Annex G

Water Resources

G1 INTRODUCTION

This Annex presents the methodology, findings and recommendations of the water resources impact assessment of the Gaziantep Integrated Healthcare Campus (the Project), located in Şahinbey District of Gaziantep, southeast Turkey.

The assessment considers proposed Project activities during construction and operation with the potential to cause impacts to water resources.

G1.1 SCOPE OF THE ASSESSMENT

The scope of this assessment includes:

(i) identification of surface water bodies within the Project Site and more broadly within the Gaziantep Province;

(ii) a review of groundwater sources within the vicinity of the Project (up to 1km in distance [1]) and more broadly within Gaziantep Province based upon available secondary information;

(iii) an assessment of potential impacts on these water resources during construction and operation of the Project; and

(iv) an assessment of potential flood risks.

Impacts related to wastewater discharges during construction and operation are not included within this Annex and are instead addressed in *Volume II, Annex E, Waste Management*.

G1.2 STUDY AREA

The study area covered the immediate Project Site and a distance of up to 1km around the site. Surface water courses and groundwater were also considered within the wider Gaziantep Province (which extends up to approximately 80 km from the Project Site).

(1) 1 km for the vicinity of the Project Site is in line with the information provided by State Hydraulic Works (DSI)

G2 METHODOLOGY

G2.1 RELEVANT DOCUMENTS, STANDARDS AND GUIDELINES

There are four Turkish regulations relating to the protection of surface and groundwater resources that are relevant for this Project:

- Turkish Regulation on Water Pollution Control (RWPC) (Official Gazette (OG) Date/Number: 31/12/2004/25687);
- Surface Water Quality Management Regulation (SWMR) (OG Date/Number: 30/11/2012/28483);
- Regulation on the Protection of Groundwater against Pollution and Deterioration (OG Date/Number: 07/04/2012/28257); and
- Law on Groundwater (Law No: 167) (OG Date/Number: 23/12/1960/10688).

In addition to these national regulations, the World Bank Group EHS Guidelines (1) were used as a reference, specifically regarding ambient water quality, water conservation and water availability.

G2.2 DESKTOP ANALYSIS

Secondary data was gathered from the website of the Gaziantep Metropolitan Municipality and relevant public institutions including the State Hydraulic Works (DSI), Gaziantep Water and Sewer Works Authority (GASKİ), Ministry of Environment and Urban Planning (MEUP) and Ministry of Forest and Water Affairs (MFWA). In addition, recent studies undertaken in the region were reviewed and included:

- the Gaziantep Environmental Status Report (2014) (2);
- DSI information on dams, groundwater and surface water in Gaziantep; and
- the GIS Database of MFWA (3).

(1) IFC, April 2007, General Environmental, Health, and Safety Guidelines
(2) URL: http://www.csb.gov.tr/db/ced/editordosya/Gaziantep%202014.pdf
(3) URL: http://geodata.ormansu.gov.tr/

G2.3 ENGAGEMENT WITH REGULATORY AUTHORITIES

In addition to secondary data review, the project team held face-to-face meetings with representatives of the State Hydraulic Works and the Gaziantep Metropolitan Municipality (GASKİ and Department of Environmental Protection and Control) to gather additional information and discuss data already obtained.

G2.4 FIELD SURVEY

The ESIA team undertook a field visit to the Project Site during July 2015, and a visual assessment of the surface water courses was undertaken.

G2.5 IMPACT ASSESSMENT METHODOLOGY

The assessment of likely impacts is determined by assigning ratings for impact magnitude and the sensitivity/vulnerability/importance of receptors/resources as described in more detail in *Volume I, Chapter 5*. Once the magnitude of the impact and sensitivity of the resource/receptor is characterised, impact significance is assigned using the significance matrix presented in *Volume I, Chapter 5*.

G2.5.1 Designations for Surface Water Impacts

Table G2.1 and *Table G2.2* describe the designations used for impact magnitude and resource sensitivity/vulnerability/importance when assessing impacts to surface water resources.

Table G2.1 Magnitude of Impact on Surface Water

Magnitude	Definition
Large	• Contamination of surface water that degrades the existing water quality by 100% of the original water quality. • Potentially severe effects on surface water quality which are likely to be long-lasting (e.g. months or more) or permanent and/or give rise to indirect ecological and/or socio-economic impacts. • There are known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could experience a 'significant' increase in flood frequency (above baseline conditions) as a result of the Project.
Medium	• Contamination of surface water that degrades the existing water quality by 50% of the original water quality. • Potential localised effects on water quality which are likely to be fairly long lasting (e.g. weeks or months) and/or give rise to indirect ecological and/or socio-economic impacts. • There are known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could experience an increase in flood frequency (above baseline conditions) as a result of the Project.

Magnitude	Definition
Small	• Contamination of surface water that degrades the surface water run-off quality by 10% of the original water quality. • Potential short-term localised effects on water quality but which are likely to return to equilibrium conditions within a short timeframe (e.g. hours or days at most). • There are no known / expected physical (property, agricultural fields, infrastructure etc.) or sensitive ecological receptors upstream or downstream within the catchment that could be affected by the changed drainage regime.
Negligible	• Contamination of surface water that are temporary in nature and that do not degrade the existing surface water run-off quality. • Potential short-term localised effects on water quality but likely to be highly transitory (e.g. lasting a matter of hours) and well within natural fluctuations. • There is likely to be no alterations to existing drainage regimes and characteristics at any time of year

Table G2.2 Surface Water Sensitivity/Vulnerability/Importance

Value	Definition
Low	• Watercourse located in the vicinity that does not support diverse aquatic habitat. • Watercourse already significantly modified from some aspect of natural condition. • Watercourse with little or no community use.
Medium	• Watercourse that support diverse populations of aquatic habitat. • Watercourse that provides ecosystem services to some extent. • Watercourse used for local water supply source, small industrial abstraction or minor irrigation scheme.
High	• Watercourse with high quality e.g. in its natural state and with ecological importance. • Watercourse that provides vital ecosystem services. • Watercourse that provides urban water supplies, major industrial abstraction or large irrigation supplies.

G2.5.2 Designations for Groundwater Impacts

Table G2.3 and *Table G2.4* describe the designations used for impact magnitude and resource sensitivity/vulnerability/importance when assessing impacts to groundwater resources.

Table G2.3 Magnitude of Impact on Groundwater

Magnitude	Definition
Large	Discharges to groundwater are likely to cause breaches of statutory discharge limits (over extended periods) and cause background levels to above the site specific long-term cancer and hazard risk levels (provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites).
Medium	Discharges to groundwater bodies are expected to cause breach(s) of statutory limits (over limited periods) and cause background levels to be below the site specific but above the generic long-term cancer and hazard risk levels (provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites).
Small	Discharges to groundwater are expected to be within (but perhaps close to) statutory limits and will cause background levels to increase but remain below the generic risk levels for all sites (levels provided in Turkish Regulation on Soil Pollution Control and Point Source Contaminated Sites).
Negligible	Discharges to groundwater are expected to be well within statutory limits.

Table G2.4 Groundwater Resource Sensitivity/Vulnerability/Importance

Value	Definition
Low	• Non aquifer or groundwater in deep aquifers. • Low quality groundwater not used by the community. • Groundwater that do not provide or provide very little baseflow to surface watercourses or support habitats.
Medium	• Medium quality groundwater. • Groundwater that provides baseflow to surface watercourses used for recreational fishing. • Groundwater that is abstracted for industrial purposes or agriculture (i.e. irrigation purposes).
High	• High quality groundwater that is used for drinking or domestic purposes. • Groundwater that provides baseflow to surface watercourses that have high quality or supports a wetland with ecological importance.

G3 BASELINE

G3.1 SURFACE WATER RESOURCES

As illustrated in *Figure G3.1*, from the National Basin Management Strategy of Turkey (2014-2023), Gaziantep is located between the Euphrates-Tigris basin (see item 21 in *Figure G3.1*), the Ceyhan basin (see item 20 in *Figure G3.1*) and the Orontes basin (see item 19 in *Figure G3.1*).

Figure G3.1 River Basins in Turkey

Source: DSI, National Basin Management Strategy (2014-2023)

The Euphrates-Tigris (Fırat-Dicle) basin is the largest in Turkey with a catchment area of around 185,000 km², approximately 24% of Turkey's surface area. The catchment areas of Ceyhan and Orontes (Asi) basins are approximately 22,000 km² and 7,800 km², comprising 2.8% and 1% of the country's surface area, respectively.

The Euphrates (with an average annual flow of 30 billion m³) originates in Turkey and flows 2,700 km through Syria and Iraq to join the Tigris, where they jointly become the Shatt al-Arab river, which flows into the Persian Gulf. The Tigris (with an average annual flow of 16 billion m³ also originates in Turkey, near Hazar Lake located in the southeast of Elazig Province. It flows a distance of 1,150 km before flowing through Iraq to join the Euphrates near the Persian Gulf. Orontes River (with an average annual flow of 2,400 million m³) originates in Lebanon and flows through Syria and Turkey, where it enters the Mediterranean Sea. The Ceyhan River (with an average annual flow of 5,700 million m³) originates in the Kahramanmaras Province of Turkey and stays within the country before flowing into the Mediterranean Sea. The sections of the Euphrates, Ceyhan and Orontes Rivers that flow through Turkish territory are illustrated in *Figure G3.2*. The Tigris is located further to the east and is excluded from *Figure G3.2* (1).

(1) DSI, 2013, http://www.dsi.gov.tr/dsi-resmi-istatistikler

Figure G3.2 Three Main Rivers around Gaziantep

In addition to the major rivers there are a number of permanent creeks in Gaziantep Province. These creeks (1), together with their average flow rates, are listed in *Table G3.1*. There are also several artificial reservoirs in Gaziantep, namely Zülfikar, Yamaçoba, Çakmak, Burç, Nogaylar, Balıkalan and Gölühöyük with a total surface area of 175 ha.

Table G3.1 Major Creeks of Gaziantep Province

Name of the creek	Average flow rate (m^3/sec)
Ardıl Creek	1.14
Karasu (Aşağımülk) Creek	1.20
Merzimen Creek	1.26
Nizip Creek	1.96
Sacır Creek	4.12
Karasu Creek	4.21

Source: Gaziantep Environmental Status Report, 2014

In addition to the major creeks present in Gaziantep, there are also other seasonal creeks. *Figure G3.3* shows the locations of those creeks closest to the Project site, including Sacır Creek, which dominates.

The following information about local creeks was obtained during a face to face meeting with the 202nd Branch Directorate of DSI in Gaziantep in July 2015:

(1) Creek is referred to as the smallest surface water course.

- Kahvelipınar Creek is located approximately 1 km to the north of the Project Site. This area is reportedly going to be developed into a recreational area (including includes play areas, gardens, picnic areas, an artificial pond, sports areas, cafes/restaurants) as a part of the 'Yeşil Vadi' (Green Valley) Project the creek has been diverted through a culvert. Kahvelipınar Creek joins Kanlıdere Creek approximately 2 km to the north of the Project Site.

- Boz Creek, which is the closest creek to the Project Site (approximately 300 – 400 m to the northeast) also joins Kanlıdere Creek and they feed into Sacır Creek. The bed of Boz Creek is illustrated in *Figure G3.4.*

- Sacır Creek (approximately 3.5 km from the Project Site) is one of the major creeks of Gaziantep and flows through the city centre. The creek collects storm water run-off and conveys it into collectors, which direct the water to a wastewater treatment plant located to the south of Gaziantep. Also, according to the GASKİ Activity Report (2014), a daily average wastewater flow of 300,000 m^3 is effectively treated in Gaziantep Central Wastewater Treatment Plant (i.e. meeting the discharge criteria) and the effluent stream was discharged into Sacır Creek.

- Edenboğazı Creek is located approximately 1 km to the south of the Project Site.

Figure G3.3 Nearby Creeks

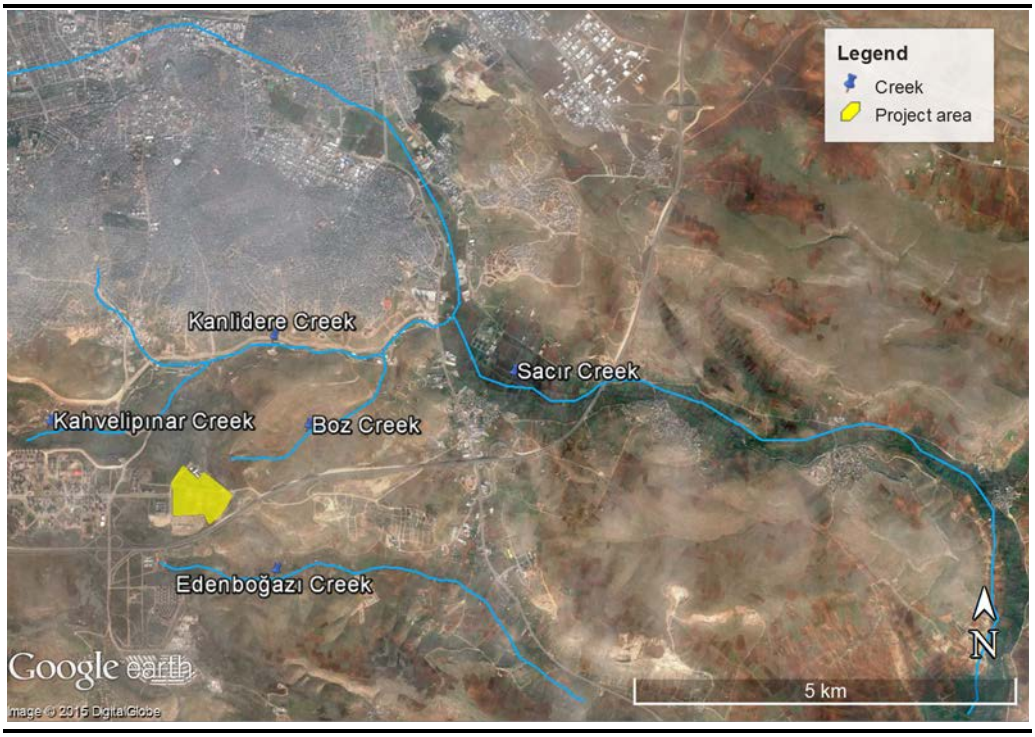


Figure G3.4 The Bed of Boz Creek (photographed 4th July, 2015)

There are no surface water features within the Project Site itself; however, perched water was observed in a number of holes, accumulated on impermeable layers near the surface.

There are no surface water protection zones around the Project site based on the review of 1/100,000 scaled Gaziantep Province Environmental Plan and 1/25,000 scaled Gaziantep Metropolitan Municipality Master Zoning Plan. There are also several dams and reservoirs within the provincial borders of Gaziantep as well as within the borders of the neighbouring provinces (see *Figure G3.5)*. The information related to the dams such as their distance to the Project Site, purpose of use, reservoir capacity etc. are provided in *Table G3.2*. Information is also provided about three dams in the planning process, but not yet operational.

Figure G3.5 Dams and Reservoirs around Gaziantep

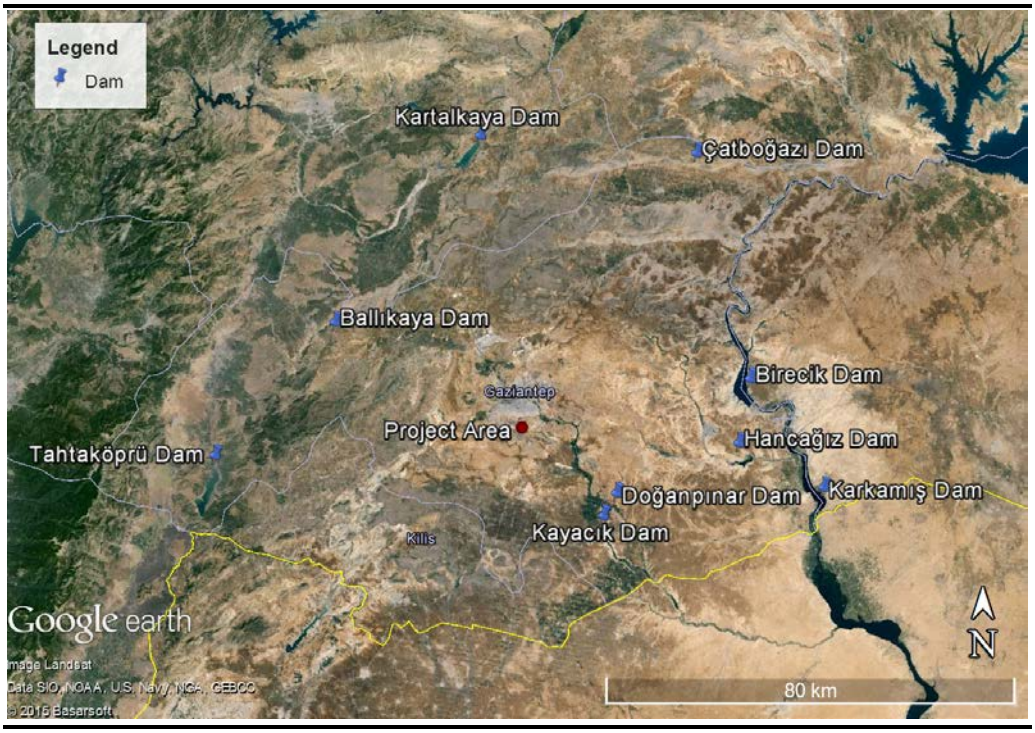


Table G3.2 Dams around Gaziantep

Name	Operational State	Distance to Project Site	Stream	Purpose	Reservoir surface area – storage capacity	Power Production Capacity	Water Supply Capacity
Hancağız	Operation	42 km	Nizip Creek	Irrigation	4.33 km² 100 Mm³	-	-
Tahtaköprü	Operation	62 km	Karasu Creek	Irrigation	23.4 km² 200 Mm³	-	-
Kayacık	Operation	25.5 km	Aynifar Creek	Irrigation	11 km² 117 Mm³	-	-
Karkamış	Operation	60 km	Euphrates River	Power production, Flood control	28.4 km² 150 Mm³	189 MW	-
Birecik	Operation	45 km	Euphrates River	Power production, irrigation	56km² 1,220 Mm³	672 MW	-
Kartalkaya	Operation	55 km	Aksu River	Irrigation, fresh water supply	10.2 km² 148 Mm³	-	47.3 Mm³/ year
Ballıkaya	Planning	44 km	-	-	-	-	-
Çatboğazı	Planning	60 km	-	-	-	-	-
Doğanpınar	Planning	23 km	-	-	-	-	-

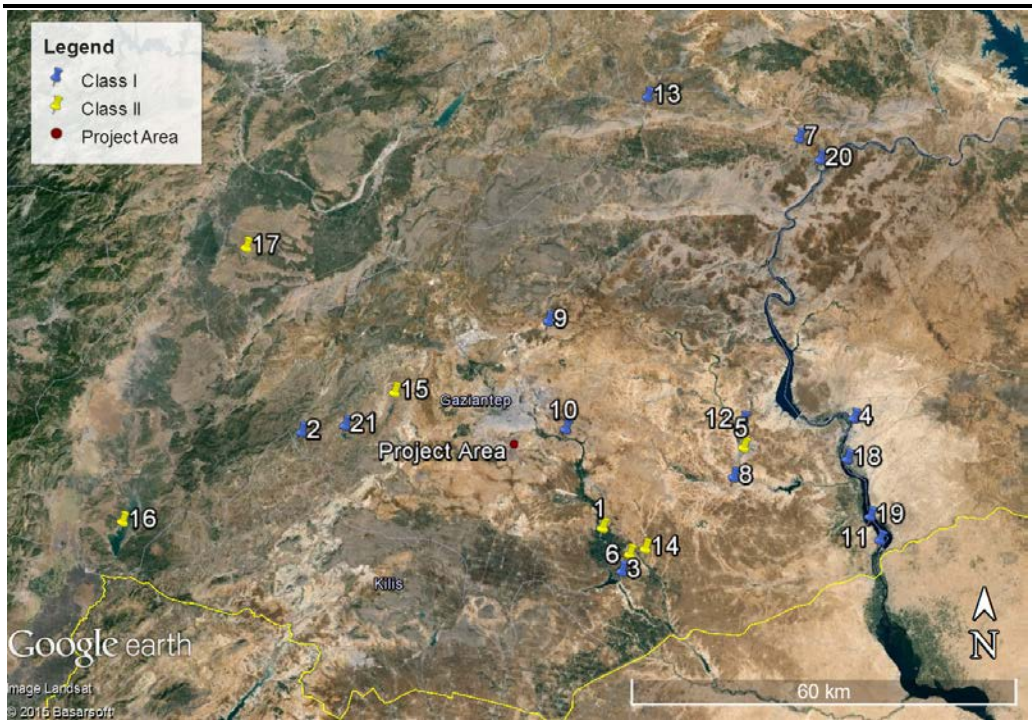
G3.2 SURFACE WATER QUALITY

The Turkish Regulation on Water Pollution Control (RWPC) and the Surface Water Quality Management Regulation (SWMR) classify surface water quality as:

- Class I: High quality water;
- Class II: Less polluted water;
- Class III: Polluted water; and
- Class IV: Highly polluted water.

DSI has surface water monitoring stations located throughout Gaziantep Province. The water quality classifications for these stations, based on average annual nitrate concentrations for the year 2012, are reported in the Environmental Status Report for the Gaziantep Province (2014) (see *Figure G3.6*).

Figure G3.6 Surface Water Quality Based on Nitrate Measurements in DSI Monitoring Stations, 2012



Source: Gaziantep Environmental Status Report, 2014

Table G3.3 lists the monitoring stations (with the same numbers as given in *Figure G3.6*), the average nitrate concentrations (and related classification), as well as the distance of the sampling point to the Project Site. Accordingly, all the surface water sources are classified as Class I and II water quality; however, it should also be noted that these water sources are not located in close vicinity of the Project Site (the closest is located 7 km away).

Table G3.3 Information on Monitoring Stations, 2012

Number	Monitoring Station	Annual Average NO_3-N Concentration (mg/l)	Water Quality Classification	Distance to Project Site (km)
1	Sacır Creek-Gündoğan Regulator	5.62	II	20
2	Afrin Creek-Upper Afrin Dam	2.07	I	34
3	Sacır Creek-Kayacık Dam outlet	2.39	I	26
4	The Euphrates-Karkamış Dam	1.76	I	60
5	Nizip Creek-Road Bridge	8.96	II	35
6	Sacır Creek	9.65	II	25
7	Karasu Creek	1.50	I	65
8	Mizar Creek-Hancağız Dam entrance	0.59	I	34
9	Samözü Creek-Gaziantep Organised Industrial Site outlet	0.28	I	18
10	Sacır Creek-Bayramlı Regulator	1.95	I	7
11	The Euphrates-Karkamış Dam	1.34	I	59
12	Nizip Creek-Organised Industrial Site entrance	0.08	I	35
13	Ardıl Creek-Ardıl Dam	1.67	I	34
14	Sacır Creek-Doğanpınar Dam	8.40	II	26
15	Burç Pond	9.25	II	20
16	Tahtaköprü Dam - surface	7.16	II	63
17	Ballıkalan Nurdağı-surface	8.16	II	52
18	The Euphrates-Nizip	2.11	I	52
19	The Euphrates-Karkamış	2.41	I	57
20	Eski köprü-Araban	2.12	I	65
21	Hacıaslan Pond	3.63	I	27

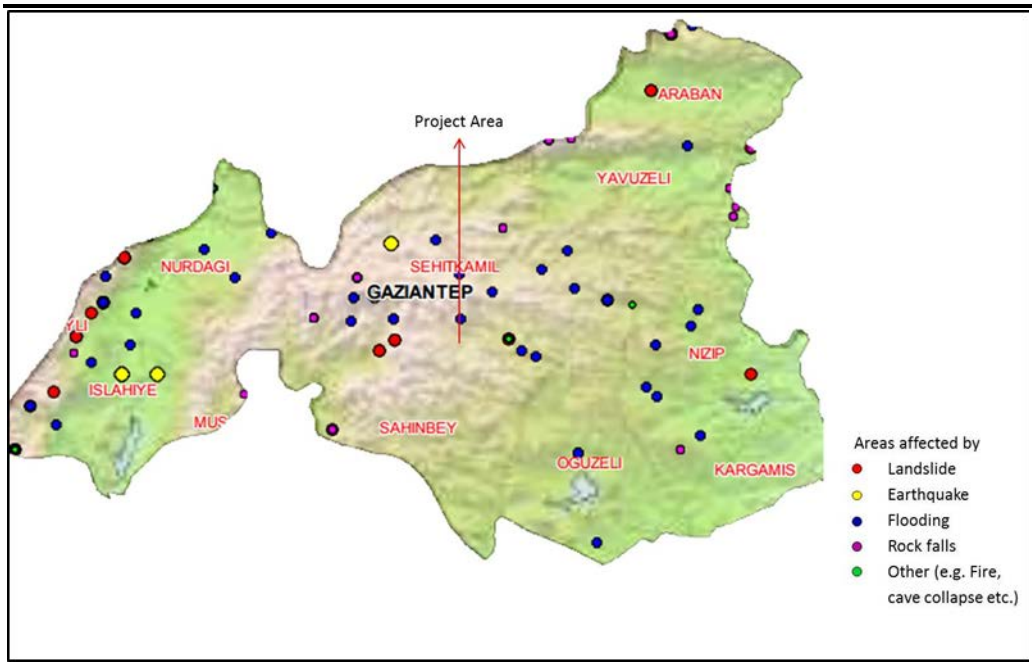
Source: Gaziantep Environmental Status Report, 2014

G3.3 FLOOD RISK

According to information obtained from the Turkish State Meteorological Service, there have been 11 flood events in Gaziantep between 1940 and 2010. Being located in the Euphrates basin, flooding incidents are frequently recorded in İslahiye, Nurdağı, Şehitkamil, and Nizip districts of Gaziantep [(1)] (see the blue dots marked in *Figure G3.7*).

(1) Spatial and Statistical Distribution of Natural Disasters in Turkey' report prepared by Disaster Affairs General Directorate of the Ministry of Public Works and Settlement in 2008

Figure G3.7 Distribution of Disaster Incidents in Gaziantep



Source: 'Spatial and Statistical Distribution of Natural Disasters in Turkey' report prepared by Disaster Affairs General Directorate of the Ministry of Public Works and Settlement in 2008

The official view given by the 202nd Branch Directorate of DSI (dated 13.07.2015) states that there is no flooding risk around the Project Site due to its elevation (approximately 940 m above sea level).

G3.4 GROUNDWATER RESOURCES

DSI has undertaken hydrogeological surveys within the provincial territories of Gaziantep and the results of these surveys are summarised in *Table G3.4*. Araban and Yavuzeli plains, as well as Nurdağı and İslahiye plains have been identified as areas where there is sufficient groundwater supply for economic development (distances of plains to the Project Site range from between 40 to 70 km).

Table G3.4 Groundwater Resources in Gaziantep Province

Survey Report	Total Water Capacity (10^6 m^3/year)	Available Water Capacity (10^6 m^3/year)
Gaziantep Plains (Center, Nizip and Oğuzeli) – Hydrogeological Survey Report	6.7	3.3
Upper Orontes Basin (İslahiye – Fevzipaşa Plains) – Revised Hydrogeological Survey Report	103.2	62.0
Yavuzeli – Araban Plains – Hydrogeological Survey Report - Araban Plain Yavuzeli Plain	159.2 139.2	95.5 83.5

Source: Gaziantep Environmental Status Report, 2014

Most of the fresh water for Gaziantep Province comes from Kartalkaya Dam, which is located in Pazarcık District of Kahramanmaraş Province. However, groundwater wells in Mizmilli (a total number of 30, with a total water capacity of 85,000 m^3/day) located at the Kahramanmaraş – Gaziantep border, are also considered as being significant fresh water sources for the City. Around the City there are 14 groundwater wells which provide a total fresh water supply of 35,000 m^3/day to the City's water network. In addition to the groundwater wells providing fresh water to the water network, it is stated in the Gaziantep Environmental Status Report (2014) that there are approximately 13,000 licensed, privately owned groundwater wells present which are used for drinking, irrigation and industrial purposes.

G3.4.1 *Groundwater in the Vicinity of the Project Site*

An official letter from the 20th Regional Directorate of DSI to the Project, provided information on the groundwater wells near to the Project Site together with their characteristics. *Figure G3.8* illustrates the location of these groundwater wells (both public and private) within a 1,250 m radius of the Project Site and *Table G3.5* summarises their characteristics.

Figure G3.8 Groundwater Wells within a 1,250 m Radius of Project Site

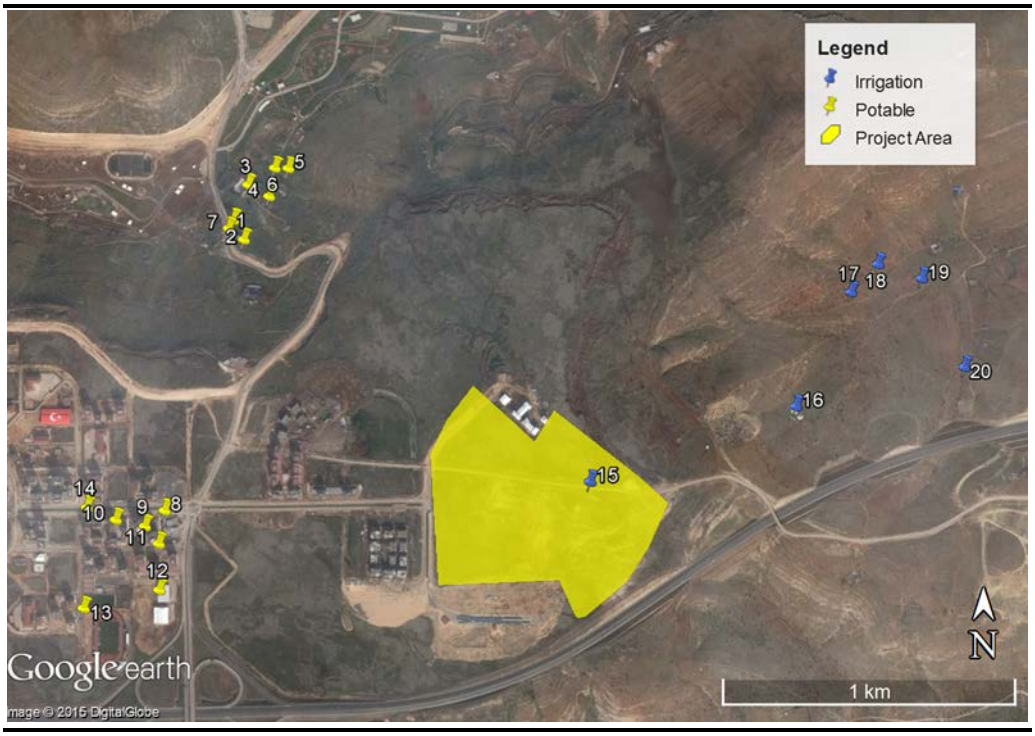


Table G3.5 Details of the Groundwater Wells

Number	Neighbourhood	Purpose	Depth (m)	Static head (m)	Description
1	Dumlupınar	Potable	-	-	In a shelter
2	Dumlupınar	Potable	-	-	Covered on top

Number	Neighbourhood	Purpose	Depth (m)	Static head (m)	Description
3	Dumlupınar	Potable	87	30	Daily 3 tons
4	Dumlupınar	Potable	100	35	Farmland
5	Dumlupınar	Potable	-	-	Farmland
6	Dumlupınar	Potable	-	-	No access
7	Güneş	Potable	-	-	Caisson
8	Akkent	Potable	450	50	In a garden
9	Akkent	Potable	275	-	In the construction site
10	Akkent	Potable	-	-	In the construction site
11	Akkent	Potable	300	-	In the construction site
12	Akkent	Potable	-	15	In the construction site
13	Akkent	Potable	-	-	Drill in progress
14	Akkent	Potable	-	-	In the construction site
15	Yeşilkent	Irrigation	110	33	Municipality owned crushing plant
16	Yeşilkent	Irrigation	-	-	-
17	Yeşilkent	Irrigation	-	-	Dry Well
18	Yeşilkent	Irrigation	-	15	Vineyard irrigation caisson
19	Yeşilkent	Irrigation	-	13	Vineyard irrigation caisson
20	Yeşilkent	Irrigation	-	-	Vineyard irrigation caisson

The authorities from the 202nd Branch Directorate of DSI in Gaziantep stated during a meeting with the ESIA project team that groundwater levels in and around the Project Site are known to be very deep. According to the Drilling-based Ground and Sub-surface Survey Report (details are given in *Volume II: Annex H*), groundwater was not observed in any of the borehole locations, drilled at a maximum depth of 31 m, at the Project site.

There are no groundwater protection zones around the Project site based on the review of 1/100,000 scaled Gaziantep Province Environmental Plan and 1/25,000 scaled Gaziantep Metropolitan Municipality Master Zoning Plan.

According to the information given in *Table G3.5*, there is an existing well (labelled as item 15 in *Figure G3.8*) within the Project Site. Based on information provided by the SPV, this well was not used during the operations of the former stone crushing plant on the Project Site as it failed to provide groundwater. The SPV has no current plans to abstract groundwater for the Project and has confirmed that the existing well within the Project Site is not being used and currently is not functional. It was reported by the SPV that there was no water in the well and the well has been closed with fill material. The water demand of the concrete batching plant will be supplied by tankers. On the other hand, it was further reported by the SPV that wells may be developed depending on the need during construction (i.e. related to water need for the batching plant), however this is currently unlikely to happen.

Due to the fact that there is no current planning for the use of groundwater, the SPV has not requested any permits from DSI. In case a future demand occurs for groundwater use, the SPV reported that necessary permissions will be obtained from the authorities.

G3.4.2 Storm Water

Based on initial information from GASKI, there is no storm water drainage system in the region where the Project Site is located. However, based on recent information obtained from the SPV, there is a storm water collection drain at the southwest of the Project Site near the municipality sewer pipeline. An official letter from GASKI to the SPV (dated 15.01.2015) states that it is appropriate to let the storm water run-off naturally during construction. During operation, the surface water run-off should be collected in a site drainage system which then should be directed to the storm water collection system. SPV has confirmed that the municipal storm water collection drain at the southwest of the Project site, as shown in GASKI's letter (dated 13.06.2016), has adequate capacity for discharge of storm water generated at the IHC site during operation.

G4 IMPACTS

G4.1 POTENTIAL IMPACTS DURING CONSTRUCTION

G4.1.1 Run-off from Construction Sites

During construction, activities associated with soil movement during excavations, as well as exposed and stockpiled soil could give rise to suspended sediment in water run-off from the Project Site. Exposed soils that are dampened to reduce dust generation, could also produce surface run-off, as well as water used to wash the wheels of construction vehicles. Run-off during construction will be exacerbated during rainfall events. Without appropriate management, these activities have the potential to impact the quality of nearby surface water through increased suspended solids and siltation. These aspects will be carefully managed and monitored during construction and the SPV will have a Construction Management Plan in place. This will include measures such as the need to have designated areas for stockpiled soil and perimeter drains/channels/ bunds in place around all working areas to collect site run-off.

In addition, whilst GASKİ's official view is that water could run-off the site without specific drainage during construction, the SPV plans to implement site drainage so that run-off will be collected and discharged from the southwest of site to the storm water collection system. The necessary permits currently need to be approved and obtained from GASKİ. With these measures in place the impacts on surface water resources are expected to be **negligible.**

There are no surface water bodies within or adjacent to the Project Site. The closest creek to the Project Site is the Boz Creek which is seasonal and located at a distance of approximately 400 m northeast. It is important to note that Boz Creek is separated by a new road that has been constructed to replace the existing road which currently passes through the Project Site. The construction of the new road (except for the surface pavement works) was completed prior to the ESIA studies. The construction of this new road has a very small footprint compared to the Project Site and due to the fact that its construction has almost been completed its impact is negligible.

Boz Creek is classified as low sensitivity because it has little or no community use. Considering that site drainage will be implemented at the Project Site and discharged into the municipal sewer line, no direct discharges to Boz Creek are expected to occur. As such the impact would be of **negligible** significance.

G4.1.2 Contamination of Surface and Groundwater

There is the potential for poor storage and handling of hazardous materials (fuel oil and/or lubricants) as well as construction materials (liquid cement, lime) to lead to accidental spills which could result in the contamination of surface and groundwater. Accidental spills may also occur from the refuelling of equipment onsite during construction. The volumes are likely to be small and isolated but there is the potential to impact the quality of nearby surface waters. Whilst the vulnerability of Boz Creek (the closest water course) is assessed as being low, it is important that the risk of any potential contamination is appropriately managed.

Embedded mitigation included in the design such as suitably sized impervious bunds or other containment will be installed where hazardous materials are handled (such as concrete mixing, hazardous material storage area) to prevent hazardous materials entering site drainage. Moreover, appropriate spill response kits including absorbent materials will be present on site. These will be kept at designated areas with specific instructions for their use. Site staff will be trained on the use of spill kits. Contaminated materials will be collected and sent to appropriate disposal facilities, as described in *Volume II, Annex E*. All staff and subcontractors will be required to report any incidents and these will be subject to investigation and remedial and preventive actions will be taken as needed.

It is also important to note that the official view given by the 202nd Branch Directorate of DSI (dated 13.07.2015) states that there is no irrigation facility in the Project site and the Branch Directorate has no objection for the construction of the Gaziantep IHC at the Project site. Based on 1/100,000 scaled Gaziantep Province Environmental Plan and 1/25,000 scaled Gaziantep Metropolitan Municipality Master Zoning Plan, there is no surface water and/or groundwater protection zone around the Project site.

Groundwater wells have depths ranging between 100 m to 450 m within a 1,250 m radius around the Site. Information from DSI, provides details of a well inside the Project Site with a depth of 110 m and a static head of 33 m, however it was reported by the SPV (based on information received from the former operator), that this well was not used during the operations of the former stone crushing plant as it failed to provide groundwater. It is currently unlikely that the SPV will abstract groundwater during construction. Moreover, the groundwater is in a deep aquifer, so its sensitivity is considered low. The potential for groundwater to be contaminated during construction is assessed as low; the aquifers are deep and the magnitude of any impact considered small as volumes of any spills are likely to be small and isolated. The significance of this impact is considered to be **negligible**.

The potential for surface water to be contaminated during construction is also assessed as low; the closest creek, Boz Creek, is assessed as having low sensitivity and the magnitude of any impact is considered small with any spills likely to be small and isolated, as a result of the embedded mitigation

measures (as described previously) being in place. The significance of this impact is therefore considered to be **negligible**.

G4.1.3 Flood Risk

Based on recent information obtained from the SPV, there is a storm water collection system only at the southwest of the Project Site. GASKI has reported that the municipal storm water collection system around the Project Site will be constructed prior to operation of the Project. Considering that there is an existing system at the southwest of the Project Site, no significant impacts are expected. Moreover, the SPV has confirmed that GASKI reported in a letter (dated 13.06.2016) that the municipal storm water collection drain at the southwest of the Project site has adequate capacity for discharge of storm water generated at the IHC site during operation.

G4.2 POTENTIAL IMPACTS DURING OPERATION

G4.2.1 Contamination of Surface and Groundwater

There is the potential for poor storage and handling of hazardous materials that may lead to accidental spills which could then lead to contamination of surface and groundwater. Accidental spills may also contaminate surface soils which could subsequently contaminate surface water. Unlike surface water run-off generated from rainfall, contaminated surface water run-off will ultimately contaminate the soil; hence, the sensitivity may be high depending on the amount of contamination.

The design and operation of the Project incorporates embedded mitigation. The SPV plans to install impervious bunds or other containment where hazardous materials (eg. oils, solvents, paints) are handled (such as a hazardous material storage area which is detailed in the Hazardous Material Management Procedure) to prevent contamination of soil and water courses. A Hazardous Materials Handling Procedure will be in place to ensure materials are stored and handled appropriately and spills are avoided. An Emergency Response Plan will also be implemented to reduce the impact of spills in the event that they do happen Spill response kits including absorbent materials will be present on site. These will be kept at designated areas with specific instructions for their use. Site staff will be trained on the use of spill kits. Contaminated materials will be collected and sent to appropriate disposal facilities. All staff and subcontractors will be required to report any incidents and these will be subject to investigation, and remedial and preventive actions will be taken as needed.

Considering the handling procedures and emergency response measures that are planned to be implemented by the SPV, the potential for adverse impacts on groundwater quality from accidental spills is assumed to be low; the aquifers are deep and the magnitude of any impact considered to be small. Similarly, the sensitivity of Boz Creek is low and the magnitude of any impact likely to be small. Therefore, the impacts are predicted to be **negligible**.

G4.2.2 Flood Risk

Appropriate storm water drainage is incorporated into the Project design to ensure that storm water is effectively collected. GASKI reported in a letter (dated 13.06.2016) that the municipal storm water collection drain at the southwest of the Project site has adequate capacity for discharge of storm water generated at the IHC site during operation. Therefore, significance of this impact is considered to be **negligible.**

G4.3 MITIGATION AND MANAGEMENT MEASURES

The following measures will be implemented by the SPV to ensure that potential impacts on water resources are appropriately mitigated during construction:

- Good construction site practices will be employed and detailed within the Construction Management Plan (CMP). This will include measures such as using designated areas for storing materials, regular inspections at construction sites, training of construction workers, placement of sediment traps, etc.) to minimise the generation of site run-off and the risk of water pollution.
- Construction activities will be regularly inspected (either by the SPV or third parties) on site including water quality testing of surface run-off
- Construction workers and relevant staff will all be appropriately trained in good construction site practices and spill response and prevention measures.
- No fuelling of vehicles or equipment will take place within excavated areas. Fuelling shall only be carried out in designated areas away from surface drainage pathways exiting the site.

The following measures will be implemented by the SPV to ensure that potential impacts on water resources are appropriately mitigated during construction and operation:

- A Hazardous Material Handling Procedure will be developed to ensure appropriate handling of hazardous materials. This will detail that no hazardous materials will be stored in excavated areas and all handling of hazardous materials will take place only by authorised staff.
- The storm water will be discharged into the municipal storm water collection system during construction and operation. Relevant approvals and permits have been obtained from GASKI (13.06.2016) for operation phase, and need to be obtained for construction phase.

- Regular periodic integrity testing for hazardous material storage equipment will be conducted and appropriate leak detection systems will be in place.

- An Emergency Preparedness and Response Plan will be developed to ensure appropriate management of any spills.

G4.4 RESIDUAL IMPACTS

With the implementation of the mitigation measures outlined above no significant residual impacts are expected during construction or operation.

G4.5 CUMULATIVE IMPACTS

No cumulative impacts on surface water and groundwater have been identified.