards) Convention, 1976 (No. 147) ratified 01:04:2004 - C 150 Labour Administration Convention, 1978 (No. 150) ratified 10:07:2003 - C 159 Vocational Rehabilitation and Employment (Disabled Persons) Convention, 1983 (No. 159) ratified 13:05:2003 - C 185 Seafarers Identity Documents Convention (Revised), 2003 (No. 185) ratified 09:08:2004 - C 111 Discrimination (Employment and Occupation) Convention, 1958 (No. 111) ratified 04:07:1963 - C 138 Minimum Age Convention, 1973 (No. 138) species at 16 years ratified 23:03:1998 - C182 Worst Forms of Child Labour Convention, 1999 (No.182) ratified 20:04:2000	

Table 6: Legislative context for each environmental and social receptor to be studied in the ESIA

Parameter	Responsible Regulator/Entity and Relevant Legislations
Visual and Landscape	- ASEZA: - Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 - Civil Aviation Regulatory Commission - Civil Aviation Law No. 41 of the year 2007
Land Use Planning	- ASEZA - ASEZ law No.(32) of 2000 - Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Ministry of Agriculture - Agriculture Law No. 44 of 2002
Geology and Hydrology (soil and groundwater)	- ASEZA - ASEZ law No.(32) of 2000 - Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Instruction for Environmental Damage Committee No.(37) of 2002

	▪ Ministry of Environment - Solid Waste Management Regulation No. (27) of 2005 - Management, Transportation, and Handling of Harmful and Hazardous Substances Regulation No. (24) of 2005, - Instruction for Management and Handling of Consumed Oils for 2003, - Instruction for Hazardous Waste Management for the year 2003 ▪ Ministry of Water and Irrigation - Water Authority Law No. 18 for 1988 and it's amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof - Instructions for the Protection of Water Resources Allocated for Drinking Purposes for 2006 ▪ Ministry of Health - Public Health Law No. 47 for 2008 ▪ Jordan Institution for Standards and Metrology (JISM) - Jordanian Standard 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials
Biodiversity	▪ ASEZA - Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 ▪ Ministry of Agriculture - Agriculture Law No. 44 of 2002 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008
Archaeology	▪ Department of Antiquities - Antiquities Law No. 21 of 1988 and its amendments No. 23 for 2004
Air Quality and Noise	▪ ASEZA - Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 ▪ Ministry of Environment - Air Protection Regulation No. 28 for 2005 - Instruction for the Control of Ozone Depleting Substances for the year 2003 - Instruction for Reduction and Prevention of Noise for 2003 ▪ Jordan Institution for Standards and Metrology (JISM) - JS 1140-2006 Ambient Air Quality - JS 1189-2006 Maximum Allowable Limits of Emissions from Stationary Sources - JS 1052-1998 Motor Emissions - JS 1059-1998 Motor Vehicles - Noise Levels - JS 1053-1998 Motor Vehicles-Emissions-Diesel Engines
Infrastructure and Utilities	▪ ASEZA - ASEZ law No.(32) of 2000 - Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 ▪ Ministry of Interior - Traffic Law No. 49 for 2008 - Regulations for the Registration and Licensing of Vehicles No. 104 for 2008 - Regulation for Maximum Dimensions, Weights and Total Engine Power for Vehicles No. 42 of 2002 - Instructions for Allowable Speed Limits for 2002 ▪ Ministry of Public Works and Housing - The Roadway Law No. 24 for the Year 1986 (for non-penetrating roads) - The Penetrating Roadway Law No. 82 for the Year 2001 - Bylaw of Maximum Dimension, Overall Weights and Engine Power of Vehicles No. 42 for the year 2002 - Regulation of Management and Administration of the Ministry of Public Works and Housing ▪ Ministry of Water and Irrigation - Water Authority Law No. 18 for 1988 and it's amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof ▪ Ministry of Environment: - Instruction for Hazardous Waste Management for the year 2003
Occupational Health and	▪ Ministry of Labour - Labour Law No. 8 for the Year 1996 and its amendments

Safety	- Regulation of Protection and Safety from Industrial Tools and Machines and Work Sites No. 43 for 1998 and its amendment thereof - Formation of Committees and Supervisors of Occupational Health and Safety Regulation No. 7 for 1998 - Instructions for the Protection of Workers against the Risks of the Work Environment - Regulation for Preventive and Curative Health Care for Workers in Establishments No. 42 for 1998 and its amendments thereof - Regulation for the Fees of Work Permits for Non-Jordanians No. 36 for 1997 and its amendments thereof
Community Health, Safety, and Security	▪ ASEZA - ASEZ law No.(32) of 2000 - Environmental Protection Regulation in the ASEZ No.(21) of 2001 ▪ Ministry of Health - Public Health Law No. 47 for 2008

3.3 Jordanian Institutional Set-up

This section identifies the institutional and administrative framework of entities involved in environmental management in Jordan in general and in the ASEZ in specific. Within the ASEZ, environmental management is mainly the responsibility of the Regulator, ASEZA, in accordance with the Regulation No. 21 for the Year 2001 'Regulation for the Protection of the Environmental in the Aqaba Special Economic Zone'. However, other regional and national entities are involved through providing a supporting role to the ASEZA such as the Ministry of Environment, Ministry of Agriculture, Ministry of Water and Irrigation, Ministry of Health, etc. The role of each of those entities is summarized in Table 7 below.

Table 7: Institutional and Administrative Framework governing the Project

Entity	Mandate
ASEZA	In accordance with ASEZ Regulation No (21) for the year 2001, ASEZA is the main responsible entity for environmental protection within the zone as well as enforcement of applicable environmental legislations. As stated earlier, ASEZA assumes the powers of the national environmental regulator (Ministry of the Environment) within the ASEZ. Their main responsibilities include the following: ▪ Issue the environmental permit for the project and the operational permit which includes all requirements and conditions to be fulfilled. The mitigation, management plan and monitoring plan of the EIA constitutes an integral part of it. ▪ Undertake periodical monitoring during all phases of the project (construction, operation, and decommissioning) to ensure compliance of the project owner with the conditions and requirements stated within the environmental permit granted to the project. ▪ Undertake periodic environmental inspection on facilities to ensure their compliance with environmental regulations and requirements. ▪ Force operators to conduct an environmental audit on their facilities in the case of receiving complaints, occurrence of accidents, or if an audit is required to monitor compliance with the environmental management plan as part of the EIA of the project. ▪ Suspend the operations of any activity if it causes or threatens to cause environmental pollution, or results in the deterioration of the quality of water resources in the ASEZ. In accordance with the above, ASEZA has established within its Environmental Directorate different departments that ensure that the following is implemented: ▪ Environmental Audit and Inspection, and planning and implementation of environmental inspection and audit activities within the Zone to ensure compliance. Three main types of inspections are conducted by ASEZA; regular monthly inspections, sudden inspections, and upon complaint inspections. ▪ Reviewing and analyzing the environmental implications of potential investments and projects in the Zone; supervising and managing the implementation of both preliminary and comprehensive EIA studies, required as part of the environmental permit procedure; as well as holding public hearings; and recommending the acceptance/rejection of EIAs and the project classification with regard to the environmental permit request.
Ministry of Environment	ASEZA collaborates with the Ministry of Environment (MoEnv) in all matters related to hazardous waste management in the ASEZ. MoEnv inspects and supervises that hazardous waste is properly contained and transported to the relevant final disposal location (mainly Swaqa Hazardous Waste

	Landfill, 80 km south of Amman).
Ministry of Agriculture (MoA)	Responsible for managing public rangelands and forests, protecting soil resources, pastureland and flora, permitting pesticides, protecting and managing wildlife, issuing fishing and hunting licenses, determining capacity and setting 'take' limits.
Ministry of Health (MoH)	Responsible for the health sector in Jordan, and for community health and safety. It operates most hospitals and clinics and collects data on health indicators.
Ministry of Labour (MoL)	Responsible for the protection of workers' health and safety and has requirements on health checks, provision and use of protective equipment and operational procedures for employees in different types of industry.
Water Authority of Jordan (WAJ)	Responsible for the regulation and protection of Jordan's surface and groundwater resources, including monitoring and protecting water against pollution, in addition to water supplies, irrigation and sewerage. Groundwater, aquifer management and abstraction monitoring and licensing are the responsibility of WAJ.
Royal Society for the Conservation of Nature (RSCN)	The RSCN is an environmental NGO. It is empowered to establish and manage protected environmental reserves as well as Important Bird Areas (IBAs) under the supervision of the MoEnv.

3.4 Requirements for Project Financing

In addition to Jordanian requirements, the following international standards are applicable to the Project:

- International Finance Corporation (IFC) Policy on Social and Environmental Sustainability, 2012, including the IFC Performance Standards (PS) and the Environmental, Health and Safety (EHS) Guidelines.

3.4.1 The IFC Environmental and Social Requirements

The IFC Policy on Social and Environmental Sustainability (2012) sets out the environmental, health and safety and community requirements for projects financed by IFC. Through the implementation of the Equator Principles, IFC requirements have become the *de facto* international environmental and social performance benchmark for project financing.

IFC requirements are set out in its Performance Standards (PSs) of Social and Environmental Sustainability, which are summarized in Table 8.

Table 8: Overview of IFC Performance Standards of Social and Environmental Sustainability

IFC Performance Standard	Description
PS1: Assessment and Management of Environmental and Social Risks and Impacts	PS1 underscores the importance of managing social and environmental performance throughout the life of a project by using a dynamic social and environmental management system. Specific objectives of this Performance Standard are: - to identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence; - to avoid, or where avoidance is not possible, minimise, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment; - to ensure that affected communities are appropriately engaged on issues that could potentially affect them; and - to promote improved social and environment performance of companies through the effective use of management systems.

IFC Performance Standard	Description
PS2: Labour and Working Conditions	The requirements set out in this PS have been in part guided by a number of international conventions negotiated through the International Labour Organisation (ILO) and the United Nations (UN). Specific objectives of this Performance Standard are: ▪ to establish, maintain and improve the worker-management relationship; ▪ to promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labour and employment laws; ▪ to protect the workforce by addressing child labour and forced labour; and ▪ to promote safe and healthy working conditions, and to protect and promote the health of workers.
PS 3: Resource Efficiency and Pollution Prevention	This Performance Standard outlines a project approach to pollution prevention and abatement in line with international available technologies and practices. It promotes the private sector's ability to integrate such technologies and practices as far as their use is technically and financially feasible and cost-effective in the context of a project that relies on commercially available skills and resources. Specific objectives of this Performance Standard are: ▪ to avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities; and ▪ to promote the reduction of emissions that contribute to climate change.
PS 4: Community Health, Safety and Security	This PS recognises that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase risks arising from accidents, releases of hazardous materials, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this PS addresses the project sponsor's responsibility in respect of community health, safety and security.
PS 5: Land Acquisition and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the use of renewable natural resources in a sustainable manner. This Performance Standard addresses how project sponsors can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources. Specific objectives of this Performance Standard are: ▪ to protect and conserve biodiversity; and ▪ to promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.
PS 7: Indigenous Peoples	Performance Standard 7 recognises that Indigenous Peoples, as social groups with identities that are distinct from dominant groups in national societies.
PS 8: Cultural Heritage	Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to protect irreplaceable cultural heritage and to guide project sponsors on protecting cultural heritage in the course of their business operations.

Where the IFC are investors in a Project, as part of their review of environmental and social risks and impacts of a proposed investment, they use a process of environmental and social categorization. The same categorization is also applied under Equator Principles (EP) III (June 2013) by Equator Principle Financial Institutions (EPFIs). The category also specifies IFC's institutional requirements for disclosure in accordance with IFC's Access to Information Policy. The main applicable categories are:

- Category A: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented;
- Category B: Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures; and
- Category C: Business activities with minimal or no adverse environmental or social risks and/or impacts.

It is considered that the Project is likely to be categorized as a Category B project and therefore subject to a 30 day disclosure period.

3.4.2 IFC Environmental Health and Safety Guidelines

In addition to the Performance Standards, the IFC has the EHS Guidelines, which contain technical performance levels and measures related to environmental, health, and safety that are normally acceptable to IFC. There are general EHS guidelines which are applicable to all projects and sector specific guidelines. However, there is no sector specific Guidelines for Solar Projects as opposed to other renewable energy such as Wind Farm Guidelines.

4. ESIA APPROACH & METHODOLOGY

In order to produce an ESIA report as per the requirements of the Environmental Protection Regulation No. 21 for the year 2001, all the issues raised during the Screening and Scoping stages, and that relate to the project development and components should be addressed. Some issues required explanation or verification of existing data, while others required more detailed research and assessment. Additional data had to be collected in order to fully assess some of the issues.

ECO Consult undertook field investigations and desktop research in consultation with experts in the various fields, where necessary, in order to understand fully the issues, and to provide workable recommendations for mitigation and monitoring. Each issue was clearly addressed, and the baseline environmental conditions were described, together with the expected impacts of the project.

This chapter of the Environmental and Social Impact Assessment (ESIA) describes the approach and methodology used to assess the environmental and social impacts of the Project. The chapter describes the ESIA assessment methodology, including:

- Approach to screening and scoping phases;
- Approach for the analysis of alternatives;
- Approach to stakeholder engagement;
- Approach to determining the spatial and temporal study area;
- Methodology for assessment of the baseline environmental and social conditions;
- Methodology used to assess the potential environmental and social impacts of the Project -(including the approach to determining significance, development of mitigation measures and the assessment of residual effects);
- Approach used for the assessment of cumulative and trans-boundary effects; and
- Approach for development of an Environmental and Social Management Plan (ESMP).

4.1 Overall Approach to ESIA Process - Screening, Scoping and Assessment

The ESIA process for the Project is following the environmental permit process outlined in Chapter 3, as summarised below:

- Scoping Phase: the Pre-scoping report was submitted to ASEZA on the 13th of May 2014, and the scoping session for the Project was held on the 20th of May 2014. The Scoping Report/ToR was submitted to ASEZA for review in June 2014.
- Assessment Phase: The assessment phase is being carried out in accordance with the national requirements, the ESIA good practice, the IFC policies and performance standards, and in accordance with the Scoping Report/TOR after being approved by ASEZA. This EIA (or in this case termed the ESIA) document is the output of the assessment for submission to ASEZA and IFC for review and approval.
- Disclosure Phase: This phase is carried out post the submission of the Draft ESIA Report to ASEZA and before the issue of comments and/or approval on the ESIA. During this phase, all main findings of the ESIA represented to the stakeholders.

4.2 Stakeholder Engagement

Stakeholder engagement and scoping are not statutory requirements for PV Projects being developed within the ASEZ; however, it is an integral part of ESIA good practice and is a requirement of IFC PS1¹¹. The Developer is committed to a technically and culturally-appropriate approach to consultation and engagement with all stakeholders affected either directly or indirectly by the Project. The consultation program for the Project is planned based on Informed Consultation and Participation (ICP) in line with IFC requirements with affected

¹¹ IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts: January 1, 2012.

people, and is being designed to be both fair and inclusive. Consultation activities have been underway since the commencement of the Scoping Process of the ESIA in May 2014.

A stakeholder is defined as any individual or group who is potentially affected by the proposed Project or can themselves affect the proposed Project directly or indirectly. Stakeholder consultation is an inclusive process for sharing information that enables stakeholders to understand the risks, impacts, and opportunities of a development or project, allowing them to express their views and articulate their perceptions towards it.

The objective of stakeholder consultation is to ensure that a participatory approach takes place, which in turn documents concerns of all stakeholder groups and makes sure that such concerns are considered, responded to, and incorporated into the decision making process of the development. Stakeholder consultation needs to be a two-way communication process that imparts information to stakeholders, but also obtains additional and on-the-ground information from them. Stakeholder consultation and engagement is planned to take place at the inception phase of the ESIA process and implemented all through the study period.

It is important to highlight that the Project is located within the South Zone of Aqaba which is an area allocated for industrial activities. It has been allocated as such since the establishment of the ASEZ and ASEZA in 2001. The closest community is located in the City of Aqaba with the Main Port Area at a distance of more than 14 km north of the Project site. No other residential areas exist in the vicinity of the Project site.

Some recreational and touristic attractions exist along the coast of the Middle and South Ports such as the Tala Bay and the chalets of the General Intelligence Department which are located at a distance of around five (5) km west of the Project site on the coast of Aqaba. Those are only used by visitors for the purpose of relaxing, diving, swimming, and other recreational and holiday use.

However, it is not envisaged that the Project will have any interaction or impact on these facilities for the following reasons:

- These have been mainly set up after the establishment of the SZ and the SIZ and ASEZA manages the whole area as an industrial area and applies the quality objectives linked with industrial uses regardless if these facilities exist within the zone;
- Since these facilities are located on the coastline and the spatial boundaries for the activities of its visitors are only within the sea and the hotel/chalets, then there are no expected interactions or overlapping between the Project and these facilities; and
- ADC has created a road network within the South Zone which aims to separate the tourist commuters and industrial trucks minimizing them using the same roads or interacting with each other. This has been done to ensure safety and security on the road and minimise visual and aesthetic issues to the extent possible. The road network within the SZ is divided into two parts:
 - Coastal road which is the main coastal road that links the Aqaba City with the touristic attractions and is only allocated for use for small cars; and
 - The Parallel Coastal Road (or the National Highway as named by ADC) and the Aqaba Back Road (or the Escape Lane Highway as named by ADC). Both of these roads are allocated for heavy industrial trucks and shipment trucks and they both have a direct connection with the City of Aqaba (Figure 24).



Figure 24: Alternative road network to reach the Project site (ADC, 2014)

The previous and planned future stakeholder consultation and engagement for the Project is presented and discussed in detail in Chapter 6.

For the reasons provided above, it is foreseen that the primary stakeholders involved within the immediate vicinity of the Project site are those of the adjacent industrial activities, any operation that exists within the corridor of the transmission line, Electricity Distribution Company (EDCO), and NEPCO Office within the ATPS.

The stakeholder consultation and engagement for the Project to date has included both: (i) high level consultations and (ii) detailed engagement and consultations.

The high level consultation mainly includes the undertaking of a scoping session, and which is considered high level as various stakeholder groups representing various entities are consulted at once. The scoping session was held on 20th of May 2014 and included stakeholder groups such as local and national governmental entities, non-governmental organizations, academic and research institutions, and local community representatives.

The detailed engagement and consultation activities have been engagements with a single entity within a stakeholder group at a given time. The detailed engagement includes specific consultations with certain key stakeholder entities whose concerns need to be taken into account throughout the ESIA study. Such detailed engagement and consultation comprised:

- **Primary stakeholder consultation.** This includes the closest stakeholders whom are potential directly to be affected by the Project development, and which include JPMC, KEMAPCO, NEPCO, and EDCO. The consultation was undertaken on one-to-one basis via telephone conversations and unstructured interviews session.
- **Other stakeholder engagements.** This mainly includes consultations with certain groups (governmental organizations, NGO's, etc) whose specific concerns needed to be taken into account throughout the ESIA. Such engagement plans included communication protocols such as bi-lateral meetings, e-mail communication, phone communication, formal letters and other. Such engagements have taken place all throughout the ESIA study.

Chapter 6 also discusses future stakeholder engagement and consultations which are to take place and which mainly include the following:

- The disclosure of the ESIA; and
- The implementation of the Stakeholder Engagement Plan (SEP) by the Developer. The SEP is presented in Annex I – Stakeholder Engagement Plan. The SEP for the Project describes the planned stakeholder consultation activities and engagement process.

The ESIA, Non-Technical Summary, and SEP will be disclosed on the Developer's website <<http://www.shamsuna.com/>> and as it is considered that the Project is likely to be categorized as a Category B project it will be disclosed for a minimum of 30 day disclosure period. The non-technical summary will also be distributed to the relevant stakeholders. This will be done through ASEZA who can send the non-technical summary to all stakeholders within the ASEZ. The list of stakeholders will be identified in coordination between the EIA Team and the ASEZA.

4.3 Analysis of Alternatives

The ESIA shall identify and analyze alternatives, including project site, process and technological alternatives, the no project alternatives etc., and present the main reason for the preferred choice. The examination of alternatives is considered to be a key element of the ESIA process under good international practice, including the IFC Performance Standard 1¹² and the associated IFC Guidance Note 1¹³. Environmental and social considerations have been part of the planning of the Project and a core element of the decision-making process.

A core element of the approach will be the application of the environmental and social mitigation hierarchy of: **avoid; reduce; mitigate and manage, and compensate and offset whereby possible major adverse impacts were designed out and avoided as early as possible in the Project development process.**

The ESIA investigated and compared several alternatives to the Project development in relation to: i) the Project site, ii) the chosen technology, iii) the Project design, and finally investigate the 'no action alternative' - which assumed that the Project development does not take place. The consideration which informed the provisional route of the transmission line up to the substation have been presented within the ESIA. The analysis of alternatives is presented and discussed in detail in this ESIA report in Chapter 5.

¹² IFC Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts: January 1, 2012.

¹³ IFC Guidance Note 1: Assessment and Management of Environmental and Social Risks and Impacts: January 1, 2012.

4.4 Delineation of Study Boundaries and Scope of Assessment

4.4.1 Definition of Spatial Study Area

The overall Study Area for the ESIA represents the potential area of influence of the Project. This is *'the area over which significant effects of the Project could reasonably occur, either on their own, or in combination with those of other developments and projects'*.

In general terms, the Study Area for the on-site facilities related to the Project ESIA includes the footprint of Project disturbance as demarcated in purple in Figure 25 below.

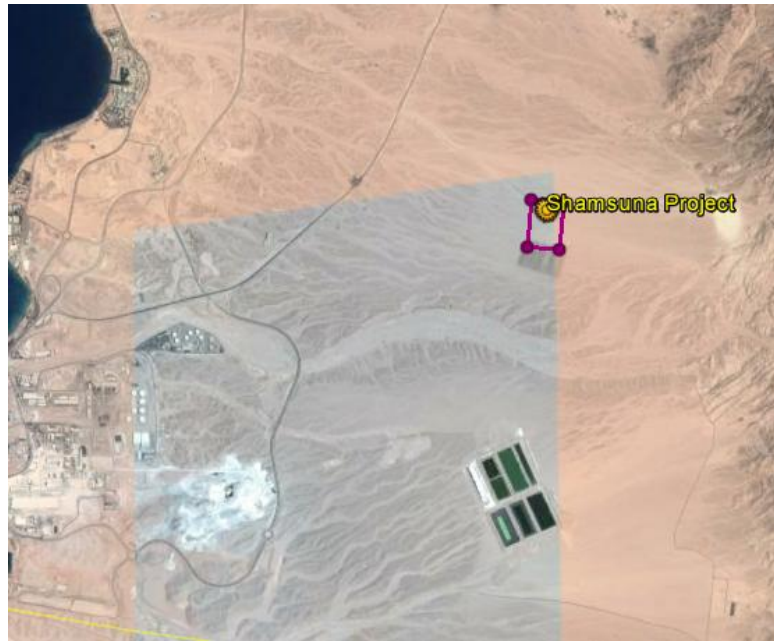


Figure 25: Study Area

However, for the assessment of the individual environmental and social parameters (infrastructure and utilities, air and noise, etc), an appropriate thematic Study Area is determined for each theme on a case by case basis. Such a thematic Study Area is clearly identified within the relevant Section it relates to throughout this ESIA.

In identifying these thematic Study Areas, the type and degree of the potential direct and indirect effects were taken into consideration. The core area where direct effects are likely to occur was determined, as well as the wider area of influence where indirect, combined and cumulative effects are likely to occur on the surrounding areas and communities. For the purpose of the social assessments, the Study Area was determined by consideration of the potential effects on the nearby stakeholders which mainly includes the adjacent industrial activities and operations with the SIZ.

For the 'offsite' infrastructure, namely the transmission line up to the substation, the exact and specific plans and construction methods for the offsite transmission line are not available so far. The only available information are the approximate route and corridor of the 6 km transmission line and according to ADC and ASEZA, this may be modified based on site-specific surveys to be undertaken by the EPC Contractor during the construction phase. Therefore a higher level of assessment on this element has been undertaken in the ESIA, whilst mitigation measures and monitoring plans are described to some degree further studies necessary to enable a more detailed review of the impacts and to inform construction are advised within the suite of mitigation measures. In addition, these offsite activities and based on the level of information available, a set of Environmental Performance Requirements have been identified in Chapter 10 to be considered by the Developer, and the EPC Contractor (and his sub-contractors). Such performance requirements aim to ensure that environmental and social issues are taken into account and adequately considered.

4.4.2 Temporal Scope of the Assessment

The Project will be developed in a three phase sequence, as follows:

- Planning & Construction Phase
- Operation Phase
- Decommissioning Phase

Potential impacts are assessed throughout the various Project phases as defined below. As noted earlier, the scope for assessment of impacts is mainly for those onsite activities which will be undertaken within the Project site throughout the various phases. However, there are additional anticipated offsite impacts which are mainly related to the offsite infrastructure and connection with the substation. These are only considered at a high level and not in detail. Nevertheless, within Chapter 10, a set of Environmental Performance Requirements have been identified which must be considered by the Developer and the EPC Contractor (and his sub-contractors).

Planning and Construction Phase

This includes onsite construction activities which will be undertaken by the EPC Contractor. This mainly includes preparing the detailed design and layout of the Project, transportation of Project components onsite, as well as onsite site preparation and construction activities for installation of PV arrays, internal access roads, buildings, switchgear. In addition, offsite activities will be undertaken for laying transmission cables from the switchgear to the NEPCO substation.

Operation Phase

This includes activities to be undertaken by the Project Operator. Activities expected to take place mainly include the normal daily operation of the PV Plant and the routine maintenance activities (e.g. PV module cleaning), inverter servicing, checks on structural integrity, etc.)

Decommissioning Phase

It is not clear at this point whether at the end of the lifetime of the Project (where according to the agreement between the Developer and MEMR is set for 20 years) MEMR would take ownership of the Project and continue operating it or whether the Project will be completely decommissioned. Should MEMR decide to continue to operate the Project, then in this case, the Project is expected to operate for an additional five years (given that the PV modules lifetime is 25 years), and after that MEMR could continue operation through repowering it by replacing older PV modules with more modern and efficient modules, or could decide to completely decommission the Project. Nevertheless, in the case of the complete decommissioning of the PV farm, decommissioning activities could include the disconnection of the various Project components (PV array, transformer/inverter stations, substations, etc) for final disposal. In addition, tracks used for maintenance vehicles will be restored and gates and fences will be removed.

Generally, the anticipated impacts throughout the decommissioning phase are similar in nature to impacts assessed during the construction phase – and specifically in impacts related to soil and groundwater (from improper management of waste streams), air quality and noise, and occupational health and safety. Therefore, the assessment of impacts for those receptors and mitigation identified during the construction phase will be assumed to apply to this phase in particular without the need to reiterate or emphasize this throughout this Chapter. However, impacts which are clearly specific to the decommissioning phase only (e.g. disposal of panels at end of life) have been clearly identified and assessed throughout this chapter..

4.5 Environment & Social Baseline Conditions

As part of the ESIA process, the baseline environmental and social conditions of the Study Area were established. Describing the baseline includes identifying and defining the importance and sensitivity of the various environmental and social resources and receptors likely to be impacted, i.e. within the Study Area.

Understanding the value or sensitivity of the resources and receptors to impacts and changes is an important consideration when determining the significance of effects, and allows for better identification of the most appropriate measures that could be employed to avoid impacts, and to mitigate any adverse impacts.

The description of environmental and social baseline conditions has considered a wide range of data and information gathered from various sources, including:

- Desk-based studies and literature reviews;
- Data from statutory and non-statutory stakeholders; and
- Field surveys and site investigations.

These studies have covered all the environmental and social aspects related to the Project as defined within the Terms of Reference Report (June, 2014). The baseline conditions are treated as those conditions which would prevail in the absence of the Project.

Studies of the environment and social baseline are described in the Chapter 7 and include the following: Landscape & Visual; Land Use; Geology & Hydrology; Biodiversity; Archaeology; Air Quality & Noise; Infrastructure & Utilities; Socio-economic. Within the Chapter, the methodology which was undertaken for assessment of the each of those baseline conditions is described in detail.

4.6 Impact Assessment Methodology

The impact assessment is presented in Chapter 8. Given the scale and type of the Project, the Chapter commences with an assessment of the positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Jordan faces.

It then moves forward into the main body of the ESIA undertaking the assessment of impacts on environmental and social parameters as required under the ToR. The following section provides a description of the approach, methodology and process adopted for the impact assessment presented within this ESIA.

4.6.1 Approach to Assessment of Impacts

The adverse and beneficial environmental and social impacts of the Project have been identified and assessed against the established baseline. A consistent approach to the assessment of impacts was followed to enable environmental and social impacts to be broadly compared across the ESIA. A set of generic criteria were used to determine significance (see below) which were applied across the various environmental social and environmental parameters.

As far as possible, environmental and social impacts were quantified. Where it was not possible to quantify impacts, a qualitative assessment was conducted using professional experience, judgment and available knowledge, and including the consideration of stakeholder views. Where there were limitations to the data, and/or uncertainties, these have been recorded in the relevant chapters, along with any assumptions that were taken during the assessment.

In order to determine the significance of each impact, two overall factors are considered:

- The importance and/or sensitivity of the environmental and social receiving parameter, as determined during the assessment of baseline conditions; and
- Magnitude and Nature of the impact.

4.6.2 Sensitivity of the Receiving Parameter:

Receiving parameter sensitivity was determined using information taken from the baseline description on the importance, significance or value of the social or environmental component under examination. It is important to understand the sensitivity of the receiving parameter, as this is a measure of the adaptability and resilience of an environmental parameter to an identified impact. The following categories of sensitivity were applied to the assessment:

- *High*: The environmental parameter/receptor is fragile and an impact is likely to leave it in an altered state from which recovery would be difficult or impossible.
- *Medium*: The parameter/receptor has a degree of adaptability and resilience and is likely to cope with the changes caused by an impact, although there may be some residual modification as a result; and
- *Low*: The parameter/receptor is adaptable and is resilient to change.

4.6.3 Magnitude and Nature of the Impact:

The magnitude of the impact is the scale of change which the impact may cause compared to the baseline and how this change relates to accepted thresholds and standards. The following categories were applied to the assessment:

- *High*: a large change compared to variations in the baseline. Potentially a clear breach of accepted limits;
- *Medium*: change which may be noticeable and may breach accepted limits; and
- *Low*: when compared with the baseline, change which may only just be noticeable. Existing thresholds would not be exceeded.

Furthermore, in determining the magnitude of the impact it is important to take into account and consider several other factors which define the nature of the impact. This includes the following:

Type of Impact

- *Positive*: applies to impacts that have a beneficial environmental result, such as enhancement of the existing environmental conditions; and
- *Negative*: applies to impacts that have a harmful aspect associated with them such as loss or degradation of environmental resources.

Type of Effect

- *Direct*: applies to impacts which can be clearly and directly attributed to a particular environmental or social parameter (e.g. generation of dust directly impacts air quality); and
- *Indirect*: applies to impacts which may be associated with or are subsequent to a particular impact on a certain environmental or social parameter (e.g. high levels of dust could entail nuisance and health affects to construction workers onsite).

Duration (how long the stressor or its effect last)

- *Short Term*: applies to impacts whose effects on the environment will disappear within a 1 year period, or once construction activities are completed;
- *Medium Term*: applies to impacts whose effects on the environment will disappear within a 5 year period; and
- *Long Term*: applies to impacts whose effects on the environment will disappear in a period greater than 5 years.

Reversibility

- *Reversible*: applies to impacts whose significance will be reduced and disappeared over time (either naturally or artificially), once the impacting activity ceases; and
- *Irreversible*: applies to impacts whose significance will not be reduced nor disappeared over time (either naturally or artificially), once the impacting activity ceases.

4.6.4 Assessing the Significance of the Impacts

The concept of ‘significance’ is central to the ESIA process and aids the identification and categorisation of environmental and social effects. As noted, in order to determine impact significance, the sensitivity of each environmental and social parameter/receptor is considered in combination with the magnitude of the impact. Table 9 below demonstrates how these parameters are considered in the assessment of significance.

Table 9: Determination of Significance

Sensitivity of Receiving Parameter/Receptor \ Magnitude and Nature of Impact	Low	Medium	High
	Low	Medium	High
Low	Not significant	Minor	Minor
Medium	Minor	Minor	Moderate
High	Minor	Moderate	Major

While the above matrix provides a framework for the determination of significance, and enables comparison across environmental and social parameters, a degree of professional judgement must be used and some parameter-specific factors to be considered in making the determination of significance.

Below provides additional guidance to the degrees of significance used in this ESIA. Note that positive impacts are defined, but are not rated for significance.

- *Major significance*: requires thorough investigation in the ESIA. These impacts have been studied extensively by consulting expertise in the areas of the identified impacts to design needed mitigation and environmental management measures. Moreover, conducting specific studies and assessments to some of the key issues identified;
- *Moderate significance*: requires reasonable investigation in the ESIA. These impacts have been studied by expertise in the areas of the identified impacts to design needed mitigation and environmental management measures;
- *Minor significance*: must be listed, and addressed in some way, but which did not require detailed assessment in the ESIA; and
- *Not significant*: for completeness, impacts which have been included in the assessment but determined not to be significant, are rated formally as ‘not significant’.

4.6.5 Mitigation

A vital step in the ESIA process is the identification of measures that can be taken to ensure that impacts are mitigated or reduced to acceptable levels. The ESIA will firstly consider the significance of any impacts caused by the Project and then assigned mitigation options through applying the following hierarchy:

- Avoiding or ‘designing out’ impacts wherever possible;
- Considering alternatives or modifications to the design to reduce the impacts wherever possible;
- Applying measures to minimise and manage impacts on the receptor; *then*

- As a last resort, identifying fair compensation, remediation and offsetting measures to address any potentially significant residual effects. However, as noted throughout this ESIA there are no significant residual effects which require compensation or offsetting.

Some negative impacts can be easily mitigated, whilst others cannot or are too difficult and costly to mitigate. The various potential impacts are described in this ESIA, along with the provision of 'feasible mitigation measures' that can be implemented. Moreover, for positive impacts it is not possible to identify mitigation measures, but rather recommendations have been identified which aim to enhance the positive impact.

4.6.6 Assessment of Residual Effects

If there are mitigation measures it is then necessary to make an assessment of the 'residual significance' after mitigation has been taken account. A re-assessment of Project impacts is then made, taking into account the effect of the proposed mitigation measures in order to determine the significance of the *residual effects*.

As noted throughout this ESIA, the effect of all impacts assessed will be reduced to insignificant levels. Residual effects are discussed for each environmental and social theme in the ESIA chapters, and their significance determined and summarized in an Impact Assessment Table.

4.7 Assessment of Cumulative Impacts

The assessment of cumulative impacts is an important component of an ESIA. The purpose is to address the cumulative impacts of the proposed Project, other existing projects and anticipated future projects where there may be an overlap in spatial scope use of resources or impact on resources. An effect on a receptor or resource may not be significant when individual impacts are considered in isolation, but the cumulative effect of multiple impacts may be significant and require consideration of additional mitigation measures. Cumulative impacts can be considered in two categories:

- the combined effects of different Project impacts on a particular receptor, for example noise, dust and visual impacts, which combine to impact the same community; and
- cumulative impacts that result from incremental changes caused by other past, present or reasonably foreseeable activities or projects (where these are known and can be determined), in combination with the proposed Project.

Combined effects of different Project impacts are considered within the ESIA.

Cumulative impacts which could result from incremental impacts from the other known existing and/or planned developments in the area have been reviewed but given the site surrounds are considered to be insignificant based on the currently planned and approved other projects in the area. The basis to this conclusion is outlined below:

- Section 2.3 outlines the 2006 SZ Master Plan, however none of the proposed developments surrounding the Project site have reached the approval stage at the time of the ESIA.
- A Strategic Environmental Assessment accompanied the 2006 Master Plan, which included thorough stakeholder engagement and consultation, provided comprehensive performance requirements to ensure environmental protection and a structured a road map for environmental permitting for any project planned as part of the 2006 Master Plan. The spatial scope of the Strategic Environmental Assessment was the whole SZ area including the SIZ.
- It is not considered necessary to undertake a cumulative impact assessment with regarding to 'incombination effects' with other projects/development as part of the ESIA process, as there are no approved developments in the local area and once the Project is operational, it is not considered that the project will have any significant effect on any of the planned activities in the area.

4.8 Development of an Environmental and Social Management (ESMP) Plan

Based on the results of the impact assessment, development of mitigation measures, and development of monitoring plan, an ESMP was compiled into a single table that details all of the above. The ESMP will be a key document and will list the environmental/social requirements and detail the procedures necessary for managing the significant environmental/social issues connected to proposed Project activities. The ESMP will be developed specifically to provide flexibility in the nature and exact location of operations, while ensuring all potential impacts are identified and properly mitigated and monitored throughout the later stages of the Project. This ESMP can be used as a stand-alone document during the different phases of the Project by the EPC Contractor, Developer, ASEZA, and other responsible parties.

5. PROJECT JUSTIFICATION AND ALTERNATIVES

The Environmental Protection Regulation in the ASEZ No.(21) of 2001 requires that the ESIA shall identify and analyze alternatives, including project site, process and technological alternatives, the no project alternatives etc., and present the main reason for the preferred choice. The examination of alternatives is considered to be a key element of the ESIA process under good international practice, including the “IFC Performance Standard 1” (IFC, 2012) and the associated “IFC Guidance Note 1” (IFC, 2012). Environmental and social considerations have been part of the planning of the Project and the decision-making process.

This chapter summarises the Project’s approach to the application of the mitigation hierarchy during the development of the Project. Furthermore it presents the analysis of certain alternatives to the Project development in relation to: (i) the Project site, (ii) the chosen technology, (iii) the Project design, and finally investigates (iv) the ‘no action alternative’ - which assumes that the Project development does not take place.

In addition the considerations and alternatives analysis which informed the identification of the provisional corridor for transmission line are summarised.

5.1 Application of Mitigation Hierarchy

The application of the environmental and social mitigation hierarchy (avoid; reduce; mitigate and manage, and compensate and offset) was considered throughout the Project development process. A summary of such mitigation hierarchy for certain key environmental and social issues is summarized below and discussed throughout this Chapter.

- **Location and Land Use Issues.** The site selected for the development of the Project is already located within an area designated for industrial uses, which is the South zone of Aqaba and specifically on a land allocated for development of solar energy projects. Hence, it is concluded that there is no conflict of the Project site in relation to the formal land use planning as set by ASEZA and ADC. Additionally, several meetings were held with all involved parties (e.g. ASEZA, ADC, EDCO, NEPCO...etc.) in order to draft an initial corridor for the offsite infrastructure (i.e. the transmission line from Shamsuna to the ATPS). The transmission line will be layed within the Wadi 2 or buffer zone which is allocated by ADC as a corridor for extending utilities and infrastructure. These have been important steps in order to avoid any potential issues with the local community and/or disrupt or affect the operations and activities within the South Industrial Zone.
- **Water Requirements.** PV modules require regular cleaning in order to prevent dust build up which in turn could affect their output capacity. Dust can reduce efficiency by 35% in a month (Cube engineering, 2014). Generally, panels are cleaned through the use of water resources. However, the Project has opted for cleaning the panels through a ‘dry’ brush cleaning mechanism which does not entail the use of water. This in turn reduces water consumption levels of the Project during the operation phase and maximizes water efficiency measures.
- **Flood Risks.** Wadi 2 which is a deep and wide wadi crossing the area 1 km south of the Project location from the mountains and running to the coast. Although Wadi 2 is large, in terms of the drainage of the Zone it does not have a huge impact partly because it is already controlled along its lower reaches by containment revetments. . This area is categorised as a buffer zone according to the SIZ land use (Figure 14). Although the region is mainly dry there are periodically short intensive rainstorms which produce flash floods in the wadi system which crosses the Zone. The 2006 Master Plan for the SIZ studied drainage and flood management within the SIZ and recommended containment structures and channels to protect infrastructure investments within the catchment area of Wadi 2 against flooding, erosion and sediment deposition. However, according to ADC, the already existing containment revetments have been functioning adequately and ADC only had to construct a culvert to protect the road networks downstream of Wadi 2. ADC is already using Wadi 2 as a buffer zone area and as a corridor zone for extending utilities and infrastructure (e.g. Fajr Gas Pipeline and the High Voltage Electricity Transmission Line). According to ADC, to date, there have been no issues caused by any floods within Wadi 2. Additionally, it is most

probable that the whole cable will be Over-head Line (OHL) except under the bridge on the main coastal highway that runs from Aqaba City till the SZ in addition to the last section of the route “entry to NEPCO Substation in the ATPS”. The selection of the site and the route for offsite infrastructure has been important steps in order to avoid any potential issues with flood risks.

- **Other Issues.** One of the objectives of this ESIA is the identification of any environmental and social constraints on the site specific level which must be taken into account by the Project developer throughout the planning and design phase of the Project. Such constraints could include amongst others: possible onsite archaeological resources of significant value, critical habitats which must be protected, infrastructure and utilities restrictions, etc. However, as presented throughout the ESIA, no site specific constraints have been identified in relation to the Project site which needs to be taken into account throughout planning and design phase of the Project.

Additionally, the exact and specific plans and construction methods for the offsite transmission line and the upgrades to the existing substation are not available so far. The only available information are the approximate route and corridor of the 5-6 km transmission line and according to ADC and ASEZA, this may be modified based on site-specific surveys to be undertaken by the EPC Contractor during the construction phase. For such offsite activities and based on the level of information made available by the time of the submission of this ESIA (around mid June 2014 based on financing requirements and timeline), this ESIA will identify a set of Environmental Performance Requirements to be considered by the Developer, and the EPC Contractor (and his subcontractors). Such performance requirements aim to ensure that environmental issues are taken into account and adequately considered.

In addition, as noted throughout this ESIA study, the significance of the anticipated impacts from the Project is generally minor. Furthermore, appropriate mitigation and management measures have been identified for such impacts, and there are no significant residual effects predicted which would require compensation or offsetting.

5.2 Site Selection Alternatives

As discussed earlier, the Project is located in the South Zone of Aqaba and specifically within the Southern Industrial Zone. It is located on a 1,308 dunums¹⁴ land allocated by ASEZA and ADC for solar energy projects within the SIZ based on a decision by the joint committee of ASEZA and ADC.

There are several factors which ensure that an optimal location has been chosen with regards to a solar PV Project development, and those include the following:

- **Ideal Solar Resources:** according to the National Energy Research Centre (NERC), the southern region represented by Ma'an and Aqaba have the highest solar isolation in Jordan and the lowest values of diffuse irradiance. Such areas have an annual average daily global irradiance between 6-4 kWh/m². In addition, the average sunshine duration is more than 300 days per year. Such characteristics make the Project site in Aqaba an ideal location for solar PV Project.
- **No need to build a new substation:** Presence of an already built substation within the Aqaba Thermal Power Station that the Project can connect to. This would eliminate the need to choose new locations for a substation and avoid any potential environmental impacts associated with construction of a new substation.
- **Site already served with a road network:** the project site is already served with a proper road network and no need for access roads. Besides reduced costs, this would avoid environmental impacts associated with the construction of roads.

¹⁴ 130.8 hectares

- **Natural Landscape of the Site:** PV solar developments generally require flat surface for the installation of the various Project components to include the PV arrays. The Project area in general can be characterized as being dominantly of fairly flat surfaces and therefore site preparation and earthwork activities are not expected to be substantial.
- **Site already allocated for development of solar projects:** the land use within the SZ and the SIZ is already for industrial uses, and the Project is located at a distance of around 14 km south of the closest residential areas in Aqaba City. The site itself and the surrounding plots (total area 1,308 dunums¹⁵) are allocated for solar energy projects. There is no conflict with the existing or planned land use of the site and also uninhabited and unused, and is considered of no value to the local community.
- **Distance to Key Sensitive Receptors:** the Project site in general is located at a reasonable distance from any key potential sensitive receptors which includes community settlements, environmental sensitive areas, grazing reserves, airports, etc. Even though the site is located within an Important Bid Area but the SIZ is heavily disturbed by the industrial activities which affects the biodiversity within the SIZ and the site itself lacks natural resources.

From the factors mentioned above, it can be concluded that the Project site, to some extent, offers the ideal factors for the development of a solar PV Project.

5.3 Provisional Transmission Line Route/Corridor Selection Alternatives

As discussed earlier, the onsite switchgear will connect through a 30 kV cable, with the substation located at the Aqaba Thermal Power Station (ATPS). With the support of ADC, the Developer, EPC Contractor, and Owner's Engineer undertook an extensive consultation and held coordination meetings with the relevant entities in relation to selecting the proposed transmission line route including ASEZA and EDCO. Three (3) different route alternatives were proposed at the onset of the Project by the Developer and the EPC Contractor as shown in Figure 26 below.



BLUE: UNDERGROUND CABLE

RED: OVER HEAD LINES

Green: OVER HEAD LINES – temporary until the new roads are constructed

Figure 26: Different transmission line alternatives proposed by the Developer and the EPC Contractor at the onset of the Project (Trina, 2014)

A Grid connection routing stakeholders meeting was held on the 20th of May 2014 at ASEZA offices prior to the Scoping Session held on the same day. The meeting was attended by the Developer, EPC Contractor, Owner's Engineer, ADC, ASEZA, and EDCO. The three (3) proposed routes were presented by the Developer. The purpose of the meeting was to: clarify the location of the site location and grid connection, get other recommendations for the routing that ADC or others might have, get comments on the proposed options, get the required approvals from each party involved on the routing layout, and initiate the required coordination with other utilities.

Based on discussions, neither one of the proposed routes was preferred due to the following reasons:

¹⁵ 130.8 hectares

- The Back road is crowded already with utilities and activities and there is no space for the transmission line;
- If the transmission line were to go the right of way of the Back road, then the only option was to have it underground. Based on EDCO, many underground cables already exist within the right of way of the road which implicates that the excavation and construction of the transmission line for the project will only be manual since EDCO does not allow any other means on excavation in the corridors of their cables. This is a huge implication on cost and time;
- Underground cables are costly;
- The length of the transmission line in all three (3) options is around 8 km;
- There is a plan to expand the Back road into four (4) lanes as per the recommendations of the 2006 SIZ Master Plan which will increase traffic and movement in that area; and
- ADC and ASEZA had already designated Wadi 2 as a buffer zone for extending all utilities and infrastructure.

Based on this, the provisional route as shown in Figure 18 was set as an initial corridor plan for the transmission line. The EPC Contractor will have to undertake site specific surveys in order to assess the corridor and ensure the route is clear of any obstacles and limitations and accordingly finalise the design. The final design will be submitted to ADC and to ASEZA for approval as the regulator in the whole of the ASEZ. The EPC Contractor will also need to coordinate with all existing utilities within the pathway of Wadi 2 in order to ensure all clearance requirements set by NEPCO, EDCO, Fajr Gas pipeline are met.

5.4 Technological Alternatives

This section discusses several alternatives besides the development of a solar PV project. This mainly includes other renewable energy alternatives suitable for the area in general – such as Concentrated Solar Power (CSP) and Concentrated Photovoltaic (CPV). In addition, this section discusses other technological alternatives for power generation such as wind power and thermal power plants.

▪ Solar Technology Alternatives

Other solar technology alternatives that were considered and which are suitable for the Project site area in general include the Concentrated Solar Power (CSP) and the Concentrated Photovoltaic (CPV). CSP technology uses mirrors to concentrate (focus) the sun's light energy and convert it into heat to create steam to drive a turbine that generates electrical power. On the other hand, CPV technology uses optics such as lenses or curved mirrors to concentrate a large amount of sunlight onto a small area of solar photovoltaic (PV) cells to generate electricity.

The alternatives were compared on three (3) main criteria and which include: (i) technical performance, (ii) commercial-technical maturity, and (iii) production cost. First, the PV technology was compared with the CSP and based on a qualitative analysis the PV technology was preferred. Table 10 below summarizes the technical attributes which were investigated and compared between both technologies.

Table 10: Summary of Qualitative Analysis of PV and CSP

Attribute	PV	CSP
Power Density (land area)	✓	
Water Requirements	✓	
Field Experience	✓	✓
Operation and Maintenance (O&M) Cost	✓	
Suitability to Jordan's Solar Resources	✓	✓
Ease of Siting and Permitting	✓	
Modularity and Scalability	✓	
Peak Load following Capability	✓	✓
Suitability for Storage		✓
Dispatchability		✓

Simplicity of Design and Operation	✓	
Capacity Factor		✓
Balance of Plant Requirements	✓	
Total	10	6

Similarly, a comparative assessment was undertaken for the PV technology and the CPV. Based on a qualitative analysis, the PV technology was preferable. Table 11 below summarizes the technical attributes which were investigated and compared between both technologies.

Table 11: Summary of Qualitative Analysis of PV and CPV

Attribute	PV	CPV
Ground Coverage Ratio	✓	
Water Requirements	✓	✓
Field Experience	✓	
Operation and Maintenance(O&M) Cost	✓	
Suitability of Jordan Solar Resource	✓	✓
Ease of Siting and Permitting	✓	✓
Modularity and Scalability	✓	✓
Suitability for Storage		
Potential for Future Cost Reductions	✓	✓
Simplicity of Design and Operation	✓	
Balance of Plant Requirements	✓	✓
Total	9.5	7.75

▪ **Wind Technology Alternative**

MEMR have installed wind measurement systems throughout the Kingdom to undertake wind measurement campaigns. The objective is to assign promising locations for wind farm developments throughout the Kingdom, and the outcome was a comprehensive map which denotes such areas. As noted in Figure 27 below, such areas are mainly limited to the Northern and Southern parts of Jordan.

In addition, Figure 27 presents the Project location relevant to those promising locations for wind farm developments. As noted in the figure, the Project is located outside those areas. Therefore, the natural characteristics of the Project site are likely to be considered unsuitable for the development of a feasible wind farm at a commercial scale.

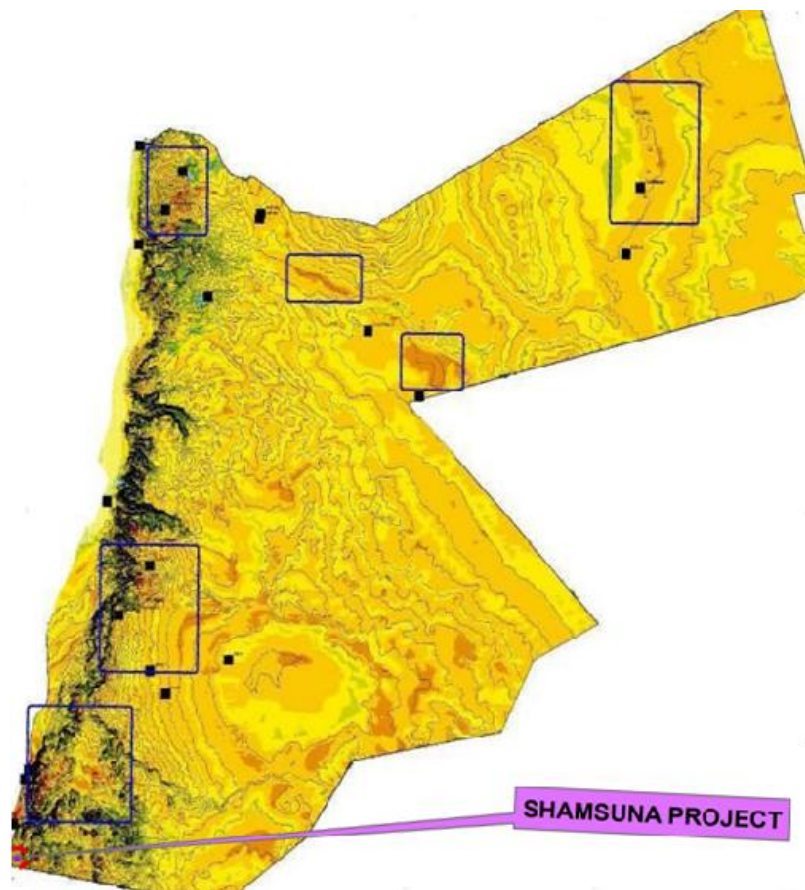


Figure 27: Wind Map of Jordan with Promising Locations

In addition, from an environmental stand point of view, wind farms are associated with other environmental impacts when compared to PV development projects. Apart from general impacts similar to those associated with PV development projects as discussed throughout this ESIA (biodiversity, archaeology, air quality and noise, occupational health and safety, etc), wind farm developments are associated with other impacts. This includes the following: (i) impacts on birds from risks of strikes and collision on both migratory and resident soaring birds, (ii) community health and safety impacts related to noise and shadow flicker caused by operating turbines, and (iii) visual impacts as turbines are tall structures that can be seen from several kilometres away and impose a change on the landscape of the area where they are installed.

▪ **Other Technological Alternatives**

Other energy generation alternatives suitable to be built in Jordan include thermal power plants which are fuelled with natural gas or oil, similar to others already existent in the country.

Despite the advantages that a solution of this kind would entail - such as a potential bigger energy generation capacity or the creation of more jobs during both construction and operation - the disadvantages would be significant; especially those related to environmental impacts. Thermal power plants are well known for their environmental impacts when compared to this Project and could include significantly higher water consumption, generation of air pollutants and greenhouse gas emissions, noise generation, etc. More importantly, such developments would not be in line with the Government of Jordan's "Master Strategy of Energy Sector in Jordan" which in broad terms advocates for the diversification of energy resources and increasing the share of renewable energy to 7% in 2015 and 10% in 2020.

5.5 Project Design Alternatives

One of the objectives of this ESIA is the identification of any environmental and social constraints on the site specific level which must be taken into account by the Project developer throughout the planning and design phase of the Project. Such constraints could include possible onsite archaeological resources of significant value, critical habitats which must be protected, infrastructure and utilities constraints restrictions amongst others.

However, as presented throughout the ESIA, no site specific constraints have been identified in relation to the Project site, which need to be taken into account throughout planning and design phase of the Project. Therefore, there are no design alternatives to be considered in relation to environmental issues.

In addition, as noted throughout this ESIA study, the significance of the anticipated impacts from the Project are generally minor. In addition, as presented throughout this ESIA, appropriate mitigation and management measures have been identified for such impacts, and there are no significant residual effects which would require compensation or offsetting.

Nevertheless, several other project component alternatives were investigated with the Developer and key contributors. Those are summarized below:

- PV module cleaning: regular cleaning of the modules is required in order to prevent dust build-up which would affect their performance. The modules will be cleaned through a dry brush cleaning program using special telescope brooms which does not entail the use of water. Another option which is usually used for the cleaning of modules in PV Projects is the use of water. Water cleaning might be faster and require less man-hour, as a time for the cleaning is not a concern and can be arranged to clean the whole site within five (5) days. However, osmotic water has to be used to avoid minerals on the glass; water can cause tensions on the modules which will cause microcracks in the module and thus additional cost. Also, such an alternative would result in higher water consumption for the Project throughout the operation phase. However, the Developer and the EPC Contractor has opted for utilizing 'dry' cleaning mechanisms in an effort to promote water efficiency; this is the preferable option from an environmental stand point of view.
- Anti-Reflective Coatings (ARC): Anti-Reflective coatings are sometimes used within PV modules to enhance to some extent the absorption of sunlight and minimize reflections (which could be a potential for glare). However, after discussions with the Owner's Engineer and the EPC Contractor, it was stated that ARC cannot be used on the PV modules as the ARC layer would not withstand the natural environmental setting of the Project site – the desert nature will result in regular build up of dust which will require regular dry brush cleaning, in turn affecting the ARC layer and consequently put their warranty at risk. However, as it has been concluded within the ESIA (refer to Section 8.2.2) that the potential of glare from the Project is not considered an issue of concern.

5.6 The 'No Project' Alternative

The 'no project' alternative assumes that the Project will not be developed. Should this be the case, then the Project site area would remain the same. The land area would remain with its current characteristics – an escarpment deeply incised by dry river courses and marked by extensive alluvial deposits. In addition, the land use of the area would most likely remain as is; unused and uninhabited.

Should the Project not move forward, then the Project-related negative environmental impacts discussed throughout this ESIA would be averted. However, as noted throughout the ESIA, generally such impacts do not pose any issue of concern and can be adequately controlled and mitigated through the implementation of general best practice management measures. Nevertheless, should the Project not move forward, then, the significant and crucial positive economic and environmental benefits would not be realized. Such benefits have been previously discussed and include the following:

- Contribute to increasing energy security through development of local energy resources and reducing dependency on external energy sources;
- Producing clean energy contributes to lowering electricity generation costs compared to the current costs associated with liquid fuels and thus leads to a decrease in the Government of Jordan's fiscal deficit;
- This development allows for more sustainable development and shows the commitment of the Government of Jordan to realising the energy strategy;
- The clean energy produced from renewable energy resources is expected to reduce consumption of alternative liquid fuels for electricity generation in Jordan, and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions; and
- Project is expected during the construction and operation phase to generate local employment and commit to other social responsibilities. As such, this is expected, to a certain extent, to subsequently enhance the socio-economic conditions and standards of living of the local communities.

In conclusion, an ESIA must investigate all potential positive and negative impacts from a project development. In the case of this Project, it is important to weigh the significant positive economic and environmental impacts incurred from the Project development, against the negative environment impacts anticipated at the site specific level – in which this ESIA concludes to be minor in nature and can be adequately mitigated. The comparison in this chapter clearly concludes that the 'no project' alternative is not a preferable option.

6. STAKEHOLDER CONSULTATION AND ENGAGEMENT

6.1 Introduction

Even though stakeholder engagement and scoping are not statutory requirements of the national EIA framework for PV Projects being developed within the ASEZ, it is an integral part of ESIA good practice and is a requirement within IFC PS1. The Developer is committed to a technically and culturally-appropriate approach to consultation and engagement with all stakeholders affected either directly or indirectly by the Project. The consultation program for the Project is planned based on Informed Consultation and Participation (ICP) in line with IFC requirements with affected people, and has been designed to be both fair and inclusive. Consultation activities have been underway since the commencement of the ESIA Scoping Process in May 2014.

A stakeholder is defined as any individual or group who is potentially affected by the proposed Project or can themselves affect the proposed Project directly or indirectly. Stakeholder consultation is an inclusive process for sharing information that enables stakeholders to understand the risks, impacts, and opportunities of a development or project, allowing them to express their views and articulate their perceptions towards it.

6.2 Objectives

The objective of stakeholder consultation is to ensure that a participatory approach takes place, which in turn documents concerns of all stakeholder groups and makes sure that such concerns are considered, responded to, and incorporated into the decision making process of the development. Stakeholder consultation needs to be a two-way communication process that imparts information to stakeholders, but also obtains additional and on-the-ground information from them. Stakeholder consultation and engagement starts at the inception phase of the ESIA process and implemented all through the study period.

The specific objectives of this chapter are to:

- Summarise Developer, national and international legal & policy requirements for stakeholder engagement;
- Describe and identify the stakeholders affected and/or with an interest in the Project;
- Summarise stakeholder engagement and consultation conducted to date;
- Describe how the views and issues raised have informed and influenced the development of the Project; and
- Outline the future plans and approach to stakeholder engagement.

6.3 Requirements & Policy Requirements for Stakeholder Engagement

6.3.1 Shamsuna Power Company Policies

Shamsuna have prepared Health, Safety, and Environment (HSE) and Labour policies. The ESIA includes a draft proposed structure of the Environmental, Health, Safety and Social system for the Project (Shamsuna EHSS system – Policies and Plans – Structure). This comprises the following: Environmental Policy; Health & Safety Policy; Social & Community Policy; Human Resources Policy; Social & Communities Policy; E&S Management Plan - *this comprises the commitments/mitigation in the ESIA report; and OHS Management Systems - plans prepared by the Contractor and Operator.*

6.3.2 ASEZA Legal & Policy Standards

As discussed in Section 3.1.1, the Project is subject to a comprehensive ESIA study. The Environmental Protection Regulation in the ASEZ No.(21) of 2001 requires that for those projects which require a comprehensive ESIA study, a scoping session must be held from the onset of the ESIA for all stakeholders whom may be potentially affected by the Project. The objective of the session is to provide the stakeholder

groups with all available information on the Project and the surrounding environment, in order to allow them to participate in investigating and identifying the potential impacts which may arise from the Project so that their concerns are taken into account throughout the ESIA study.

ASEZA provided full cooperation to the Developer and the EIA Team in facilitating the requirements for a comprehensive ESIA.

ASEZA generally requires that the following stakeholder groups be invited to participate in the scoping session: (i) national governmental entities, (ii) local governmental agencies, (iii) Non-Governmental Organizations, (iv) academic and research institutions, and (v) local community representatives.

In addition, the Regulation specifies that the outcomes of the ESIA study are to be announced to stakeholders and the public in a manner (e.g. through holding a disclosure session).

6.3.3 Requirements in IFC Performance Standards on Environmental & Social Sustainability (2012)

The IFC Performance Standards form part of their Sustainability Framework, where the “IFC Performance Standard 1” (IFC, 2012) sets out the following recommendations for stakeholder engagement:

- Stakeholder Engagement is an on-going process that may involve: stakeholder analysis & planning, disclosure & dissemination of information, consultation & participation, grievance mechanism, and on-going reporting to Affected Communities.
- A Stakeholder Engagement Plan (SEP) will be developed and implemented that is scaled to the project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities.
- Affected Communities will be provided with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.
- When Affected Communities are subject to identified risks and adverse impacts from a project, a process of consultation will be undertaken in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them.
- The extent and degree of engagement should be commensurate with the project’s risks and adverse impacts and concerns raised by Affected Communities.
- The consultation process will be tailored to language preferences of Affected Communities, their decision-making process, and the needs of disadvantaged or vulnerable groups.
- For projects with potentially significant adverse impacts, the client will conduct an Informed Consultation and Participation (ICP).
- A grievance mechanism will be established to receive and facilitate resolution of Affected Communities’ concerns and grievances about the client’s environmental and social performance.
- As it is considered that the Project is likely to be categorized as a Category B project under the IFC (and EPIII) requirements, it will be disclosed for a minimum of 30 days.

6.4 Stakeholder Identification & Analysis

The Project has been identifying potential stakeholders since it began the development of the ESIA program in May 2014. The Project has a wide range of stakeholders ranging from national/local government and other bodies involved in the permitting and ESIA process in addition to stakeholders within the Area of Influence of the Project. As such stakeholders have been identified at all geographic levels, including national, regional and local levels.

The two principal categories of stakeholders are as follows:

- Affected Communities, defined as people and organisations directly affected by the Project and/or those who have been identified as most vulnerable to change and who need to be engaged in identifying impacts and their significance, as well as in decision-making on mitigation and management measures (see below).
- Other Interested Parties, defined as people and organisations that are interested in the Project and/or could affect the Project in some way.

6.4.1 Affected Communities

The affected communities have been identified based on a detailed understanding of the Project site location and its administrative setup in addition to discussions with the concerned local authorities.

The Project site is located within the Aqaba Special Economic Zone and specifically within the Southern Industrial Zone. The closest community settlement to the Project site is Aqaba which is located 14 km north of the project site. There are no envisaged direct impacts from the Project on the community, except for employment opportunities, benefits from social responsibility initiatives, and other strategic and national level impacts. Representatives from the local communities and stakeholder groups were engaged and consulted throughout the ESIA study through the scoping session held on the 20th of May 2014 in Aqaba. The representatives were selected by ASEZA in agreement with the ESIA Team.



Figure 28: Closest Local Communities

Some recreational and touristic attraction exist along the coast of the Middle and South Ports such as the Tala Bay and the chalets of the General Intelligence Department which are located at a distance of around five (5) km west of the Project site on the coast of Aqaba. Those are only used by visitors for the purpose of relaxing, diving, swimming, and other recreational and holiday use. However, it is not envisaged that the Project will have any interaction or impact on these facilities for the reasons indicated in Section 4.2.

Based on this analysis undertaken at the scoping phase of the ESIA, it is foreseen that the primary stakeholders involved within the immediate vicinity of the Project site are those of the adjacent industrial activities, any operation that exists within the corridor of the transmission line, Electricity Distribution Company (EDCO), and NEPCO Office within the ATPS.

Vulnerable Groups

Vulnerable groups are project specific and depend on a range of issues which must be understood such as project location, socio-economic and demographic context, as well as the nature of the development and type of impacts anticipated.

The vulnerable groups within this context were investigated by the 'ESIA Team' along with ASEZA. Such vulnerable groups could include the following women groups and youth and unemployed groups. Discussion with those groups was undertaken as part of the scoping session held in Aqaba on the 20th of May 2014.

Given the nature and location of the Project there are considered to be no additional vulnerable groups which would require special consideration throughout the consultation process and which could include groups which are expected to be disproportionately affected by the project impacts.

6.4.2 Other Interested Parties/Stakeholders

Other interested parties and stakeholder groups were identified based on the understanding of the Project location, nature of activities which are to take place, type of development, and the potential environmental and social impacts and how they could potentially affect certain stakeholder groups.

The primary stakeholders foreseen within the immediate vicinity of the Project site are those of the adjacent industrial activities, any operation that exists within the corridor of the transmission line, Electricity Distribution Company (EDCO), and NEPCO.

Such stakeholder groups were mainly identified by the ESIA Team and the ASEZA and were mainly consulted through the scoping session which was held for the Project on 20th May 2014 (refer to Section 6.5.4 below for additional details).

In addition, some of those stakeholder groups were engaged in additional unilateral consultation through specific engagement plans as those had specific concerns which needed to be taken into account throughout the ESIA. This includes the closest stakeholders whom are potential directly to be affected by the Project development within the SIZ, and which include KEMAPCO, JPMC, EDCO, and NEPCO. The consultation was undertaken on one-to-one basis via telephone conversations and unstructured interviews (refer to Section 6.5.5 for additional details on those stakeholder groups and the objective for additional engagements).

6.5 Stakeholder Consultation & Engagement To-date

The stakeholder consultation and engagement for the Project to date has included both:

- High level consultations; and
- Detailed engagement and consultations.

The high level consultation mainly includes the scoping session, and which is considered high level as various stakeholder groups representing various entities are consulted at once (such as national governmental entities, local governmental entities, non-governmental organizations, etc).

The detailed engagement and consultation tends to focus on a single entity within a stakeholder group at a given time. The detailed engagement includes specific consultations with certain key stakeholder entities whose concerns need to be taken into account throughout the ESIA study. Such detailed engagement and consultation included one-to-one discussions and telephone conversations and unstructured interviews.

The following provides a summary of the consultation to date (Stakeholder consultation that the ESIA Team undertook for the Project is provided in **Annex II – Stakeholder Consultation Details**).

6.5.1 Jordanian Governmental Stakeholders (National and Local)

National and local government stakeholders include ASEZA, Ministries, Directorates, and other agencies whom generally have a regulatory role in ensuring the implementation and compliance of projects with the various applicable legislations under the mandate of the relevant legislations (Table 7). In addition, such entities are involved in the permitting and ESIA process. Thus, such stakeholders have the potential to influence the authorisation of the Project and assist in its delivery.

Generally, the objective of consultations with such entities was to introduce the project and its various components, and allow them to participate in the process of scoping of environmental impacts from the Project and address any concerns and fears they might have regarding the Project development.

Table 12 below provides a list of the key national and regional level government stakeholders consulted along with a summary as far as possible of their key areas of interest.

Table 12: List of Key Governmental Stakeholders

Governmental Entity	Interest in/influence on the Project
National Governmental Entities	
ASEZA	The official governmental entity responsible for protection of the environment in the ASEZ. In addition, it is responsible for approval of the ESIA and making sure it complies with the Environmental Protection Regulation No. 21 for the year 2001 and granting the environmental clearance for the Project.
Ministry of Environment	ASEZA collaborates with the Ministry of Environment (MoEnv) in all matters related to hazardous waste management in the ASEZ. MoEnv inspects and supervises that hazardous waste is properly contained and transported to the relevant final disposal location (mainly Swaqa Hazardous Waste Landfill, 80 km south of Amman).
Water Authority of Jordan (WAJ)/The Aqaba Water Company	The official body responsible for the overall monitoring of the water sector and water supply. For the Project this mainly includes issues related to the water requirements and supply to the Project.
Ministry of Agriculture (MoA)	The official body responsible for managing rangelands and forest as well as protecting and managing wildlife. For this project this includes land use issues related to grazing reserves and forest lands as well as potential impacts related to biodiversity.
Ministry of Tourism and Antiquities (MoTA)	The official body responsible for tourism development and protection of antiquities in Jordan. For this project, this mainly includes potential impacts related to archaeology and cultural heritage related to the Project.

6.5.2 Non-Governmental Organizations

Other interested parties considered during the ESIA related consultation include those who have the potential to influence the authorisation of the Project and assist in its delivery. This mainly includes Non-Government Organizations (NGOs).

Similarly, the objective of consultations with such entities was to introduce the project and its various components, and allow them to participate in the process of scoping of environmental impacts from the Project and address any concerns and fears they might have regarding the Project development. The key NGOs which were consulted are summarized in the table below.

Table 13: List of Key NGO consulted

Stakeholder	Interest in/influence on the Project
The Royal Society for the Conservation of Nature	The RSCN is an environmental NGO responsible for the conservation of Jordan's biodiversity and natural resources. In addition, it is empowered to establish and manage protected environmental reserves as well as IBAs under the supervision of the MoEnv. For this project this includes land use issues related to environmental reserves and IBAs as well as potential impacts from the project on biodiversity.

BirdLife International – Jordan	The organization is widely involved in ensuring bird conservation and protection. For this project in specific this includes potential impacts from the project on birds.
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6.5.3 Stakeholder within the vicinity of the Project Site

The primary stakeholders foreseen within the immediate vicinity of the Project site are those of the adjacent industrial activities, any operation that exists within the corridor of the transmission line, Electricity Distribution Company (EDCO), and NEPCO. Such engagement and consultation was done through one-to-one discussions and telephone conversations and unstructured interviews. The consultation results are provided in Table 14.

Table 14: Consultation results with stakeholders within the vicinity of the project (ECO Consult, 2014)

Entity/facility	Interest in/influence on the Project	Comments
National Electric Power Company (NEPCO)	Responsible for designing, building, and management of: 132KV OH transmission lines, 400KV OH transmission lines, and substations. NEPCO is also responsible for deciding the connection route and angle at the entrance of the substation and the connection to the grid.	- The EPC Contractor shall coordinate directly with the NEPCO Team located within the ATPS for the finalisation of the final design for the transmission route from the Project to the ATPS before any construction activities takes place. The NEPTO Team will review the proposed route (AutoCAD and coordinates) and study in relation to their transmission lines and provide comments on final preferred route for transmission line as well as the entrance and the connection within the ATPS substation. - The EPC Contractor shall provide as built drawings to the NEPCO Team in order to have as reference for future planning.
Electricity Distribution Company (EDCO)	EDCO is one of the three distribution companies responsible for distribution of electricity through medium and low voltage lines. EDCO is responsible for all electricity distribution in the southern governorates to include Aqaba as well as Ma'an, Al-Tafileh, and Karak. They are responsible for all underground electricity cables within their area of work including the SIJZ.	- The EPC Contractor shall coordinate directly with the EDCO Team for the finalisation of the final design of the underground cables under the bridge and the last section of the route "entry to NEPCO S/S" before any construction activities takes place. The EDCO Team will review the proposed route (AutoCAD and coordinates) and study in relation to their underground cables and provide comments on final preferred route as well as performance requirements to ensure that their cables are not affected (e.g. manual excavation, entrance tunnel, clearance and buffer zone...etc). - The EPC Contractor shall provide as built drawings to the EDCO Team in order to have as reference for future planning.
Jordan Phosphate Mining Company	The Jordan Phosphate Mines Company is a public company that works in the exploration, mining and marketing of phosphates and fertilizers, and contributing to the establishment of related industries. The company's main office is located in Amman, and it mines for phosphates from Al-Hessa, Al-Abiad, Eshidiya (located south of the Kingdom) mines, and to a lesser extent from Rusaifa mine. JPMC owns an industrial complex in the SIJZ for the production of chemical fertilizers and owns a sulphur storage land located at a distance of 1.6 km east of the Project site.	- JPMC does not see any impact from the Project on their operations either during construction or operation. They think that the Project is not close to the Industrial Complex and so interactions are not foreseen and they only use the sulphur storage yard in case of surplus amounts of sulphur that need to be stored, which rarely occurs.

KEMAPCO	Chemicals Industries LTD. (KEMAPCO®) has a plant production capacity of 150,000 MT/Year of Potassium Nitrate (NOP) fertilizer and up to 60,000 Mt/year in batches of Dicalcium Phosphate (DCP) animal feed additive, in addition to Nitric Acid that is currently used for its own consumption. KEMAPCO® production facilities are located in the SIZ within Aqaba with close proximity to the raw Materials and the exporting port. The plant is established in an Area of 126,000 m2 and employs around 215 employees. KEMAPCO Evaporation Ponds are located within the vicinity of the Project.	- Impact of the project on the climate, humidity, and rate of evaporation around the project and what is the buffer for such impact, if any. - The flood risk should be studied by the EPC Contractor/Developer. There are some risks of flash floods in the area around KEMAPCO and this could affect the infrastructure within the Project.
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6.5.4 Scoping Session

A Scoping Session was held on the 20th of May 2014 at the Movenpick Hotel in Aqaba. ASEZA invited stakeholders (including government and private entities as well as civil society organisations) to participate in the process of scoping of environmental impacts related to the Project. The invitation letters were dispatched to the stakeholders by ASEZA along with a project brief (prepared and submitted to ASEZA by the EIA Team). The list of invitees was identified jointly by ASEZA and the EIA Team, and is considered to include all stakeholders affected by the project.

The ESIA Team documented all records of the scoping session to include transcripts, minutes of meetings, list of participants and attendees and comments which are provided in **Annex II – Stakeholder Consultation Details**.

The objectives of the scoping session were to:

- Introduce the Project and its various components to the stakeholders and provide them with all available information about the Project;
- Present the various anticipated impacts from the Project throughout its various phases and allow stakeholders to participate in the process of scoping environmental impacts of the Project;
- Early consideration of stakeholders concerns and fears regarding the nature, scale and impacts of the Project; and
- Present the suggested methodology for the ESIA and allow stakeholders to comment on the scope of work and methodology.

The following presentations were given:

- A welcome speech by Mr. Essam Jaradat, Director of Environmental Directorate at ASEZA. Mr. Jaradat started by welcoming the attendees to the scoping session, after which he briefly explained the purpose of the session and stressed on its importance as it aims to take into account the concerns and comments of stakeholders throughout the ESIA study. In addition, Mr. Jaradat discussed and emphasized on the importance of renewable energy projects to Jordan given the current challenges in meeting the energy demands. This welcome speech was given in Arabic language.
- First Part of the Scoping Session:
 - A Presentation a by Mr. Samer Judeh, the Chairman of Shamsuna Power Company that covered the following points: the Project concept, strategy, identification of Developer and key contributors, and implementation plans. This presentation was given in Arabic language.
 - A Presentation by Mr. Mothana Qteishat, the Business Development Manager at Trina Solar, that covered the following points: Profile and experience of Trina Solar, business segments which it operates

in, discussed representative projects developed by Trina throughout the world which are similar to this Project in specific, discussed the importance of PV projects to Jordan, given the challenges Jordan faces in meeting its energy requirements. This presentation was given in Arabic language.

- A Presentation by Mr. Karsten Dippel, Senior PV Consultant at Cube Engineering that covered the following points: Project details to include the following: (i) Project location, (ii) main Project components, (iii) anticipated activities expected to take place during the Project's construction and operation phase, and (iv) the timeline for the implementation of the Project. This presentation was given in English language and instant translation to Arabic was given by Mr. Qteishat.

There was time for questions and answers following these presentations as well as a facilitated discussion, moderated by the three presenters and translation to Arabic was provided for any discussions that took place in English.

▪ **Second Part of the Scoping Session:**

- A presentation by Ms. Lana Zu'bi, Senior Environmental Consultant at ECO Consult (ESIA Practitioner). Ms. Zu'bi reiterated the objectives of the scoping session and the main Project components as discussed earlier, briefly discussed the environmental clearance process for the project and explained the importance of this EIA process in identifying the benefits of this Project to the country and weighing them against the implications on the environment and in designing mitigations for the impacts, which must be considered in the design and implementation of the Project. Ms. Zu'bi discussed in detail the anticipated negative and positive environmental and social impacts during the various Project phases and the methodology that will be adopted throughout the EIA study for assessing those impacts.

There was time for questions and answers following this presentation as well as a facilitated discussion, moderated by Ms. Zu'bi.

Attendees raised and discussed a number of issues and concerns, which are summarized in Table 15 below. Selected photos from the session are shown in Figure 29 below.



Figure 29: Selected Photos from the Scoping Session

The following table presents the main issues raised by the stakeholders throughout the scoping session and also highlights how those comments were taken into account and incorporated throughout the ESIA study.

Table 15: Summary of Comments raised during Scoping Session and Response

No.	Attribute	Comment	Response within ESIA
1	Socio-economic development and social responsibility	A question was raised regarding the socio-economic development expected from the project for the area in terms of number of job opportunities, capacity building, as well as social responsibility plan that Shamsuna could adopt to increase benefits.	The current socio-economic conditions of the area have been characterized and assessed in details; based on secondary data and consultations with the relevant entities (Section 7.8). As part of the assessment, discussion with local stakeholders and community members was undertaken to understand their views on the proposed development and to ensure that those views are considered, as outlined in this Chapter. Section 8.9 investigated the current plans of the Developer for contribution to local community and employment opportunities as well as other engagement plans (job opportunities, capacity building programs, etc).

			Based on the above, the potential positive impacts on the area were assessed (Section 8.9). In addition, the ESIA also provided recommendations for a Stakeholder Engagement Plan (Section 11) to be developed and implemented by the developer during the Project phases.
2	Geology and Hydrology	A question was raised regarding flood risks in the Project site which might damage the Project components.	As part of the EIA, the EIA Team assessed the project site and identified any potential flood risks that may impact the project (Section 7.3 and Section 8.4).
3	Land use	The future land use of the area and potential developments should be taken into account	The EIA studied the historic and future land use in the vicinity of the site and also considered the plans for other developments (Section 2.3, Section 7.2 and Section 8.3)
4	Landscape and Visual	A concern was raised if glare from panels could affect nearby receptors.	Any nearby sensitive visual receptors which may be affected by glare was identified and the potential impacts were assessed. However, initially such impact is anticipated to be of minor concern as ARC will be utilized for this project and those are expected to eliminate any issue of concern related to glare. Nevertheless, this issue was investigated throughout the EIA study (Section 8.2).
		Suggestions were raised by stakeholders regarding improving the area visually by planting trees.	As part of the EIA, such suggestions were discussed with the Developer and the outcomes are included. However, it is important to note that there could be technical limitations to such suggestions as trees could cast shadows on the area which in turn would affect the PV panel performance and electricity output (Section 8.2).
5	Birds and Biodiversity	The EIA should study the impact of the Project in migratory and resident birds	The importance and sensitivity of the Project site in terms of birds and avi-fauna were identified based on literature review (BirdLife International's Migratory Soaring Bird Sensitivity Map Tool), a rapid site assessment and examination for any signs of presence of breeding and resident birds, and consultations with academic experts and with Non-Government Organisations in Jordan involved in the protection of birdlife (e.g. the Royal Society for the Conservation of Nature (RSCN), and BirdLife International). Additionally, important 'biodiversity values' (IUCN Red List Threatened Species, endemics / restricted-range, migratory/congregatory species, species of local importance) were identified. Biodiversity values were identified through a combination of literature review, expert / stakeholder consultation, and field surveys) (Section 7.4).
6	Impact of nearby sensitive receptors	Impact of the project on the climate, humidity, and rate of evaporation around the project and what is the buffer for such impact, if any.	The EIA Team assessed the impact of the Project on infrastructure, utilities, and nearby sensitive receptors in order to answer these comments, the EIA Team consulted with the EPC Contractor and the Owner's Engineer to establish a technically-sound and valid response (Section 8.8).

After the scoping session, a Scoping Report & Terms of Reference (ToR) was submitted to ASEZA and which included the following components highlighted below.

- A brief description of the project, the overall concept and components;
- The accrued environmental, economic, and social benefits of the project;
- The anticipated impacts which may arise during the various projects phases (planning, construction, operation, and decommissioning);

- Main outcomes of the scoping session and deliberations that took place to include a table that summarizes the raised concerns/comments/questions, and their response. In addition, details on invitees, attendees, and minutes of meetings are also presented; and
- The detailed methodology to be adopted for the ESIA study.

The Scoping Report & ToR was submitted to ASEZA on the 8th of June 2014. The EIA Committee with ASEZA met to discuss the TOR and had no objections on its content and on the approach for the ESIA. However, this approval has not been sent officially yet.

6.5.5 Summary of Other Stakeholder Engagement Activities

Throughout the ESIA process various stakeholders were engaged and consulted. From the onset of the ESIA study, and in accordance with the issues and impacts anticipated from the Project throughout its various phases, the key stakeholder groups that needed to be consulted, involved, and collaborated with on a detailed level were identified.

Such engagement was intended for various purposes and which included to: (i) introduce the project and its overall concept and components, (ii) understand thoughts, views, and concerns from the Project development, (iii) collection of relevant data for assessment of baseline conditions and anticipated impacts from the Project, (iii) discussion on anticipated impacts, (iv) discussion on proposed mitigation measures, etc.

Such stakeholder groups were engaged and consulted through one or more of the following communication protocols: (i) bi-lateral meetings, (ii) e-mail communication, and (iii) phone communication.

Table 16 below presents the entities which were engaged and consulted and the purpose of such engagement. Generally, the outcomes of such consultations are presented and included within the Section that the attribute relates to.

Table 16: List of Other Consultations during the ESIA

Entity	Attribute	Objective of Consultation
ASEZA	General	Discussion on general concerns and impacts from Project development.
	Land Use, Infrastructure and Utilities	Collection of information on and discussions on management plans
ADC	Land use	Current and future land use planning in Project area
	Infrastructure and Utilities	Infrastructure, utilities, and road networks within the project area
	Project offsite infrastructure	The preliminary route tentatively set for the transmission line
	General	Collection of information on and discussions on management plans
MoEnv	Infrastructure and Utilities	Collection of information on hazardous waste landfills and discussion on disposal plans for the Project at decommissioning phase.
Ministry of Agriculture (MoA)	Land Use	Current and future land use planning in relation to agriculture.
Ministry of Water and Irrigation (MWI)	Geology and Hydrology	Collection of secondary data on site geology and hydrology.
The Royal Society for the Conservation of Nature (RSCN)	Land Use	Current and future land use planning in relation to areas of critical environmental concern and the location of the Project in relation to protected areas and Important Bird Areas
	Biodiversity	Flora, fauna, and migratory and resident birds within the Project area

6.6 Future Stakeholder Engagement & Consultation

Future stakeholder engagement and consultations mainly include the disclosure of the ESIA, undertaking of a disclosure session and the implementation of the Stakeholder Engagement Plan by the Developer and the EPC Contractor who is also responsible for the Operation and Maintenance (O&M) activities. Both are discussed in additional details below.

6.6.1 Disclosure of Documentation and Disclosure Session

Upon submission of this ESIA report to ASEZA, and after their comments are taken into account, a disclosure phase will follow. This will be done through disclosing the ESIA, Non-Technical Summary, and SEP on the Developer's website <<http://www.shamsuna.com/>> and as it is considered that the Project is likely to be categorized as a Category B project it will be disclosed for a minimum of 30 day disclosure period. The non-technical summary will also be distributed to the relevant stakeholders. This will be done through ASEZA who can send the non-technical summary to all stakeholders within the ASEZ. The list of stakeholders will be identified in coordination between the EIA Team and the ASEZA. This will include all the stakeholders invited to the scoping session as well as other stakeholder consulted during the making of this ESIA.

This is also expected to meet the IFC's Performance Requirements.

The main objective of the disclosure phase is to present to the stakeholders the findings and recommendations proposed within the ESIA study.

6.6.2 Stakeholder Engagement Plan

Stakeholder Engagement is an on-going process that involves: stakeholder analysis & planning, disclosure & dissemination of information, consultation & participation, grievance mechanism, and on-going reporting to Affected Communities. In line with the requirements of "IFC Performance Standard 1" (IFC, 2012) a Stakeholder Engagement Plan (SEP) will be developed and implemented that is scaled to the Project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities and key stakeholders. The SEP is presented in **Annex I – Stakeholder Engagement Plan**.

The SEP for the Project describes the planned stakeholder consultation activities and engagement process and includes the following:

- Define the Project's approach to future stakeholder engagement;
- Identify stakeholders within the area influenced by the Project;
- Profile identified stakeholders to understand their priorities;
- Propose an action plan for future engagement with identified stakeholders; and
- Set out the grievance/project complaints mechanism.

7. ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

This Chapter investigates the environmental and social baseline conditions within the Project site for the parameters/receptors identified below. For each receptor, the parameter specific methodology adopted for the assessment has been identified, followed by a detailed description of the outcomes and results. This has followed the generic approach and Study Area, where applicable, outlined in Chapter 4.

- Landscape and Visual;
- Land Use;
- Geology and Hydrology;
- Biodiversity;
- Archaeology;
- Air Quality and Noise;
- Infrastructure and Utilities; and
- Socio-economic conditions.

Impacts on the above parameters are considered within Chapter 8 along with impacts related to Occupational Health and Safety (OHS) and Community Health, Safety, and Security (CHSS).

7.1 Landscape and Visual Characteristics

This section presents the landscape and visual characteristics of the Project site and surrounds.

7.1.1 Baseline Data Collection Methodology

Thematic Study Area: this includes the footprint of Project disturbance (Onsite and Offsite facilities) within the Project site itself and the surroundings.

The baseline data collection assessment of the Project site was based on a site visit by the 'ESIA Team' which aimed to characterize the landscape, topography, and visual character of the Project site. In addition, based on understanding of the potential impacts from the Project (as discussed in further details in Section 8.2.2), the most important critical visual receptors which could be affected within the area have been identified (which includes civil/military airports, environmental reserves, recreational activities, industrial activities...etc.). This involved communications with the relevant authorities, which mainly include the ASEZA, ADC, Ministry of Agriculture (MoA), and the Royal Society for Conservation of Nature (RSCN).

7.1.2 Landscape and Topography

The Project area can be characterised as being located on an escarpment deeply incised by dry river courses and marked by extensive alluvial deposits. The Project site itself is dominantly of fairly flat surfaces, although it is considered as a very low relief area with an elevation around 360 meters above sea level (m asl).

A major wadi (Wadi 2) is located at a distance of less than one (1) km to the south of the Project site and runs from the eastern mountains to the coast of Aqaba to the west of the Project site.

Soil is mostly alluvial with some granite fragments. The region is called tropical or Sudanian Penetration because it has some physical and biological characters similar to those occurring in Sudan, most notably the Acacia trees. The site has minimal vegetation cover and degraded vegetation cover. The area is severely degraded due to previous human activities, which is a typical feature in the Aqaba Mountains where they are used as dumping sites since they are wrongfully considered as wastelands. Construction rubble, deserted facilities, plastic bags and even old furniture was observed on site. This was not the same at the proposed

transmission line route, where garbage was minimal, still present though, and the only human impact that could be seen was an off-road track.

Figure 30 below presents the general topography and landscape of the Project site while Figure 31 and Figure 32 presents the Project site and the wadi system located south of the Project site along with the limited vegetation coverage.



Figure 30: General view and landscape around the Project site (Shamsuna Cultural Heritage Draft Report, 2014)



Figure 31: A general view of the Project site, showing the scarce vegetation of scattered *Acacia raddiana* (ECO Consult, 2014)



Figure 32: Acacia raddiana trees across the wadi of the transmission line (ECO Consult, 2014)

Visual

The Project site is located on the escarpment and is at a higher elevation from the national highway leading to the Saudi Border as well as the existing industrial activities operating within the SIZ (Figure 30).

The proposed transmission line connecting the Project to the substation in the ATPS runs within the Wadi 2 which is designated as a buffer zone within the SIZ Land Use Plan (Figure 14). No activities or facilities are located within this buffer zone and it is currently being used for extending utilities and service lines such as the Fajr gas pipeline and the HV electricity transmission line extending to the north of Jordan (Figure 12).

The classification of the value of the visual character of a site is highly subjective and depends on the viewer and on the usages that the area is subject to. However, the Project area in general is not known for any key sensitive visual receptors within the surrounding vicinity, and is located within an industrial zone with several industrial establishments and industrial ports operating; mainly at a lower altitude from the Project site; for what its aesthetical value loses some importance.

Within the Project area in general and its surroundings there are no recreational activities, environmental reserves, remarkable historical or cultural sites, water courses or other natural structures normally seen as valuable by the human perception. In addition, as part of the visual character, important receptors which would be impacted by the Project have been investigated (as discussed in details in Section 8.2.2). This most importantly includes any civil or military airports and/or landing strips. Based on communication with CARC and the JRAF, it is concluded that there are no airports/landing strips within the area or its vicinity; the closest civil airport is the King Hussein International Airport located around 23 km to the north of the Project site.

7.2 Land Use

This section presents the land use, including both formal and actual, of the Project site and surrounds.

7.2.1 Baseline Data Collection Methodology

Thematic Study Area: this includes the whole SIZ and the 1,308 dunums¹⁶ land allocated for solar energy projects within the SIZ.

The baseline assessment of the ‘formal’ land use was based on collection of secondary data and plans available from the relevant governmental entities - including ASEZA and ADC.

¹⁶ 130.8 hectares

Understanding and characterizing the informal or ‘actual’ land use of the Project site was mainly based on discussions with the relevant local authorities (mainly ASEZA and ADC), consultations with the local industrial facilities and operations, and a site visits undertaken by the ‘ESIA Team’.

7.2.2 Formal Land Use

The formal land use of the Project site was investigated based on available plans set by the relevant governmental authorities. This includes the following: (i) land use planning by ASEZA and ADC; (ii) planning for areas of critical environmental concern by ASEZA, MoEnv, and the RSCN; (iii) forest lands and grazing reserves planning by MoA.

(i) Land Use Planning by ASEZA and ADC

As discussed in Section 2.2 and Section 2.3, the Project is located within the Southern Industrial Zone in the South Zone of Aqaba, which is an area designated for industrial uses. The planned transmission line runs through Wadi 2 which is a deep and wide wadi crossing the area 1 km south of the Project location from the mountains and running to the coast and designated as a buffer zone within the SIZ Land Use Plan (Figure 14).

The Master Plan adopted by ASEZA and ADC in 2006 (Figure 14) provides the Land Use for the immediate and longer term developments within the South Zone (SZ) in the ASEZ and comprises a physical plan for the phased development of both port and industrial zones within the South Zone for the period 2006-2030.

The main ASEZA goals behind this 2006 Master Plan was to allow the relocation of many of the industrial operations from the Aqaba main port to an area already classified for industrial uses which is the SZ and subsequently enable expansion of the Aqaba’s waterfront tourism sector in the main port.

According to the 2006 SZ Master Plan (Figure 14), the eastern part of the SZ, which is the area surrounding the land for the Project, was allocated for several uses and developments including:

- Housing/residential uses (Labour housing for Zone workers – single labour and possibly families);
- Supporting industries (All types of light industry and suppliers);
- Chemical industry cluster (Fertiliser, chemical and other medium/heavy industries);
- Fertiliser cluster and gypsum storage;
- Logistics and Storage (Warehousing, processing, and packaging);
- A new railway corridor extending into the Zone to allow future rail connection between the Zone and the national rail network to transport bulk phosphate for export and other cargo;
- A future industrial waste disposal cluster was proposed adjacent to the existing 420 dunums¹⁷ of large evaporation ponds used by Kemira Arab Potash Company Ltd (KEMAPCO); and
- Associated utilities and infrastructure were also planned as part of the Master Plan.

Based on discussions with ADC, it has been understood that the planned developments within the vicinity of the Project as shown in Figure 14 are still in the planning and negotiations phase. Discussions with some investors progressed more than others, however, to date there are no actual development on the ground. The priority is currently being given by ASEZA and ADC to the implementation of the south port community to include the main port, the industrial ports, and the energy ports. The implementation of any of the Projects planned in 2006 is dependent on the availability of investors willing to invest in such projects. ADC performs its own business development to attract investments but according to ADC, as it stands, there are no eminent plants for the Projects planned within the vicinity of the Project.

A recent formal decision made by ASEZA and ADC designated part of the land (1,308 dunums¹⁸) within the SIZ for developing solar energy projects. The Project is located on a 180 dunums¹⁹ of land that is part of this land

¹⁷ 42 hectares

allocated for such RE developments (Figure 15). According to ADC, According to ADC, the only project currently being planned and implemented is the Shamsuna 10MW PV Project. Discussions with other developers for solar energy projects are ongoing but to date nothing is definite and formal.

Hence, it is concluded that the Project coincides with the formal land use designated for the SIZ as an industrial area in general and for the specific located on which it is to be located as a land allocated for solar energy projects. To this extent, it is evident that the Project site does not conflict with ASEZA and ADC's land use plan; in fact the designated land use for the area allows the development of such a Project.

(iii) Areas of Critical Environmental Concern Planning by MoEnv and RSCN

The Project could potentially conflict with the use of current or planned nearby specially designated areas such as wilderness areas, areas of critical environmental concern, and/or special recreation management areas. The Ministry of Environment (MoEnv) has the responsibility of establishing natural reserves, national parks, and any site of special environmental significance for protection and management.

However, the MoEnv delegates such responsibilities to the Royal Society for the Conservation of Nature (RSCN). In accordance with the above, the RSCN has designated four (4) categories for areas of environmental concern as highlighted below. Those have been assigned based on detailed reviews prepared by the RSCN and which include: (i) National Network of Protected Areas in Jordan and (ii) Important Bird Areas (IBAs) of the Hashemite Kingdom of Jordan.

- Established Reserves: in accordance with the “National Network of Protected Areas in Jordan” the RSCN has established a number of reserves which have been announced as protected areas and are currently managed and operated by the RSCN;
- Proposed Reserves: areas proposed within the “National Network of Protected Areas in Jordan” as protected areas but have not been announced as reserves yet and currently are not managed or operated by the RSCN;
- Reserves Under Establishment: areas proposed within the “National Network of Protected Areas in Jordan” as protected areas and are announced as so, but are still underway to be established, operated, and managed by the RSCN; and
- Important Bird Areas (IBAs): areas proposed within “Important Bird Areas of the Hashemite Kingdom of Jordan”.

Taking the above into account, the RSCN has prepared a comprehensive plan that identifies the location of the reserves and IBA's discussed above. Figure 33 below presents the closest areas in relation to the Project site. As noted in the figure, the site is located within an IBA.

¹⁸ 130.8 hectares

¹⁹ 18 hectares

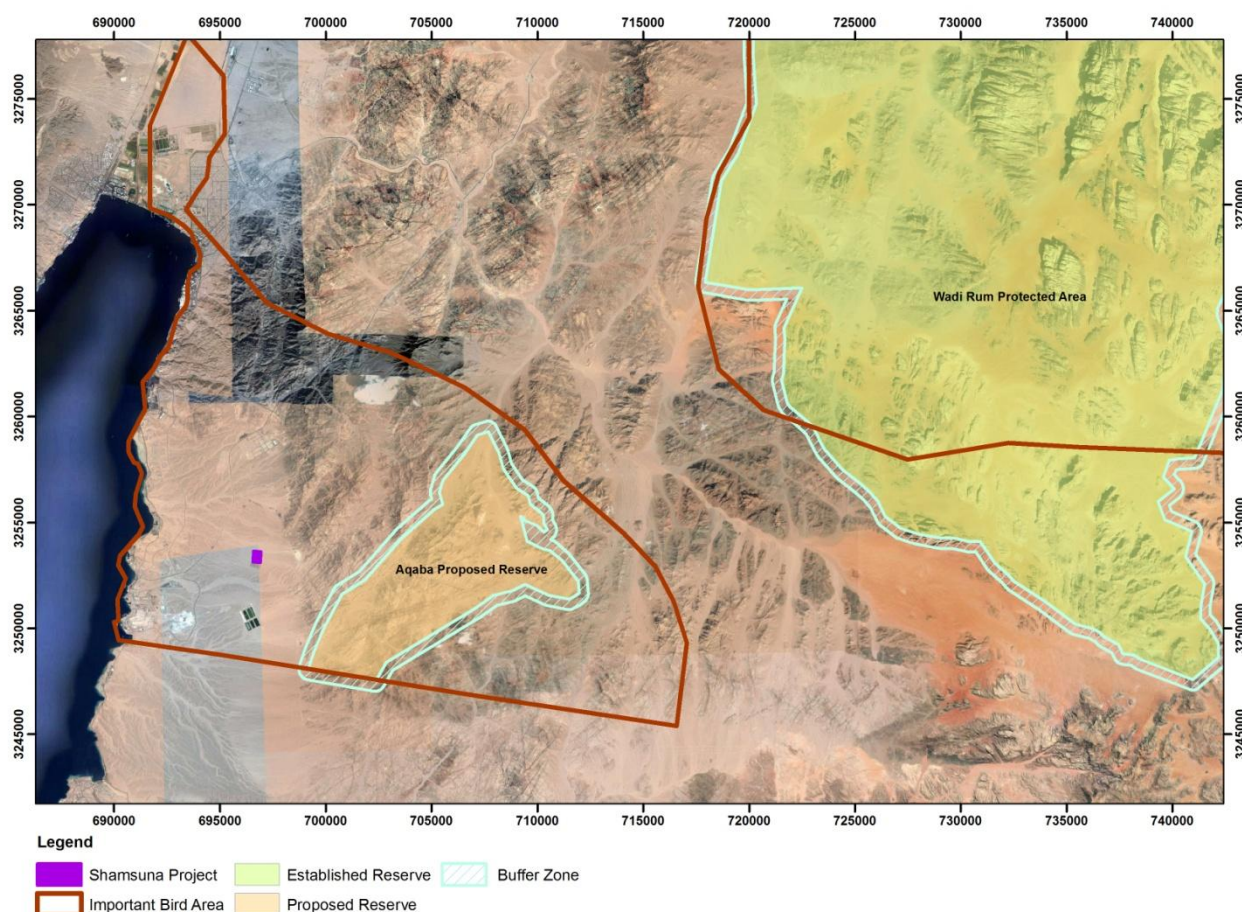


Figure 33: Areas of Critical Environmental Concern in Relation to Project Site (ECO Consult based on data from RSCN, 2014)

A number of preservation areas exist further away from the Project site with the closest delineation being around four (4) km away from the Aqaba Proposed Reserve located to the east of the Project Site and 26 km from the Wadi Rum Protected Area and IBA located to the north-east of the Project Site.

To this extent, it can be concluded that no conflict exists between the Project Site and RSCN's planning context except for that of the IBAs. The Project Site is not located within established/planned reserves but is located within an IBA which is discussed further in Section 7.4.

(iii) Forest Lands and Grazing Reserves Planning by MoA

The Project might conflict with current or proposed planning policies of the Ministry of Agriculture (MoA) for the general area. The most important planning issues that must be investigated include potential conflict with forest lands and/or grazing reserves of the MoA.

The MoA is entitled to planning grazing reserves in the Kingdom on rangelands. According to discussions with the Rangeland Directorate, there are currently 34 grazing reserves distributed throughout the Kingdom that cover an area of around 80,000 dunums²⁰. Such reserves are planned and established for sustainable grazing and prevention of overgrazing which generally reduce the usefulness, productivity, and biodiversity of the land and is one cause of desertification and erosion. In addition, through establishing grazing reserves, the Ministry also aims to improve and develop the socio-economic conditions of local communities within the area through the creation of immediate job opportunities and collaboration with communities in terms of management and operation of the reserve.

The MoA has been consulted on the above. According to discussions with the Rangeland Directorate, there are no forest lands or grazing within or in the surrounding area of the Project site.

²⁰ 8,000 hectares

To this extent, it can be concluded that no conflict exists between the Project Site and the Ministry of Agriculture's planning context, specifically for forest lands and grazing reserves. The Project Site is not located within currently established or planned forest lands or grazing reserves.

7.2.3 Actual Land Use

The actual land use of the Project site was investigated by the ESIA team, as it could provide certain value to local communities – such as agricultural activities or nomadic/semi-nomadic settlement.

Based on discussions with ASEZA, ADC, and relevant stakeholders, the actual land use of the site was investigated to indicate whether it was considered of any value or utilized for any purpose. The ESIA Team discussed the presence of any nomadic and semi-nomadic settlements in the SZ area and according to ADC and ASEZA, the Project area is not known for nomadic/semi-nomadic settlements given the natural characteristics of the site (being desert area that is arid and barren with no water resources) and the use of the Zone as an industrial area. Based on such discussions, it has been indicated that the Project site is considered of no value to local communities.

Within the area, the whole Southern Industrial Zone is currently being used for industrial operations and activities; the closest residential area and community is located at a distance of 14 km north of the Project site.

Some recreational and touristic attraction exist along the coast of the Middle and South Ports such as the Tala Bay and the chalets of the General Intelligence Department which are located at a distance of around five (5) km west of the Project site on the coast of Aqaba (Figure 5). Those are only used by visitors for the purpose of relaxing, diving, swimming, and other recreational and holiday use. However, it is not envisaged that the Project will have any interaction or impact on these facilities for different reasons including: these facilities came after the Industrial Zone and not the other way round, ASEZA treats the area as an industrial area and applies the relevant quality objectives regardless of these facilities, no interaction or overlapping is expected between the spatial boundaries of the activities of the Project and these facilities, there are several road network alternatives to reach the Project site without having to affect the recreational facilities (Figure 24), and the Project is at a higher altitude from these recreational facilities.

Part of the Project site was used as a for sheep and cattle farm but its operations stopped more than 10 years ago and the site was dismantled about five (5) years ago, even though some remaining infrastructure could be seen on some parts of the land. As seen from historic satellite images of the site for the years 2002, 2004, 2007, and 2009, Figure 34 shows that the cattle and sheep farm buildings existed throughout the years 2002, 2004, and 2007, but was removed in 2009. Consultation with ADC and ASEZA has not provided any reasons for why the farm stopped its operations and whether they relocated their facilities elsewhere. However, after the creation of the ADC in 2004 (after the farm had stopped its operations) the ownership of the land within the SZ was transferred to ADC.

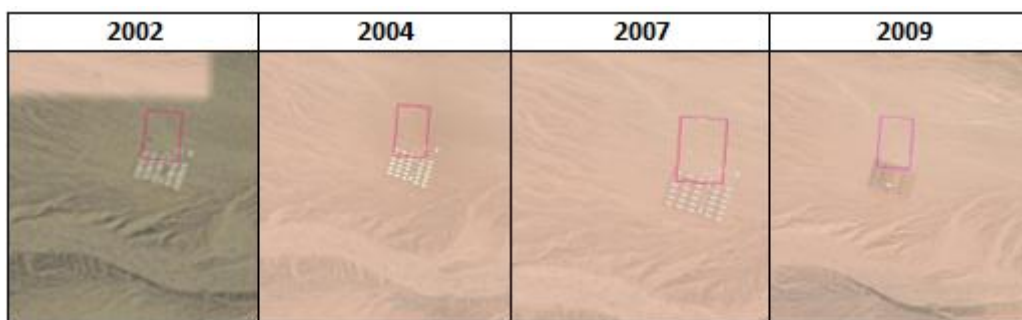


Figure 34: Historic satellite images of the Project site (ECO Consult, 2014)

Finally, based on several site visits undertaken by the 'ESIA team', the site is characterized as being uninhabited and unused as no human activity was identified within the site, nor any evidence of recent human activity was recorded.

7.3 Topography, Geology, Hydrology, and Hydrogeology

This section presents the geological and hydrological characteristics of the Project site and surrounds.

7.3.1 Baseline Data Collection Methodology

Thematic Study Area: this includes the Project site itself as well as the boundaries of the catchment area in the vicinity of the Project site.

The assessment was based on review of secondary data available from the Ministry of Water and Irrigation (MWI). This mainly includes collections of records and data as well as review of studies from MWI and analysis of the subject matter expert within the ESIA Team.

7.3.2 Topography

Topographically the project area is considered as a very low relief area with an elevation around 360 meters above sea level (m asl).

The low topographic variation is due to the geographical settings of the area on the alluvial sedimentary fan generated from the higher mountains. The continuous supply of sediments sustained a gentle slope eastward downstream of the main mountains.

The most distinctive geographic feature in the vicinity of the Project site is the Pre Cambrian Granitic mountains chain extending South west of Jordan which may reach 1500 m asl few kilometres east of the project area (Figure 35).

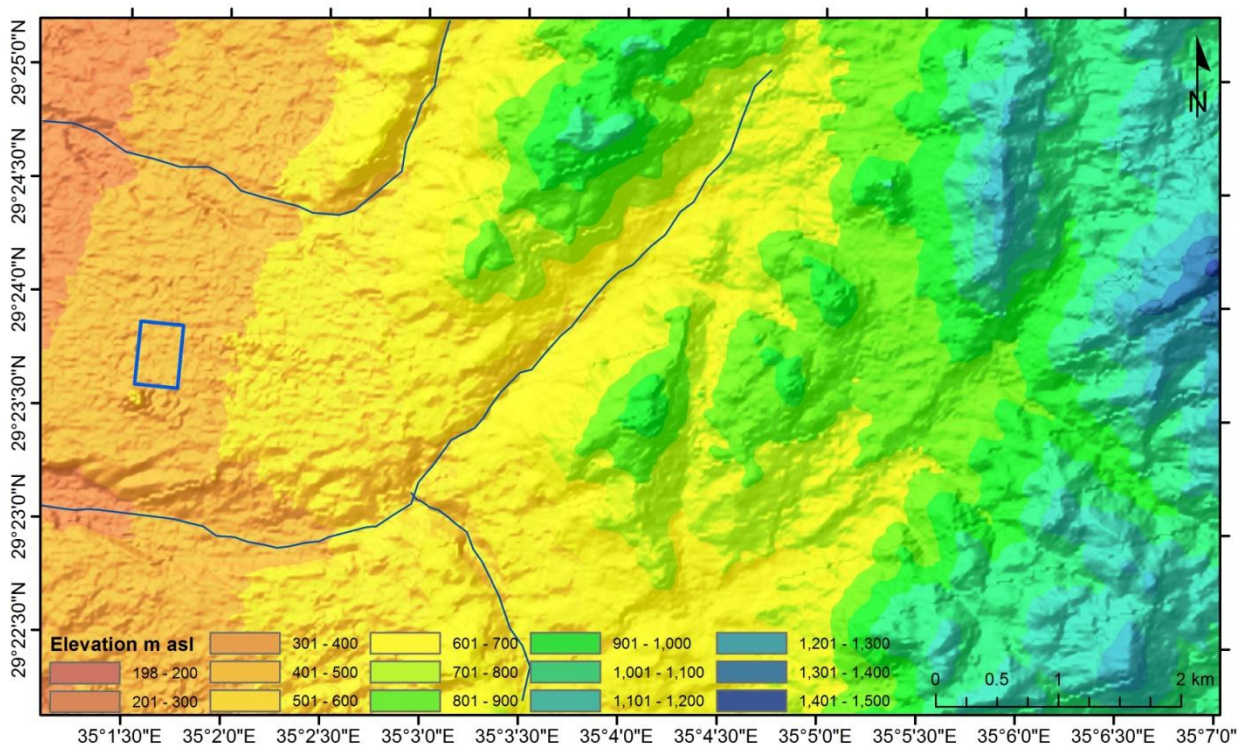


Figure 35: Digital Elevation model for the area (ECO Consult, 2014)

7.3.3 Geology

South Jordan is composed of the oldest exposed rocks in the country. A simple geology with a complicated interaction is present creating different structures and geologic settings within the main geological unit named as Abu Jadda Granite (Table 17). The exposed fractured Granitic rocks highly interacted with the climate within the area resulting in erosion of the granite and the formation of Alluvium and Wadi Sediments and Fluvial and Lacustrine Gravels along drainage system (Table 17 and Figure 36).

Table 17: The main geological formations in the area

Formation	Group	Period	Era	Stage
Fluvial and Lacustrine Gravels		Quaternary	Cenozoic	Pleistocene
Abu Jadda Granite	Yutum Granitic		Upper Proterozoic	Aqaba Complex
Alluvium and Wadi Sediments		Quaternary	Cenozoic	Holocene - Recent

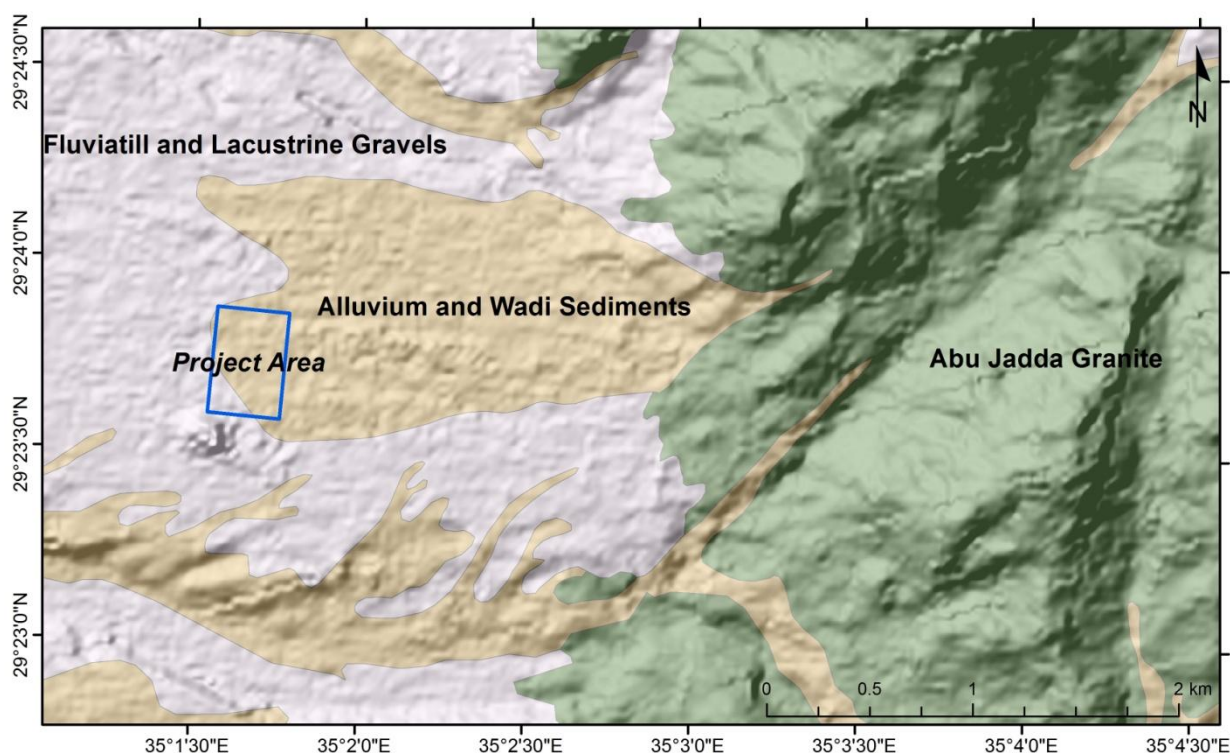


Figure 36: Geological map for the study area (ECO Consult, 2014)

7.3.4 Hydrogeology

The groundwater system in the study area composed of volcanic and fluvial deposits in the form of one connected aquifer system known as the Basement Complex Aquifer. The composite hydraulic unit stores moderate salinity groundwater at a depth of 150 to 200 m below ground level.

ASEZ includes two groundwater basins: the Wadi Araba south basin; and the South Desert basin (Royal Hashemite, 2006). In general, Wadi Araba south basin includes an alluvial deposit aquifer (within ASEZ) in addition to the Rijam, Amman-Wadi Sir, Ajloun, Kurnub, Zarqa and Disi aquifers that mainly outcrop outside ASEZ.

The static water level of the alluvial aquifer in this basin ranges from 20-150m 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 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 40m and the water saturated thickness is approximately 10-15m. Water in this aquifer originates

mainly from rainwater and floodwater infiltration during heavy rain in winter. The Disi aquifer (Section 7.7.2) is known to be the main groundwater source for the Aqaba area and is located about 65km east of Aqaba with a thickness of >1,000m in one portion representing 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 10m 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 90-200m. Recharge to this aquifer is mainly from the precipitation and infiltration of the fold flow in the rainy season.
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 40m and recharge to this zone is sourced from both the infiltration of rainwater and from infiltration of floodwater originating from adjacent wadis.
3. Durreh groundwater Sector: This sector is located in the south of ASEZ. The major aquifer is formed by the alluvium deposits.

In the southern parts of ASEZ (Durreh sector) most attempts at well drilling were not successful and resulted in the formation of dry wells. Only two wells were successfully drilled and encountered groundwater.

Groundwater quality in ASEZ varies between freshwater in Wadi Al-Yutum wells (<1,000mg/l) to brackish (5,000-6,000mg/l) in the southern parts and saline (>10,000mg/l) in the areas close to the Gulf shore (Royal Haskoning, 2006).

7.3.5 Hydrology

The hydrological regimes for dry regions is controlled by the topographic relief, geology of the area and proximity to open water bodies generating humidity need to trigger the hydrologic cycle.

Within the study area the rainfall average are below 30 mm/year as a long term average which is not significant in the flood generation within the area.

Due to the elevated mountains east of the project area and the steep sharp drainage system within the granitic bed rock, runoff is highly generated 10 km east of the study area. Flood flow will follow the main drainage line to the outlet of the catchment which is the Red Sea in this case (See Figure 37, Figure 38, and Figure 39)



Figure 37: Three dimensional model for the catchment area (ECO Consult, 2014)

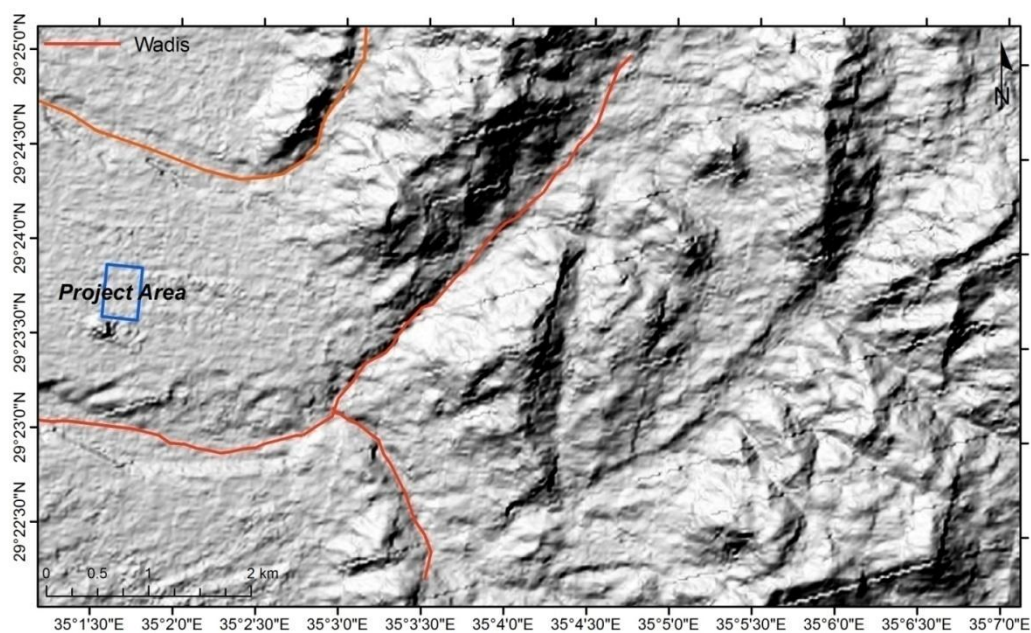


Figure 38: Hill shade relief map showing main drainage system (ECO Consult, 2014)



Figure 39: Bird's eye view for the area from the south (ECO Consult, 2014)

The nearest rainfall station to the project (ED0021) has records from 1968 to 2012 (Figure 40).

The long term record for this station shown in Figure 41 indicates the following:

- The long term average is around 36 mm per year.
- The total yearly rainfall is a result of 1 to 3 rainy events with a high intensity short duration events.
- The maximum recorded daily rainfall was in the year 1986 with more than 70 mm per day.
- More than 7 short rainy events recorded a daily rainfall exceeding 50 mm per day in the last 30 years which is a significant rain in runoff generating considering the topography of the area.
- Rainfall pattern shows clear cycles of severe drought and intense flooding.

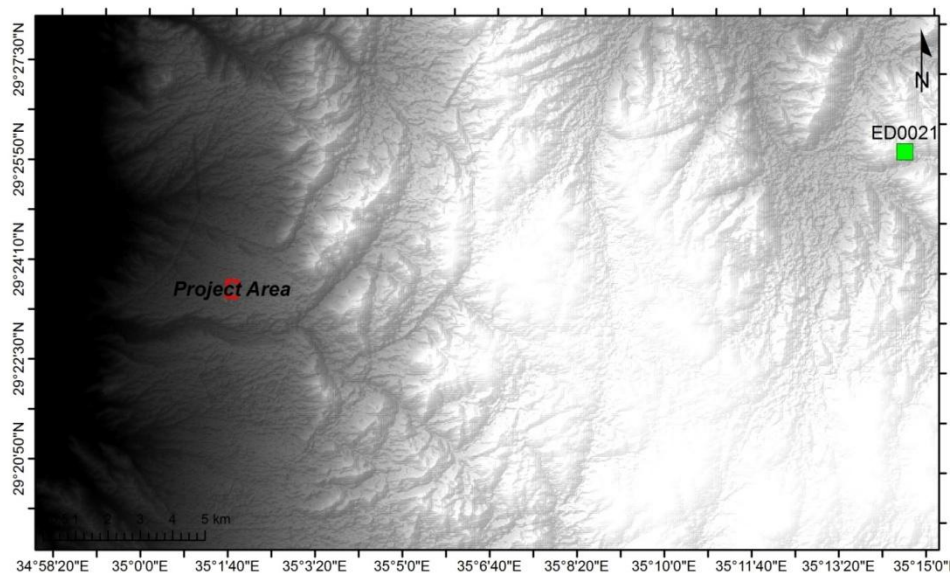


Figure 40: Location of the rainfall station no. ED0021 (ECO Consult, 2014)

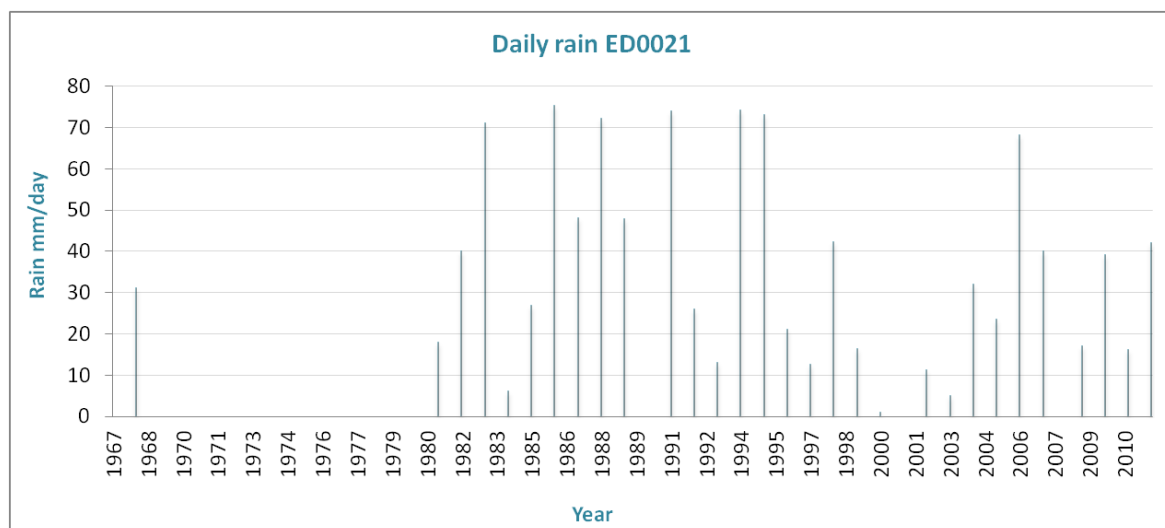


Figure 41: Rainfall record for station ED0021 (ECO Consult, 2014)

Surface Water:

The hydrology of the SZ and the runoff patterns were studied as part of the 2006 Master Plan of the SZ. The brief intensive rainfall and the subsequent run-off through the wadi system in the Zone had a significant impact on the finalisation of the physical layout of the South Zone plan.

According to the Royal Haskoning report of 2006, the industrial area is located within Wadi Mabrak sub-catchment area. The total area of this sub-catchment is about 253.7km². 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 subcatchment whilst southwards it extends beyond the border with Saudi Arabia.

Wadi flows

Coastal wadis in Aqaba generally flow from east to west, originating in mountains with elevations up to 1,340m above sea level. Extensive sand and gravel deposits are found in the flatter parts of wadi beds. The wadis discharge into alluvial fans along the coast. Most of the Zone is located within the drainage basin of a major coastal wadi called Wadi 1 (Figure 42).

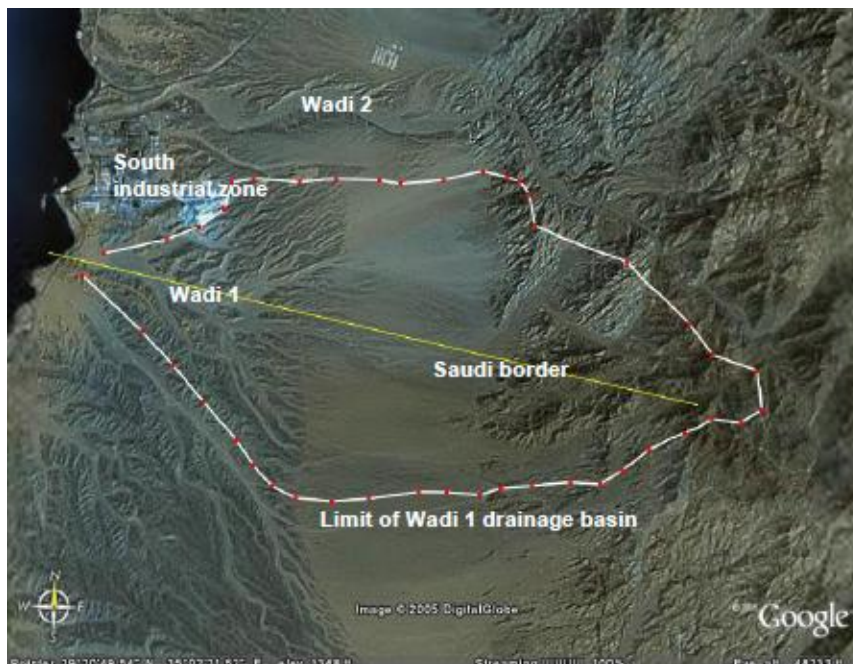


Figure 42: Drainage basin for Wadi 1 (Royal Haskoning, 2006)

A second larger wadi, Wadi 2, also crosses the South Zone running along the northern side of the site. Although Wadi 2 has an area of 62km² which is larger, in terms of the drainage of the Zone it does not have such an impact as Wadi 1 partly because it is already controlled along its lower reaches by containment revetments. These revetments are in good condition according to ADC and no major issues due to flash floods have been witnessed in the Zone.

Wadi 2 is designated as a buffer zone by the Master Plan of the SIZ (2006) and is used by ASEZA and ADC as a corridor for supporting utilities and infrastructure (e.g. the Fajr gas pipeline, and the 400 KV OH Transmission Line). Although Wadi 2 is large, in terms of the drainage of the Zone it does not have a huge impact partly because it is already controlled along its lower reaches by containment revetments.

According to ADC, the revetments are working well and maintenance is done when needed. ADC stated that they never faced any flood issues within Wadi 2 and otherwise they would not have laid the Fajr gas pipeline there which is a very strategic and important utility for the whole of Jordan and is transferring the natural gas coming from Egypt to the north of Jordan.

Additionally, the only offsite components going through the Wadi 2 are the overhead lines. The distance will be 100 to 120m between each pole and these poles are 5m high. It is not normal for floods to destroy the OH transmission line if they are implemented according to best engineering practices. The foundation should have a reinforcement to avoid undercutting and erosion. A concrete foundation or a pole made out of concrete (Figure 19) will stand it.

The project area is around 600 meters from the main drainage system giving a good protection from the main flash flood hazard but still the Project is located on 4km² alluvial fan that is directly connected to the mountainous system giving a need to evaluate the potential runoff for this alluvial fan. Hence, a detailed hydrological and flood risk study is required to be undertaken by the EPC Contractor for the Project in order to ensure that the Project and its components are protected from any potential flood risk and decide whether proper mitigation actions (culverts, gabions ...etc) should be installed to protect the onsite facilities and project components.

The available topographic models are with a low resolution which may lead to uncertainties in the flood flow modelling. A very high resolution model (5 meter cell size) will be needed to study the hydrologic pattern up to 3 km east of the project area.

Taking the above into account, it is evident that the area in general could be subject to potential risk of local flood hazard during the rainy season and especially during flash flood events. Therefore, a detailed

hydrological and flood risk study is required to be undertaken for the Project by the EPC contractor in order to ensure that the Project and its components are protected from any potential flood risk. A mathematical modelling to estimate the potential floods in the project wadis and the surrounding catchment areas is required. For this, rainfall data together with topographic map of the area should be used to illustrate runoff generation process and flood flow. The modelling exercise should be used to model and delineate the boundary of the catchment area and additionally to understand the spatial topographic variations in the catchment area. This will produce a 3D model of the project area that shows the wadis, catchments, and the flood courses within the project area and adjacent areas as well as help estimate the flood flow. Furthermore, proper mitigation actions (culverts, gabions ...etc) if needed should be used by the EPC contractor to protect the Project.

7.4 Biodiversity

This section presents the biodiversity of the Project site and surrounds.

7.4.1 Baseline Data Collection Methodology

Thematic Study Area: this includes the footprint of Project disturbance (Onsite and Offsite facilities (i.e. provisional transmission line corridor) within the Project site itself and the surroundings.

The baseline assessment of the Project site was based on a literature review, field survey, and consultations with experts, each of which is discussed in details below.

(i) Literature Review

A literature review of was undertaken of previous studies, data, surveys, and records available in published scientific papers, books, and journals on flora and fauna species recorded within the study region in general.

For avi-fauna assessment specifically, the literature review was based on BirdLife International's Migratory Soaring Bird Sensitivity Map Tool which was used to provide preliminary site-scale information. In addition, literature review also included the review of previous bird surveys and assessment undertaken by ECO Consult for avi-fauna in the area and near the Project site which exhibits similar habitats (to include migratory, resident, and breeding birds). Also, it has included the review of avi-faunal field surveys that were carried out by RSCN in Aqaba as a whole, including the Study area.

(ii) Field Survey

A two day field survey was undertaken at the Project site during May and June of 2014 for flora, fauna, and avi-fauna.

The field survey included the Project site through the following methods:

- Field observations: the site was examined carefully for the presence of breeding and resident birds, nests, active animals, animal signs and tracks, active burrows, remains or any other vital signs that indicate the activity of animals or avi-fauna species. In addition the site was surveyed for occurring plant species which were noted and recorded to include number of species, coverage interception per species, etc.
- Line transects: transects in many areas of the project site of over 100 m long were undertaken for the detailed assessment of flora, fauna, and avi-fauna species. Observed species were recorded and photographed where possible.

(iii) Consultations with Experts

As part of assessing the biodiversity of the Project site, consultations were undertaken with Environmental NGOs, both of which are considered specialists in relation to the subject matter. Such consultations mainly involved the following:

- BirdLife International – Middle East Regional Office, Jordan. BirdLife International is an NGO widely recognized as the world leader in bird conservation.
- RSCN which is an environmental NGO. It is empowered to establish and manage protected environmental reserves as well as Important Bird Areas (IBAs) under the supervision of the MoEnv.

(iv) Fauna & Flora Species' status

Floral species recorded onsite had no international conservation status as they were not assessed by the IUCN. Therefore, their status classification was based on an extensive national level study named "Jordan Country Study on Biological Diversity: Plant Biodiversity and Taxonomy" (Dawud Al Eisawi, 2000). This is the only study conducted to date that assessed the conservation status of flora species.

The fauna species status was assigned based on their conservation status within the Mediterranean region according to the International Union for the Conservation of Nature (IUCN) Red Data Books: "The Status and Distribution of Mediterranean Mammals" (Temple & Cuttelod, 2009) and "The Status and Distribution of Reptiles and Amphibians for the Mediterranean Basin" (Cox et al., 2006). In addition, the conservation status of avi-fauna species was based on their global status according to the IUCN Red List of Threatened Species.

The outcomes of the above, in addition to an expert opinion, were utilized to identify the status and importance of the biodiversity of the Project site.

7.4.2 Results

In accordance with the methodology discussed above, the results below discuss the findings and outcomes for flora, fauna, and avi-fauna based on the literature review, field survey, and consultations.

(i) Flora

Literature Review Results:

The project site, including the proposed transmission line, is located within the Sudanian biogeographical region (Eisawi, 1996), see figure 35. This region is restricted to the hottest part of the country. It is characterized by having usually warm winter and very hot summer, where temperatures range between 15 and 40 Celsius. It might go beyond these limits in some days of the year. The rainfall ranges from 50-100mm/year. Soil is mostly alluvial with some granite fragments. The region is called tropical or Sudanian Penetration because it has some physical and biological characters similar to those occurring in Sudan, most notably the Acacia trees.

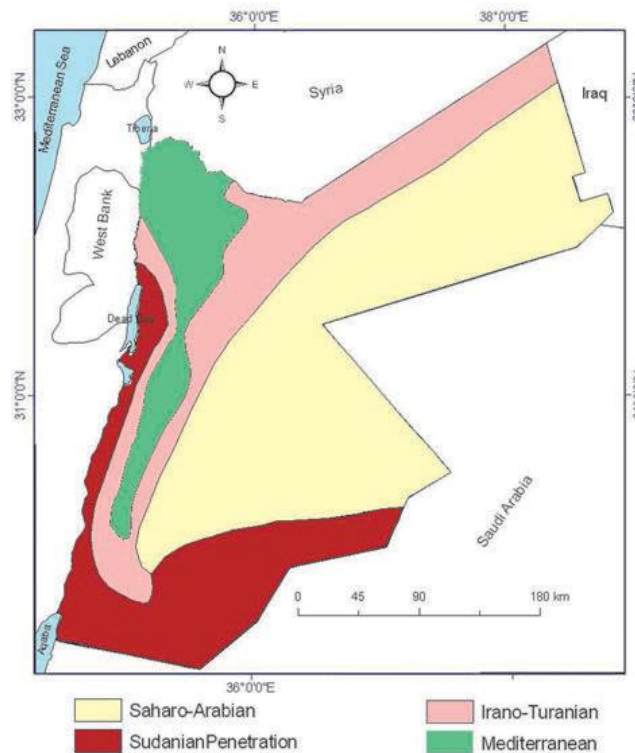


Figure 43: Biogeographical regions in Jordan (Disi& Amr, 1998)

According to Eisawi, 1996, the project site, along with the proposed transmission line, is located inside the Acacia and Rocky Sudanian vegetation type, see figure 36. This vegetation type is confined to the mountain bases and to the rocky parts of Wadi Araba, Aqaba, Wadi Al-Yutm and Wadi Rum in the Sudanian biogeographical region. The vegetation type is characterised by Acacia trees as the main arboreal component of the area that are recorded scattered along the alluvial runoff wadis.

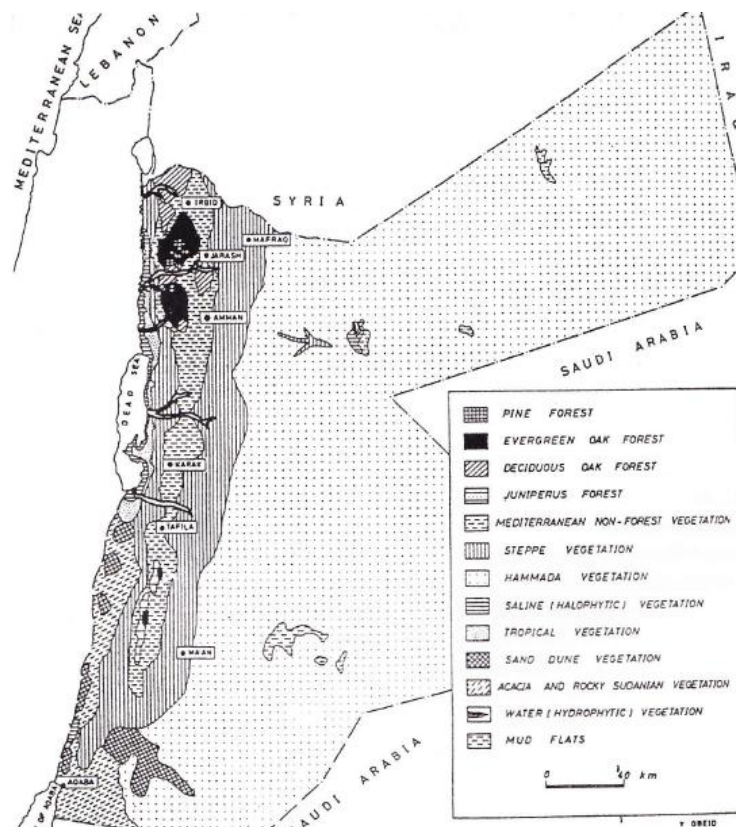


Figure 44: Vegetation types in Jordan (Eisawi, 1996)

Field Survey Results:

The field visit to the site was divided into two parts; the first part was for the station while the other was for the proposed transmission line (Figure 45). The total number of plant species recorded in the site of the station was eleven species, mostly perennials, see table 16. The coverage of plants was very low, including woody and non-woody perennials, such as *Ochradenus baccatus*, *Lycium shawii* and *Acacia raddiana*.

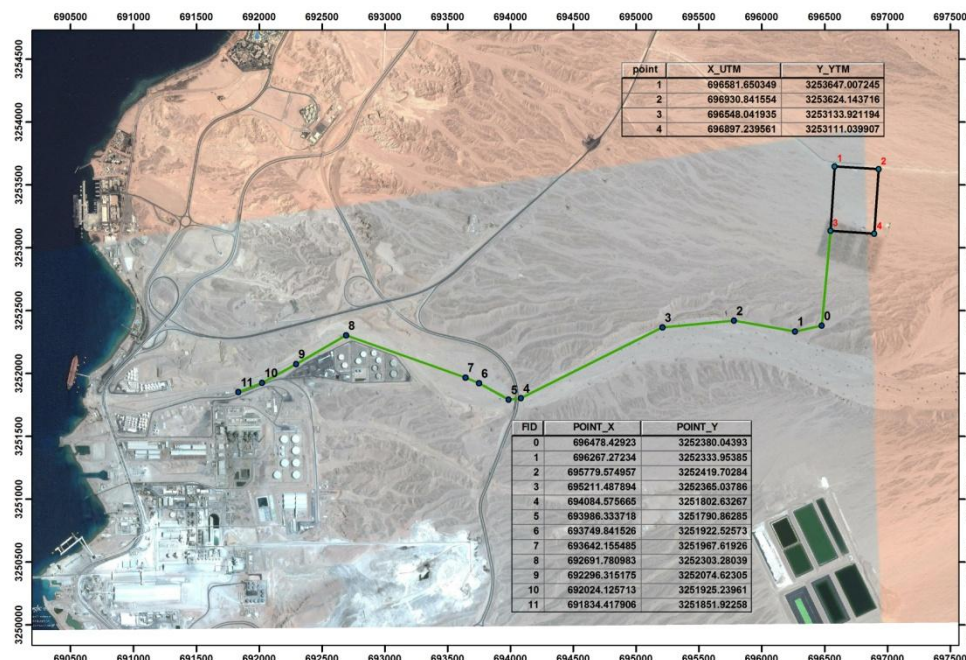


Figure 45: Map of the site showing both parts of the study area, the station (black) and the transmission line (green) (ECO Consult, 2014)

Table 18: Plant species found in the Project site (ECO Consult, 2014)

Family	Species	IUCN Red List Status	National Abundance Status
Acanthaceae	<i>Blepharisattenuata</i> Napper	Not Evaluated – NE	Common
Aizoaceae	<i>Aizooncanariense</i> L.	Not Evaluated – NE	Common
Brassicaceae	<i>Zillaspinos</i> (L.) Prantl	Not Evaluated – NE	Common
Caryophyllaceae	<i>Spergulariadiandra</i> (Guss.) Heldr.	Not Evaluated – NE	Common
Convolvulaceae	<i>Cuscutacampestris</i> Yunck.	Not Evaluated – NE	Common
Geraniaceae	<i>Monsonianivea</i> (Decne.) Webb	Not Evaluated – NE	Common
Graminae	<i>Stipagrostis</i> sp.	Not Applicable	Common
Leguminosae	<i>Acacia raddiana</i> Savi	Not Evaluated – NE	Common
Plantaginaceae	<i>Kickxiaspartioides</i> (Brouss. Ex Buch) Janch.	Not Evaluated – NE	Common
Resedaceae	<i>Ochradenusbaccatus</i> Delile	Not Evaluated – NE	Common
Solanaceae	<i>Lyciumshawii</i> Roem. &Schult.	Not Evaluated – NE	Common

As for the proposed transmission line, which is located along one of the dry wadis flowing west into the Gulf of Aqaba, the plant coverage was higher, especially on the upper stream part where *Acacia raddiana* trees were dominant. A total of fourteen species were recorded, see table below.

Table 19: Plant species found in the in transmission line route (ECO Consult, 2014)

Family	Species	IUCN Red List Status	National Abundance Status
Acanthaceae	<i>Blepharisattenuata</i> Napper	Not Evaluated – NE	Common
Aizoaceae	<i>Aizooncanariense</i> L.	Not Evaluated – NE	Common
Brassicaceae	<i>Zillaspinos</i> (L.) Prantl	Not Evaluated – NE	Common
Caryophyllaceae	<i>Spergulariadiandra</i> (Guss.) Heldr.	Not Evaluated – NE	Common
Chenopodiaceae	<i>Chenopodiummurale</i> L.	Not Evaluated – NE	Common
Chenopodiaceae	<i>Salsolaimbricata</i> Forssk.	Not Evaluated – NE	Common
Chenopodiaceae	<i>Halothamnushierochunticum</i> (Bornm.) Botsch.	Not Evaluated – NE	Common

Family	Species	IUCN Red List Status	National Abundance Status
Convolvulaceae	<i>Cuscutacampestris</i> Yunck.	Not Evaluated – NE	Common
Geraniaceae	<i>Monsonianivea</i> (Decne.) Webb	Not Evaluated – NE	Common
Graminae	<i>Poabulbosa</i> L.	Not Evaluated - NE	Common
Graminae	<i>Stipagrostis</i> sp.	Not Applicable	Common
Leguminosae	<i>Acacia raddiana</i> Savi	Not Evaluated – NE	Common
Zygpphyllaceae	<i>Fagoniaglutinosa</i> Delile	Not Evaluated – NE	Common
Zygophyllaceae	<i>Zygophyllumdumosum</i> Boiss.	Not Evaluated – NE	Common



Figure 46: *Acacia raddiana* trees across the wadi of the proposed transmission line (ECO Consult, 2014)

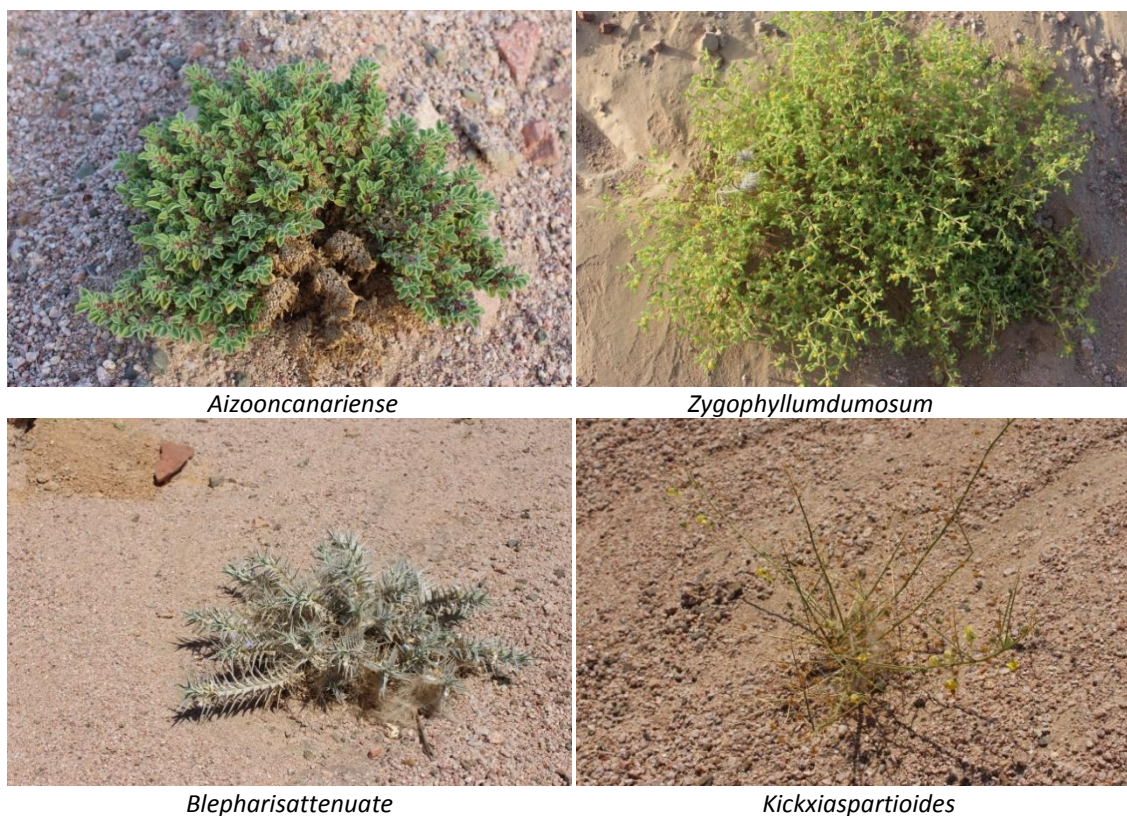


Figure 47: Plant species found in the in the project site, including the proposed transmission line route (ECO Consult, 2014)



Figure 48: Slopes, along the proposed transmission line, covered with different Graminae annuals (ECO Consult, 2014)



Figure 49: Plants of the study area, including (above), the dominant species of the vegetation type in the Project site, *Acacia raddiana* (ECO Consult, 2014)



Figure 50: Plastic garbage attached to shrubs and trees (*Lycium shawii*) in the Project site (ECO Consult, 2014)



Figure 51: Construction rubble by the southern part of the Project site (ECO Consult, 2014)



Figure 52: Cattle and sheep farm facility remains in the southern side of the Project site (ECO Consult, 2014)



Figure 53: The off-road track along the transmission line heading westward (ECO Consult, 2014)



Figure 54: Traces of the recent water flowing along the wadi as a result of the latest heavy rains in Southern Jordan (ECO Consult, 2014)

The area is a typical sample of the habitats of Aqaba Mountains and seasonal wadis. The site has minimal vegetation cover and degraded vegetation cover. Annual plant species recorded were very limited while none of the perennial species recorded covered more than 1% of the site coverage, including *Acacia raddiana*. The area is severely degraded due to previous human activities, which is a typical feature in the Aqaba Mountains where they are used as dumping sites since they are wrongfully considered as wastelands. Construction rubble, deserted facilities, plastic bags and even old furniture was observed on site. This was not the same at the transmission line route, where garbage was minimal, still present though, and the only human impact that could be seen was an off-road track. The upstream part of the transmission line was typical of Aqaba side-wadis that flow into the sea with its healthy coverage of *Acacia* trees. There was a relatively high coverage of annuals which is mainly due to the latest flash flood that has resulted from the latest heavy rain in southern Jordan.

(iii) Fauna

Mammals:

There were no previous studies that were carried out in the study area in specific but generally, and based on the literature review, the mammal species recorded in the study area are listed in the table below. It is important to note that these species have been reported based on literature review, however these are not likely found in the Project area given the degraded nature of the area.

Table 20: Mammal species recorded in the study area

Common Name	Scientific Name
European Free-tailed Bat	<i>Tadaridateniotis</i>
Kuhl's Pipistrelle	<i>Pipistrelluspipistrellus</i>
Eastern Spiny Mouse	<i>Acomysdimidiatus</i>
Golden Spiny Mouse	<i>Acomysrussatus</i>
Wagner's Gerbil	<i>Dipodillusdasyurus</i>
Lesser Egyptian Gerbil	<i>Gerbillusgerbillus</i>
Fat Sand Rat	<i>Psammomysobesus</i>
Bushy-tailed Jird	<i>Sekeetamysculurus</i>
Red Fox	<i>Vulpesvulpes</i>
Wolf	<i>Canis lupus</i>

Striped Hyena	<i>Hyaenahyaena</i>
Cape Hare	<i>Lepus capensis</i>

Reptiles

Similar to mammals, no specific herpetological studies were carried out in the study area specifically in the time frame of the study, the table below lists down species that were recorded from the Aqaba area in general, specifically from hard granite substrates, similar to the study area.

Table 21: Reptile species recorded in the study area

Common Name	Scientific Name	Reference	IUCN Red List Status
Most Beautiful Whip Snake	<i>Platyceps elegantissimus</i>	(Amr & Disi, 2011)	Least Concern
Jan's Whip Snake	<i>Platyceps rhodorachis</i>	(Amr & Disi, 2011)	Not Evaluated
Sinai Banded Snake	<i>Platyceps sinai</i>	(Amr & Disi, 2011)	Not Evaluated
Forskål's Sand Snake	<i>Psammophis schokari</i>	(Amr & Disi, 2011)	Not Evaluated
Diadem Snake	<i>Spalerosophis diadema</i>	(Amr & Disi, 2011)	Not Evaluated
Black Desert Cobra	<i>Walterinnesia aegyptia</i>	(Amr & Disi, 2011)	Least Concern
Arabia's Saw-scaled Viper	<i>Echiscoloratus</i>	(Amr & Disi, 2011)	Not Evaluated
Rough-tailed bowfoot gecko	<i>Cyrtopodion scabrum</i>	Disi 2011	Least Concern
Unknown	<i>Hemidactylus dawudazraqi</i>	(Disi, 2011)	Not Evaluated
Stout Gecko	<i>Stenodactylus grandiceps</i>	(Disi, 2011)	Least Concern
Bosk's Fringe-fingered Lizard	<i>Acanthodactylus boskianus</i>	(Disi, 2011)	Not Evaluated
Snake-tailed fringe-toed lizard	<i>Acanthodactylus opheodurus</i>	(Disi, 2011)	Least Concern
Blanford's Short-nosed Desert Lizard	<i>Mesalinabrevirostris</i>	(Disi, 2011)	Least Concern
Small-spotted Lizard	<i>Mesalinaguttulata</i>	Disi (2011)	Not Evaluated
Desert Agama	<i>Trapelus pallidus</i>	(Disi et al., 2001)	Not Evaluated

This part of the country has never been extensively studied to produce reliable data in relation to reptiles and mammals. Still, in arid areas as the study area, the number of species and individuals of species are naturally very low and most of the records would be confined to the wadis, which animals use as corridors for foraging and moving around in their home range. The only reptile species that was recorded during the site survey was *Acanthodactylus boskianus*, which was recorded in the Project site.

(iii) Avi-Fauna

The avi-fauna assessment discussed below includes assessment on soaring birds (migratory and resident) as well as non-soaring and breeding resident birds.

RSCN:

Two studies were carried out in the spring and autumn of 2002 by RSCN in order to assess the status of birds, resident and migrant, in Aqaba. Those two studies have included the study area, discussed in this report. Species that were recorded to be breeding in the spring in the habitats of Aqaba included Long-legged Buzzard *Buteo rufinus*, Kestrel *Falco tinnunculus*, Chukar *Alectorischukar*, Sand Partridge *Ammoperdix heyi*, Rock Dove *Columba livia*, Collared Dove *Streptopelia decaocto*, **Palm Dove** *Streptopelia senegalensis*, *Pterocles coronatus*, Little Green Bee-eater *Merops orientalis*, Hoopoe *Upupa epops*, Rock Martin *Ptyonoprogne fuligula*, Bar-tailed Lark *Ammomanes cinctura*, **Desert Lark** *Ammomanes deserti*, Crested Lark *Galeridacristata*, Hooded Wheatear *Oenanthe monacha*, White-crowned Wheatear *Oenanthe leucopyga*, Blackstart *Cercomela melanura*, Graceful Prinia *Prinia gracilis*, Scrub Warbler *Scotocerca inquieta*, Yellow-vented Bulbul *Pycnonotus xanthopygus*, Palestine Sunbird *Nectarinia osea*, Brown-necked Raven *Corvus ruficollis*, Tristram's Grackle *Onychognathus tristrami*, **House Sparrow** *Passer domesticus* and Trumpeter Finch *Rhodopechys githaginea*. According to IUCN Red List, all these species are evaluated as Least Concern.

Species shown in bold above are species that were also recorded during the visit to the study area even though no indications of breeding birds within the Project site itself were found during the survey, except for a flock of three Desert Larks *Ammomanes deserti*.

Since the field visit was not carried out during the migration season, no migratory species were recorded then. Still, the previous (RSCN, 2002), presents a list of migratory species that were recorded in Aqaba area and that includes Lesser Kestrel *Falco naumanni*, Corncrake *Crex crex*, Turtle Dove *Streptopelia turtur*, Namaqua Dove *Oenacapensis*, Eurasian Wryneck *Jynx torquilla*, Swallow *Hirundo rustica*, Bee-eater *Merops apiaster*, Wheatear *Oenanthe oenanthe*, Isabelline Wheatear *Oenanthe isabellina*, Black-eared Wheatear *Oenanthe hispanica*, Redstart *Phoenicurus phoenicurus*, Rufous Bush Robin *Cercotrichas galactotes*, Whinchat *Saxicola rubetra*, White-throated Robin *Irania gutturalis*, Olivaceous Warbler *Hippolais pallida*, Upcher's Warbler *Hippolais languida*, Olive-tree Warbler *Hippolais olivetorum*, Eastern Orphean Warbler *Sylvia crassirostris*, Lesser Whitethroat *Sylvia curruca*, Whitethroat *Sylvia communis*, Garden Warbler *Sylvia borin*, Blackcap *Sylvia atricapilla*, Marsh Warbler *Acrocephalus palustris*, Willow Warbler *Phylloscopus trochilus*, Spotted Flycatcher *Muscicapastriata*, Red-backed Shrike *Lanius collurio*, Lesser Grey Shrike *Lanius minor*, Woodchat Shrike *Lanius senator*, Masked Shrike *Lanius nubicus*, Cinerous Bunting *Emberiza cineracea* (Near Threatened), Cretzschmar's Bunting *Emberiza caesia* and Black-headed Bunting *Emberiza melanocephala*.

In addition to those species that were recorded using the Aqaba habitats, especially the Acacia trees, soaring migratory birds recorded during the RSCN 2002 study included Short-toed Eagle *Circus gallicus*, Black Kite *Milvus migrans*, Marsh Harrier *Circus aeruginosus*, Hen Harrier *Circus cyaneus*, Steppe Buzzard *Buteo buteo* and Sparrowhawk *Accipiter nisus*.

BirdLife International:

In addition to the RSCN 2002 survey, another assessment is done based on BirdLife International's Migratory Soaring Bird Sensitivity Map Tool. This Tool was recently launched to provide preliminary site-scale information to be reviewed at the earliest stages of development planning process. The tool is designed to inform and complement the assessments undertaken as part of an EIA study.

It is important to note that this Tool is primarily designed to guide wind energy projects (given the important anticipated impacts from turbines on soaring birds), but nevertheless it can be used for a wide range of other development sectors.

The analysis with the Tool was undertaken by inputting a polygon which represents the study area location in order to assess the site's significance and sensitivity for soaring birds (migratory and resident). The analysis produced that the area has a very high status in regard to sensitivity to soaring birds to wind energy projects and there were seven actual soaring bird species records from the study area (Full report provided in **Annex III – Detailed Biodiversity Survey Results**).

The study area is located inside an IBA; Aqaba Coast and Mountains. The IBA is has gained its significance due to its importance for passage soaring birds, as elaborated below in the IBA summary of characteristics from BirdLife International website (Table 22), and quoted in the following paragraph.

Table 22: Summary of IBA characteristics (BirdLife International website, 2014)

Location	Jordan, Aqaba
Central coordinates	35° 4.54' East 29° 25.30' North
IBA criteria	A4iv, B1iv, B2, B3
Area	28,300 ha
Altitude	0 - 1,592m
Year of IBA assessment	2000

Site description of Jordan's only coastline: Aqaba is a port town at the head of the very deep Gulf of Aqaba (2,000+ m) of the Red Sea. The coastal plain is very limited, and alluvial fans spread from the inland mountains to the shore, which is composed mainly of rock and sand/gravel beaches, fringed in part with coral reefs. Most habitats in the area have been substantially altered by man; freshwater springs along the coast support irrigated market gardens and native palm groves (near the beach), and some natural scrub vegetation survives near the Israeli border. There is some undisturbed desert to the south of the area. A very important area economically for Jordan, with port, industries, and tourism; fisheries are secondary in importance.

Table 23: Populations of IBA trigger species

Species	Season	Period	Population estimate	Quality of estimate	IBA Criteria	IUCN Category
Sooty Falcon <i>Falco concolor</i>	Breeding	1993	present [units unknown]	-	B2	Near Threatened
Levant Sparrowhawk <i>Accipiter brevipes</i>	Passage	1995-2000	3,000 individuals	Poor	B2	Least Concern
Hume's Owl <i>Strix butleri</i>	Resident	1993	rare [units unknown]	-	B3	Least Concern
Arabian Warbler <i>Sylvia leucomelaena</i>	Resident	1993	present [units unknown]	-	B3	Least Concern
Arabian Babbler <i>Turdoides squamiceps</i>	Resident	1993	present [units unknown]	-	B3	Least Concern
Tristram's Starling <i>Onychognathus tristramii</i>	Resident	1993	present [units unknown]	-	B3	Least Concern
Hooded Wheatear <i>Oenanthe monacha</i>	Resident	1993	present [units unknown]	-	B3	Least Concern
Pale Rosefinch <i>Carpodacus synoicus</i>	Winter	1993	present [units unknown]	-	B2	Least Concern
A4iv Species group - soaring birds/cranes	Passage	1993	-	Poor	A4iv, B1iv	

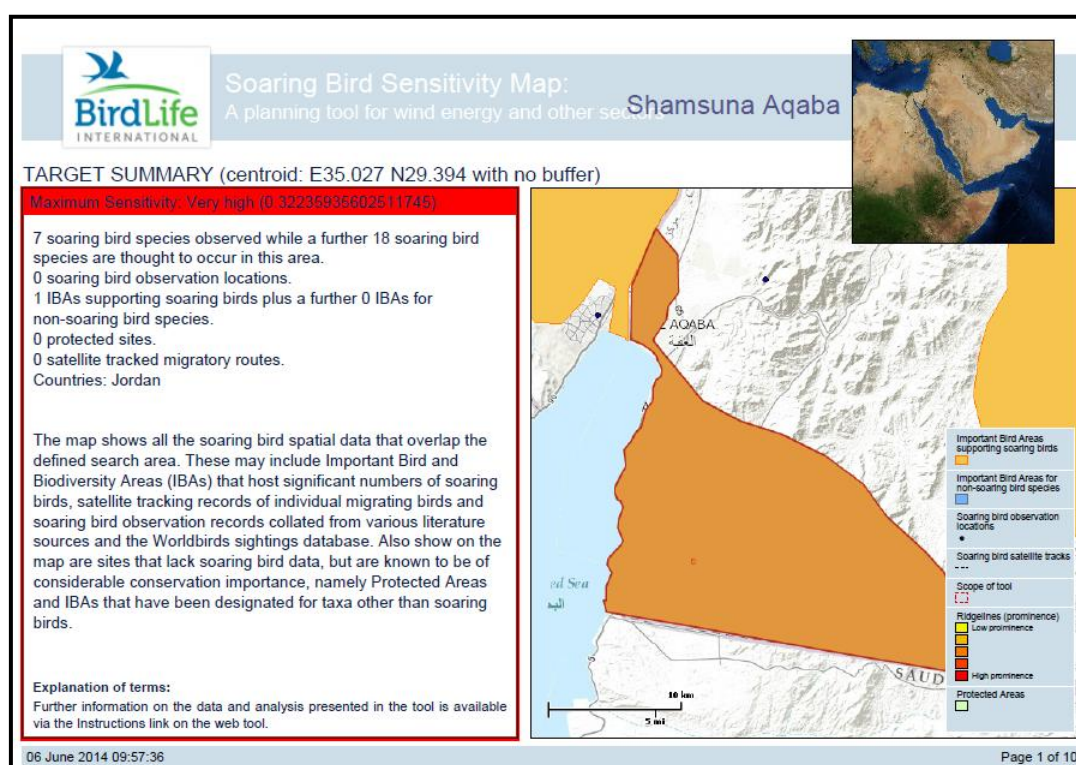


Figure 55: Outcome of BirdLife International's Migratory Soaring Bird Sensitivity Map Tool

As noted in the figure above, the analysis reported that the area has a very high status in regard to sensitivity to soaring birds to wind energy. Seven (7) soaring bird species were observed in the IBA while a further 18 soaring bird species are thought to occur in this area. Currently, there are no soaring bird observation locations.

Discussion:

As for birds, it is widely documented that Aqaba represents one of the most important bottleneck sites for migratory soaring birds in the Middle East. Still, it should be highlighted that this importance is not mainly due

to the quality of habitats in the area but mainly to the area's topography and location, being surrounded by mountains that provide perfect uplifting effect for soaring birds and also safe havens for birds to roost during the night. Being location at the top of the Gulf of Aqaba, the area works as a funnel in directing birds around the sea southward into Africa or northward into Europe.

As for the study area, the Project probably site does not provide special values for resident or migrant species due to its scarce vegetation and absence of water sources. On the other hand, the transmission line location, which runs along a wadi, is a typical area for passerines that use it for foraging, resting and roosting while on migration and also for resident species. This is mainly due to the Acacia trees cover, which provides perfect cover and roosting spots for passerines in general. The trees also provide a great food source since they provide insects for insect-feeding birds, such as flycatchers and thrushes, in addition to providing perching areas for birds that feed on macro-invertebrates and reptiles, such as shrikes. Due to the better tree cover, food items are consequently more abundant. In brief, Acacia trees along these corridor-like wadis provide perfect station for migratory passerine species to spend some time to refuel and rest before continuing their migration journeys.

Regarding the location of the site in an IBA, it should be noted that the main reason for the status of the IBA is the soaring birds that were recorded in the area in general and not near the site. Most of these records were recorded to the north of the project site close to the town of Aqaba and along Wadi Araba. The only studies that covered the study area were the studies that were carried out by RSCN in 2002, which did not produce high figures of soaring birds in the project site.

The project site survey was not undertaken during the migration season and thus no migratory birds were observed in the Project site. However, most of the species recorded by RSCN in 2002 are considered of Least Concern; but, one (1) recorded species is considered to be Near Threatened.

In addition, based on the site survey undertaken for the Project site, few resident bird species were recorded during the field visit. This included three (3) resident species, which are the **Palm Dove** *Streptopelia senegalensis*, **Desert Lark** *Ammomanes deserti*, and **House Sparrow** *Passer domesticus*. According to IUCN Red List, all these species are evaluated as Least Concern. In addition, no signs of nests or breeding activities were recorded within the Project site itself although the survey was undertaken generally at the end of the breeding season (which lasts from March till mid May). However, due to its habitat, there is a potential that the proposed transmission line route could be used for breeding activities.

All the recorded species are considered of Least Concern according to the IUCN Red List of Threatened Species, and are considered common to such area habitats.

The limited bird activity in the site can be attributed to the fact that the site is, to some extent, disturbed by the industrial activities within the whole SIZ.

Discussions with RSCN were undertaken in June of 2014 for the purposes of this ESIA. The results of the discussions were as follows:

- The Project site in general is heavily disturbed by the industrial activities within the SIZ and which affects the biodiversity of the Project site;
- The RSCN understands the need to update the IBA mapping of Jordan. IBA mapping was done in 1998 and ever since, several of those IBAs natural settings have changed due to heavy disturbances by human activities (including the Aqaba IBA), and thus such areas no longer reflect their importance as an IBA area;
- The RSCN does not have any issues of concern in relation to the Project development. Their main requirement is that the Project comply with the Ministry of Municipal Affairs (MoMA) Guidelines for Land Use Planning in Jordan. Such Guidelines were developed by MoMA in collaboration with several national stakeholders (such as the RSCN, MoEnv, etc). Such Guidelines specify requirements to be taken into account for certain designated land uses including IBAs. The Guidelines specify that within IBAs, land uses are allowed as described by the Plans of the administrative bodies responsible for management of those areas. Given that ASEZA and ADC have zoned the Project site for PV project developments there are no additional requirements to be taken into account, and such a development is allowed within an IBA.

Finally, discussions were also undertaken with BirdLife International – Middle East Regional Office, Jordan regarding the importance of the Project site in terms of avi-fauna (migratory and resident). The outcomes of

such discussions are in line with the above. BirdLife International – Jordan have stated that they are satisfied that this ESIA is using the sensitivity map tool to help educate the ESIA recommendations and asked to consult with RSCN as the BirdLife Partner in Jordan.

7.5 Archaeology & Cultural Heritage

This section presents the baseline conditions within the Project site in relation to archaeology and cultural heritage.

7.5.1 Baseline Data Collection Methodology

Thematic Study Area: this includes the footprint of Project disturbance (Onsite and Offsite facilities) within the Project site itself and the surroundings.

The baseline assessment of the Project site was based on a literature review and a field survey, each of which is discussed below.

(i) Literature Review

Desktop research was carried out, using the MegaJordan database, produced and maintained by the Jordanian Department of Antiquities (DOA). The DoA is the official governmental entity in Jordan responsible for the protection, conservation, and preservation of antiquities in accordance with the Antiquities Law No. 21 for the year 1988.

(ii) Field Survey

A baseline survey of the site was commissioned directly by the Shamsuna Power Company as part of the ESIA effort. It was carried out on the 8th April 2014 by a representative from Jordan Department of Antiquities (DOA) and an independent Archaeological Consultant.

Details of the site were recorded in the following way;

- Photography
- Located using a GPS
- Size estimate
- Topographical description
- Description of nature and condition of the site

The small size of the site meant that it was possible to systematically walk the whole area. The area was divided into 4 quadrants and by walking approximately 20 metres apart it was possible to cover each quadrant in turn.

(iii) Results

In accordance with the methodology discussed above, the results first presents the outcomes of the archaeological importance of the Project site in specific based on the DOA database and survey undertaken for the exact Project site.

Figure 56 is a screen shot taken from MegaJordan and indicates that the nearest site of importance is over 17 km away from the Project site. The grouping of known sites of importance also reinforces the view that ancient societies did not build on alluvial deposits, preferring to inhabit the area to the east of the Western Highlands in the Southern Mountain Desert Area.

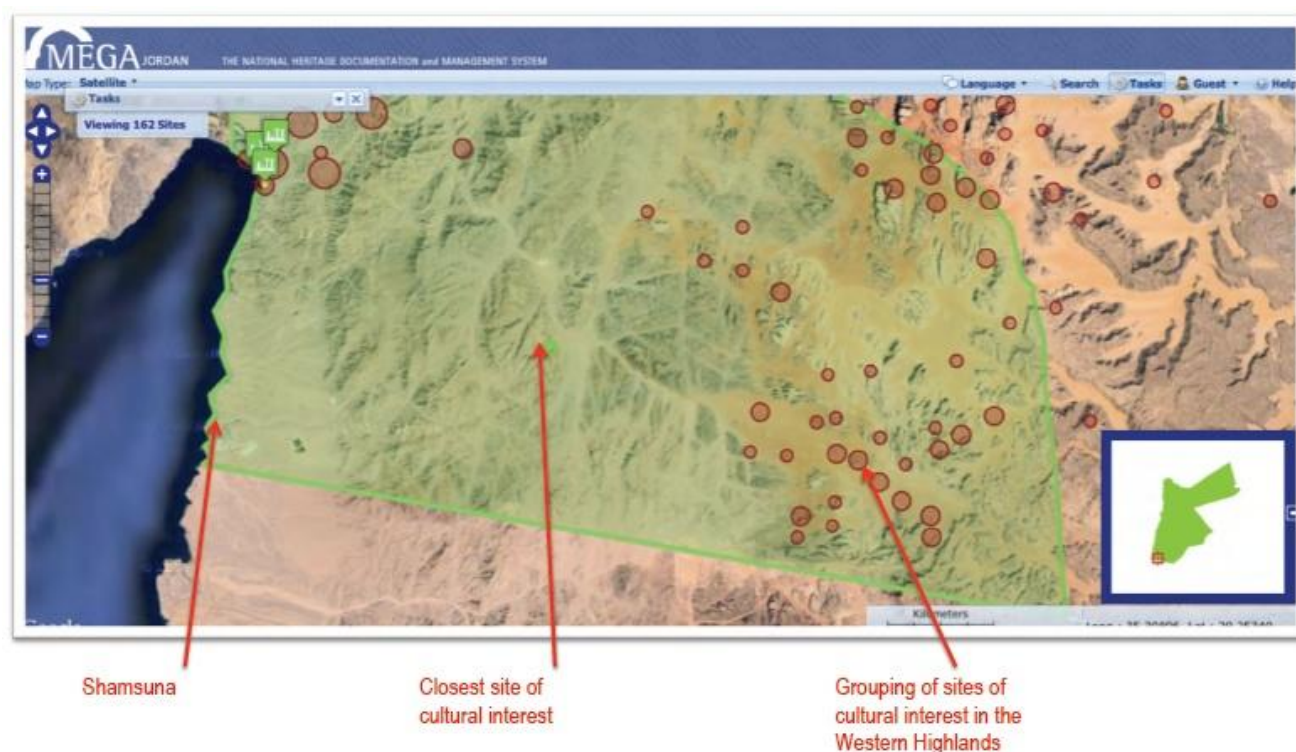


Figure 56: Screenshot taken from MegaJordan

Further desktop research using the Internet and Archaeological Survey reports again found no evidence of the existence of Cultural Heritage sites of importance.

Both the desktop and site surveys did not find anything of archaeological or cultural importance within the Project site.

Consultation with the Head of Excavations and Survey Sector for the Jordanian Department of Antiquities reinforced the view that the Project site is most unlikely to reveal either sites or artefacts of Cultural Heritage importance.

7.6 Air Quality and Noise

This section presents the ambient air quality and noise conditions of the Project site and surrounds.

7.6.1 Baseline Data Collection Methodology

Thematic Study Area: this includes the footprint of Project disturbance (Onsite and Offsite facilities) within the Project site itself and the surroundings.

Baseline assessment for air quality and noise was undertaken through onsite monitoring which was conducted continuously for 24 hours at 2 different monitoring sites that represent the Project location. Monitoring was conducted on the 1st and 2nd of June 2014 for the following parameters:

- Gases to include Carbon Monoxide (CO), Sulphur Dioxide (SO₂) and Nitrogen Dioxide (NO₂)
- Suspended Particulate Matter to include Total Suspended Particulate (TSP), Particulate Matter smaller than 10.0 microns in diameter (PM₁₀) and Particulate Matter smaller than 2.5 microns in diameter (PM_{2.5}); and
- Noise Pressure Levels.

The main objectives of the monitoring conducted included the following:

- Establish ambient air quality baseline conditions and background data to assess the existing level of pollution within the Project site;
- Establish noise level conditions and background data to assess the existing noise levels within the Project site;
- Identify the main sources of air pollutants as well as noise sources within the Project site or from surrounding areas which might affect air quality and noise, thus avoiding potential liability to the Project from any existing level of pollution;
- Define inter-relationship of source of pollution, atmospheric parameter and measurable manifestations in order to evaluate the character and magnitude of existing problems (if any); and
- Establishing baseline conditions in terms of both ambient air quality and noise ensures thorough identification and logical assessment of anticipated impacts on air quality and noise from the Project's construction and operational activities as detailed later.

Results of the monitoring conducted were compared against the relevant legislations in Jordan that govern the subject matter to include the following:

- Air quality results were compared against the Ambient Air Quality Jordanian Standard 1140/2006. This standard specifies the maximum allowable limits of pollutant concentration in ambient air. The standard also presents guidelines and methods that have to be followed when conducting monitoring for ambient air quality; and
- Instruction for Reduction and Prevention of Noise for 2003. This instruction is issued by the Ministry of Environment and specifies the maximum allowable limits of noise levels within various areas to include cities, suburbs, villages, industrial areas and other.

Additionally, results were compared with the ambient air quality limits and noise limits provided in the IFC General Environment, Health, and Safety (EHS) Guidelines.

Table 24 below summarizes the location of each monitoring point and other logistical information, whereas Figure 57 presents the location of the monitoring points within the Project area.

Table 24: Air Quality and Noise Monitoring Points

Parameters	Point 1	Point 2
Coordinates (UTM Zone 36)	0695048 3252421	0696766 3253505
Duration of Monitoring	Continuously for 24 hours	Continuously for 24 hours
Gases Monitored	CO, SO ₂ , NO ₂	CO, SO ₂ , NO ₂
Suspended Particulate Matter Monitored	TSP, PM10, PM2.5	TSP, PM10, PM2.5
Noise	Noise Level Equivalent (Leq)	Noise Level Equivalent (Leq)
Wind Speed (m/s)	1.5 – 7.8	1.5 – 7.2
Prevailing Wind Direction	West	West
Temperature (°C)	27 – 39	27 - 40
Humidity (%)	15 - 33	16 - 33



Figure 57: Location of Monitoring Points

(i) Selection of Parameters

As stated earlier, monitoring was conducted for the following parameters: (i) gases to include CO, SO₂, NO₂, (ii) suspended particulate matter (TSP, PM₁₀, and PM_{2.5}) and (iii) Noise Pressure Level. The characteristics of each of the parameters are discussed in further details in **Annex IV – Detailed Air Quality Monitoring Results**. These parameters were selected based on the following rationale:

- Such parameters are likely to be present within the Project site given its characteristic and attributes. Suspended particulate matter is expected given the desert nature of the site. On the other hand, pollutants (such CO, SO₂, and NO₂) are expected onsite from the industrial activities within the SIZ (but most likely at minimal concentrations given the distance from the industrial activities located adjacent to the main highway. Noise levels on the other hand are not expected to exceed the set quality objectives;
- Such parameters are likely to be affected mainly during the Project's construction activities. Emission from vehicles and machinery used onsite will increase gaseous emissions as well as suspended particulate matter, and are expected to be a source of noise generation within the Project site and its surrounding areas.

(ii) Selection of Locations

Proper selection of monitoring sites is crucial as an inappropriate location may result in data that may not meet the objectives of monitoring and could be of limited value. Several factors need to be taken into account when selecting the sites to include the objectives of monitoring, size of the area to be covered, variability of pollutant concentration over the area to be covered, pollutants to be monitored and possible sources of pollutants. The following was considered for site selection:

- One site was located within the Project area to represent conditions within the Project site, while another was located as a reference point taking into account the prevailing wind direction in the area being west and west-northwest and the point was selected to be approximately downwind from the industrial activities located to the west of the Project site;

- Those 2 points were considered representative areas where concentrations of selected air quality parameters and noises are expected to reflect the real concentrations of various pollutants;
- Logistical issues such as the particular method of instrument used for sampling, resources available, physical access and security against loss and tampering were also taken into account;
- Monitoring instruments were located in such a place where free flow of air is available and taking into account the direction of prevalent wind and topography of the site; and
- Air sampling points of intake were located at a height of 1.2 meter above ground level, whereas noise measurements were performed at about 1.5 meter above ground level.

(iii) ***Methods of Air Sampling and Analysis***

JS 1140/2006 includes clear guidelines and methods that have to be followed when monitoring for air quality criteria pollutants, all of which were followed for the monitoring conducted. The guidelines include specifications for siting monitors, use of equipment that has demonstrated capability, repeatability, and reliability needed to collect accurate data, and operation of the equipment within established methods. All monitoring, sampling and analytical procedures used conform to JS 1140/2006. Table 25 below presents a summary of monitoring equipment used.

Table 25: Summary of Monitoring Equipment Used for Air Quality and Noise

Parameter	Name of Instrument	Minimum detection limit (MDL)	Principle of Measurement
CO	CO Analyzer Model 2000	0.1ppm	Infra red photometry
SO ₂	Serinus 50 Sulfur Dioxide (SO ₂) analyzer	0.3 parts per billion (PPB)	UV-Fluorescence
NO ₂	Serinus 40 Oxides of Nitrogen (NOX) analyzer	0.4 parts per billion (ppb)	Chemiluminescence technology
TSP	SKC Gast Rotary Vane Pump Model1532, Flow rate of 22l/min.	1.0 µg/m ³	Gravimetric Method
PM10	The Thermo Scientific Model ADR-1500	1.0 µg/m ³	Light scattering photometry
PM2.5	The Thermo Scientific Model ADR-1500	1.0 µg/m ³	Light scattering photometry
Noise Monitoring	Octave band analyzer and noise level meter Model 407790 type 2	Accuracy = ±1.5 dB	Measures Noise Pressure levels. 30 to 130 dB(A) with Auto Ranging

7.6.2 Results

This section presents the results of the monitoring conducted at each monitoring site. The detailed results for each site are presented in **Annex IV – Detailed Air Quality Monitoring Results**. All parameters have been recorded on an hourly basis continuously for 24 hours at each monitoring site.

Table 26 below presents a summary of the results for the monitoring conducted at each of the monitoring sites. The table presents the average, maximum, and minimum values recorded, and the maximum allowable limits for air pollutants as stipulated within the Jordanian Standard 1140/2006 and the maximum allowable limits for noise levels as stipulated within the Jordanian Instruction for Reduction and Prevention of Noise of 2003.

To avoid confusion in reading the air quality results in the table below, it must be noted that the average daily concentration (summation of all concentrations at each hour divided by 24) for a pollutant is equivalent to the 24-hour concentration. When comparing results with the Jordanian Standard, the hourly concentration must be compared (that is the results at every hour) with the maximum allowable hourly limits, and the 24-hour concentration (or average daily concentration) with the 24-hour maximum allowable limits.

With regards to noise levels, the Instruction specifies a maximum allowable limit for the day average (7:00 am till 6:00 pm) and night average (from 7:00 pm till 6:00 am), and this is calculated by summing all recorded levels at each hour for the day and night respectively and dividing it by 12 hours. Results are then compared with the maximum allowable limits for rural areas and which specifies maximum allowable limits of noise within industrial areas - maximum allowable level is 75 dbA during the day and 65 dbA during the night.

Overall, the results for air quality monitoring are all well within the limits specified within the JS 1140/2006, where none of the monitored parameters exceeded any of the maximum allowable limits. With regards to the gases, recorded concentrations at both sites of CO, SO₂ and NO₂ were within, and even significantly lower, than the maximum allowable hourly and 24-hour limits specified within the JS 1140/2006. With regards to the suspended particulate matter which includes TSP, PM10 and PM 2.5, there are no hourly concentrations specified within the Jordanian Standard but only 24-hour maximum allowable concentrations. Recorded 24-hour concentrations at both sites were within, and even significantly lower, than the 24-hour limit specified within the JS 1140/2006.

Finally, with regards to noise, recorded concentrations at both sites were within the levels specified within the Instruction for day and night.

Table 26: Summary of Monitoring Result (ECO Consult, 2014)

Table 26: Summary of Monitoring Result (ECO Consult, 2014)								
Location	Parameters Measured							
	Gases (ppm)			Dust (µg/m³)			Noise (dBA)	
	CO	SO ₂	NO ₂	TSP	PM10	PM2.5	Day	Night
First Monitoring Point								
Average (24h)	0.449*	2.0×10 ⁻³	5.9×10 ⁻³	22.9	12.9	2.6	43.94**	39.5**
Max (hourly)	0.575	2.9×10 ⁻³	7.4×10 ⁻³	35.0	22.9	4.6	45.3	42.6
Min (hourly)	0.33	1.2×10 ⁻³	4.2×10 ⁻³	10.2	4.7	0.9	38.5	37.3
Second Monitoring Point								
Average (24h)	0.448*	2.6×10 ⁻³	5.1×10 ⁻³	54.0	24.6	10.6	43.3**	40.9**
Max(hourly)	0.575	3.1×10 ⁻³	6.1×10 ⁻³	65.6	41.9	18.1	44.9	41.9
Min(hourly)	0.33	1.9×10 ⁻³	3.9×10 ⁻³	40.6	18.3	7.2	40.7	39.9
JS 1140/2006 Limits								
Hourly	26ppm	0.3ppm	0.21ppm	No value	No value	No value	N/A	
24-hour	9 ppm*	0.14 ppm	0.08 ppm	260 µg/m³	120 µg/m³	65 µg/m³		
Instruction on Reduction and Prevention of Noise for 2003								
Industrial (dBA)	N/A						75	65

*Based on 8-hours as required by JS 1140/2006

**Daytime is from 7:00 am till 6:00 pm and nighttime is from 7:00 pm till 6:00 am

(i) Gases - Carbon Monoxide (CO), Sulfur Dioxide (SO₂), and Nitrogen Dioxide (NO₂)

Generally, results were consistent and similar in the two monitoring points. Results are significantly lower than the maximum allowable limits stipulated within JS 1140/2006.

To this extent, the main source of all of the above gaseous pollutant emissions can be rather attributed to their natural formation and/or represent their trace values in the atmosphere. The results indicate rather very low concentrations especially when compared to the maximum allowable hourly and 24-hour concentrations within JS 1140/2006.

(ii) Suspended Particulate Matter - TSP, PM10, and PM 2.5

As presented in Table 26 at both sites the average daily concentrations of all three parameters were well within the maximum allowable limits stipulated within the JS 1140/2006. It must be noted that the JS 1140/2006 has no limits for maximum allowable hourly concentrations.

From the current limited use of the land and the minimal traffic movement on the adjacent road, it can be noted that the main source of suspended particulates (to include TSP, PM10 and PM2.5) can be attributed to the natural characteristics of the site (being a desert area) and related to dust blown by wind. However, it is important to note that very low concentrations were recorded due to the following: (i) the generally stable and calm wind speeds recorded at both sites throughout the monitoring period; higher wind speeds (exceeding 5m/s) can considerably disturb the soil and dust and thus tend to record higher values when compared to instances with stable or clam wind.

(iii) Noise Pressure Level

As presented in Table 26 above the average noise levels during the day is 43.94dBA and 43.3dBA at the first and second site respectively. The hourly average noise levels during night are 39.5dBA and 40.9BA at the first and second site respectively.

The results of the monitoring were compared to the maximum allowable limits stipulated within the Instruction for Reduction and Prevention of Noise for 2003 which specifies a maximum allowable limit in industrial areas of 75dBA during daytime and 65dBA during nightttime. Generally, the average noise levels during daytime and nightttime are all within the maximum allowable limits specified within the Instruction.

During the monitoring conducted no major source of noise generation was noticed or recorded at both monitoring sites and no off-road passing vehicles or activities were recorded or heard. In addition, minimal traffic activities occurred on the adjacent road.

7.7 Infrastructure and Utilities

This section discusses the methodology adopted for the assessment of baseline conditions within the Project area in relation to utility and service supply infrastructure, to include: (i) water resources and utilities, (ii) wastewater, solid waste, and hazardous waste utilities, (iii) road networks, and (iv) electricity network, each of which is discussed separately below.

7.7.1 Baseline Data Collection Methodology

Thematic Study Area:

- Water resources and utilities: this includes the location of the closest water network and the proposed water supply pipeline to the Project
- Wastewater, solid waste, and hazardous waste: this includes the location of these infrastructure items within the ASEZ
- Road networks: this includes the roads within the SIZ reaching to the Project site and also connecting with the City of Aqaba
- Electricity network: this includes the high voltage transmission line and the ATPS
- The gas pipeline: this includes the gas pipeline passing through the buffer zone south of the Project site.

The baseline assessment was based on collection of secondary data and plans available as well as discussions and consultations mainly with representatives from various governmental authorities and utility service providers as discussed in details throughout this section.

7.7.2 Water Resources and Utilities

The water sector in Jordan is governed by the Ministry of Water and Irrigation (MWI), the Water Authority of Jordan (WAJ), and the Jordan Valley Authority (JVA). MWI is the official body responsible for the overall monitoring of the water sector, water supply and wastewater system, and the formulation of national water

strategies and policies. Whereas JVA is responsible for the socio-economic development of the Jordan Rift Valley, including water development and distribution for irrigation.

WAJ assumes all responsibilities related to water and wastewater structures including design, construction, operation, maintenance and administration. Within the Aqaba Governorate, the Aqaba Water Company (AWC) is the responsible entity representing WAJ.

AWC was established in 2004 with financial and management independence as a legal successor to WAJ in Aqaba Governorate for managing water supply and wastewater services within its own zone of operations. AWC aims to improve operational efficient of the water and wastewater sectors in Aqaba Governorate to meet the increasing demand on such services to local residents as well as touristic, commercial, and agriculture sectors.

Water supply services by AWC cover all parts of the Aqaba Governorate including the Southern Industrial Zone. According to discussion with AWC, the SIZ is supplied with its water requirements through twenty two (22) wells located at the Disi area which also supplies Aqaba city. There is a dedicated distribution water network which runs to the SIZ and serves the various industrial establishments within the area.

The Project site itself is not served with a direct water connection. There is a plan currently being studied by ADC to expand the water network to serve the area in the vicinity of the Project. Figure 58 below shows the closest water network point and the proposed supply network to reach the Project site. According to ADC, the date of the implementation is still uncertain but is expected within years 2014-2015.

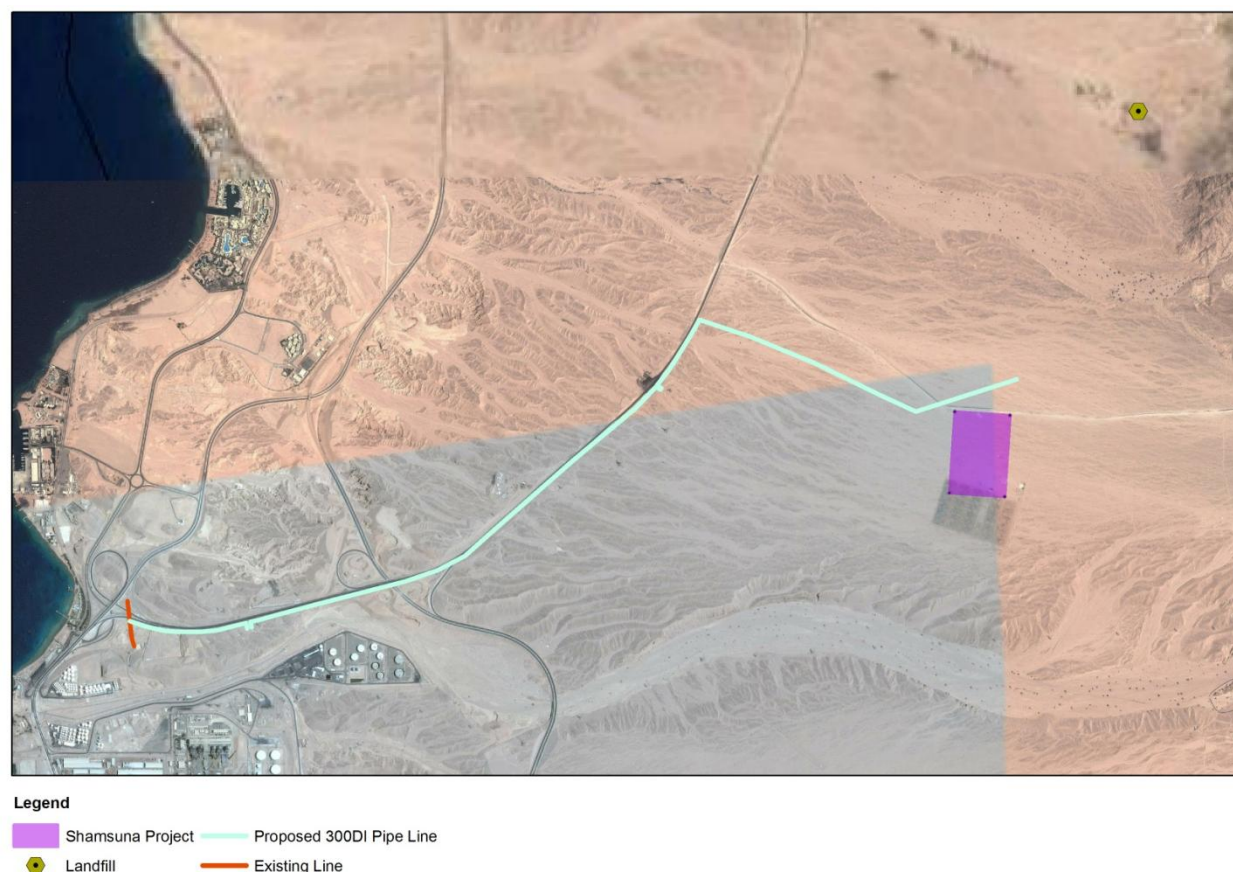


Figure 58: The existing and proposed water network in the vicinity of the Project site (ECO Consult based on data from ADC, 2014)

7.7.3 Wastewater, Solid Waste, and Hazardous Waste

(i) Wastewater Utilities

The same entities that govern the water sector are responsible for the wastewater as well. MWI is the official body responsible for the overall monitoring of the water sector, water supply and wastewater system, and the

formulation of national water strategies and policies. WAJ assumes all responsibilities related to wastewater structures, and within Aqaba Governorate, Aqaba Water Company is the responsible entity representing WAJ.

Within Aqaba Governorate, Aqaba city is the only area served with a wastewater network which covers 97% of the city's area with a total length of 325 km. The wastewater network is connected to the Aqaba Waste Water Treatment Plant (WWTP) which is located in the northern region of Aqaba City. The WWTP comprises two stations: (i) natural treatment plant which has a design capacity of 9,000m³ and receives 40% of the total wastewater of Aqaba (current capacity is 6,500m³) and (ii) mechanical treatment plant which has a design capacity of 12,000m³ and receives 60% of the total wastewater of Aqaba (current capacity is 9,500m³). This WWTP is considered to be the closest to the Project site and is located approximately 40km to southeast.

The SIZ is not served with a WWTP or a wastewater network. The AWC is currently preparing plans and studies to cover the entire southern area (including the SIZ) with a wastewater network due to the growing demand for wastewater services in the area in light of the development of various investment sectors in this region.

Within the SIZ, some of the operating industries have a small scale WWTP to treat wastewater from their facilities for reuse— such as the ATPS and the Industrial Complex. Others rely on septic tanks for wastewater disposal which are emptied at regular intervals through tankers and disposed at the Aqaba WWTP in Aqaba City.

(ii) Solid Waste Management Utilities

In Jordan, solid waste management is undertaken primarily by the public sector. Solid waste is managed through the operation of landfills (or dumpsites). In accordance with the “Municipalities Law Mo.13 of 2007”, solid waste management is the responsibility of local municipalities under the umbrella of the Ministry of Municipal Affairs (MoMA) – this includes the collection of municipal solid waste, transportation, and final disposal to landfills.

However, within the ASEZ, solid waste management is the responsibility of ASEZA – this includes the collection of municipal solid waste, transportation, and final disposal to landfills.

Within the ASEZ, there are two main authorized landfills – the Aqaba Landfill for municipal solid waste and the Aqaba Debris landfill for construction waste.

According to discussions with ASEZA, the Aqaba Landfill is located around 4km north of the SIZ at an area of around 250 dunum²¹ and receives around 120 ton per day of municipal solid waste (Figure 58). Common practice for disposal of municipal solid waste at the landfill mainly includes compacting of waste and applying regular cover. This landfill is managed by Aqaba Municipality whereas collection and transportation of waste is undertaken by ASEZA whom hires a private contractor to undertake collection and transportation activities.

The Aqaba Debris Landfill is located north of Aqaba city by around 15km. there are no statistics on the area of the landfill or the amount of incoming daily waste. The landfill is located within a wadi, where current practice for disposal is through dumping waste in the wadi. This landfill is managed by ASEZA whom also hires a private contractor for the collection and transportation of waste to the landfill.

(iii) Hazardous Waste Management Utilities

In accordance with the “Environmental Protection Law No.(52) of the year 2006” and the “Instruction for Management and Handling of Hazardous Waste of 2003”, hazardous waste must be transported and disposed at landfills which are approved by the MoEnv.

In Jordan, there is currently one landfill for disposal of hazardous waste – the Swaqa Hazardous Waste Treatment Facility. The facility is located in Al-Karak Governorate, around 70km south of the capital city of Amman and 130km to the north of the Project site. The facility is operated and managed by the MoEnv.

²¹ 25 hectares

According to discussion with the “Hazardous Substances and Waste Management Directorate” of the MoEnv, the facility is located on an area of around 8,500 dunums²² and receives around 8-10 tons per day of hazardous waste. Currently disposal of hazardous waste is undertaken through either land-filling of stabilized and inert hazardous waste in specially lined cells, while for other types of waste which require physical-chemical treatment or incineration they are stored in safe storage spaces. Such storage spaces are temporarily until the second phase of the facility construction is implemented.

The second phase mainly involves physical-chemical treatment and incineration facilities which mainly aim to improve handling and management of hazardous waste which requires treatment or incineration. Tenders for the second phase are expected to be released by the end of 2014, while construction to be completed by 2016.

In addition, there is currently a pilot project for disposal and management of electronic waste at Swaqa. Electronic waste is currently collected and stored at the landfill and once quantities are substantial, an electronic waste recycling project will be implemented.

Currently, there are no additional plans by the MoEnv for hazardous waste management in Jordan such as the construction of another hazardous waste treatment facility.

7.7.4 Road Network

The Ministry of Public Works and Housing (MPWH), operating under the Regulation of Organization and Management of the MPWH No. 55 of 1996, is the governmental authority responsible for the construction and development of the public road network in Jordan. The ministry is also responsible for connecting cities, villages, and communities together in addition to maintaining the network in good technical conditions. The mandate of the MPWH holds it responsible for roads penetrating and connecting between cities and for main highways. However the municipality is responsible for the management and maintenance of secondary roads that are not penetrating and not connecting between different communities.

ADC has created a road network within the South zone which ensures that neither of the tourist commuters and industrial trucks meets on the same roads or interacts with each other and this has been done to ensure safety and security on the road and minimise visual and aesthetic issues to the extent possible. The road network within the SZ is divided into two parts:

- Coastal road which is the main coastal road that links the Aqaba City with the touristic attractions and is only allocated for use for small cars. This road runs along the coast from Aqaba to the Al-Durrah border crossing to Saudi Arabia. The total length of road within the Zone is approximately 3.4km. The road is 25m wide dual carriageway; and
- The Parallel Coastal Road (or the National Highway as named by ADC) and the Aqaba Back Road (or the Escape Lane Highway as named by ADC). Both of these roads are allocated for heavy industrial trucks and shipment trucks and they both have a direct connection with the City of Aqaba (Figure 24 and Figure 59).
 - The Truck Road is a 25m wide dual carriageway connecting the Coastal Road junction at Wadi 2 with the container terminal in the Middle Port
 - The Back Road is 25m wide 2-lane single carriageway road which provides a route for all heavy vehicles entering and leaving the port areas and the southern industrial zone. The Back Road joins the Coastal and Truck Roads at Wadi 2 intersection and leads to Amman. The road crosses very hilly terrain with gradients up to 7%. There are plans to widen the road to 4-lane dual carriageway.

Additionally, as shown in Figure 59 the Project site is served with a direct secondary road which is directly connecting with the Aqaba Back Road (or the Escape Lane Highway as named by ADC)

²² 850 hectares

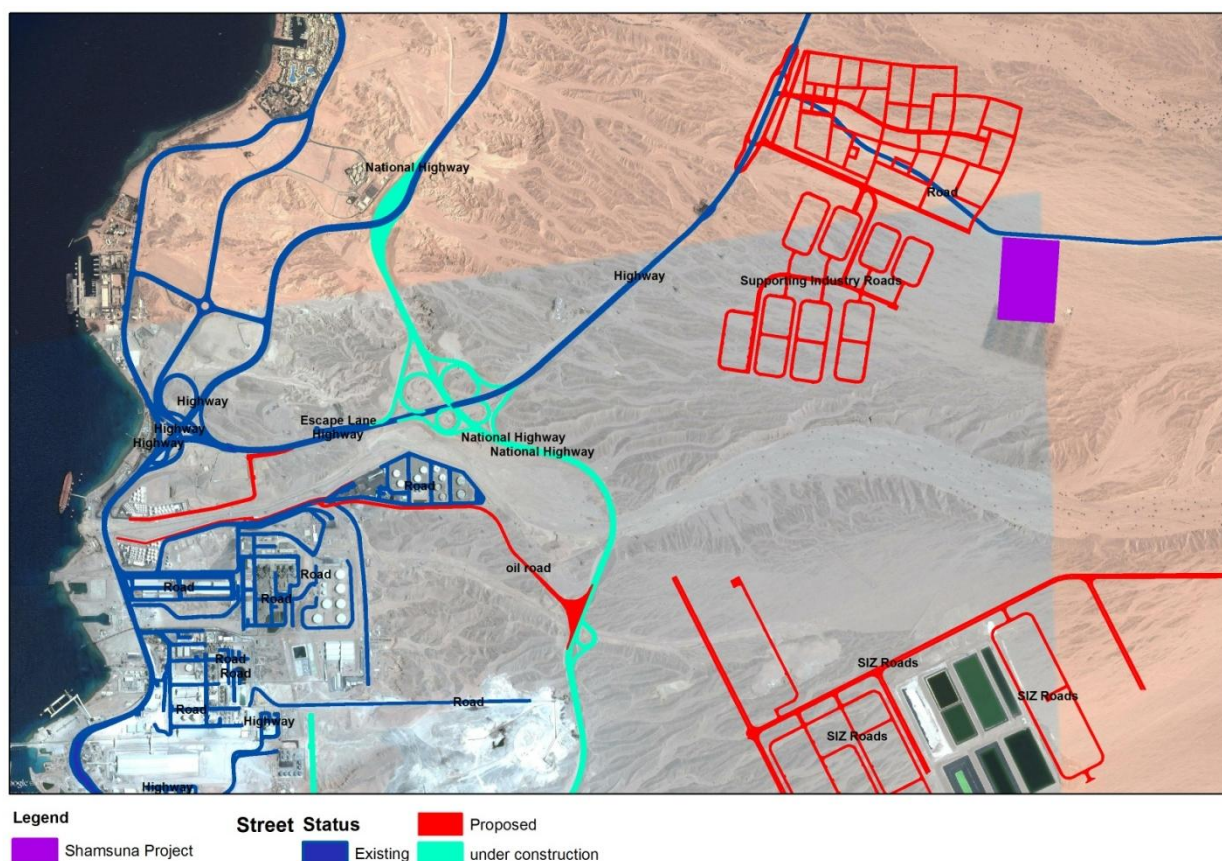


Figure 59: Road Network in the Project Area

7.7.5 Electricity Network

The electricity structure in Jordan is comprised of the following entities:

- Three electricity generation companies, namely: the Central Electricity Generating Company (CEGCO), the Samra Electricity Power Generation Company (SEPGCO), and the Amman East Power Company (AES Jordan PSC);

CEGCO is responsible for a number of thermal power plants in Jordan including the Aqaba Thermal Power Plant (ATPS) located around 6km from the Project site. The ATPS consists of five steam turbines units, each nominally rated at 130 MW gross and two hydraulic turbines with total capacity 6 MW – for a total rated capacity of 656 MW. The ATPS can run on natural gas as well as heavy fuel oil, and utilizes seawater from the Red Sea for cooling purposes.

- The National Electric Power Company (NEPCO) responsible for transmission of electricity through high voltage lines; and
- Three distribution companies responsible for distribution of electricity through medium and low voltage lines: the Jordanian Electric Power Company (JEPCO), the Irbid District Electricity Company (IDECO) and the Electricity Distribution Company (EDCO).

EDCO is responsible for all electricity distribution in the southern governorates to include Aqaba as well as Ma'an, Al-Tafileh, and Karak.

The electricity system is regulated by the Electricity Regulatory Commission (ERC), while the Ministry of Energy and Mineral Resources (MEMR) is responsible for political decisions.

Jordan transmits electricity through high voltage lines (400 and 132 kV) under the responsibility of NEPCO and distributes electricity through medium and low voltage lines (33/11/4 kV) under the responsibility of the respective distribution companies mentioned above. There are about 2,200 circuit-km of transmission lines

currently operated at 132 kV, which represents about 73% of the total networks, and 809 circuit-km of transmission lines operated at 400 kV.

The two overhead high voltage line corridors run from north to south in Jordan. The Project will be connecting with the substation within the ATPS and directly connect with the 132kV transmission line. The 400kV transmission line is located less than 1 km to the south of the Project site (Figure 11)

7.8 Socio-Economic Conditions

This section summarises the current socio-economic conditions in the ASEZ as a whole with focus on the closet community to the site Aqaba City. Given the distance to the closest community this summary is considered sufficient for the purposes of the ESIA.

7.8.1 Baseline Data Collection Methodology

The socio-economic conditions have been established based on the review of secondary data available mainly from the Department of Statistics (DOS), Governorate of Aqaba, and available published report for the ASEZ. Available data were collected and reviewed for certain indicators in order to characterize and describe the socio-economic situation. Since the Project is located within the ASEZ, hence, the socio-economic data is focused on profiling the Aqaba City and the ASEZ. It is important to note that statistical data tries to represent the current socio-economic conditions within the ASEZ and the Aqaba City to the extent possible within the available timeframe for the ESIA.

7.8.2 Results

Following the passage of the Aqaba Special Economic Zone Law, No. 32 of the year 2000, the Aqaba Special Economic Zone (the ASEZ) began functioning in early 2001 and was formally established. The heart of ASEZ is Aqaba city (Arabic: العقبة, Al-Aqabah) which is a coastal town in the far south of Jordan (Figure 4).

ASEZ had an estimated population by the DOS of about 103,000 in the year 2010. According to DOS, by the end of 2007, Aqaba city population was 98,750; of which 56.1% are male. In spite of clear growth in the population of Aqaba over the last decade, it is still of the smallest three cities in Jordan.

About 82% of the population in 2010 were Jordanians. Out of the non-Jordanians total about 44.9% were Egyptians. Population growth was about 4.3% for the period 2004-2007, compared to 2.3% Jordan growth population. Data from the Department of Statistics showed that the labour force in Aqaba included approximately 30,920 persons in 2007 out of a total local population of 98,750.

In spite of the generally positive developments in the economic sphere at the national level, there are two challenges that face Jordan and ASEZ with serious socio-economic implications. The first is unemployment which remained high in 2009, standing at 12.4%. Unemployment among youth women was about double the national rates. While unemployment declined for men in Aqaba between 2003 and 2009 – from 13.3% to 10.0%, it increased for women, from 18.0% to 23.0% (ACED, 2010). According to ACED (2010), the reasons for unemployment included a mismatch between the skills and education level of those seeking work and the requirements for job openings. In addition, job preferences of Jordanians have discouraged them from accepting positions in certain fields and avoiding jobs with poor wages, poor job security or undesirable working conditions.

Given Jordan's population age structure, the number of individuals in the working-age segment will increase exponentially in the next three decades. Moreover, as most available job opportunities are created in the Amman region, unemployment rates are particularly high in the governorates in the rest of the country. Thus the issue of job opportunities is as important to the community in Aqaba as it is to the rest of the country. It is more pronounced in the context of the economic slowdown which Jordan is experiencing as a result of the global economic crisis.

The other challenge is that of economic development of regions within Jordan. While strenuous efforts were exerted by government to establish a number of “Development Zones”, the real economy on the ground is still underdeveloped, the business environment fragile and more complex; and local communities have minimal involvement.

Labour demand in Aqaba is marked by large numbers of employees in transportation and communication followed by construction, trade, public administration and mining/manufacturing. Employers have had difficulty filling senior management positions, professional and skilled technical positions, and unskilled positions in certain industries (e.g. hospitality/tourism, construction). To fill some positions, employers have turned to foreign labour – especially in the construction, hospitality, public services (refuse disposal), and trade areas. More than one-quarter of local workers were foreign in 2007 (ACED, 2010).

Current labour demand and employment sectors in Aqaba

In 2007, according to the Jordan Department of Statistics, the largest employment sector in Aqaba was transportation and communication (the Port of Aqaba and the Aqaba Container Terminal) followed by construction, trade, public administration and defence, and mining/manufacturing.

Table 27: Aqaba Workers in Employment Sectors, 2007 (DOS, 2009)

ECONOMIC SECTORS (Jordan Dept. Of Statistics)	PERCENT OF TOTAL WORKERS IN AQABA (JORDANIAN & FOREIGN) N=27,958
Transportation & Communication	27.0%
Construction	13.1%
Trade (wholesale/retail; motor vehicle repair, personal or household goods)	11.9%
Public admin. & Defense	10.1%
Mining & manufacturing	9.7%
Education	6.3%
Hospitality (hotels and restaurants)	5.2%
Social services and personal services	4.4%
Utilities (Electricity, water, gas)	3.4%
Finance & real estate	3.1%
Health	3.0%
Housemaid	2.1%
Agriculture, hunting & fishing	0.6%
Other	0.1%
TOTAL	100.0%

Aqaba training and education programs (ACED, 2010)

- Aqaba University College: Under the umbrella of Al-Balqa’ Applied University, the Aqaba University College offers two programmes: a four-year Bachelor of Arts program and a two-year diploma program. The disciplines provided in both programmes are: Hotel Management, Finance & Banking, Information Technology, Tourism Management, Nursing, Management Information Systems, Accounting, Education, and Stores Management.
- University of Jordan/Aqaba: Jordan University opened its new campus in Aqaba in Fall 2009. It began by enrolling first-year students and adding students to that class and enrolling new classes over a period of three (3) years. Eventually a full four-year program was in place enrolling about 500 students per class. As is true of many higher education programs in Jordan, many of the first-year students are women, who tend to score higher on the Tawjihi exams than men, and therefore can enter the BA programs. The disciplines provided are: Business Administration, Accounting, English language & literature, Management Information Systems, Business IT, French language & literature, Tourism and travel management, Hotel management, Risk management & insurance, Coastal Environment, Marine Life, and Food & beverage management.
- Vocational Training and Technical Education Centre (VTC): In 2009-2010, the VTC program in Aqaba offered technical and vocational training in the following areas: Computer and information technology skills (e.g. data entry, website development), Hospitality (cooking, hospitality, housekeeping skills),

Construction skills (welding), Building maintenance (air conditioning, electricity), Auto and light vehicle repair and mechanics, Furniture carpentry, Beauty services (cosmetics, hairdressing), and Tailoring. Graduation figures for the VTC have fluctuated over the past five years, ranging from a high of 335 in 2007 to a low of 120 in 2009.

- Aqaba Training Centre (ATC): ASEZA sponsors a training centre that offered basic skills training to local residents in short term (less than 6 month) programs. Managed by the Business Development Centre, the programs included English language (9 levels), basic computer skills, workplace skills, customer relations, and accounting.
- Maharat/ Business Development Centre: The Business Development Centre (BDC) also sponsored a program that offered courses for graduates of university to obtain skill development training over a six-month period. The BDC focused on skills suitable for jobs at companies that are small or medium enterprises. The programs included on-the-job workplace skills, human resources, marketing and sales, customer relations, and public relations. It reported in an interview for this study that 275 people completed programs in 2008, and that 304 are expected to do so during 2010.

None of the existing training or education programmes within Aqaba cover disciplines related to renewable energy or solar energy projects. This is partly due to the limited requirement in the Aqaba market for such disciplines. Generally, there is a match between labour demand and education and training programs in Aqaba. However, the future demand for engineering and specialists in education cannot be met locally.

8. ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

8.1 Overview of the Strategic Environmental and Economical Impacts

The Project will result in significant positive environmental and economic impacts on the strategic and national level given the current challenges the energy sector in Jordan is facing which have serious implications on Jordan's energy security as well as major economic burdens to the Jordanian economy.

Such positive impacts are important to highlight, consider, and take into account as well as investigating the potential negative environmental impacts anticipated from the Project, as discussed in the following sections

The anticipated positive environmental and economic impacts on the strategic level are discussed and highlighted below.

8.1.1 Master Strategy of Energy Sector in Jordan

The energy demand in Jordan is characterized with a rapid increase to cope with the development. The expected demand for primary energy in 2020 will amount to 15 million tons of oil equivalent, compared to 7.6 million tons of oil equivalent in 2007. Similarly, electricity demand in 2020 is 5,770 MW compared to 2,100 MW in 2007; and average increase of 300MW per year.

To meet the energy demand and the challenges of the energy sector a comprehensive energy strategy was approved by the Cabinet in December 2004 revised in 2007 – “Master Strategy of Energy Sector in Jordan”. The Strategy is to provide a vision for development of energy sector over the next ten years. The Strategy studied all options and alternatives for securing all types of energy from the following points of views: (i) the optimal options to cope with the energy demands and its investment cost, (ii) reforming and restructuring the energy sector to open the market for competition, and (iii) expanding on renewable energy projects and implementing energy conservation programs.

To this extent, the future goals of the Strategy can be summarized as follows:

- Reduce the dependence on foreign energy sources (energy independence);
- Security of supply with energy production based on a variety of sources;
- The target for 2015 is for domestic resources to cover 25% of demand reducing imports to 75%;
- The target for 2020 is for domestic resources to cover 39% of demand reducing imports to 61% and achieving energy production from additional energy sources; and
- Promote renewable energy sources to share to 7% in the primary energy mix in 2015, and 10% in 2020. This is to be met through 600-1000 MW from wind energy and 300-600 MW from solar energy.

To promote renewable energy sources and in order to open the way for private sector to effectively participate in the implementation of renewable energy project, the Renewable Energy and Energy Efficiency Law was issued and officially entered into force in April 2012. With this law, and for the first time in Jordan, investors had the opportunity to identify and develop renewable grid-connected electricity production through the Direct Proposal Submission as discussed earlier in Section 1.2.

In line with the above, this development allows for more sustainable development and shows the commitment of the Government of Jordan to realizing its energy strategy and meeting the set targets for renewable energy sources.

8.1.2 Energy Security

Recently, most policy makers around the world are grappling with issues related to energy security, energy poverty, and an expected increase in future demand for all energy sources – and Jordan is no exception. Almost certainly, the most spoken words by policy makers and government bodies in Jordan in the last couple

of years revolved around ‘energy security’, which is one of the key goals of the Master Strategy of Energy Sector in Jordan discussed above.

Currently, the Jordanian local energy resources are very limited commercially and Jordan is highly dependent on imported energy, as the total imported energy amounted to 97% of Jordan's total energy needs.

In line with the above, the project in specific will contribute to increasing energy security through reliance on an indigenous, inexhaustible and mostly import-independent energy resource. The expected electricity generation from the Project is 20GW hours per year, on average; which will serve the annual electricity needs of more than 10,000 individuals or of three (3) large five (5) star hotels.

8.1.3 Economic Benefits

The reliance on imported energy as discussed earlier above has led to major economic burdens to the Jordanian economy. Over the past year, Egyptian gas supplies through the Jordan Gas Transmission Pipeline (JGTP) have been severely interrupted. To substitute the shortfall in Egyptian gas supply, Jordan had to rely to more expensive alternative fuels (imported fuel oil, diesel, gasoline) for power generation resulting in significant economic implications to the Government of Jordan's energy bill. In 2012, the cost of imported energy amounted to 20% of Jordan's Gross Domestic Product (GDP).

In line with the above, the Project will produce clean energy which will contribute to lowering electricity generation costs by 0.5% compared to the current costs associated with liquid fuels and thus leads to a substantial decrease in the Government of Jordan's fiscal deficit.

8.1.4 Environmental Benefits

The negative environmental impacts from generating electricity through conventional fossil fuel burning at thermal power plants are very well known. This most importantly includes air pollutant emissions such as ozone, sulfur dioxide (SO₂), Nitrogen Dioxide (NO₂), particulate matter, and other gases which are the cause of some serious environmental concerns such as smog, acid rain, health effects, and many others.

In addition, the burning of fossil fuels results in carbon dioxide emissions; a primary greenhouse gas emitted through human activities which contributes to global warming. The main human activity that emits CO₂ is the combustion of fossil fuels for electricity production and transportation. Concurrently, global climate change has become an issue of concern and so reducing greenhouse gas emissions have also emerged as primary issues to be addressed as the world searches for a sustainable energy future.

Generating electricity through PV power is rather pollution-free during operation and compared with the current conventional way of producing electricity, the clean energy produced from renewable energy resources is expected to reduce consumption of alternative liquid fuels for electricity generation in Jordan, and will thus help in reducing greenhouse gas emissions, as well as air pollutant emissions. The Project will on average displace more than 16500 tons per annum (according to IEA 0,64kg CO₂/kWh in Jordan).

8.2 Landscape and Visual

This section identifies the anticipated impacts on the landscape and visual characteristics of the site from the Project activities during the construction and operation phase. In addition, for each impact a set of mitigation measures and monitoring requirements have been identified.

8.2.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of PV arrays and the various Project components to include transmission cables, switchgear, access roads and internal road network, buildings, etc are expected to include land clearing activities, leveling, excavation, grading, etc.

Construction activities would create a temporary effect on the visual quality of the site and its surroundings. The visual environment during the construction phase would include the presence of elements typical of a construction site such as equipment and machinery to include excavators, trucks, front end loaders, compactors and other.

However, as discussed in Section 7.1.2, there are no key sensitive visual receptors within the surrounding vicinity – such as recreational activities, environmental reserves, remarkable historical or cultural sites, water courses or other natural structures normally seen as valuable by the human perception. In fact, the Project site is within a planned Industrial park to which the aesthetical value of the area loses some importance.

The visual environment created during the construction period would be temporary, of a short-term duration, limited to the construction phase only. For the duration of construction the visual impacts will of a negative nature and be noticeable, and therefore of a medium magnitude. As there are no key sensitive visual receptors which would be affected the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- Ensure proper general housekeeping and personnel management measures are implemented which could include:
 - Ensure the construction site is left in an orderly state at the end of each work day.
 - To the greatest extent possible construction machinery, equipment, and vehicles that are not in use should be removed in a timely manner and kept in locations to reduce visual impacts to the area.
 - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in Section 8.4.2.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Inspections of the works should be carried out at all times to ensure the above measures are implemented.

Following mitigation it is considered the residual landscape and visual effect during construction will be of a not significant nature.

8.2.2 Potential Impacts during the Operation Phase

(i) Potential Impacts from Project Visibility

- The Project is expected to be visible within the immediate vicinity and up to some kilometres around the Project site only and thus is likely to create visual impacts. The maximum height of the PV mounting structures is expected to be in the range of 2-3.5 m. The transmission line connecting the project with the substation at the ATPS will run through Wadi 2 which already has the existing infrastructure of a 400 kV transmission line and the Fajr gas pipeline running through it and will therefore not significantly change any views of the Wadi. The most important receptor to which this Project would be visible would be to those using the secondary road to the north of the Project, where such views would be temporary and limited to the time of passage within the area.
- However, being visible is not necessarily the same as being intrusive. Aesthetic issues are by their nature highly subjective. For some viewers, a PV Plant could be regarded as manmade structures with visual burdens while to others it represents a positive impact in the sense that they introduce a break in the otherwise dull and monotonous view.
- More importantly, as discussed earlier, there are no key sensitive visual receptors within the surrounding vicinity of the Project site – such as recreational activities, environmental reserves, remarkable historical or cultural sites, water courses or other natural structures normally seen as valuable by the human perception. In fact, the Project site is within a planned Industrial park to which the aesthetical value of the area loses some importance.
- The visual environment created will be of a long-term duration throughout the operation phase of the Project. For the duration of operation, the visual impacts will be of a negative nature and be noticeable, and therefore of a medium magnitude. As there are no key sensitive visual receptors which would be affected the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

(i) Potential Impacts from Glare

Another issue associated with the Project is the potential for glare caused by sunlight reflected off the PV panel modules. It is important to note that PV Panels work on the concept of absorbing sunlight rather than reflecting it as in the case of other technologies (e.g. Concentrated Solar Panels CSP).

Nevertheless, not all of the incoming sunlight is absorbed and thus a minimal amount of incoming sunlight is reflected. Therefore, PV panels could be associated with potential for glare caused by sunlight reflected off the modules. This depends on several factors such as the amount of sunlight hitting the surface, surface reflectivity, geographic location, time of year, cloud cover, and solar panel orientation. However generally, glare is likely to occur when the sun moves away from perpendicular to the panel and when the sun is low on the horizon (toward sunrise and sunset), because the solar panel is absorbing much less of the incoming light.

In addition, it is important to put things into perspective. According to the “Glint and Glare Study for Panoche Valley Farm” (Jack Pfaff, 2011), standard solar glass reflects much less light and has lower potential for glare when compared to other materials widely used in other human developments such as steel, standard glass, plastic and even when compared to snow and smooth water. Figure 59 below provides a comparison of sunlight reflection from various incidents angles of solar glass in comparison to such materials.

In addition, throughout the world there are several PV development projects operating close to sensitive areas which could be potentially impacted by glare – such as airports; and thus indicating that the potential for glare is rather not considered an issue of concern. This include PV Project development near Thunder Bay Airport in Canada, Nellis Air Force Base in USA (Figure 60 below), Dusseldorf International Airport in Germany, Denver Airport in USA, and many others.

Common Reflective Surfaces (in surrounding environments for PV systems)		Incident angle in degrees						
		0	15	30	45	60	75	90
Material Reflectivity (percent of incident light reflected)	Steel	36.73%	39.22%	46.34%	57.11%	70.02%	83.15%	94.40%
	Snow (fresh, flakey)	21.63%	23.09%	27.29%	33.63%	41.23%	48.96%	55.59%
	Standard Glass	8.44%	9.01%	10.65%	13.12%	16.09%	19.10%	21.69%
	Plexiglass	8.00%	8.54%	10.09%	12.44%	15.25%	18.11%	20.56%
	Plastic	6.99%	7.46%	8.82%	10.87%	13.33%	15.83%	17.97%
	Smooth Water	4.07%	4.35%	5.14%	6.33%	7.76%	9.22%	10.47%
	Solar Glass (high light transmission, low iron)	3.99%	4.26%	5.03%	6.20%	7.61%	9.03%	10.26%
	Solar Glass w/AR coating	2.47%	2.64%	3.12%	3.84%	4.71%	5.59%	6.35%

(Note: Index of refraction values may vary slightly depending on suppliers and reference documentation. The values for the above calculations are averages or single values obtained from the list of references for this document).

Figure 60: Reflectivity of Various Materials based on Incident Angles

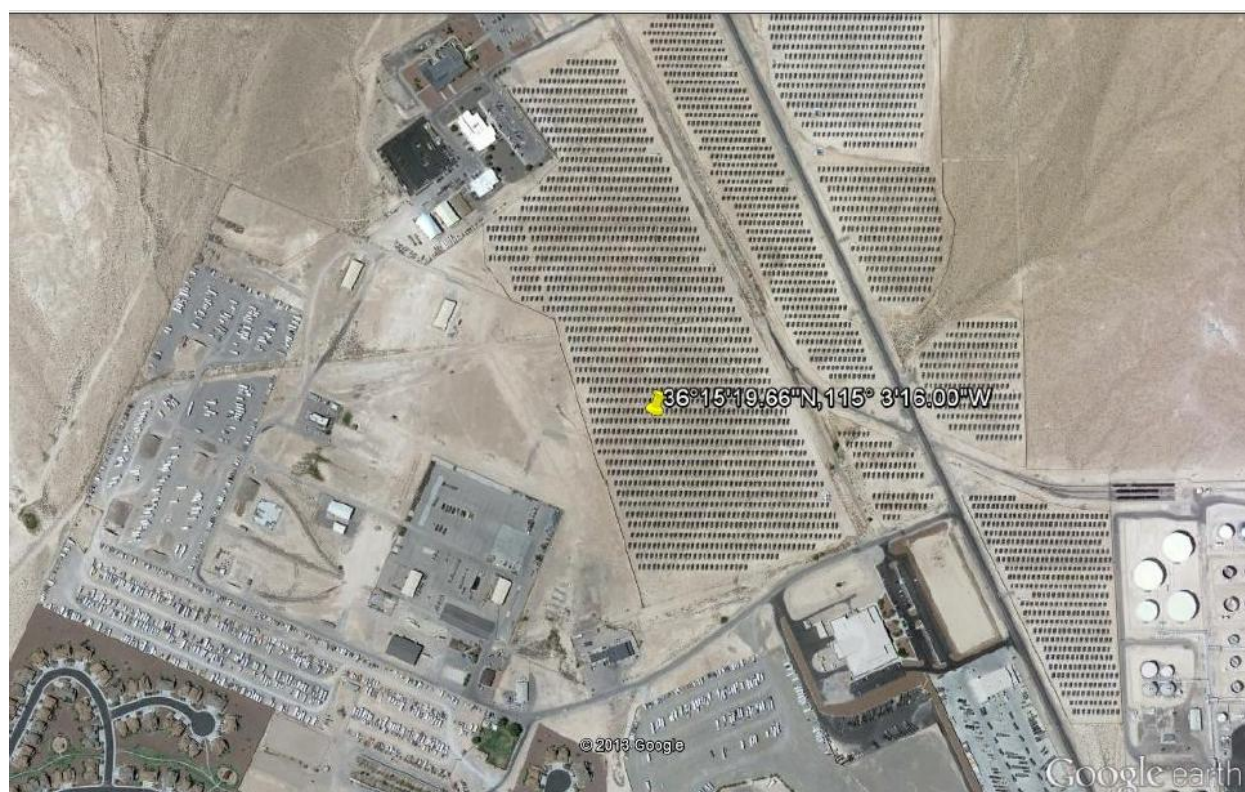


Figure 61: PV Modules Installed near the Nellis Air Force Base in Nevada – USA

In addition, an even more relevant effect of minimizing glare is soiling, though not regarded as desirable. With soiling, the deposition of dust and small particles on the module surface is inevitable, which often starts

accumulating some hours after cleaning. The higher the degree of soiling, the lower the potential for glare. Therefore the highest possibility of glare exists only directly after cleaning.

Nevertheless, taking all of the above into account, the sensitive receptors which could be affected by glare would include the following:

- Civil and military aviation. There are no airports or landing strips within the area and the closest civil airport is the King Hussein International Airport located 23 km to the north of the Project.
- The Secondary road which runs to the north of the Project site. In certain conditions, road users could be temporarily affected by glare as they pass through the area. However, such impacts are minimal and temporary.

The potential impacts from glare will be of a long-term duration throughout the operation phase of the Project. For the duration of operation, the potential for glare will be of a negative nature and be noticeable, and therefore of medium magnitude. The only key sensitive visual receptors which would be affected are the commuters along the highway, and thus the receiving environment is determined to be of a medium sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Further follow up actions:

The Developer/EPC Contractor shall submit an application for a permit from the Civil Aviation Regulatory Commission (CARC) and the Jordanian Royal Air Forces (JRAF) along with the required details and information. After studying the application and based on the distance of the Project from the closest airports, CARC and JRAF will most probably respond officially with a no objection on the Project development but will require a guarantee from the Developer /EPC Contractor that the panels won't result in higher reflections when compared to other factors such as water bodies (where such issues has been discussed earlier).

Mitigation Measures

The following identifies the mitigation measures to be applied by the Project Operator (EPC Contractor) during the operation phase and which include:

- Upon completion of construction activities, coordinate with ADC and ASEZA to install informative signs on the Highway for commuters regarding potential for glare within the area.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Project Operator (EPC Contractor) during the operation phase and which include:

- Submission of proof of coordination with authorities discussed above.

8.3 Land Use

This section identifies the anticipated impacts on land use from the Project activities during the planning and construction phases.

8.3.1 Potential Impacts during the Planning and Construction Phase

The Project site location does not conflict with any of the relevant governmental entities formal planning context. In addition, the Project site does not provide any value to local communities and the area is not used

by nomadic or semi-nomadic peoples. Therefore, there are no anticipated impacts during the planning and construction phase of the Project.

8.4 Geology, Hydrogeology, and Hydrology

This section identifies the anticipated impacts on geology, hydrology, and hydrogeology from the Project activities during the planning and construction and operation phase. In addition, for each impact a set of mitigation measures and monitoring requirements has been identified.

8.4.1 Potential Impacts from Local Flood Hazards during Planning, Construction and Operational Phases

As discussed in Section 7.3, the Project is located 600 m from the main drainage system, however the Project is located on a 4 km² alluvial fan that is directly connected to the mountain system to the west of the Project site

As no flood risk study has been carried out, it is not possible to determine the potential risk of local flood hazards during the rainy season and flash flood events, and so a worst-case scenario of flash flooding has been assumed for this assessment.

Such risks would result in impacts which are of long-term duration throughout the construction and operational phases of the Project. For the duration of construction and operation, such flood risks will be of a negative nature and of medium magnitude given that they are limited to seasonal floods of short durations. However, this is considered of high sensitivity given that it could entail serious damage to the Project. Given all of the above, such an impact is considered to be of moderate-major significance.

Mitigation Measures

In order to inform the Developer and EPC Contractor of any flood risks at the Project site (which will then be able to be mitigated through project design), the Developer shall undertake a hydrological and flood risk study for the Project site with the aim of determining flood quantities within the Project site and peak flood estimates, which in turn will determine the required hydraulic design structure which would be able to convey these flows safely and prevent flood risks.

The study will inform the detailed design of the Project and will mitigate the risk of flash floods and therefore it is considered that there will be minimal impact of a minor significance, if not insignificant residual effects.

8.4.2 Potential Impacts from Improper Management of Waste Streams during Construction and Operation Phase

Given the generic nature of the impacts on soil and groundwater for both phases of the Project (construction and operation) those have been identified collectively throughout this section. This includes potential impacts from improper housekeeping practices (e.g. improper management of waste streams, improper storage of construction material and of hazardous material).

Improper housekeeping practices during construction and operation (such as illegal disposal of waste to land) could contaminate and pollute soil which in turn could pollute groundwater resources. This could also indirectly affect flora/fauna and the general health and safety of workers (from being exposed to such waste streams). Generally, such impacts can be adequately controlled through the implementation of general best practice housekeeping measures as highlighted throughout this section, and which are expected to be implemented by the EPC Contractor throughout construction phase and Project Operator (EPC Contractor) during the operation phase.

The potential impacts from improper management of waste streams could be of a long-term duration throughout the construction and operation phase. Such impacts are negative in nature, and could be

noticeable and are therefore of medium magnitude. However, they are considered of low sensitivity as they are generally controlled through the implementation of general best practice housekeeping measures. Given all of the above, such an impact is considered to be of minor significance.

Following the implementation of the mitigation measures highlighted throughout this Section, the residual significance can be reduced to not significant.

(i) Solid Waste Generation

Solid waste is expected to be generated from construction and operational activities. Solid waste generated will likely include construction waste (such as debris) and municipal solid waste (during construction and operation such as cardboard, plastic, food waste, etc).

Municipal solid waste generated during construction and that generated from operations will likely be collected and stored onsite and then disposed either to the 'Aqaba landfill' or the 'Aqaba debris landfill'. Both landfills are managed by ASEZA whom hires a private contractor for the collection of municipal/construction waste and disposal to the relevant landfill.

If solid waste is improperly managed (such as fly-dumping by workers into land) there are potential impacts on the land, soil, and environment and the general health and safety of workers on site (as waste attracts rodents and vectors).

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase and the Project Operator (EPC Contractor) during the operational phase unless stated otherwise:

- Develop a Solid Waste Management Plan (SWMP) that presents the approximate quantities of waste generated, type of waste, and disposal locations. The plan is to be developed in accordance with the Solid Waste Management Regulation No. (27) of 2005;
- Coordinate with ASEZA or hire a competent private contractor for the collection of solid waste from the site to the municipal approved landfill (the closest landfill being the Aqaba Landfill and Aqaba Debris Landfill);
- Prohibit fly-dumping of any solid waste to the land;
- Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste";
- EPC Contractor only - during construction, distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste. Where possible, the EPC Contractor must seek ways to reduce construction waste by reusing materials (for example through recycling of concrete for road base coarse);
- Implement proper housekeeping practices on the construction site at all times; and
- Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator (EPC Contractor) during the operational phase unless stated otherwise:

- Inspection of waste management practices onsite;
- Review of records and manifests for volume of waste generated to ensure consistency; and
- Regular environmental reporting on implementation of the waste management practices onsite.

(ii) Wastewater Generation

Wastewater is mainly expected to include black water (sewage water from toilets and sanitation facilities), as well as grey water (from sinks, showers, etc) generated from workers during the construction and operation phase. Wastewater quantities are expected to be minimal.

During the construction and operation phases it is expected that wastewater will be collected by septic tanks which will be served by service trucks. All generated wastewater is expected to be disposed at the Aqaba Wastewater Treatment Plant.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities, to include the EPC Contractor during the construction phase and the Project Operator (EPC Contractor) during the operational phase, unless stated otherwise:

- Develop a Wastewater Management Plan that presents the approximate quantities of wastewater generated, type of waste, and disposal locations;
- Coordinate with ASEZA to hire a private contractor for the collection of wastewater from the site to the Industrial Park WWTP;
- Prohibit illegal disposal of wastewater to the sea or land in accordance with ASEZA's "zero discharge policy" set within the Regulation for the Protection of the Environment in the ASEZ No. 21 for the Year 2001;
- Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the Aqaba Wastewater Treatment Plant. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;
- Ensure that constructed septic tanks during construction and operation are well contained and impermeable to prevent leakage of wastewater into soil. In addition, proper bunding must be in place to prevent further spillage if leakage occurs;
- Develop a regular inspection and maintenance schedule for the sanitation facilities and septic tanks for early detection of issues; and
- Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing. In addition, proper bunding must be in place to prevent further spillage if leakage occurs.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator (EPC Contractor) during the operational phase, unless stated otherwise:

- Inspection of wastewater management practices onsite;
- Review of records and manifests for volume of wastewater generated to ensure consistency; and
- Regular environmental reporting to ASEZA on implementation of the Wastewater Management Plan discussed above (time period of monitoring to be agreed with ASEZA).

(iii) Hazardous Waste Generation

Hazardous waste is expected to be generated throughout both the construction and operation phase and this could include consumed oil, chemicals, paint cans, etc. Hazardous waste generated will likely be collected and stored onsite and then disposed at the 'Swaqa Hazardous Waste Treatment Facility' which is managed by the MoEnv.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase the Project Operator (EPC Contractor) during the operational phase, unless stated otherwise.

- Coordinate with the MoEnv and hire a private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility;
- Follow the requirements for management and storage as per the 'Instructions for Hazardous Waste Management and Handling of the Year 2003' of the MoEnv;
- Prohibit illegal disposal of hazardous waste to the land;
- Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits). The oil sumps below the transformers of the substation area need to be prevented from intrusion of run-off water. Contaminated drainage must be orderly disposed of as hazardous waste;
- Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing; and
- Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the Swaqa Facility. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator (EPC Contractor) during the operational phase, unless stated otherwise:

- Inspection of hazardous waste management practices onsite;
- Review of records and manifests for volume of hazardous waste generated to ensure consistency; and
- Regular environmental reporting on implementation of the hazardous waste management practices onsite.

(iv) Hazardous Material

The nature of construction and operational activities entail the use of various hazardous materials such as oil, chemicals, and fuel for the various equipment and machinery. Improper management of hazardous material entails a risk of leakage into the surrounding environment either from storage areas or throughout the use of equipment and machinery.

In addition, of particular importance in relation to solar PV technologies is whether a crystalline modules or thin film modules were used in the PV Project. Crystalline modules are made from silicon as a semi-conductor material whereas thin film is made from thin layers of photovoltaic material such as Cadmium Telluride (CdTe) or Copper Indium Gallium Selenide (CIGS) which are hazardous material. In general, silicon modules do not utilize hazardous semiconductor materials (silicon as semiconductor material), whereas thin film could utilize hazardous materials (such as CdTe).

In the case of this Project, crystalline modules used for the Project are made from silicon as a semi-conductor material. In general, silicon modules do not utilize hazardous semiconductor materials (silicon as semiconductor material). The panels do not contain hazardous material and also the EPC Contractor is committed to a recycling programme of the panels at the end of their lifetime, hence, there is no anticipated impact from hazardous material within the panels based on the solar PV technology used for this Project.

Mitigation Measures

The following identifies the mitigation measures to be applied by all involved entities to include the EPC Contractor during the construction phase the Project Operator (EPC Contractor) during the operational phase, unless stated otherwise.

- Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of hard impermeable surface, flame-proof, accessible to authorized personnel only, locked when not in use, and prevents incompatible materials from coming in contact with one another. The provisions of the Jordanian Standard 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials must be adhered to;
- Maintain a register of all hazardous materials used and accompanying Material Safety Data Sheet (MSDS) must present at all times. Spilled material should be tracked and accounted for;
- Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc);
- Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refueling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material;
- Ensure that a minimum of 1,000 liters of general purpose spill absorbent is available at hazardous material storage facility. Appropriate absorbents include zeolite, clay, peat and other products manufactured for this purpose; and
- If spillage on soil occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by all involved entities to include the EPC Contractor during the construction phase and the Project Operator (EPC Contractor) during the operational phase, unless stated otherwise.

- Inspection for storage of hazardous materials to include inspections for potential spillages or leakages; and
- Report any spills and the measures taken to minimize the impact and prevent from occurring again.

8.5 Biodiversity

This section identifies the anticipated impacts on biodiversity from the Project activities during the construction and operation phase. In addition, for each impact a set of mitigation measures and monitoring requirements have been identified.

8.5.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of PV arrays and the various Project components to include transmission cables, switchgear, access roads and internal road network, buildings, etc are expected to include land clearing activities, leveling, excavation, grading, etc.

Such construction activities could result in the alteration of the site's habitat and thus potentially disturb existing habitats (flora, fauna, and avi-fauna) and result in the displacement or exclusion of species particularly threatened, endemic, or endangered species which might be present within the Project site and surrounding areas.

Other impacts on the biodiversity of the site are mainly from improper management of the site which could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc).

However, based on the biodiversity baseline assessment conducted (which included review of secondary data, a site survey, and consultations with academic experts), it was concluded that the main Project site's habitat in general is considered barren and of low ecological significance due to its natural setting of scarce vegetation and absence of water sources. In addition, the site is considered, to some extent, disturbed by human activities with construction rubble, deserted facilities, plastic bags and old furniture discarded on site. Such disturbances could affect, to some extent, the presence of fauna (especially large animals) and avi-fauna within the Project site.

The proposed transmission line route is less disturbed and has a healthy coverage of Acacia trees which support a number of passerines and are likely to be used for breeding by birds. There is a risk that this habitat may be disturbed during construction.

The Project site and proposed transmission line route are located within an IBA, however there are not any other not located within or near areas of critical environment concern (to include environmental reserves of important bird areas), where the closest is around 15km away from the site nearby. The near threatened sooty falcon (*Flaco concolor*) has been recorded in the IBA as have a further 17 soaring bird species, however it is unlikely that they are using the project site and proposed transmission line route.

Generally, all recorded flora/fauna/avi-fauna species within the Project site are considered of least concern and common to such habitat areas. However, based on the literature review, two key species are considered important at the national level. This includes the Arabian Hare - which is considered threatened due to hunting activities, and the Spiny Tailed Lizard –which is considered threatened due to hunting activities and extensive harvesting (for collection and selling purposes). However, those species in particular have not been recorded throughout the field survey.

Given all of the above, the potential impacts on biodiversity created during the construction phase at the main project site would be of a long-term duration as they would result in a permanent change in the natural biodiversity of the site. Such impacts are considered of negative nature, and of a medium magnitude given that the change in the natural biodiversity of the site will be noticeable. However, as the site is considered of low ecological significance, the receiving environment is determined to be of a low sensitivity and such an impact is considered to be of minor significance.

The potential impacts on biodiversity during the construction phase along the proposed transmission line route would be of a long-term duration as they would result in a permanent change in the natural biodiversity of the proposed route. Such impacts are considered to be of negative nature, and of a medium magnitude given that the change in the natural biodiversity of the route will be noticeable. As the proposed route follows a potential breeding area for passerines, the receiving environment is determined to be of a medium sensitivity and such an impact is considered to be of moderate significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- Before construction commences, undertake a fauna survey (through an ecological expert) to identify the presence of any key faunal species of importance (reptiles and mammals) onsite and along the proposed transmission line route. Should viable populations of such key species exist within the Project site then it should be relocated outside of construction active areas;

- Undertake avifauna species (migratory, resident and breeding) prior to construction within the proposed transmission line only to ensure that there are no indications of breeding taking place within Wadi 2
- Undertake construction of the proposed transmission line route outside of the bird breeding season and avoid any destruction of Acacia trees along the wadi corridor. This is discussed in Chapter 10.
- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
 - Prohibit hunting at any time and under any condition by construction workers onsite
 - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in Section 8.4.2.
 - Restrict activities to allocated construction areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances. Use the already existing track as an access route along the wadi.
 - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures as detailed in Section 8.7.2.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Reporting on outcomes of fauna survey and actions undertaken (e.g. relocation of certain key species to areas outside of construction activities).
- Inspection of the works should be carried out at all times.

8.5.2 Potential Impacts during the Operation Phase

Potential impacts during the operation phase are mainly limited to avi-fauna. According to the “Guidelines to Minimize the Impact of Solar Facilities and Associated Infrastructure in South Africa” (BirdLife International), the most important impact of solar facilities on avi-fauna is the displacement of critical species and loss of habitat from construction activities – which were discussed earlier.

In addition, according to the Guidelines, other impacts discussed also include the electrocution and collision caused when perching on, or flying into, the power line infrastructure. During operation there is a particular risk to birds mainly from operation of the high voltage overhead lines that connect the Project to the substation at ATPS. Risks for avi-fauna are electrocution and collision, both leading to serious injuries and, in most cases, death. Big and heavy birds are in special risk, because of their reduced ability to avoid suddenly appearing power lines, especially in times of reduced sight distances (sandstorms, fog, rain, etc) or strong winds. However, as discussed earlier, impacts from overhead lines need further review and studies (above under mitigation measures) and have also been addressed through the identification of Environmental Performance Requirements (refer to Chapter 10) to be considered by EPC Contractor. Such Performance Requirements include measures to reduce collision risk of birds with overhead lines.

Other potential impacts were raised by stakeholders as part of the scoping session regarding potential impacts on avi-fauna include the PV panels being reflective surfaces which could act as attractants for birds. These surfaces may be confused for large water bodies, and can cause disorientation of flying birds, resulting in injury and/or death. However, according to the BirdLife Guidelines discussed above, such impacts from PV projects are considered not applicable as PV panels are considered less reflective, especially when compared to other technologies such as Concentrated Solar Power (CSP).

Nevertheless, putting things into perspective there is some risk of avi-fauna mortality and which could occur with most human development (ranging from buildings to large scale industrial projects). However, with regards to the Project in specific it is highly unlikely that avian mortality levels would be of any concern and in fact is expected to be minimal due to the following:

- The Project site in general is considered barren and of low ecological significance due to its natural setting and does not support endangered or rare species or sensitive avi-fauna habitats, while all recorded avi-fauna species are generally common to such habitats. In addition, such an area is considered, to some extent, disturbed by human activity and which would affect bird activity in the area.
- As stated earlier, the PV panels work on the concept of absorbing sunlight rather than reflecting it and thus reflections and potential for glare are not considered issues of concern as in the case of other technologies (e.g. Concentrated Solar Panels CSP);
- To date, there is no empirical evidence that PV facilities lead to significant avian mortality or large-scale collision impacts resulting from contact or collision with PV panels or from reflective surfaces.

Other impacts on the biodiversity of the site are mainly from improper management of the site which could include improper conduct and housekeeping practices by workers (i.e. hunting of animals, discharge of hazardous waste to land, etc).

Another potential impact to be investigated is whether the PV Project will have an impact on the macro climate within the Project which could increase of soil humidity and flora formation and also reduce the evaporation within KEMAPCO (as highlighted by one the Scoping Session participants). The following answers these potential impacts based on expert advice:

- Soil fertility: Soil is the mixture of minerals, organic matter, gases, liquids and a myriad of organisms that can support plant life. There is no soil in the Project site but instead sand and boulder exists all over the place. It's a huge alluvial deposit and soil cannot develop in this place in this climate.
- Macro-climate and evaporation: only the microclimate of the site is changed. The incoming photons are not changed into heat – they become electricity in the solar plant. Under the modules there will be shadowing which will reduce the temperature on the site by a small degree. This will not impact the surrounding and especially not the evaporation of the ponds. This is microclimate which cannot be measured in the close proximity of the site. The evaporation works mainly with the direct irradiation. The liquid is absorbing the photons, which lets the electrons of the liquid “run” around. This effect heats up the liquid and will cause evaporation. The existing evaporation of the sea is the main source of humidity in that area. The constant wind at the site is exchanging the temperature difference between sea and mountains. The impact of a PV plant does not account in any aspect.

The potential impacts on biodiversity would of a long-term duration throughout the operation phase of the Project. Such impacts are of negative nature, and of a medium magnitude as they are likely to be minimal. However, as the site is considered of low ecological significance, the receiving environmental is determined to be of a low sensitivity. Given all of the above, such an impact is considered to be of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied during the operation phase and which include:

- Undertake short term avi-fauna monitoring along the transmission line route, through an ornithologist during the first year of operation of the Project. The objective of the monitoring is intended to ensure that no breeding takes place in the transmission line area, and confirm and validate the outcomes of this ESIA assessment in relation to impacts on avi-fauna from the Project. Short-term monitoring is required for 8 days distributed throughout the spring, summer, autumn, and winter season – as this would ultimately cover migration seasons, breeding seasons, and wintering seasons of resident and migratory birds.
- With regards to the high voltage overhead lines, EPC Contractor must consider measures which reduce collision risk of birds with the overhead lines. This could include the following: (i) the installation of bird diverters which increase the visibility of the power lines. The installation of dynamic bird diverters in a

distance of 15 to 25 m between each other is recommended, and (ii) horizontal arrangement of the phases, reducing the height of the conductors, and, as therefore, minimizing the risks of collision and electrocution of birds. Once installed, these often fall down need to be replaced. Depending on the type of diverter, sometimes with the wind they flip up and need to be re-adjusted. Monitoring should be conducted to ensure that they are functional.

- Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel and good housekeeping which include the following:
 - Prohibit hunting at any time and under any condition by workers onsite
 - Ensure proper storage, collection, and disposal of waste streams generated as discussed in detail in Section 8.4.2.
 - Restrict activities to allocated areas only, including movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances
 - Avoid unnecessary elevated noise levels at all times. In addition, apply adequate general noise suppressing measures as detailed in Section 8.7.2.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Project Operator (EPC Contractor) during the construction phase and which include:

- Report the outcomes of the avi-fauna monitoring which summarizes the results and observations; and
- Inspection of the works should be carried out at all times.

8.5.3 The BirdLife Solar Energy Guidance

The “Solar Energy Guidance V.1 – Birds and Solar Energy within the Rift Valley/Red Sea Flyway” (BirdLife International) is a guidance document designed to inform solar farm developers of potential impacts of developments upon birds within the Rift Valley/Red Sea region and recommends specific practices that can reduce these impacts.

The document identifies potential impacts from industrial-scale solar technologies. Those relevant to PV projects are summarized below.

- Habitat loss/fragmentation: this is considered the most important impact as generally the construction of such facilities involves large areas of habitats to be removed, replaced, or degraded. The actual ecological significance of the impact will be site and scale-specific; and many developments are likely to have limited impacts. An assessment of the ecological value will show the significance of the impact;
- Risk of collision: with associated infrastructure particularly with associated power lines. In addition, some species of birds may collide with panels because they are attracted to shaded areas, particularly if panels are located in previously undisturbed areas; and
- Pollution: activities during construction and maintenance activities could lead to the release of pollutants to the environment.

In addition, the Document refers to a number of other impacts but which have limited data and require further study such as disorientation of birds from panels which may resemble water bodies.

Summarized below are the main recommendations discussed within the Guidelines and how they were taken into account throughout this ESIA:

- **Strategic planning and assessment:** Strategic Environmental Assessment (SEA) should be consulted to inform the choice of sites which are appropriate for development. Where no SEA exists, developers should look to governments, designated national authorities and conservation organizations and experts for guidance on appropriate areas for development. An Environmental Planning Study was undertaken in 2006 in the context of the existing environment of ASEZ and the development of the South Zone master plan.
- **Appropriate site selection** can also be informed by the use of sensitivity mapping such as the mapping tool for the Rift Valley/Red Sea Area. As discussed in Section 7.4, this mapping tool has been used and identified that the Project site and proposed transmission line route were located within an IBA.
- **Undertake an EIA for the site specific development.** The EIA must include a baseline survey which appropriately assesses the ornithological value and the biodiversity of the site. The Document recommends that the baseline survey take place for a minimum of one year for breeding birds, vulnerable and protected species, and migratory birds as well as one year post-construction monitoring.

A baseline survey has been undertaken (as presented in Section 7.4) which appropriately assess the biodiversity of the site based on literature review, field survey, and consultations with experts. Based on the outcome of the biodiversity assessment, the Project site is considered to be of low ecological significance and the proposed transmission line route is considered to be of medium ecological significance. Refer to Section 7.4 for additional details on the biodiversity baseline assessment of the Project site.

The extent of the survey recommended in the Document (minimum of one year) is unwarranted when taking into account the Project site area).

- **Consider recommendations to reduce impacts from power lines and associated infrastructure** - which mainly includes appropriate routing of lines, use of bird deflectors, and pole design which minimizes electrocution risks. Those have been taken into account and are highlighted in Chapter 10.
- **Consider recommendations to reduce impacts from construction activities** and which include measures such as minimizing any clearing of natural vegetation, implementing adequate measures to control soil erosion and runoff, ensuring proper disposal of waste streams, etc. Those have been taken into account and were highlighted earlier throughout this section.

8.6 Archaeology and Cultural Heritage

This section identifies the anticipated impacts on archaeology from the Project activities during the construction and operation phase. In addition, for each impact a set of mitigation measures and monitoring requirements have been identified.

8.6.1 Potential Impacts during the Construction Phase

Site preparation activities which are to take place onsite by the EPC Contractor for installation of PV arrays and the various Project components to include transmission cables, switchgear, access roads and internal road network, buildings, etc are expected to include land clearing activities, levelling, excavation, grading, etc.

Such activities could damage or **disturb** potential archaeological remains which might be present on the surface of the Project site and which could potentially be of archaeological importance. However, based on the baseline archaeological assessment conducted, it was concluded that the Project site is devoid of any important or significant archaeological or cultural remains. Therefore, there are no anticipated impacts on surface archaeological remains within the site.

There is a chance that throughout such construction activities, archaeological remains buried in the ground are discovered. Improper management (if such sites are discovered) could potentially disturb or damage such sites which could potentially be of archaeological importance.

Given all of the above, the potential impacts on archaeology created during the construction period would be of a short-term duration as they are limited to the construction phase only. The impacts will be of a negative nature, and medium magnitude as it is possible that once a site is damaged or disturbed it cannot be restored. In addition, given that no locations have been recorded within the Project site or surrounds the receiving environment is considered of low sensitivity. Given all of the above, such an impact is considered to be of a not significant nature or potential of minor significance should a chance find occur (but this is felt unlikely).

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- Ensure that the Code of Conduct, awareness raising, and training developed for construction workers and personnel involved in the construction phase of the Project to emphasize the presence of archeological locations in the area - this could include providing information on their locations, prohibit any improper conduct which could disturb/ damage those locations, etc.
- Implement appropriate chance find procedures. Throughout the construction phase and as the case with any Project development that entails such construction activities there is a chance that potential archaeological remains in the ground are discovered. It is expected that appropriate measures for such chance find procedures are implemented which are standard requirements by the DoA as required by the Antiquities Law No. 21 for 1988 and its amendments No. 23 for 2004. Those mainly require that construction activities be halted and the area fenced, while immediately notifying the DoA. No additional work will be allowed before the Department assesses the found potential archaeological site and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Inspection of actions taken in case of new discoveries, including fencing, limiting access to site, and contacting the DoA. Report should be prepared and submitted to the DoA in such a case which details the above.
- Inspections of construction activities to ensure that archeological locations are avoided throughout the construction activities and proper code of conduct is enforced.

8.6.2 Potential Impacts during the Operation Phase

No potential impacts are considered during the operational phase as the nearest site of archaeological importance is over 17 km away from the Project site.

8.7 Air Quality and Noise

This section identifies the anticipated impacts on air quality and noise from the Project activities during the construction and operation phase. In addition, for each impact a set of mitigation measures and monitoring requirements have been identified.

8.7.1 Potential Impacts during the Construction Phase on Air Quality

Site preparation activities which are to take place onsite by the EPC Contractor for installation of the PV arrays and the various Project components to include transmission cables, switchgear, access roads and internal road network, buildings, etc are expected to include land clearing activities, levelling, excavation, grading, etc.

The above activities will likely result in an increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and to a lesser extent to nearby receptors from windblown dust (such as the secondary road that passes to the north of the Project site). It is not feasible that the closest sensitive receptors (such as Tala Bay and Aqaba) will be affected from windblown dust, given the distance.

It is important to note that the generation and dispersion of dust depends on weather conditions; dry conditions with high wind speeds would cause excessive dust generation, while wet conditions and low wind speeds wouldn't. Given the characteristics of the site (its arid desert nature with frequent dry/windy conditions) sandstorms are probable. However, this is not within the control of the EPC Contractor and hence impacts from such events are not within their responsibility.

In addition, construction activities will likely entail the use of vehicles, machinery and equipment (such as generators, compressors, etc) which are expected to be a source of other pollutant emissions (such as SO₂, NO₂, CO, etc) which would also have minimal direct impacts on ambient air quality.

The above impacts are anticipated to be temporary and of short-term nature as they are limited to the construction period only. Such impacts are of a negative nature, and will be noticeable and therefore of medium magnitude. However, the impacts will be dispersed and are reversible as air quality would revert back to baseline conditions after construction works is completed and thus the receiving environment is considered of low sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase (to prevent impacts caused by their construction activities and which are within their control) and which include:

- If dust or pollutant emissions were found to be excessive, construction activities should be stopped until the source of such emissions have been identified and adequate control measures are implemented;
- Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Jordanian Codes to ensure that for activities associated with high dust levels, workers are equipped with proper Personal Protective Equipment (e.g. masks, eye goggles, breathing equipment, etc);
- Apply basic dust control and suppression measures which could include:
 - Regular watering of all active construction areas.
 - Proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period.
 - Proper management of stockpiles and excavated material (e.g. watering, containment, covering, bunding).
 - Proper covering of trucks transporting aggregates and fine materials (e.g. through the use of tarpaulin).
 - Adhering to a speed limit of 15km/h for trucks on the construction site.
- Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant emissions.

Following the implementation of these mitigation measures, the significance of the residual impact is categorized as not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Inspection and visual monitoring of the works should be carried out at all times. In addition, periodic inspections should be conducted at nearby sites (e.g. nearby Highway) to determine whether high levels of dust from construction activities exist; and
- Reporting of any excessive levels of pollutants/dust and the measures taken to minimize the impact and prevent it from occurring again.

8.7.2 Potential Impacts during the Construction Phase on Noise

Site preparation activities which are to take place onsite by the EPC Contractor for installation of PV arrays and the various Project components to include transmission cables, switchgear, access roads and internal road network, buildings, etc are expected to include land clearing activities, leveling, excavation, grading, etc.

All the above activities will likely include the use of machinery and equipment such as generators, hammers, compressors, etc and which are expected to be a source of noise and vibration generation within the Project site and its surroundings. If improperly managed, there is risk of nuisance and health affects to construction workers onsite. It is very unlikely that other nearby surrounding receptors (such as Tala Bay and Aqaba) will be affected from noise generating activities given their distance from the Project site.

The above impacts are anticipated to be temporary and of short-term nature as they are limited to the construction period only. Such impacts are of a negative nature, and will be noticeable and therefore of medium magnitude. However, the given that the baseline conditions will be restored after construction works is completed, the receiving environment is considered of low sensitivity. Given the above such an impact is considered of minor significance.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor during the construction phase and which include:

- If noise levels were found to be excessive, construction activities should be stopped until adequate control measures are implemented;
- Apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc; and
- Comply with the Occupational Safety and Health Administration (OSHA) requirements and the Jordanian Codes to ensure that for activities associated with high noise levels, workers are equipped with proper Personal Protective Equipment (e.g. Earmuffs)

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor during the construction phase and which include:

- Inspection of the works should be carried out at all times; and

- Reporting of any excessive levels of noise and the measures taken to minimize the impact and prevent from occurring again.

8.8 Infrastructure and Utilities

This section identifies the anticipated impacts on infrastructure and utilities from the Project activities during the construction, operation, and decommissioning phase. In addition, for each impact a set of mitigation and monitoring requirements have been identified.

8.8.1 Potential Impacts on Water Resources during the Construction and Operation Phase

It is expected that the Project throughout the construction and operation phase will require water for potable usage (drinking) and non-potable usage (e.g. cleaning of machinery and vehicles).

Based on information from the EPC Contractor the water requirements during the construction phase are estimated at 22,500 litres which will cover 6 months of construction. The calculation is based on the assumption that during work hours each worker drinks 3 litres of water per day. There is no water needed for the civil works. The water requirements throughout the construction phase will be required temporary (for construction period only) and are considered minimal and not significant.

In addition, water will be required during the operation phase and mainly for drinking and other personal use of onsite staff (around 6 personnel). It is important to note that with regards to cleaning of the PV modules during operation, no water will be required.. To this extent, the water requirements of the Project throughout the operation phase are considered minimal and not significant.

Aqaba Water Company will provide water to the site (as outlined in Section 7.7.2) and as the water requirements for the Project during construction and operation are minimal it is not considered that the Project will put any constraints on other existing users supplied by Aqaba Water Company.

Taking all of the above into account, the anticipated impacts on the local water resources and utilities are considered of long-term duration during the Project construction phase and of short-term duration during the operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude and of low sensitivity given the minimal water requirements of the Project. To this extent, the impact is considered not significant.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor and Project Operator (EPC Contractor) during the construction and operation phase respectively and which include:

- Coordinate with the Aqaba Water Company for securing water requirements of the Project, whom has sufficient capacity to cover the rather minimal water requirements of the Project.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator (EPC Contractor) during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

8.8.2 Potential Impacts on Wastewater Utilities during the Construction and Operation Phase

The Project is expected to generate wastewater during both the construction and operation phases to include black water (sewage water from toilets and sanitation facilities) and grey water (from sinks, showers, etc). Wastewater quantities generated are expected to be minimal and not significant at all during both phases of the Project and are likely to be easily handled by the Industrial Park WWTP.

Generally, the approximate estimated wastewater to be generated from the Project can be accounted as follows. Throughout the construction phase, 100 construction workers are expected, whereas during the operation phase a maximum of 7 workers are expected. The water requirements per capita during the construction and operation is not expected to exceed 50 litres per day; and taking into account an 80% wastewater generation factor per capita – then the anticipated wastewater to be generated during construction and operation is 4,000 l/d and 280 l/d (4m³/d and 0.28 m³/d).

The wastewater generated will most likely be collected by tankers from the Project and disposed at the Aqaba Wastewater Treatment Plant.

Taking all of the above into account, the anticipated impacts on wastewater utilities are considered of short-term duration during the Project construction phase and of long-term duration during the Operation phase. Such impacts are of a negative nature, and are expected to be of low magnitude given the minimal wastewater quantities generated, and of low sensitivity as they will be easily handled by the WWTP. Given the above impact is considered not significant.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor and Project Operator (EPC Contractor) during the construction and operation phase respectively and which include:

- Coordinate with ASEZA for disposal of wastewater at the Aqaba Wastewater Treatment Plant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator (EPC Contractor) during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

8.8.3 Potential Impacts on Solid Waste Disposal Utilities during the Construction and Operation Phase

The Project is expected to generate solid waste during both the construction and operation phases to include construction waste (mainly during construction to include dirt, rocks, debris, etc) as well as general municipal waste (such as food, paper, glass, bottles, plastic, etc). Solid waste quantities generated are expected to be minimal and not significant at all during both phases of the Project and are likely to be easily handled by either the Aqaba landfill or the Aqaba debris landfill, both of which are managed by ASEZA.

The construction waste is rather difficult to estimate, but rather is not expected to be of significant quantities. On the other hand, the approximate estimated municipal solid waste to be generated from the Project can be accounted as follows. Throughout the construction phase, 100 construction workers are expected, whereas during the operation phase a maximum of 7 workers are expected. The average theoretical municipal solid waste generation in Jordan is 0.85kg/capita/day (SWEEPNET, 2010). Thus, the anticipated municipal solid waste is estimated to be around 85 kg/day and 5.95 kg/day during the construction and operation phase respectively. The Aqaba Landfill has enough capacity to process this amount of waste.

Taking all of the above into account, the anticipated impacts on solid waste utilities are considered of short-term duration during the Project construction phase and of long-term duration during the Operation

phase. Such impacts are of a negative nature, and are expected to be of low magnitude given the minimal solid waste quantities generated, and of low sensitivity as they will be easily handled by the landfill. Given the above impact is considered not significant.

Mitigation Measures

The following identifies the mitigation measures to be applied by the EPC Contractor and Project Operator (EPC Contractor) during the construction and operation phase respectively and which include:

- Coordinate with ASEZA or hire a competent private contractor for the collection of solid waste from the site to the municipal approved landfill (Aqaba landfill or Aqaba debris landfill) (I).

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements to be applied by the EPC Contractor and the Project Operator (EPC Contractor) during the construction and operation phase respectively and which include:

- Submit report with proof of coordination with authorities discussed above.

8.8.4 Potential Impacts on Road Networks during the Construction Phase

Components for PV plant projects are usually transported by sea from the manufacturing country to the country of installation and are then loaded in existing ports to trucks which manoeuvre their way through existing roads to the installation site.

With regards to the Project, the various Project components and equipment are expected to be transported to the port of Aqaba (14 km from the Project site) and then transported by road to the Project site.

The Parallel Coastal Road (or the National Highway) and the Aqaba Back Road (or Escape Lane Highway) are allocated for heavy industrial and shipment trucks and connect the Project site with Aqaba. Domestic traffic uses different roads.

Taking all of the above into account, the anticipated impacts on road networks are considered of short-duration as they are limited to the transportation phase of the Project components, of a negative nature, and are expected to be of low magnitude and of low sensitivity. Given the above such an impact is considered to be not significant.

8.8.5 Potential Impacts on Electricity Network during Operation Phase

The Project is expected to an installed capacity of 10 MWp and will connect with the substation at the ATPS . The transmission line and the connection to the substation will be designed and built by NEPCO.

To this extent, the Project is expected to entail positive impacts on the electricity network as it will contribute to supplying electricity to the National Grid for end users and help meet the increasing electricity demands throughout the Kingdom. The Project is expected to provide 20 GWh of electricity per year, which is enough to cover annual electricity consumption of 10,000 individuals or three large 5 star hotels.

Additional positive impacts include amongst others: (i) contributing to increasing energy security through development of local energy resources and reducing dependency on external energy sources, (ii) producing electricity which contributes to lowering electricity generation costs compared to the current costs associated with liquid fuels and thus leads to a substantial decrease in the Government of Jordan's fiscal deficit (iii) the Project will produce 'clean' energy which will help Jordan reduce its carbon footprint by displacing approximately 16,500 metric tons of CO₂ per year.

8.8.6 Potential Impacts on Fajr Gas Pipeline during Construction Phase

The construction of the proposed transmission line connecting the Project with the substation at ATPS is not considered to have any impacts upon the Fajr Gas Pipeline and management to ensure this is addressed through the identification of Environmental Performance Requirements (refer to Chapter 10) to be considered by EPC Contractor.

8.9 Socio-economic

This section identifies the anticipated impacts on the socio-economic development from the Project activities during the construction and operation phase. Those mainly include positive impacts as discussed below.

8.9.1 Potential Impacts during the Construction and Operation Phase

Given the generic nature of the impacts on socio-economic development for both phases of the Project (construction and operation) those have been identified collectively throughout this section. During the construction and operation phases, the Project is expected at a minimum to provide job opportunities for local communities of Aqaba. The Project will create the following job opportunities:

- Around 100 job opportunities during the construction phase for a duration of approximately 6 months (to include skilled and unskilled labour) ; and
- Around 7 job opportunities during the operation phase to include skilled labour (such as a plant manager,) and unskilled labour (such as module cleaners and security personnel) for a duration of 20 years.

The Developer has shown commitment to social responsibility as the Developer will aim to hire to the greatest extent possible local community members throughout the construction and operation phase. There is already a strong construction workforce available in Aqaba.

It is not clear whether the construction workforce will come from Aqaba or from further afield. Any workers not from the local area would need provision of accommodation during the construction period. Any migrant workers would need accommodation to be provided, and any workforce accommodation would need to be developed in line with good international guidance such as IFC Guidance²³.

The construction workers will have a fixed term contract, and where possible assistance will be provided to help these workers find alternative work at the end of construction (for example, training records and letters of reference will be provided).

Given the above, socio-economic impacts are anticipated to generally be positive.

Recommendations

As the impacts discussed are mainly positive, no mitigation measures have been identified. This section provides recommendations which aim to enhance such positive impacts anticipated from the Project throughout the construction and operation phases to the greatest extent possible.

From the onset of the Project, it is recommended that the Developer adopts and implements an action Plan for working with the local community members, and this may be built into the actions within the SEP. The plan must aim to support the local economy stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program (in which the local community can express their concerns, strengths and limitations) even before the development is in place. The action plan must also aim to manage expectations so that local communities are realistic about opportunities from the Project.

²³ http://www.ifc.org/wps/wcm/connect/9839db00488557d1bdfcff6a6515bb18/workers_accomodation.pdf?MOD=AJPERES

Nevertheless, it is recommended that the plan, at a minimum, consider the following:

- Identify the number of job opportunities targeted to the local community throughout the construction and operation phase, to include skilled and unskilled job opportunities. The developer is expected to provide in details the qualifications and skills required for each job opportunity as well as limitations and constraints of local community members and how they could be addressed (to the extent possible through training, capacity building, etc);
- Present a transparent recruitment procedure for the local community members which should be specified and encouraged in the various construction/operation contracting arrangements. Such recruitment procedures must provide equal opportunity for all, including females;
- Detail additional areas where local community members can benefit or be involved besides job opportunities provided they have the required skills and expertise needed to meet the development standards. For example, during construction the Project shall consider the appointment of local contractors, local sourcing of materials and supplies, etc;
- Consider additional areas where the Developer could implement social reasonability programs. This could include but not limited to the following: (i) installation of residential PV systems for local community facilities such as governmental buildings, mosques, schools, hospitals and health centres, etc (ii) provide scholarship programs for students, and (iii) support local academic institutions in developing academic programs and degrees in PV and renewable energy, (iv) provide educational benefits and attracting visits by local schools, universities and colleges, etc; and
- Ensure timely and continuous communication and dissemination of information between the Developer and the local community members to alleviate potential sense of social marginalization and improve their understanding and perception of the benefits associated with development. Communication should also include information and updates on the Project development, number of employment opportunities, the bidding process for Project components, construction plans, etc.

The SEP will include provisions to engage with the local community regarding the Project, including the potential job opportunities associated with it.

8.10 Occupational Health and Safety

This section identifies the anticipated impacts on the occupational Health and Safety from the Project activities during the construction and operation phases. In addition, for each impact a set of mitigation and monitoring requirements have been identified.

8.10.1 Potential Impacts during the Construction Phase

Throughout the construction phase there will be generic occupational health and safety risks to workers, as working on construction sites increases the risk of injury or death due to accidents. The following risks are generally associated to construction sites and apply for the construction of the Project and could include:

- Slips and falls,
- Working at heights;
- Struck-by objects;
- Moving machineries;
- Working in confined spaces and excavations;
- Exposure to chemicals, hazardous or flammable materials;
- Particularly for the PV plant, workers are potentially exposed to electric shocks and burns when touching live components;

- Taking into account the Project site, construction workers are expected to work in very hot weather conditions, and thus are exposed to dehydration, heat exhaustion, and heat stroke; and
- Taking into account the Project site, there are potential risks to the construction workers from the railway which runs close to the Project site. Improper planning and management of construction activities could lead to certain occupational health and safety risks, especially to personnel entering and/or leaving the site.

Such impacts are considered of short-term duration as they are limited to the construction period only, of a negative nature, and are expected to be of medium magnitude and medium sensitivity as in extreme cases they could entail permanent impacts (e.g. permanent disability). Given the above such an impact is considered of minor significance.

Mitigation Measures

Trina Solar has a general corporate Occupational Health & Safety Manual (OHSM) regarding construction, installation and commissioning works as well the general construction site operations for solar power projects.

The Shamsuna Power Company will ensure that a site-specific Occupational Health and Safety (H&S) Procedure is developed for the construction phase, that includes location-specific emergency preparedness and response procedures. Such location-specific information will also be included in the operations phase Occupational H&S Procedure.

This includes Occupational H&S Procedures for the construction phase that adequately includes location-specific emergency preparedness and response procedures.

The objective of the Manual is to ensure the health and safety of all personnel in order to concur and maintain a smooth and proper progress of work at the site and prevent accident which may injure personnel or damage property of the EPC Contractor and all involved sub-contractors.

The OHSM will be prepared taking into account the national requirements as well as international best practice and which include: (i) Labour Law No. 8 for the Year 1996 and its amendments, including Chapter IX, Occupational Safety & Health, (ii) OSHA Workplace Requirement for Safety and Health, (iii) CITB Construction Site Safety Course, (iv) IOSH Principle of Health and Safety at Work, and (v) OHSAS 18001. In summary, the OHSM will provide details on the following components.

- Identification of roles and responsibilities of the personnel involved within the Project to include the EHS manager, construction manager, supervisor, and other subcontractors responsibilities;
- Identifies in details information in relation to formulation of safety committees, communication protocols, first aid personnel and facilities, first aid training programs, occupational health and safety culture, quality system, reporting requirements, competence and job safety training , safety inspections, recruitment procedures, safety audits, risk assessment, etc;
- Identifies in details the hazards which may be associated with the various activities to take place and the various measures to be implemented to reduce such risks. This includes for example safety devices, welding and cutting, work at elevated places, installation of solar modules, excavations, etc.
- Identifies in details the hazards which may be associated with the work equipment to be used and the various measures to be implemented to reduce such risks. This includes for example hand tools, access equipment, lifting equipment, mobile working equipment, etc.
- Identifies in details the fire control systems to include fire risk assessment, fire alarm systems, fire risk management, emergency planning, and others.

The EPC Contractor is expected to adopt and implement the recommendations/provisions of the Occupational Health and Safety Manual throughout the Project construction phase.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the EPC Contractor.

- Inspection to ensure the implementation of the recommendations/ provisions of the OHSM and assess compliance with its requirements; and
- Regular Reporting on the health and safety performance onsite in addition to reporting of any accidents, incidents and/or emergencies and the measures undertaken in such cases to control the situation and prevent it from occurring again.

8.10.2 Potential Impacts during the Operation Phase

Similarly, throughout the operation phase, there are occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. The following risks are generally associated to such a Project and which could include:

- Exposure to a variety of hazards such as electric shock, and thermal burn hazards;
- Exposure to chemicals, hazardous or flammable materials;
- Taking into account the Project site, maintenance activities are expected to work in very hot weather conditions, and thus workers are exposed to dehydration, heat exhaustion, and heat stroke; and
- Taking into account the Project site, there are potential risks to workers from the railway which runs close to the Project site. Improper planning and management of operation activities could lead to certain occupational health and safety risks, especially to personnel entering and/or leaving the site.

Such impacts are considered of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity as in extreme cases they could entail permanent impacts (e.g. permanent disability). Given the above such an impact is considered of minor significance.

Mitigation Measures

Trina Solar will prepare an Occupational Health and Safety Manual (OHSM) regarding the Project's operation and maintenance activities. On a broad level, the OHSM will aim to eliminate health and safety risks, or when it is not possible to eliminate a risk to minimize the risk to the greatest extent possible.

This also includes location-specific emergency preparedness and response procedures included in the operations phase Occupational H&S Procedure one month prior to operations.

In summary, the OHSM will provide details on the following components.

- Identification of roles and responsibilities of the personnel involved within the Project to include senior management, mid-management, front-line leaders, front-line employees, and the safety manager.
- Identifies in details specific requirements, instructions, and guidelines for the following:
 - Safety expectations that help reduce accidents and close call events that may result in injury. This includes for example requirements for safety orientation, safety inspections and worker observations, general safety instructions, emergency response instructions, safety meeting guidelines, lifting safety instructions, housekeeping guidelines, fire safety instructions, first aid kit instructions, and other;
 - Safety expectations in regards to protective equipment, devices, and clothing. This was based on hazard assessments of all job categories to evaluate the potential for injury to various body parts and to determine the necessary protective equipment and clothing to protect against those injuries;

- Purchasing and using hazardous chemicals.;
- Workers involved in welding at the Facility;
- Purchasing and using hand and power tools;
- Conducting activities within confined spaces;
- Controlling or working on or around hazardous energy sources;
- Controlling and working with electrical systems;
- Operating mobile equipment and vehicles;
- Working outdoors and which include interaction with wildlife, temperature extremes, lightning and others; and
- Specific requirements, instructions, and guidelines for all O&M Technicians to help prevent electrical contact or accidents during the operations and maintenance of a PV utility-scale power plant.

The Project Operator is expected adopt and implement the provisions of the Occupational Health and Safety Manual throughout the Project operation phase.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Project Operator (EPC Contractor):

- Inspection to ensure the implementation of the recommendations/ provisions of the OHSM and assess compliance with its requirements; and

Regular Reporting on the health and safety performance onsite in addition to reporting of any accidents, incidents and/or emergencies and the measures undertaken in such cases to control the situation and prevent it from occurring again.

8.11 Community Health, Safety, and Security

This section identifies the anticipated impacts on the community health, safety, during the operation phase. In addition, for each impact a set of mitigation and monitoring requirements have been identified.

8.11.1 Potential Impacts during the Construction Phase

There is a risk that some construction workers will come from outside Aqaba looking for work which could put pressure on local community services and pose a risk to community health from an increased incidence in communicable diseases.

Such impacts are considered of short-term duration throughout the Project operation phase, of a negative nature, and are expected to be of low magnitude and low sensitivity and are considered to be of minor significance.

Mitigation Measures

The EPC Contractor will consider undertaking worker health screening in order to minimise the spread of communicable disease.

The EPC Contractor will develop a Code of Conduct for workers to follow.

The EPC Contractor will provide a Grievance Procedure in the SEP where stakeholder may contact the Company to log a complaint, which will be dealt with by the Company within 30 days of receipt.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

8.11.2 Potential Impacts during the Operation Phase

The only foreseen impacts in relation to community health, safety, and security is related to the Project operation phase. Such impacts are mainly limited to trespassing of unauthorized personnel into the Project site and which could result in potential risks from several hazards of the various Project components (e.g. electric shock, thermal burn hazards, exposure to chemicals and hazardous materials, etc).

Such impacts are considered of long-term duration throughout the Project operation phase, of a negative nature, and are expected to be of medium magnitude and medium sensitivity as in extreme cases they could entail permanent impacts (e.g. permanent disability). Given the above such an impact is considered of minor significance.

Mitigation Measures

The Developer will be installing a fence around the entire facility to control trespassing of unauthorized personnel. In addition, two (2) security guards (one armed and other unarmed) will be employed throughout the Project operation phase, whom will be available onsite on a 24hour/ 7day basis.

In addition, the Project operator is expected to undertake the following measures throughout the Operation phase:

- Ensure fence around the facility is well maintained at all times and in good conditions; and
- Ensure onsite guards are adequately trained to deal with trespassing incidents. In addition, guards must refrain from using excessive force, unless situation extremely requires so.

Following the implementation of these mitigation measures, the significance of the residual impact can be reduced to not significant.

Monitoring and Reporting Requirements

The following identifies the monitoring and reporting requirements that must be adhered to by the Project Operator (EPC Contractor):

- Regular inspections on fence around the facility; and
- Reporting of any trespassing incidents and the measures undertaken in such cases to control the situation and prevent it from occurring again.

8.12 Summary of Anticipated Impacts

Table 28, Table 29, and Table 30 below present a summary of the anticipated impacts during the planning and construction, operation, and decommissioning phase of the Project. The information in the tables includes:

- Key and generic environmental attributes (e.g. air quality, noise);
- Impact (textual description);
- Nature of impact (negative or positive);
- Duration (long-term or short-term);
- Reversibility (reversible or irreversible);
- Magnitude (high, medium, or low);
- Sensitivity (high, medium, or low);
- Significance (major, moderate, minor, or not significant);
- Management action – this describes whether impact can be mitigated or not. In addition, for positive impacts recommendations have been provided which aim to enhance the impact. Hence, those collectively have been referred to as management measures (mitigation and recommendations); and
- Residual significance after management actions are implemented (major, moderate, minor, or not significant).

Table 28: Summary of Anticipated Impacts during the Planning and Construction Phase

Environmental Attribute	Likely Impact – Planning and Construction Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Landscape and Visual	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not significant
Land use	Project could conflict with formal land use set at the planning level for the area. In addition, project could conflict with actual land use as it could provide value to locals.	No anticipated impact.							
Geology and Hydrology	There is a potential risk of local flood hazard within the site during the rainy season and especially during flash flood events	Negative	Long term	Irreversible	Medium	High	Moderate – minor	Mitigation available	Minor
	Risk of soil and groundwater contamination during the various construction activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater.	Negative	Could be long term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not significant
Biodiversity	Construction activities could disturb existing habitats (flora, fauna, avi-fauna) and any threatened or endangered species which might be present within the Project site. In addition, other impacts could be from improper management of the site (e.g. improper conduct and housekeeping practices).	Negative	Long Term	Irreversible	Medium	Low	Minor	Mitigation available	Not Significant
	Construction activities could disturb Acacia tree habitat in Wadi 2, which supports other species and potentially provides habitat for breeding birds	Negative	Long term	Could be irreversible	Medium	Medium	Moderate	Mitigation available	Not significant
Archaeology	Improper management of construction activities could disturb/damage the archaeological locations in the nearby area as well as potential archaeological remains which could be buried in the ground (if any).	Negative	Short-term	Could be irreversible	Medium	Medium	Minor	Mitigation available	Not Significant
Air Quality and Noise	Construction activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not Significant
	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not Significant
Infrastructure and utilities	Hazardous materials and wastes – it is important to ensure that hazardous materials and waste are handled and disposed of correctly	Negative	Short term	Reversible	Low	Low	Not significant	Mitigation Available	Not Significant
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.	Positive	Not applicable.						
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents.	Negative	Short Term	Could be irreversible	Medium	Medium	Minor	Mitigation Available	Not significant
Community Health, Safety and Security	There is a risk that some construction workers will come from outside Aqaba looking for work which could put pressure on local community services and pose a risk to community health from an increased incidence in communicable diseases	Negative	Short Term	Reversible	Medium	Low	Minor	Mitigation Available	Not significant

Table 29: Summary of Anticipated Impacts during the Operation Phase

Environmental Attribute / Issue	Likely Impact – Operation Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Landscape and Visual	The Project is expected to be visible within the immediate vicinity and up to some kilometers around the Project site only and thus is likely to create visual impacts related to interaction with surrounding landscape.	Negative	Long term	Reversible	Medium	Low	Minor	Not applicable	Minor
	Potential for glare caused by minimal sunlight reflected off the PV panel modules which in turn could affect nearby receptors.	Negative	Long term	Reversible	Medium	Medium	Minor	Mitigation available	Not significant
Geology and Hydrology	Risk of soil and groundwater contamination during the various operational activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater	Negative	Long term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not significant
Biodiversity	Impacts limited to improper management of the site (e.g. improper conduct and housekeeping practices). Potential risk for avi-fauna collision with PV panels and transmission lines.	Negative	Long term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not significant
Infrastructure and utilities	Hazardous materials and wastes – it is important to ensure that hazardous materials and waste are handled and disposed of correctly	Negative	Long term	Reversible	Low	Low	Not significant	Mitigation Available	Not significant
	Electricity network - Project is expected to contribute to supplying electricity to the National Grid for end users and help meet the increasing electricity demands throughout the Kingdom	Positive	Not applicable.						
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity to local communities.	Positive	Not applicable.						
Occupational Health and Safety	There will be some risks to workers health and safety during the operation and maintenance activities of the Project.	Negative	Long term	Could be irreversible	Medium	Medium	Minor	Mitigation available	Not significant
Community Health, Safety, and Security	Trespassing of unauthorized personnel into the Project site could result in potential risks from several hazards of the various Project components (e.g. electric shock, thermal burn hazards, exposure to chemicals and hazardous materials, etc).	Negative	Long term	Could be irreversible	Medium	Medium	Minor	Mitigation available	Not significant

Table 30: Summary of Anticipated Impacts during the Decommissioning Phase

Environmental Attribute / Issue	Likely Impact – Operation Phase	Impact Assessment							
		Nature	Duration	Reversibility	Magnitude	Sensitivity	Significance	Management Action	Residual Significance
Geology and Hydrology	Risk of soil and groundwater contamination during the various decommissioning activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater	Negative	Short term	Could be irreversible	Medium	Low	Minor	Mitigation available	Not significant
Air Quality and Noise	Decommissioning activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not significant
	Possible noise emissions to the environment from the decommissioning activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Negative	Short term	Reversible	Medium	Low	Minor	Mitigation available	Not significant
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Negative	Short Term	Could be irreversible	Medium	Medium	Minor	Mitigation Available	Not significant

8.13 Assessment of Cumulative Impacts

Recently, a formal decision was made by the joint committee of ADC and ASEZA to allocate part of the land within the SIZ for solar energy projects. The total area for this land is 1,308 dunums²⁴ including the 180 dunums²⁵ allocated for the Project, shown in Figure 15. The solar energy projects are considered to be part of the supporting industries development. According to ADC, the only project currently being planned and implemented is the Shamsuna 10MW PV Project. Discussions with others have been ongoing but to date nothing is definite.

The Shamsuna Power Company discussed the possibility of submitting a direct proposal for developing a hybrid (solar PV & Wind Farm) in the land adjacent to Shamsuna Project site to MEMR as part of the Request for Submission of Expression of Interest under the Direct Proposal Submission Process (Phase II) which is currently being processed by the MEMR and proposals from interested developers are due first week of July 2014. However, MEMR has not been eager to develop hybrid projects and according to MEMR this is not within the scope for development within this Request for Expression of Interest. Shamsuna Power Company cannot proceed with the Project without the approval of MEMR as the soul entity with the mandate to regulate projects that generate energy within Jordan. Shamsuna Power Company signed an MOU with ADC to lease the land, but since the MOU with MEMR has not been signed yet, hence the MOU is not binding and accordingly the hybrid project is excluded at this stage and it is unclear whether it will be approved by MEMR at all.

Hence, there is currently no information available that will enable the assessment of cumulative impacts which could result from incremental impacts due to the PV Projects that could take place in the future on the 1,308 dunums²⁶ land in the SIZ allocated for solar Projects.

²⁴ 130.8 hectares

²⁵ 18 hectares

²⁶ 130.8 hectares

9. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Institutional Framework and Procedural Arrangement for ESMP Implementation

Generally, two main pillars govern the successful implementation of any Environmental and Social Management Plan (ESMP):

1. Proper identification of roles and responsibilities for the entities involved; and
2. Effective control of the process.

All management practices are interlinked, and this section describes how these two pillar criteria could be fulfilled, which in turn helps ensure that the overall objectives of the ESMP are met.

Defining roles and responsibilities of the involved entities in any ESMP identifies where and when each entity should be engaged, their degree of involvement, and the tasks expected of the entity. This in turn eliminates any overlap of jurisdiction or authority and ensures proper communication and effective management of ESMP components. Control processes mainly include training and awareness for entities involved and control of non-conformances that might occur throughout the process.

The objective is to ensure that the ESMP recommendations are implemented in practice, during construction and operation, and assess how environmental resources are affected. Table 31 below summarizes the overall proposed institutional and procedural arrangement for the implementation of the ESMP, while Table 32 discussed in details the roles and responsibilities of each of the entities involved in implementation of the ESMP.

Generally, a self-compliance approach is advocated, whereby the body responsible for the causative action should ensure that the objectives and requirements stipulated within the ESMP are met – this mainly includes the appointment of a competent HSE Officer by the EPC Contractor during the Construction Phase, while during the Operation Phase this is to be undertaken through the appointment of a competent staff member of the Project Operator Team – there is no need to appoint a separate HSE Officer during operation due to the limited and simple mitigation/monitoring measures detailed within the ESMP which are mainly limited to ensuring proper waste management practices onsite.

In addition, the Developer is required to review the reporting requirements as per the ESMP and undertake auditing exercises to ensure that the EPC Contractor and Project Operator meets the requirements stipulated within the ESMP. This could be undertaken through the appointment of a competent HSE Officer as part of the Developer Team or through a third party Employer Representative. It is recommended to undertake the auditing exercises on a monthly basis during the construction phase and on a bi-annual basis during the operation phase.

Finally, in accordance with Regulation for the Protection of the Environment in the ASEZ No.(21) for the year 2001, the Regulator (being ASEZA), will be responsible for undertaking compliance monitoring to ensure that the responsible entity is adhering to the ESMP requirements.

Table 31: Overall proposed institutional and procedural arrangement for ESMP Implementation (ECO Consult, 2014)

Issue	Self Compliance	Review/Checks	Compliance Monitoring/ Inspection
Construction Phase			
Compliance with ESMP Requirements	EPC Contractor – HSE Officer	Project Developer – HSE Officer or third party (monthly basis)	ASEZA
Compliance with environmental legislations	EPC Contractor – HSE Officer	Project Developer – HSE Officer or Employer Representative (monthly basis)	ASEZA
Operation Phase			
Compliance with ESMP Requirements	Project Operator – Project Staff Member	Project Developer – HSE Officer or Employer Representative (on an bi-annual basis)	ASEZA
Compliance with environmental legislations	Project Operator - Project Staff Member	Project Developer	ASEZA

Table 32: Roles and Responsibilities of Entities Involved in ESMP (ECO Consult, 2014)

Designation	Entity	Project Role	Environmental and Social Responsibilities
Project Developer	Shamsuna Power Company	Project Owner and Developer	- Selection of EPC Contractor and Project Operator; - Implement mitigation and monitoring requirements as detailed in the ESMP; and - Appoint a competent HSE Officer or Third Party Employer representative to review the reporting requirements as per the ESMP and undertake auditing exercises to ensure that the EPC Contractor and Project Operator conform to the requirements of the ESMP. Auditing is to be undertaken on a monthly basis during the construction phase and on a bi-annual basis during the operation phase.
Engineering, Procurement, and Construction (EPC) Contractor	Trina Solar	Undertake detailed design and construction of the project	- Appoint a competent HSE officer responsible for implementing the ESMP. - Implement mitigation and monitoring requirements as detailed in the ESMP; - Prepare and submit reporting requirements to Project Developer as detailed in the ESMP; - Implement corrective action measures in case of non-compliance incidents and submit non-conformance report to Project Developer whom in turn will submit to ASEZA.
National Electric Power Company (NEPCO)	National Electric Power Company (NEPCO)	Build substation with overhead lines to the existing grid	Refer to Chapter 10.
Project Operator	Trina Solar	Operation and maintenance of the Project	- Due to the limited and simple mitigation/monitoring measures detailed within the ESMP for the Operation Phase, a staff member of the Project Operator Team must be appointed to implement the requirements detailed within the ESMP. As noted within the ESMP, such mitigation/monitoring measures are mainly limited to proper waste management practices ; - Prepare and submit reporting requirements to Project Developer as detailed in the ESMP; and - Implement corrective action measures in case of non-compliance incidents and submit non-conformance report to Project Developer whom in turn will submit to ASEZA.
Environmental Regulator	ASEZA	Granting environmental clearance to the Project	Undertake compliance monitoring

9.2 Training and Awareness Raising

Effective and efficient implementation of any ESMP requires that all personnel involved in the Project (construction/operation staff across all levels) understand its objectives and requirements. A proper training and awareness program ensures that applying mitigation measures is more of a sense of responsibility rather than an enforcing protocol.

Training and awareness is an ongoing process, but most importantly must take place before the commencement of any activity in any phase of the Project. The EPC Contractor and Project Operator are responsible, each for his own staff, for conducting inductions, training requirements and awareness raising which should include at a minimum the following:

- Ensure that staff understand all requirements, measures, and protocols stipulated within the ESMP;
- Ensuring that all personnel engaged in activities that may have an impact on the environment are competent to carry out their duties, or, where necessary, arrange for suitable training to be undertaken;

- Cultural change towards environmental perception;
- Waste, wastewater, and hazardous waste management practices as identified throughout the ESMP;
- Occupational health and safety;
- Emergency response procedures.

9.3 Control of Non-Compliances

In case any incidents of non-compliance with the ESMP or relevant environmental legislations were noted by ASEZA, as part of their compliance monitoring, then the responsible entity (EPC Contractor or Project Operator) is responsible for issuing a Non-Compliance Report to be submitted to the ASEZA. 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 ASEZA should verbally notify the Contractor of the non-compliance. The Contractor should then take all necessary measures to address the non-compliance.

9.4 Compilation of Environmental and Social Management Plan

Table 33, Table 34, and Table 35 below present the ESMP for the planning and construction, operation, and decommissioning phase respectively and which include the following:

- The environmental attribute (e.g. air quality) that is likely to be impacted;
- A summary of the potential impact and/or likely issue;
- The identified mitigation actions that aim to eliminate and/or reduce the potential impact to acceptable levels;
- Monitoring actions to ensure that the identified mitigation measures are implemented. Monitoring actions include: inspections, review of reports/plans, reporting, etc;
- The frequency for implementing the monitoring actions, which include: once , continuously throughout the construction/operation period (depending on the mitigation measure identified this could include daily, weekly, or monthly), or upon occurrence of a certain issue;
- The responsible entity for implementing the mitigation measures and monitoring actions identified; and
- The relevant legislation that must be adhered to and which govern the environmental attribute or likely issue identified.

It is important to note that additional performance requirements for the EPC Contractor to follow during the offsite construction activities for the connection to the substation at the ATPS through the High Voltage overhead line have been included in Chapter 10 (Table 36 and Table 37). Accordingly these two tables include measures that shall be undertaken by the EPC Contractor and are considered complementary actions to the ESMP. Should the EPC Contractor fail to undertake any of the actions listed in the tables, ASEZA and the Developer must take all necessary actions to ensure corrective action is completed.

Table 33: ESMP for the Planning and Construction Phase

Environmental Attribute	Potential Impact	Mitigation Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Landscape and Visual	Visual and landscape impacts due to presence of elements typical of a construction site such as equipment and machinery.	Ensure proper general housekeeping and personnel management measures are implemented which could include: (i) ensure the construction site is left in an orderly state at the end of each work day, (ii) to the greatest extent possible construction machinery, equipment, and vehicles not in use should be removed in a timely manner, (iii) proper handling of waste streams, etc.	Inspection	Continuous	EPC Contractor	- ASEZ law No.(32) of 2000 Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001
Geology and Hydrology	There is a potential risk of local flood hazard within the site during the rainy season and especially during flash flood events	The Developer will undertake hydrological and flood risk study for the Project site with the aim of determining flood quantities within the Project site and peak flood estimates, which in turn will determine the required hydraulic design structure which would be able to convey these flows safely and prevent flood risks. The flood risk study will inform the detailed design of the Project and will mitigate the risk of flash floods	Undertake hydrological and Flood Risk Study	Once; before construction commences	Developer and EPC Contractor	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Instruction for Environmental Damage Committee No.(37) of 2002
	Improper management of solid waste	Develop a Solid Waste Management Plan (SWMP) that presents the approximate quantities of waste generated, type of waste, and disposal locations. The plan is to be developed in accordance with the Solid Waste Management Regulation No. (27) of 2005;	Implementation of Management Plan	Once, before project commences	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Solid Waste Management Regulation No. (27) of 2005
		Coordinate with ASEZA or hire a competent private contractor for the collection of solid waste from the site to the Aqaba Landfill or Aqaba Debris Landfill.	Review contract with contractor	Once; before construction commences	EPC Contractor	
		Prohibit fly-dumping of any solid waste to the land.	Inspection	Continuous	EPC Contractor	
		Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste".	Inspection	Continuous	EPC Contractor	
		Distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste. Where possible, the EPC Contractor must seek ways to reduce construction waste by reusing materials (for example through recycling of concrete for road base coarse).	Inspection	Continuous	EPC Contractor	
		Implement proper housekeeping practices on the construction site at all times.	Inspection	Continuous	EPC Contractor	
		Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas	Review manifests to ensure consistency	Continuous	EPC Contractor	
	Improper management of wastewater	Develop a Wastewater Management Plan that presents the approximate quantities of wastewater generated, type of waste, and disposal locations;	Implementation of Management Plan and Inspection	Once; before operation commences	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 Public Health Law No. 47 for 2008
		Coordinate with Aqaba Water Company to hire a private contractor for the collection of wastewater from the site to the Aqaba WWTP	Review contract with contractor	Once; before operation commences	Project Operator	
		Prohibit illegal disposal of wastewater to the sea or land in accordance with ASEZA's "zero discharge policy" set within the Regulation for the Protection of the Environment in the ASEZ No. 21 for the Year 2001 Prohibit illegal disposal of wastewater to the land;	Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the Aqaba Wastewater Treatment Plant Industrial Park WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;	Inspection	Continuous	Project Operator	
		Ensure that constructed septic tanks during construction and operation are well contained and impermeable to prevent leakage of wastewater into soil. In addition, proper bunding must be in place to prevent further spillage if leakage occurs; EPC Contractor only - ensure that constructed septic tanks during construction and those to be used during operation are well contained and impermeable to prevent leakage of wastewater into soil;	Inspection	Continuous	Project Operator	
		Develop a regular inspection and maintenance schedule for the sanitation facilities and septic tanks for early detection of issues	Inspection	Continuous	Project Operator	

		Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing. In addition, proper bunding must be in place to prevent further spillage is leakage occurs.	Inspection	Continuous	Project Operator		
		Develop a Wastewater Management Plan that presents the approximate quantities of wastewater generated, type of waste, and disposal locations;	Implementation of Management Plan and Inspection	Once; before operation commences	Project Operator		
	Improper management of hazardous waste	Coordinate with the MoEnv and hire a private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility	Review contract with contractor	Once; before construction commences	EPC Contractor	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001Management, Transportation, & Handling of Harmful & Hazardous Substances Regulation No. (24) of 2005, - Instruction for Management and Handling of Consumed Oils for 2003, - Instruction for Hazardous Waste Management for the year 2003	
		Follow the requirements for management and storage as per the ‘Instructions for Hazardous Waste Management and Handling of the Year 2003’ of the MoEnv	Inspection	Continuous	EPC Contractor		
		Prohibit illegal disposal of hazardous waste to the land	Inspection	Continuous	EPC Contractor		
		Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate facilities (such as sumps and pits) and must be orderly disposed of as hazardous waste	Inspection	Continuous	EPC Contractor		
		Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing	Inspection	Continuous	EPC Contractor		
		Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the Swaqa Facility. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas	Review manifests to ensure consistency	Continuous	EPC Contractor		
	Improper management of hazardous material	Ensure hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of impermeable surface, accessible to authorized personnel only, prevent incompatible materials from coming in contact, etc.	Inspection	Continuous	EPC Contractor	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - -Jordanian Standard 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials	
		Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for.	Inspection	Continuous	EPC Contractor		
		Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc).	Inspection	Continuous	EPC Contractor		
		Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material.	Inspection	Continuous	EPC Contractor		
		Ensure that a minimum of 1,000 liters of general purpose spill absorbent is available at hazardous material storage facility.	Inspection	Continuous	EPC Contractor		
		If spillage occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.	Inspection	Upon Occurrence	EPC Contractor		
			Reporting of incident and measures taken to minimize impact				
	Biodiversity	Impacts limited to improper management of the site (e.g. improper conduct and housekeeping practices).	Before construction commences, undertake a fauna survey (through an ecological expert) to identify the presence of any key faunal species of importance (reptiles and mammals) onsite and along the proposed transmission line route. Should viable populations of such key species exist within the Project site then it should be relocated outside of construction active areas;	Reporting on outcomes of survey	Once; before construction commences	EPC Contractor	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001Agriculture Law No. 44 of 2002 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008. - Instruction for Environmental Damage Committee
			Undertake avifauna species (migratory, resident and breeding) prior to construction during fall season 2014 within the proposed transmission line only to ensure that there are no indications of breeding taking place within Wadi 2	Reporting on outcomes of survey	Once; before construction commences	EPC Contractor	
Undertake construction of the proposed transmission line route outside of the bird breeding season and avoid any destruction of Acacia trees along the wadi corridor. This is discussed in Section 10			Inspection	Continuous	EPC Contractor		
Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel (e.g. with respect to prohibiting hunting) and good housekeeping (e.g. keeping the site orderly and clean).			Inspection	Continuous	EPC Contractor		

						No.(37) of 2002
Archaeology	Improper management of construction activities could disturb/damage the archaeological locations in the nearby area as well as potential archaeological remains which could be buried in the ground (if any).	Ensure that the Code of Conduct, awareness raising, and training developed for construction workers and personnel to emphasizes the presence of archaeological locations in the area.	Inspection	Once; before construction commences	EPC Contractor	- Antiquities Law No. 21 of 1988 and its amendments No. 23 for 2004
		Implement appropriate measures for chance find procedures which mainly require that construction activities be halted and the area fenced, while immediately notifying the DoA. No additional work will be allowed before the Department assesses the found archaeological site and grants a clearance to resume the work. Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply.	Inspection	Upon Occurrence	EPC Contractor	
			Report prepared and submitted to the DoA	Upon occurrence	EPC Contractor	
Air Quality and Noise	Construction activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality	If dust or pollutant emissions are found to be excessive, construction activities should be stopped until adequate control measures are implemented.	Inspection and visual monitoring to include periodic inspections at nearby sites (e.g. nearby Highway) to determine whether high levels of dust from construction activities exist.	Continuous	EPC Contractor	- Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 Air Protection Regulation No. 28 for 2005 - Instruction for the Control of Ozone Depleting Substances for the year 2003 - Instruction for Reduction and Prevention of Noise for 2003 - JS 1140-2006 Ambient Air Quality - JS 1189-2006 Maximum Allowable Limits of Emissions from Stationary Sources - JS 1052-1998 Motor Emissions - JS 1059-1998 Motor Vehicles - Noise Levels - JS 1053-1998 Motor Vehicles-Emissions- Diesel Engines
			Reporting of any excessive levels of pollutants and measures taken to minimize impact	Upon occurrence	EPC Contractor	
		Comply with the OSHA requirements and the Jordanian Codes to ensure that for activities associated with high dust levels, workers are equipped with proper protective equipment (e.g. masks, eye goggles, etc).	Inspection	Continuous	EPC Contractor	
		Apply basic dust control and suppression measures which could include: regular watering of all active construction surfaces, proper management of stockpiles/excavated material, proper covering of trucks transporting aggregates and fine materials, adhering to a speed limit of 15 km/h for trucks on construction sites, etc.	Inspection	Continuous	EPC Contractor	
	Possible noise emissions to the environment from the construction activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant emissions.	Inspection	Continuous	EPC Contractor	
			Inspection	Continuous	EPC Contractor	
		If noise levels were found to be excessive, construction activities should be stopped until adequate control measures are implemented. Apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level	Reporting of any excessive levels of noise and measures taken to minimize impact.	Upon occurrence	EPC Contractor	
			Inspection	Continuous	EPC Contractor	
Infrastructure and Utilities	Water Requirements – water requirements of the Project could entailing constraint on the existing users such as the Industrial Park or local communities.	Coordinate with the Aqaba Water Company for securing water requirements of the Project, whom has sufficient capacity to cover the rather minimal water requirements of the Project	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	- ASEZ law No.(32) of 2000 - Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Instruction for Environmental Damage Committee
	Wastewater Utilities – it is important to ensure that existing utilities would be able to handle the amount of wastewater generated from the Project.	Coordinate with the Aqaba Water Company for disposal of wastewater at the Aqaba Wastewater Treatment Plant	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	

	Solid Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of solid waste generated from the Project	Coordinate with ASEZA or hire a competent private contractor for the collection of solid waste from the site to Aqaba Landfill or Aqaba Debris Landfill.	Submit report with proof of coordination	Once; before construction commences	EPC Contractor	No.(37) of 2002 - Traffic Law No. 49 for 2008 - The Roadway Law No. 24 for the Year 1986 (for non-penetrating roads) - The Penetrating Roadway Law No. 82 for the Year 2001 - Regulations for the Registration and Licensing of Vehicles No. 104 for 2008 - Bylaw of Maximum Dimension, Overall Weights and Engine Power of Vehicles No. 42 for the year 2002 - Instructions for Allowable Speed Limits for 2002 - Instruction for Hazardous Waste Management for the year 2003 - Water Authority Law No. 18 for 1988 and its amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity.	Adopt and implement an action Plan for working with the local community members during the construction phase. The plan must aim to support the local community stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program (in which the local community can express their concerns, strengths and limitations) even before the development is in place.	Regular reporting on outcomes of action plan implementation	Continuous	Project Developer	- Labour Law No. 8 for the Year 1996 and its amendments. - Law No. 48 of 2008 amending Labour Law 1996. - Interim Act No. 26 of 2010 amending Labour Code - Instructions - Conditions and Procedures for Bringing and Employing Non-Jordanian Workers for 2012 Note: these legislations only refer to local employment (i.e. from Jordan). There is no specific

						legislation that encourages employment from the local community within the vicinity of the Project zone.
Occupational Health and Safety	There will be some generic risks to workers health and safety from working on construction sites, as it increases the risk of injury or death due to accidents	Prepare a site-specific Occupational Health and Safety (H&S) Procedure that includes location-specific emergency preparedness and response procedures. Adopt and implement the recommendations/provisions of the Occupational Health and Safety Manual throughout the Project construction phase	Inspections to ensure the implementation of provisions of OHSM	Continuous	EPC Contractor	- Labour Law No. 8 for the Year 1996 and its amendments - Social Security Law No. 1 of 2014 - Civil Defence Law No. 18 of 1999 and amendments - Regulation of Protection and Safety from Industrial Tools and Machines and Work Sites No. 43 for 1998 and its amendment thereof - Regulation for Formation of Committees and Supervisors of Occupational Health and Safety No. 7 for 1998 - Regulation for Preventive and Curative Health Care for Workers in Establishments No. 42 for 1998 and its amendments thereof - Regulation for the Fees of Work Permits for Non-Jordanians No. 36 for 1997 and its amendments thereof - Instructions for the Protection of Workers against the Risks of the Work Environment - Instructions- initial medical examination of workers in institutions of 1999 - Instructions- periodic medical examination of workers in institutions of 1999
			Regular reporting in addition to reporting of any accidents, incidents and/or emergencies and the measures undertaken in such cases to control the situation and prevent it from occurring again.	Upon occurrence		
Community Health,	There is a risk that some	Undertake worker health screening in order to minimise the spread of	Reporting on worker health	Continuous	EPC Contractor	N/A

Safety and Security	construction workers will come from outside Aqaba looking for work which could put pressure on local community services and pose a risk to community health from an increased incidence in communicable diseases	communicable disease. Develop a Code of Conduct for workers to follow. Provide a Grievance Procedure in SEP where stakeholders may contact the Company to log a complaint, which will be dealt with by the Company within 30 days of receipt.	screening results and number of complaints received through Grievance Procedure			
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Table 34: ESMP for the Operation Phase

Environmental Attribute	Potential Impact	Mitigation Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Landscape and Visual	Potential for glare caused by minimal sunlight reflected off the PV panel modules which in turn could affect nearby receptors.	Upon completion of construction activities, coordinate ASEZA to install informative signs on the Secondary road for commuters regarding potential for glare within the area	Submission of report with proof of coordination	Once; before operation commences	Project Operator	- ASEZ law No.(32) of 2000 - Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001
Geology and Hydrology	Improper management of solid waste	Develop a Solid Waste Management Plan (SWMP) that presents the approximate quantities of waste generated, type of waste, and disposal locations. The plan is to be developed in accordance with the Solid Waste Management Regulation No. (27) of 2005;	Implementation of Management Plan	Once, before project commences	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 - Solid Waste Management Regulation No. (27) of 2005 - Soil Protection Regulation No. 25 of 2005
		Coordinate with ASEZA or hire a competent private contractor for the collection of solid waste from the site to the Aqaba Landfill.	Review contract with contractor	Once; before operation commences	Project Operator	
		Prohibit fly-dumping of any solid waste to the land.	Inspection	Continuous	Project Operator	
		Distribute appropriate number of properly contained litter bins and containers properly marked as "Municipal Waste".	Inspection	Continuous	Project Operator	
		Implement proper housekeeping practices on the construction site at all times.	• Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. The numbers within the records are to be consistent to ensure no illegal dumping at the site or other areas	Review manifests to ensure consistency	Continuous	Project Operator	
	Improper management of wastewater	Develop a Wastewater Management Plan that presents the approximate quantities of wastewater generated, type of waste, and disposal locations;	Implementation of Management Plan and Inspection	Once; before operation commences	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Public Health Law No. 47 for 2008 - Soil Protection Regulation No. 25 of 2005 - Instruction for Environmental Damage Committee No.(37) of 2002
		Coordinate with Aqaba Water Company to hire a private contractor for the collection of wastewater from the site to the Aqaba WWTP	Review contract with contractor	Once; before operation commences	Project Operator	
		Prohibit illegal disposal of wastewater to the sea or land in accordance with ASEZA's "zero discharge policy" set within the Regulation for the Protection of the Environment in the ASEZ No. 21 for the Year 2001 Prohibit illegal disposal of wastewater to the land;	Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of wastewater generated onsite, collected by contractor, and disposed of at the Aqaba Wastewater Treatment Plant Industrial Park WWTP. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas;	Inspection	Continuous	Project Operator	
		Ensure that constructed septic tanks during construction and operation are well contained and impermeable to prevent leakage of wastewater into soil. In addition, proper bunding must be in place to prevent further spillage if leakage occurs; EPC Contractor only - ensure that constructed septic tanks during construction and those to be used during operation are well contained and impermeable to prevent leakage of wastewater into soil;	• Inspection	Continuous	Project Operator	
		Develop a regular inspection and maintenance schedule for the sanitation facilities and septic tanks for early detection of issues	Inspection	Continuous	Project Operator	
		Ensure that septic tanks are emptied and collected by wastewater contractor at appropriate intervals to avoid overflowing. In addition, proper bunding must be in place to prevent further spillage if leakage occurs.	Inspection	Continuous	Project Operator	
	Improper management of hazardous waste	Coordinate with the MoEnv and hire a private contractor for the collection of hazardous waste from the site to the Swaqa Hazardous Waste Treatment Facility	Review contract with contractor	Once; before operation commences	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Management, Transportation, &
		Follow the requirements for management and storage as per the 'Instructions for Hazardous Waste Management and Handling of the Year 2003' of the MoEnv	Inspection	Continuous	Project Operator	
		Prohibit illegal disposal of hazardous waste to the land	Inspection	Continuous	Project Operator	
		Possibly contaminated water (e.g. runoff from paved areas) must be drained into appropriate	Inspection	Continuous	Project	

		facilities (such as sumps and pits) and must be orderly disposed of as hazardous waste			Operator	Handling of Harmful & Hazardous Substances Regulation No. (24) of 2005, - Instruction for Management and Handling of Consumed Oils of 2003, - Instruction for Hazardous Waste Management of 2003 - Instructions for Fees for Hazardous Waste Treatment and Final Disposal of 2004
		Ensure that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing	Inspection	Continuous	Project Operator	
		Maintain records and manifests that indicate volume of hazardous waste generated onsite, collected by contractor, and disposed of at the Swaqa Facility. The numbers within the records are to be consistent to ensure no illegal discharge at the site or other areas	Review manifests to ensure consistency	Continuous	Project Operator	
	Improper management of hazardous material	Ensure hazardous materials are stored in proper areas and in a location where they cannot reach the land in case of accidental spillage. This includes storage facilities that are of impermeable surface, accessible to authorized personnel only, prevent incompatible materials from coming in contact, etc.	Inspection	Continuous	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Management, Transportation, and Handling of Harmful and Hazardous Substances Regulation No. 24 of 2005 - JS 431/1985 – General Precautionary Requirements for Storage of Hazardous Materials
		Maintain a register of all hazardous materials used and accompanying MSDS must present at all times. Spilled material should be tracked and accounted for.	Inspection	Continuous	Project Operator	
		Incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc).	Inspection	Continuous	Project Operator	
		Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material.	Inspection	Continuous	Project Operator	
		Ensure that a minimum of 1,000 litres of general purpose spill absorbent is available at hazardous material storage facility.	Inspection	Continuous	Project Operator	
		If spillage occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.	Inspection	Upon occurrence	Project Operator	
			Reporting of incident and measures taken to minimize impact			
Biodiversity	There could be potential impacts on avi-fauna during the project operation phase such as collision risks with PV panels, overhead lines, etc.	Undertake short term avi-fauna monitoring along the transmission line route, through an ornithologist during the first year of operation of the Project. The objective of the monitoring is intended to ensure that no breeding takes place in the transmission line area, and confirm and validate the outcomes of this ESIA assessment in relation to impacts on avi-fauna from the Project. Short-term monitoring is required for 8 days distributed throughout the spring, summer, autumn, and winter season – as this would ultimately cover migration seasons, breeding seasons, and wintering seasons of resident and migratory birds.	Reporting on outcomes of monitoring	Once	Project Operator	- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 Agriculture Law No. 44 of 2002 - Regulation for Categorizing Wild Birds and Animals Banded from Hunting No.43 of 2008. - Instruction for Environmental Damage Committee No.(37) of 2002
		With regards to the high voltage overhead lines, EPC Contractor must consider measures which reduce collision risk of birds with the overhead lines. This could include the following: (i) the installation of bird diverters which increase the visibility of the power lines. The installation of dynamic bird diverters in a distance of 15 to 25 m between each other is recommended, and (ii) horizontal arrangement of the phases, reducing the height of the conductors, and, as therefore, minimizing the risks of collision and electrocution of birds. Once installed, these often fall down need to be replaced. Depending on the type of diverter, sometimes with the wind they flip up and need to be re-adjusted. Monitoring should be conducted to ensure that they are functional.	Inspection	Continuous	Project Operator	
	Other impacts limited to improper management of the site (e.g. improper conduct and housekeeping practices).	Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel (e.g. with respect to prohibiting hunting) and good housekeeping (e.g. keeping the site orderly and clean).	Inspection	Continuous	Project Operator	
Infrastructure and Utilities	Water Requirements – water requirements of the Project could	Coordinate with the Aqaba Water Company for securing water requirements of the Project, whom has sufficient capacity to cover the rather minimal water requirements of the Project	Submit report with proof of coordination	Once; before operation	Project Operator	- ASEZ law No.(32) of 2000

	entailing constraint on the existing users such as the Industrial Park or local communities.			commences		- Regulation for the Protection of the Environment in the ASEZ - Regulation No. 21 for the year 2001 - Instruction for Environmental Damage Committee No.(37) of 2002 - Traffic Law No. 49 for 2008 - The Roadway Law No. 24 for the Year 1986 (for non-penetrating roads) - The Penetrating Roadway Law No. 82 for the Year 2001 - Regulations for the Registration and Licensing of Vehicles No. 104 for 2008 - Bylaw of Maximum Dimension, Overall Weights and Engine Power of Vehicles No. 42 for the year 2002 - Instructions for Allowable Speed Limits for 2002 - Instruction for Hazardous Waste Management for the year 2003 - Water Authority Law No. 18 for 1988 and it's amendments thereof - Groundwater Control Regulation No. 85 for 2002 and its amendments thereof -
	Wastewater Utilities – it is important to ensure that existing utilities would be able to handle the amount of wastewater generated from the Project.	Coordinate with the ASEZA for disposal of wastewater at the Aqaba Wastewater Treatment Plant	Submit report with proof of coordination	Once; before operation commences	Project Operator	
	Solid Waste Utilities – it is important to ensure that existing utilities would be able to handle the amount of solid waste generated from the Project	Coordinate with ASEZA or hire a competent private contractor for the collection of solid waste from the site to Aqaba Landfill.	Submit report with proof of coordination	Once; before operation commences	Project Operator	
Socio-economic	The Project is expected at a minimum to provide job opportunities for local communities. This, to some extent, could contribute to enhancing the living environment for its inhabitants, elevate their standards of living, and bring social and economic prosperity.	Adopt and implement an action Plan for working with the local community members during the operation phase. The plan must aim to support the local community stating its aims and objectives and should acknowledge the importance of building a strong socio-economic relationship with the local community through a participatory planning program (in which the local community can express their concerns, strengths and limitations) even before the development is in place.	Regular reporting on outcomes of action plan implementation	Continuous	Project Developer	- Labour Law No. 8 for the Year 1996 and its amendments. - Law No. 48 of 2008 amending Labour Law 1996. - Interim Act No. 26 of 2010 amending Labour Code - Instructions - Conditions and Procedures for Bringing and Employing Non-

						Jordanian Workers for 2012 Note: these legislations only refer to local employment (i.e. from Jordan). There is no specific legislation that encourages employment from the local community within the vicinity of the Project zone.
Occupational Health and Safety	There will be some generic risks to workers health and safety from operational and maintenance activities.	Prepare a site-specific Occupational Health and Safety (H&S) Procedure that includes location-specific emergency preparedness and response procedures. Adopt and implement the recommendations/provisions of the Occupational Health and Safety Manual throughout the Project operation phase	Inspections to ensure the implementation of provisions of OHSM	Continuous	Project Operator	- Labour Law No. 8 for the Year 1996 and its amendments - Social Security Law No. 1 of 2014 - Civil Defence Law No. 18 of 1999 and amendments - Regulation of Protection and Safety from Industrial Tools and Machines and Work Sites No. 43 for 1998 and its amendment thereof - Regulation for Formation of Committees and Supervisors of Occupational Health and Safety No. 7 for 1998 - Regulation for Preventive and Curative Health Care for Workers in Establishments No. 42 for 1998 and its amendments thereof - Regulation for the Fees of Work Permits for Non-Jordanians No. 36 for 1997 and its amendments thereof - Instructions for the Protection of Workers against the Risks of the Work Environment - Instructions- initial medical examination of workers in institutions of 1999
			Regular reporting in addition to reporting of accidents, incidents and/or emergencies and measures undertaken in such cases to control the situation and prevent reoccurrence.	Upon occurrence		

						Instructions- periodic medical examination of workers in institutions of 1999
Community Health, Safety, and Security	Trespassing of unauthorized personnel into the Project site could result in potential risks from several hazards of the various Project components	Ensure fence around the facility is well maintained at all times and in good conditions	Inspections	Continuous	Project Operator	- ASEZ law No.(32) of 2000
		Ensure onsite guards are adequately trained to deal with trespassing incidents. In addition, guards must refrain from using excessive force, unless situation extremely requires so.	Reporting of trespassing incidents and measures to control situation.	Upon occurrence	Project Operator	- Environmental Protection Regulation in the ASEZ No.(21) of 2001 - Public Health Law No. 47 for 2008

Table 35: ESMP for the Decommissioning Phase

Environmental Attribute	Potential Impact	Mitigation Action	Monitoring Action	Frequency	Responsible Entity	Legal Requirements
Geology and hydrology	Risk of soil and groundwater contamination during the various decommissioning activities from improper housekeeping activities, spillage of hazardous material, random discharge of waste and wastewater	Refer to mitigation and monitoring actions for improper management of waste streams within Table 33.			Developer or MEMR	Refer to legal requirements within Table 33.
Air quality and noise	Decommissioning activities will likely result in an increased level of dust and particulate matter emissions which in turn will directly impact ambient air quality.	Refer to mitigation and monitoring actions for air quality within Table 33.			Developer or MEMR	Refer to legal requirements within Table 33.
	Possible noise emissions to the environment from the decommissioning activities which will likely include the use of machinery and equipment such as generators, hammers, and compressors and other activities	Refer to mitigation and monitoring actions for noise within Table 33.			Developer or MEMR	
Occupational health and safety	There will be some generic risks to workers health and safety from working on decommissioning sites, as it increases the risk of injury or death due to accidents.	Refer to mitigation and monitoring actions for occupational health and safety within Table 33.			Developer or MEMR	Refer to legal requirements within Table 33.

10. EPC CONTRACTOR ENVIRONMENTAL PERFORMANCE REQUIREMENTS

As discussed earlier, there are offsite construction activities to be undertaken by EPC Contractor for the connection to the substation at the ATPS through the High Voltage overhead line. Details and information are not available or finalized at this stage which includes the finalised route for the overhead lines, etc.

Therefore, throughout the ESIA whilst the provisional transmission corridor was assessed this will need further review and studies due to the fact that details and information are not available. Nevertheless, detailed below are a set of Environmental Performance Requirements which must be implemented by EPC Contractor in addition to the other relevant commitments within this ESIA report, and which aim to ensure that environmental & social issues are taken into account and adequately considered.

Should the transmission line corridor substantially alter that review to establish if a new ESIA for the transmission line is required would need to be done.

It is important to note that additional performance requirements for the EPC Contractor to follow during the offsite construction activities for the connection to the substation at the ATPS through the High Voltage overhead line have been included in Chapter 10 (Table 36 and Table 37). Accordingly these two tables include measures that shall be undertaken by the EPC Contractor and are considered complementary actions to the ESMP. Should the EPC Contractor fail to undertake any of the actions listed in the tables, ASEZA and the Developer must take all necessary actions to ensure corrective action is completed.

Table 36: Performance Requirements for EPC Contractor for Offsite Construction Activities

Component	Performance Requirement
Biodiversity	Once a final detailed design is available for the proposed route for the overhead lines, EPC Contractor must undertake a biodiversity survey (as detailed within the mitigation measures in the ESIA). The survey must cover the route through Wadi 2 as well as the individual areas where the poles are to be erected for installation of the high voltage overhead lines. The survey must aim to determine whether any sensitive or endangered or rare flora/fauna/avi-fauna species exist, particular breeding birds which use the Acacia trees and the potential for soaring birds (as part of the IBA designation)–.Appropriate mitigation measures must be identified and which could include the avoidance of destroying Acacia vegetation and the relocation of species outside of construction active areas.
	During the construction phase EPC Contractor is expected to implement general proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel (e.g. with respect to prohibiting hunting) and good housekeeping (e.g. keeping the site orderly and clean).
	With regards to the high voltage overhead lines, EPC Contractor must consider measures which reduce collision risk of birds with the overhead lines. This could include the following: (i) the installation of bird diverters which increase the visibility of the power lines. The installation of dynamic bird diverters in a distance of 15 to 25 m between each other is recommended, and (ii) horizontal arrangement of the phases, reducing the height of the conductors, and, as therefore, minimizing the risks of collision and electrocution of birds. Once installed, these often fall down need to be replaced. Depending on the type of diverter, sometimes with the wind they flip up and need to be re-adjusted. Monitoring should be conducted to ensure that they are functional.
Archaeology	Once the final design for grid connections plans and route for the overhead line is available, EPC Contractor is responsible for undertaking an archaeological survey for the individual areas where the poles are to be erected for installation of the high voltage overhead lines. The survey must aim to assess whether any surface archaeological remains of significance exist. Should this be the case, appropriate mitigation measures must be identified such as the protection and fencing of the site in coordination with ASEZA.
	Implement appropriate chance find procedures. Throughout the construction phase there is a chance that potential archaeological remains in the ground are discovered. It is expected that appropriate measures for such chance find procedures are implemented which are standard requirements by the ASEZA. Those mainly require that construction activities be halted and the area fenced, while immediately notifying the ASEZA. No additional work will be allowed before the DASEZA assesses the found potential archaeological site and grants a clearance to resume the work.

	Construction activities can continue at other parts of the site if no potential archaeological remains were found. If found, same procedures above apply.
Air Quality and Noise	During the construction phase, EPC Contractor is expected to apply adequate dust suppression measures for dust generating activities and avoid unnecessary pollutant emissions from vehicles, machinery, and equipment to be used.
	During the construction phase EPC Contractor is expected to apply adequate general noise suppressing measures.
Geology and Hydrology	The proposed transmission line route runs along Wadi 2 and therefore there is high risk of flooding. Therefore, EPC Contractor must undertake a hydrology and flood risk study which determine such flooding risks and determine the appropriate pole structures required for protection from potential floods.
	During the construction phase, EPC Contractor is expected to implement proper waste management practices onsite to include solid waste, wastewater, hazardous waste, and hazardous materials. Refer to section 8.4.2 which identifies in detail the mitigation actions required for proper management of waste streams.
Utilities	The proposed transmission line route runs through Wadi 2 where the Fajr gas pipeline runs from the port towards the eastern mountains of the SIZ. EPC Contractor is expected to consult with the Fajr Company and undertake a risk assessment and produce a management plan to ensure that construction activities do not pose any risk to the gas pipeline.
Occupational Health and Safety	EPC Contractor is expected to develop an Occupational Health and Safety Manual in accordance with the provisions of the Labour Law No. 8 for the Year 1996 and its amendments, including Chapter IX, Occupational Safety & Health before construction activities commence. The Manual must address the likely hazards, emergency response procedures, and provision of protective clothing, adequate safety management.

The existing utilities and infrastructure within the corridor of the transmission line are as follows and the EPC Contractor shall undertake the following in relation to these interactions:

Table 37: Required interaction to be undertaken by the EPC Contractor for Offsite Construction Activities

Existing Utility& Infrastructure	Description	Resp. Party	Action Required by EPC Contractor
400kV OH electricity transmission line and 132 KV OH electricity transmission line	400kV OH line coming from the Aqaba Thermal Power Station and running to the north of Jordan 132kV OH line coming from the Aqaba Thermal Power Station and running adjacent to the Jordan Petroleum Refinery Co.	National Electric Power company (NEPCO)	- The EPC Contractor shall coordinate directly with the NEPCO Team located within the ATPS for the finalisation of the final design for the transmission route from the Project to the ATPS before any construction activities takes place. The NEPCO Team will review the proposed route (AutoCAD and coordinates) and study in relation to their transmission lines and provide comments on clearance/buffer zone requirements and provide the final preferred route for transmission line - The EPC Contractor shall provide as built drawings to the NEPCO Team in order to have as reference for future planning.
Fajr Gas Pipeline	East Gas operates a 36" sub-sea pipeline supplying natural gas from Egypt to Jordan. The landfall of this pipe is on the coast of the South Zone and up to this point it is the responsibility of East Gas Company. From there onwards the pipeline runs towards the eastern mountains of the	Fajr Company	- The EPC Contractor shall coordinate directly with the Fajr Company in Aqaba for the finalisation of the final design for the transmission route from the Project to the ATPS before any construction activities takes place. The Fajr Company has their own specifications and requirements

	SIZ and is the responsibility of the Fajr Company. Its route is located at a distance of around 1 km south of the Project site.		in terms of their gas pipeline and these shall be considered by the EPC Contractor for the final route for the transmission line.
underground cables	EDCO is one of the three distribution companies responsible for distribution of electricity through medium and low voltage lines. EDCO is responsible for all electricity distribution in the southern governorates to include Aqaba as well as Ma'an, Al-Tafileh, and Karak. They are responsible for all underground electricity cables within their area of work including the SIZ.	EDCO	- The EPC Contractor shall coordinate directly with the EDCO Team for the finalisation of the final design of the underground cables under the bridge and the last section of the route "entry to NEPCO S/S" before any construction activities takes place. The EDCO Team will review the proposed route (AutoCAD and coordinates) and study in relation to their underground cables and provide comments on final preferred route as well as performance requirements to ensure that their cables are not affected (e.g. manual excavation, entrance tunnel, clearance and buffer zone...etc). - The EPC Contractor shall provide as built drawings to the EDCO Team in order to have as reference for future planning.
Bridge- National Highway	As part of the proposed transmission line, it is planned to extend an underground cable under the bridge when it intersects with the National Highway.	MPWH	- The EPC Contractor shall coordinate directly with the MPWH-Aqaba in order to finalise the final route of the cable under the bridge.
Substation in ATPS	The Substation managed by NEPCO exists with the ATPS. The Transmission line with connect with this Substation	NEPCO	- The EPC Contractor shall coordinate directly with the NEPCO Team located within the ATPS for entrance and the connection within the ATPS substation.

11. ANNEXES

Annex I – Stakeholder Engagement Plan

Annex II – Stakeholder Consultation Details

Annex III – Detailed Biodiversity Survey Results

Annex IV – Detailed Air Quality Monitoring Results