

Summary Report: Springs and Water Users Study

Springs and Water Users Study

1.0 Introduction

An inventory of water users and water usage in the Project area and surrounding communities was completed by Vilik Sargsyan, professor at Yerevan State University of Architecture and Construction with the help of Geoteam CJSC, with review and input by Geoteam environmental and community relations staff. The study documented current water supply sources, water supply infrastructure, and water usage in the following communities nearest to the Project:

- Jermuk
- Kechut
- Gndevaz
- Saravan
- Saralanj
- Ughedzor
- Gorayk

Water use by seasonal herders present in the Project area was also included in this study.

Information for the study was obtained from interviews with villagers, as well as existing information sources including Geoteam spring inventory data, satellite and cartographic imagery, and hydrologic reports.

All of the communities studied utilized springs as their main water supply source, typically drawing water from multiple springs to meet demand and to assure year-round water supply. Table 1 below lists the number of springs used by each of the surrounding communities for water supply; Figure 1 shows the locations of the principle water sources for these communities.

Table 1 – Springs Supplying Local Communities

Community	Number of Springs Supplying Community
Jermuk	9
Kechut	12
Gndevaz	5
Saravan and Saralanj	9
Ughedzor	9
Gorayk	3

Surface water, although abundant in the Project area, was only utilized as irrigation water by local communities, often to supplement spring water usage.

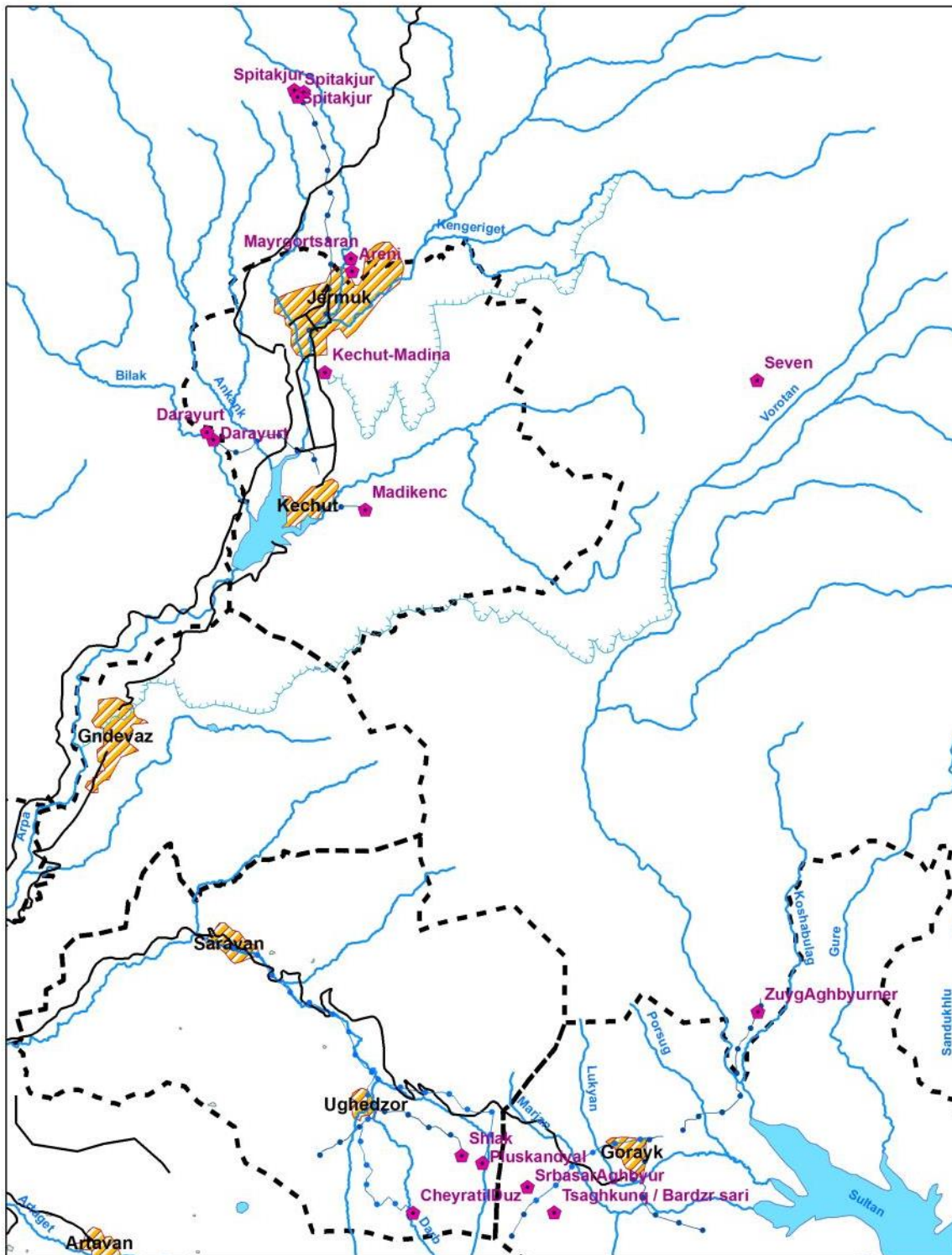


Figure 1 – Local Community Water Sources (Springs)

The following sections present the results of the study, by community. Information regarding water supply sources, delivery and treatment infrastructure, and irrigation is presented for each community group, along with a figure showing water supply sources and infrastructure.

2.0 Jermuk Water Use

Jermuk has a population of 5134 people, according to the 2001 census. The town is supplied with drinking and domestic water via four main groups of springs (Table 3), with the majority of flow provided by the SpitakJur group of springs, located approximately 3 km north of the town (see Figure 1). These springs provide approximately 65 L/sec flow year-round. Figure 2 shows the water supply system for Jermuk.

Table 3 – Principal Jermuk Water Supply Characteristics

Community	Spring name	Average Spring Flow, L/s
Jermuk	SpitakJur	65
	Mayrgortsaran	9
	Darayurt	6
	Kechut-Madina	4
	Areni	5
Total		89

The Armenian Water and Sewerage Company provides potable and domestic water supply to Jermuk, via a water collection system at the spring heads that pipes the water to Jermuk and to individual users.

Jermuk has a sewage collection system, however there is no sewage treatment, and raw domestic and industrial wastewater is discharged directly into the Arpa River downstream of Kechut Reservoir. The sewage collector system is antiquated and is thought to be leaking where it passes through Kechut Reservoir. To upgrade the system and provide for adequate sewage treatment and disposal, the community is working with the EBRD to fund and construct a wastewater treatment plant that will be built in 2014, with completion scheduled for early 2015. The new wastewater treatment plant will divert the sewage collector lines around Kechut Reservoir as part of system upgrades.

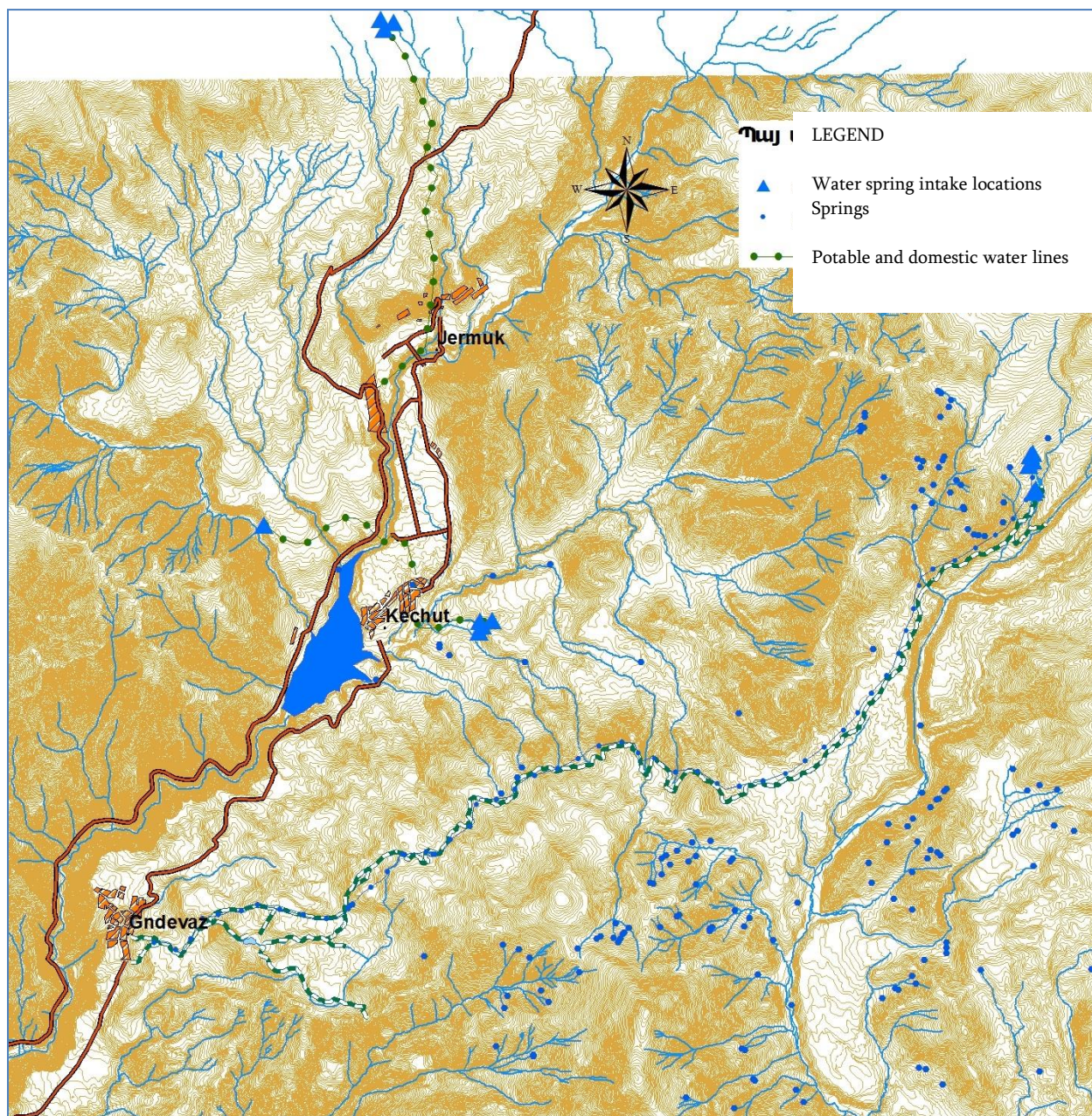


Figure 2. Water abstraction and supply networks for Jermuk, Kechut, and Gndevaz

3.0 Kechut Water Use

Kechut's population of 1004 is supplied with domestic water from the Madikenc group of springs, located approximately 2 km east of the town (Figure 1). The springs flow into concrete catchment basins, where chlorine is added as a disinfectant. The water then flows into a central reservoir and into a gravity-fed 220 mm-diameter pipeline for 2 km, and then into the water supply network, at a rate of 5-7 L/s. Figure 2 shows the water supply system for Kechut.

Water is available to Kechut residents 24 hours/day, but there are no water meters and residents do not pay for water used. Domestic wastewater including sewage flows into a collection pipeline where it is discharged without treatment into Kechut Reservoir. Kechut Reservoir is connected to the Lake Sevan drainage basin via two tunnels, which are in active managed use diverting water from the reservoir into Lake Sevan.

4.0 Gndevaz Water Use

Water for domestic use in the village of Gndevaz is supplied from two groups of springs (see Figure 1). Table 4 provides more detail about these springs. Both springs are located at a substantial distance from the village (Seven springs – 17 km, Darayurt springs – 11 km); water from both spring groups is conducted to Gndevaz via gravity-fed pipelines, as shown on Figure 2. Water from the Seven springs is transported via a 212 mm-diameter pipeline that decreases to a 150 mm-diameter pipe closer to the community; the pipeline was constructed in 2000. Water from the Darayurt springs is transported through a 150 mm-diameter pipeline, constructed in 1964. Darayurt spring flow is consistent year-round and is the preferred drinking and domestic water source; flow from the Seven springs decreases in winter.

Table 4 – Gndevaz Water Supply Characteristics

Community	Spring name	Average Spring Flow, L/s
Gndevaz	Seven	60
	Darayurt	17
Total		77

Access to spring water is available to 90% of the community; the gravity delivery system does not provide residents in the higher-elevation areas of the community with service. Water use is not metered; however there is a set charge per person and per household for water use. The water supply piping infrastructure dates from the 1970s and suffers from frequent pressure losses and leaks.

Domestic wastewater including sewage is collected but discharged directly into the Arpa River without treatment.

Gndevaz uses surface water from nearby rivers for irrigation purposes. A 21 km long open, concrete channel (dashed green and white line in Figure 2) constructed to divert up to 600 L/s of water from the upper Vorotan River to the Gndevaz Reservoir. However, the channel is currently in general disrepair, with numerous breaches and structural failures, with the result that no water from the intake reaches the reservoir via this channel. As a result, Gndevaz residents are only able to irrigate half of the community's arable lands.

In 2006, a 1000 mm-diameter pipeline was constructed to divert water from Kechut Reservoir to Gndevaz and other downstream communities for irrigation purposes – at the Gndevaz bridge, a smaller diameter pipe tees off the larger diameter pipe to deliver irrigation water to Gndevaz via gravity.

5.0 Saravan Municipality Water Use

The Municipality of Saravan consists of the three communities of Saravan, Saralanj, and Ughedzor. The Municipality supplies drinking and domestic-use water to all three communities via a series of springs, as shown on Figure 1. Figure 3 presents details of the water supply networks. The Municipality treats all collected water with chlorine to disinfect it prior to the waters' entry into the distribution system.

Residents of Saravan use water from the Pluskandyal springs; water flows via gravity from the springs through a 100 mm-diameter, 6 km-long pipeline at a rate of approximately 5 L/s. From the pipeline, the water flows into a small (30 m³-capacity) reservoir from which it is distributed via pipes to the residents. Approximately 90% of Saravan's residents have access to this water, although there are no water supply or sanitation systems in the community.

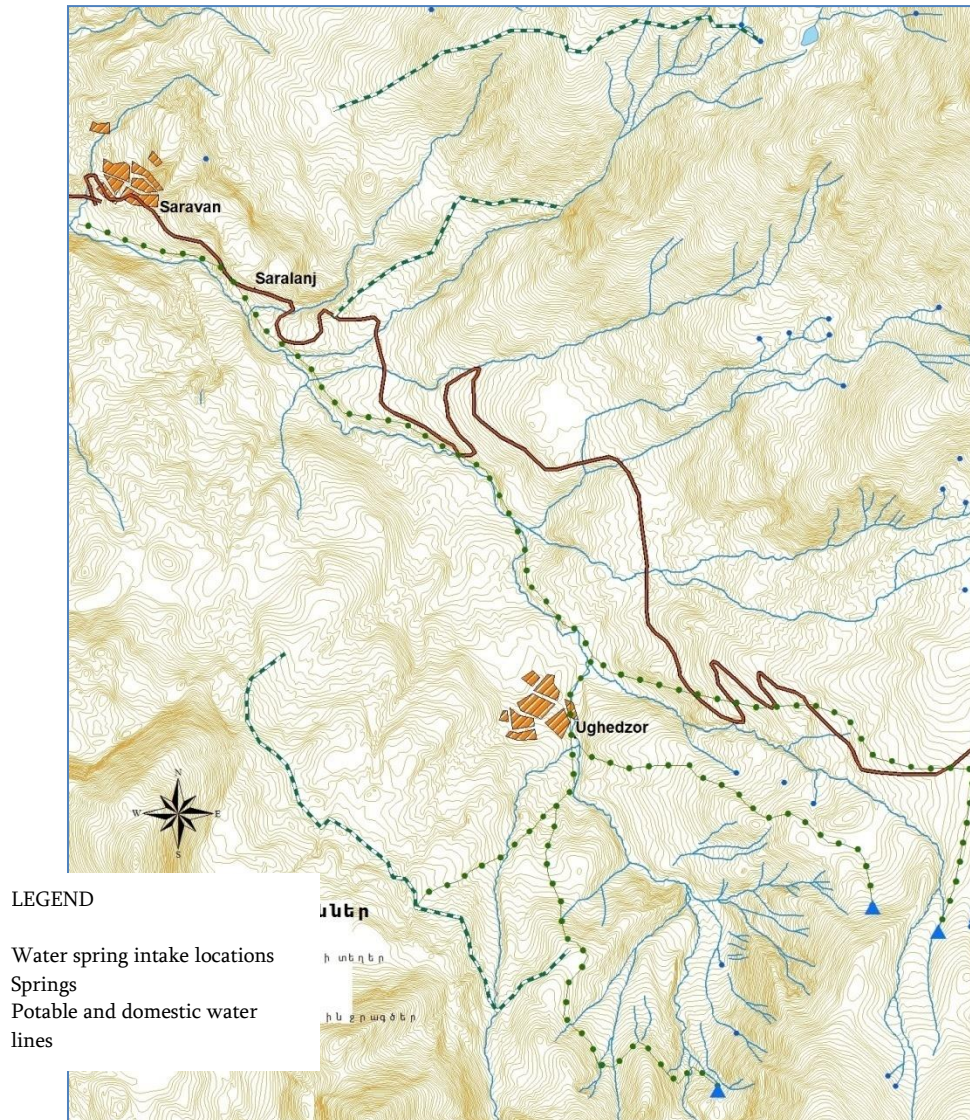


Figure 3 - Water abstraction and supply networks for Saravan, Saralanj and Ughedzor

Water for drinking and domestic use for the residents of Saralanj is collected from the Shlak springs, located above Ughedzor (Figure 2). A 5 km-long, 76 mm-diameter gravity-fed pipeline provides 5 L/s of water from the springs to the community. The Municipality of Saravan (which includes the villages of Saravan, Saralanj and Ughedzor) is disinfecting the water with chlorine at the spring head and provides water supply 24 hours/day. Figure 3 shows the water supply network for Saravan.

Drinking and domestic use water for Ughedzor is collected from the CheyratiDuz springs 2 km south of the community (Figure 1). Two 55 mm-diameter pipelines collect the spring water and transport it 2.5 km to the community, where it is distributed to individual households via a smaller pipeline network.

Domestic wastewater and sewage for Saravan, Saralang, and Ughedzor report to individual septic tanks within each community.

Irrigation water for the three communities is collected from many sources via both open channels and pipes. The Municipality is in charge of maintenance of the system, including springs above Ughedzor, Benik Pond and springs adjacent to Benik Pond, northeast of Saravan. Currently, only 40% of Saravan households have access to a permanent, full-time irrigation water source. Irrigation water from Benik Pond and adjacent springs is only used by the intinerant population of Ughedzor. At each community, household gardens and small plots are irrigated by water from the nearest springs.

6.0 Gorayk Water Use

Water for drinking and domestic use for the community of Gorayk is provided from a network of three springs, as shown in Figure 1. Table 5 presents more information about the springs network.

Table 5: Gorayk Water Supply Characteristics

Community	Spring Name	Flow Rate, L/s
Gorayk	ZuygAghbyurner	2.5
	SrbasarAghbyur	1.5
	Tsaghkunq or Bardzr sari spring	3.5
Total:		7.5

Gravity-fed pipelines transport water from each of the three springs to two central reservoirs in Gorayk (Figure 4), where the water is chlorinated. ZuygAghbyurner spring water flows into a separate reservoir on the eastern edge of the village; SrbasarAghbyur and Tsaghkunq spring water drains into a reservoir on the western edge of the village, where it is disinfected by the municipality with chlorine tablets.

Pipeline specifics for transporting water from of the springs are as follows: ZuygAghbyurner – 150 mm-diameter, 3.5 km-long pipeline; SurbAghbyur = 100 mm-diamter, 3.5 km-long pipeline; and Tasghkunq – 125 mm-diameter, 4.5 km-long pipeline. Figure 4 shows details of the water supply system for Gorayk. Water is available to the community 24 hours/day. The water is distributed via an internal water distribution system, and there is no charge for drinking or domestic water usage.

Domestic wastewater and sewage from Gorayk report to individual septic tanks.

Household gardens and small plots are irrigated with water from the same three springs.

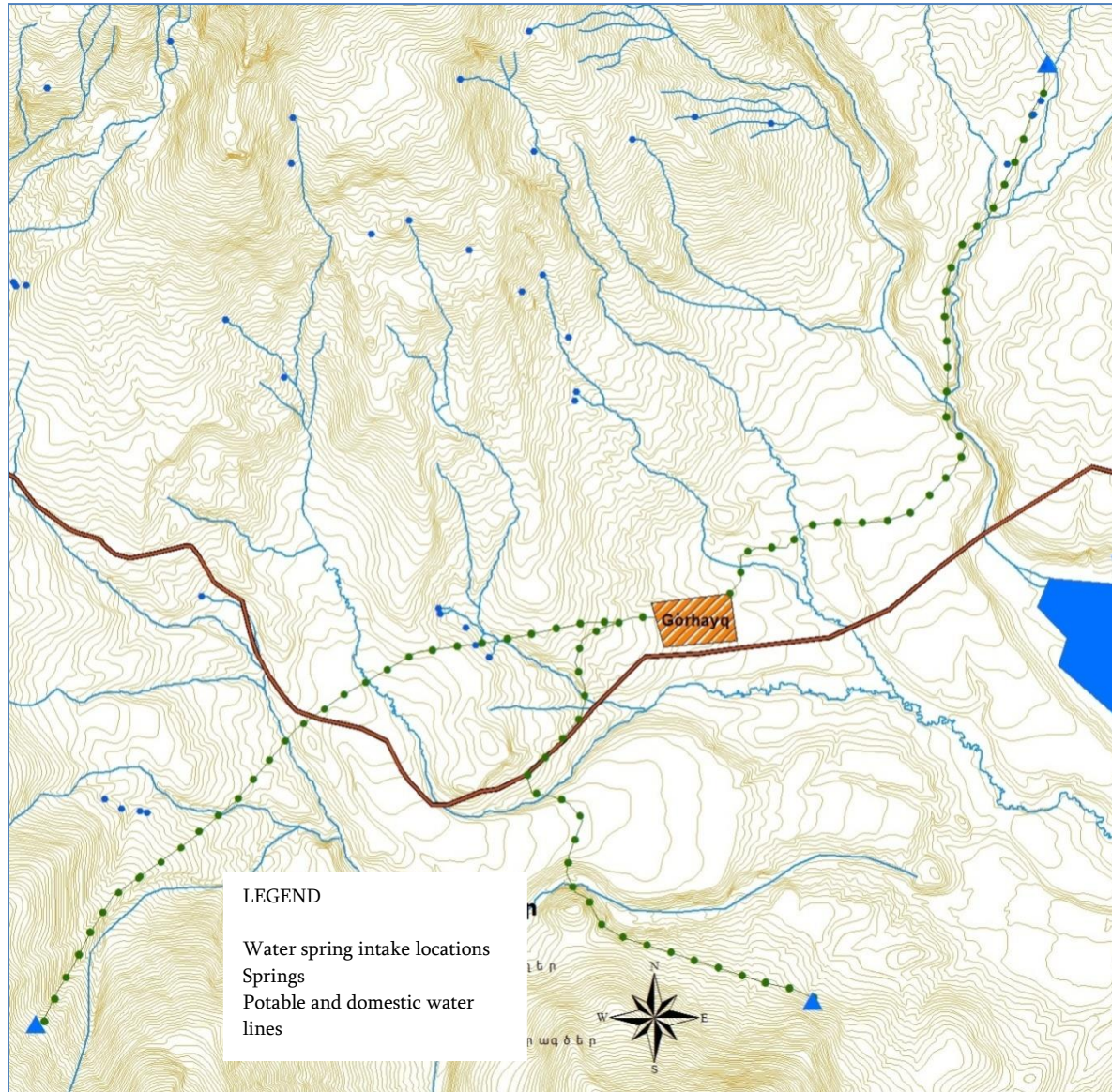


Figure 4 - Water abstraction and supply network for Gorayk

7.0 Herder Water Use

Domestic use of potable water by herders of Amulsar surrounding communities and temporary inhabitants of other localities, as well as the water supply for livestock during seasonal cattle breeding is given in Table 6.

Table 6 - Domestic use of potable water by herders and inhabitants of temporary settlements

N	Seasonal water users	Locality	Domestic water use location	Water supply location	Time period
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1.	Inhabitants of Gndevaz village	East Gndevaz reservoir, between sites 4 and 15	From springs of upper reaches of the right tributary of the River Darb flowing down from Saravan village	From springs of upper reaches of the right tributary of the River Darb flowing down from Saravan village	June-October
2.	Herders of Shaki village and their families	Koshabulakh tributary of River Vorotan, in sites 6, 8 and 9	From upper reaches of Koshabulakh River	from Koshabulakh River	June-September
3.	Herders of Khndzoresk village and their families	River Vorotan, in sites 11 and 13	From the potable water pipeline to Gndevaz	from Vorotan River	June-September
4.	Herders of Gorayk village	North from Gorayk, in site 5	From the springs, north from Gorayk village	from Vorotan River	May-October
5.	Herders of Saravan and Saralanj villages	South from Saravan, near site 1	Fro water pipelines of Saravan and Saralanj villages	From Darb River near Saravan village	May-October
6.	Temporary inhabitants in Ughedzor village: from Vayk and Malishka localities	South-eastern UghedzorUpper reaches of Darb river	From the springs of the upper reaches of Darb River	From Darb River, in the upper reaches	May-October

Figure 5 shows the main locations of water used by herders and their animals in the Project Area.

8.0 Water Supply Issues in the Study Area

The main issues affecting water supply infrastructure in the study area are:

- Inadequate and/or aging water supply infrastructure
- Lack of resources to maintain and repair water supply infrastructure
- Lack of sewage treatment facilities
- Low (or no) charge for water use
- Water quality problems
- Lack of water meters

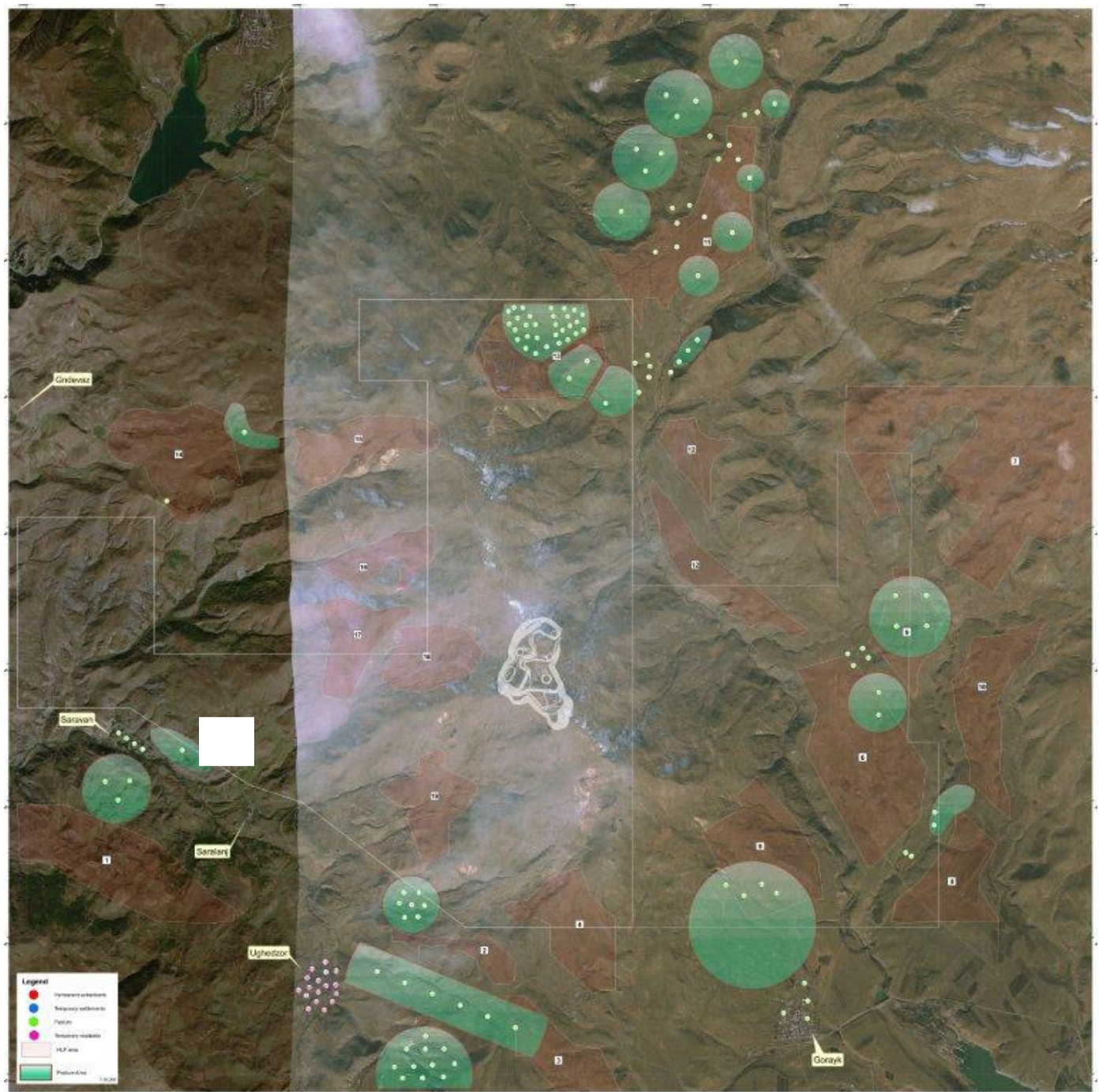


Figure 5 – Water supply for herders from surrounding communities and temporary inhabitants of other localities