Jewish National Fund

מכון הערבה
Arava Institute
معهد وادي عربة

Restoration of the Besor-Hebron-Be'er Sheva Stream

A Transboundary Project Supported by the JNF Parsons Water Fund

Arava Institute for Environmental Studies
Principle Investigators: Dr. Clive Lipchin, Eng. Shira Kronich
Report by Shae Selix and Clive Lipchin
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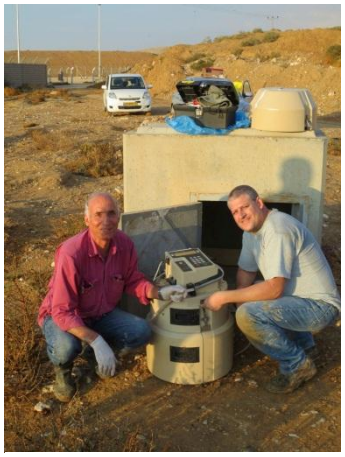
JNF CEO, Russell Robinson, explaining Blueprint: Negev to a group of Arizona water managers on Pipes Bridge, Be'er Sheva stream.

Fulfilling its dual mission of developing Israel and improving the environment, the JNF has worked tirelessly to restore the Besor-Hebron-Be'er Sheva Stream, a section of which runs through the center of Be'er Sheva. As a part of JNF's Blueprint Negev, the Be'er Sheva river parkway seeks to accomplish a service for a much larger region in the Negev that also relies on a safe and clean Besor-Hebron-Beer Sheva Stream. This project has the added feature of incorporating transboundary environmental protection, bringing together parties from both Israel and the Palestinian Authority. To fulfill these goals, the JNF Parsons Water Fund has joined with the Arava Institute for Environmental Studies, which has a long history in Israel of seeking practical solutions to environmental problems with diverse voices and a regional focus. While the JNF has made strides in community outreach and infrastructure projects within Be'er Sheva, the Arava Center for Transboundary Water Management (CTWM) is researching the broader causes of pollution in the stream and using state-of-the-art hydrological monitors and Geographic Information Systems (GIS) and computer mapping software to evaluate water quantity and quality in the stream. This baseline is necessary before any restoration efforts can begin.

This document gives an update on the progress we have made. To date, we have almost completed our historical data collection of previous water quantity and quality data, socio-economic information on water-use, population, and poverty in affected communities, and regional geographic maps. We are storing this information within a computer mapping database that will be used to build a website to freely display this information for the public. For the monitoring, we have selected three sites and completed one installation. At CTWM, the project currently involves three Israelis, one Palestinian, and two Americans.



Dr. Lipchin and Yehoshua Ratzon from BGU installing our first monitor

Background

This research fits within JNF's wider development plan, Blueprint: Negev. The city of Be'er Sheva, the capital of the Negev, is a central focus of Blueprint: Negev. Any effort to bring more Israeli citizens to the region must focus on its largest city. Ten years into the project, the JNF has made significant headway in improving the infrastructure and physical outlook of the city, which has had a large impact on Be'er Sheva's image to both the region and the entire country. The centerpiece has been the beautification of the Be'er Sheva river parkway. Looking to San Antonio as an example, the JNF has sought to make the park a hub for the city's residential and commercial development. Trash and debris have been removed, landscaping is in progress, and soon recycled water will flow within the stream year around.

Untreated sewage flowing in the stream at Umm Batin, a Bedouin village northeast of Be'er Sheva

However, the Be'er Sheva stream does not operate in isolation. Water already does flow through the city permanently because upstream, untreated wastewater continuously pours into the section of the stream originating in the West Bank near Hebron. This sewage flows through several Palestinian communities with limited wastewater infrastructure as well as active stone cutting and olive oil industries. It crosses into Israel at the Green Line crossing north of Meitar, where it is treated. This treatment however, is minimal, as Israel cannot use this water which legally belongs to the Palestinian Authority. By the time the water enters Be'er Sheva, it fails to match the beauty of the park that has been created around it.

Treating this wastewater effectively and efficiently is the impetus for this project, which takes the local conditions of the stream and expands the view to tackle the issue at the regional level, in order to find a more permanent solution for the stream's restoration. Our research looks at the entire Hebron-Besor-Be'er Sheva watershed, meaning the region where any flowing water ultimately ends up in the stream and, eventually, the Mediterranean Sea via Gaza. This region is roughly triangular, defined by Hebron in the northeast, Sde Boqer in the south, and Gaza in the west. While water freely flows across hostile political borders, the management of this transboundary watershed remains fractured. The diverse group of settlements and industry along the stream all contribute to its pollution, yet they blame each other and rarely coordinate, simply making the situation worse for all.

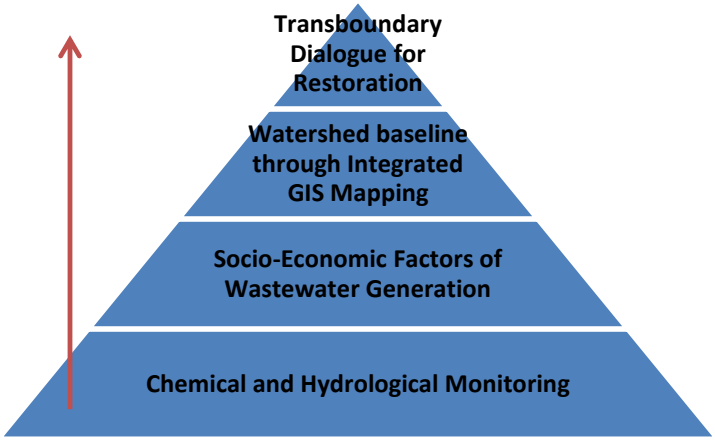
Hebron-Besor-Beer Sheva Watershed in Israel and the PA

Both the JNF Parsons Water Fund and the Arava

Institute have a commitment to transboundary solutions to regional environmental problems. This is why at CTWM we are approaching this project from a watershed and systems-based view. The Jewish communities in the Negev cannot be separated from the Bedouin and Palestinian communities upstream. The current body of research in the area often ignores this and only looks at water quality from one side of the Green Line or the other, or may only look at physical factors while ignoring the underlying political tensions which have led to the current situation. We seek to understand the entire area that may be contributing to pollution in Be'er Sheva from both hydrological and socio-economic factors. This will give us the knowledgeable authority to begin a transboundary dialogue for sustainable restoration of the stream, for the benefit of not only Be'er Sheva and the planned Be'er Sheva River Park, but also the entire region.

Our Work

Our research team is particularly well situated to handle this project. Dr. Clive Lipchin has worked as a water management expert in Israel for over ten years and acted as a senior editor for two books on regional transboundary water management in the Middle East. Shira Kronich is a native of the Negev region and has degrees in both environmental engineering and development policy. Both currently live in and around Be'er Sheva. As respective director and associate director of CTWM, they have recruited a diverse group of students and interns, only possible at the Arava Institute, to work on the project and bring together all of its complex elements.



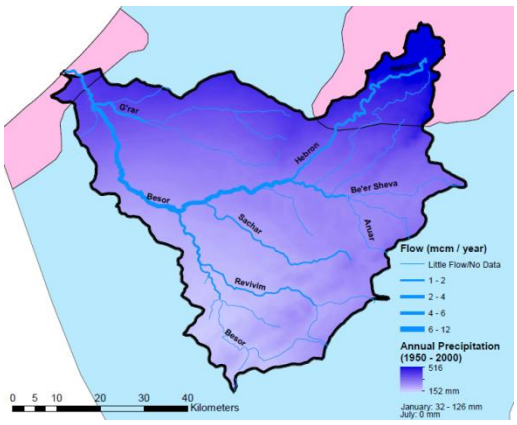
Eran Meiri, an Israeli student, has the task of acquiring all the previous water quality monitoring within the watershed to form an idea of how the stream has looked in the past and how it might be changing. As a graduate of the Geography department at Hebrew University, Eran uses his background to contact Israeli governmental agencies and universities to request the appropriate data and identify patterns in the measurements. Between BGU, the Hydrological Service, the Nature and Parks Authority, and the Soil Erosion Research Station, he has found data from 37 stations dating back more than ten years. The monitoring stations each show what chemicals and how much water was flowing in the stream in one location over time. Eran will be using his research as a culminating project for an M.Sc. in Hydrology at BGU's campus at Sde Boqer.

Installation process for a monitoring station

In addition to these data, we are in the process of implementing are own monitoring program. As is typical in JNF projects, the Parsons contribution for the monitoring was matched by other community organizations, the local drainage authority and Ben Gurion University, to establish a joint effort to determine the water quality in the stream around Be'er Sheva. When completed, three advanced hydrological monitoring stations will collect data along the Hebron-Be'er Sheva stream. These stations will operate continuously, providing water quantiy and quality data in real time. There are no stations like these operating anywhere else in Israel. The first station has already been installed, just west of Be'er Sheva and outside of the urban area. The other two stations will be placed on the Hebron and Be'er Sheva streams before they meet east of the city. The Be'er Sheva stream is considered much less polluted than the Hebron stream. Our hypothesis is that the stream will show less pollution east of the city than west, as the cleaner waters of the Be'er Sheva stream will dillute the more polluted Hebron stream.

In addition to our analysis of the physical aspects of the watershed, we are also collecting socio-economic information for communities in the entire watershed, both Israeli and Palestinian communities. This semester, the Institute recruited a Palestinian student from East Jerusalem, Leila Hashweh. Leila will also be using this project for an M.Sc. in Hydrology and Water Resources at BGU starting next semester, although she is focusing on the human factors that lead to wastewater generation in the West Bank. Leila is also the receipent of the JNF Parsons Water Fund scholarship. She has a deep passion for the issue and can speak four languages fluently. Her data collection has shown the need for more wastewater treatment in the area, especially in light of another finding that wastewater generation may increase as a community becomes more developed in the West Bank. A contrasting picture can be drawn from the data we have collected for the Israeli communities. Brian Hoefgen, an American intern at CTWM who speaks Hebrew, has traveled to the Central Bureau of Statistics in Jerusalem to acquire corresponding data to compare wastewater treatment and generation, population dynamics, and metrics of poverty between the two sides of the Green Line.

To establish a baseline of pollution in the watershed, we are building a geographic database of all the above factors to integrate them into a single map. Shae Selix, an American, was brought on as a CTWM intern in September of last year to work on the Geographic Information Systems (GIS) element of the project. We are using ArcGIS Editor 10.0, which is state-of-the-art software and the industry standard. The program allows the input of layers of maps containing

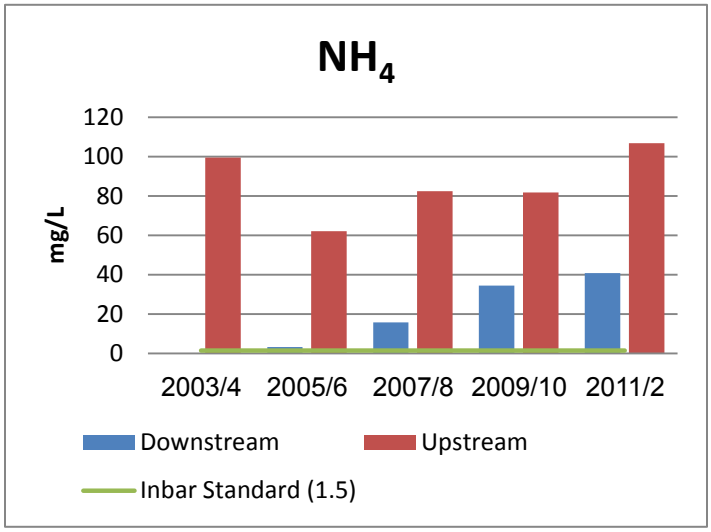


GIS map of hydrological factors in the watershed

different data to interact with one another such that patterns can be determined on a spatial basis. Thus far, we have generated digital maps for hydrological factors such as water flow and precipitation, human factors such as settlements and wastewater treatment facilities, and geographic factors such as landuse and elevation. The benefit of putting all of these maps into a single digital database is that we can juxtapose maps of different types in order to generate patterns of physical and human interaction. For example, we can easily calculate and display how many of these factors change over time, or show how certain socio-economic characteristics may line up geographically with certain types of water pollution. Ultimately, we will use the tools of the software to build a website, as easy to use as mapquest, to distribute the information to the public. The website will be the basis for the broader and long-term effort of regional watershed restoration.

Results

This project is currently ongoing, and the research has not yet reached the stage where any conclusive results about the state of the watershed or specific recommendations about its restoration can be reported. That being said, we have made significant progress in the data gathering phase of the project. With previous water monitoring, socio-economic data, and GIS layers we can observe some significant patterns that reveal new information about the watershed.



Ammonium levels downstream, at Gesher Havalim, and upstream, at Shima checkpoint. Note that the upstream levels have always been high, while in 2003/4, downstream was within the accepted standard, but has since exceeded and only increased

Interpreting the data from monitoring stations over the past ten years confirms what is already visually clear, which is that the watershed is extremely polluted. Compared to the Israeli Inbar standards for effluent reuse and river health, pollutants in the stream exceed safe levels by several orders of magnitude. This goes for both the upstream (the West Bank) and downstream (Israel) environments. However, it is clear the downstream areas, west of Be'er Sheva, suffer from much less pollution than the upstream areas, northeast of Be'er Sheva and in the West Bank. For some key indicators of stream health, both overall levels and the difference between upstream and downstream levels have increased.

By mapping various layers of the watershed on ArcGIS, one can see that the watershed rests on a particularly heterogeneous area of Israel, in both natural and human terms. The region of the watershed represents a shift from humid to arid zones, which is evident by the

vastly different average temperatures and levels of rain the area experiences. When mapping social factors, one sees how the watershed houses large urban areas in Be'er Sheva, Hebron, and Gaza, in addition to hundreds of comparatively small kibbutzim, moshavim, Palestinian villages and Bedouin settlements. This heterogeneity makes characterizing the pollution dynamics in the watershed a complex task that requires the gathering of both physical and socioeconomic data.

Relevant statistics analysed for landuse within the watershed include the fact that more than 75% of landuse in the watershed is agricultural and amongst the other 25%, almost half is devoted to industry. Both of these could explain much of the pollution in the watershed in terms of agricultural runoff and industrial effluent. The landuse data therefore are indicators of sewage generation that needs to be further characterized at a community level. This will require extensive stakeholder engagement in order to best identify, quantify and characterize the diffuse pollution sources. The stakeholder analysis is now underway and will be extended in the second year of the project.

Going Further

Our most immediate task in the project will be to fill in the gaps in our historical data collection, so we can get a complete picture of the past ten years in the watershed. Once this is complete, we will add all these data to the mapping software, so as to identify areas with noticably increasing pollution concentration, population, or stream flow. Our final mapping task is to acquire more information on wastewater treatment facilities, urban wastewater generation and treatment, and drinking water wells. Each of these will explain key linkages between population dynamics in the watershed and the physical and chemical pollution. We are also completing the installation of three permanent in-stream monitoring stations, two east of Be'er Sheva and one west of Be'er Sheva. These state of the art monitoring stations will provide continous data on the hydological health of the stream and will form the basis for data collection for the stream restoration strategy.

The Be'er Sheva River Parkway as it is today with untreated sewage flowing in the stream.

Finally, we are beginning work on building an interactive website to display this information for anyone to access. The website will allow decision-makers and citizens to see where and how their water may be polluted, researchers to examine the baseline pollution and level changes over time, and industry or government groups to see information on pollution and

wastewater treatment across political borders. The website will be used to gather support for the importance of a watershed-based stream restoration strategy, and will also be used as an educational tool for school children and university students in both Israel and the Palestinian Authority