

A river back from the dead

VAL ROSS chronicles the Canadian-led rescue effort that has devoted five years — and \$580-million — to reviving Wadi Hanifah, the fabled river that runs through the capital of Saudi Arabia. As this graphically enhanced map shows so clearly, an array of heavy equipment and thousands of labourers have cleaned up and, in some cases, reshaped the 120-kilometre waterway. Long-lost plants and animals have been reintroduced, and the deluge of sewage and toxic waste that turned the wadi into ‘a toilet’ has been slowed to a trickle. As a result, the residents of Riyadh are rediscovering the natural wonder that first gave their city life

You can give yourself virtual vertigo by swooping around on Google Earth, the 3-D computer program that offers aerial views of almost every place on the planet. Especially if you zoom from, say, Toronto to the barren desert of Saudi Arabia and then zero in on the tangle of housing and highways that is Riyadh. Just to the left of the biggest interchange, you'll see an intriguing dark line. It's a river, Wadi Hanifah, which rises to the northwest of Riyadh and flows for 120 kilometres, passing through the city before disappearing in the desert sand.

This is the water source that made human settlement possible there 1,000 years ago. But now the oil-fuelled Saudi economy has made Riyadh the world's fastest-growing capital city. In 1950, it had fewer than 30,000 residents; today, the metropolitan area's population is about 5.5 million, and is expected to double by 2020.

In the course of this frenzied growth, Riyadh has embraced the automobile and the high-rise — and turned their life-giving waterway in a dumpsite for everything from construction debris, chemical waste and old tires to sewage and animal carcasses.

It's hard to plan wisely for any city metastasizing at such a feverish rate, but Riyadh had the bad luck to fall into the hands of Western planners who preferred highways to sidewalks. The city's name derives from *rawdah*, the Arabic word for garden, but most of the few remaining green spaces are found within the walled neighbourhoods inhabited by the rich.

However, attitudes change, and six years ago, the ArRiyadh Development Authority (ADA), which is responsible for local planning, drew a line in the sand, and the Saudi princes who call the shots summoned experts from Canada to help reclaim their river.

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The architecture firm Moriyma & Teshima is better known for designing remarkable museums and site-sensitive buildings, but it also has a planning arm with an international reputation for environmental design. Led by George Stockton and Drew Wensley, its president and executive vice-president, Moriyma & Teshima Planners Ltd. has been working with Buro Happold, an British engineering firm, to perform a \$580-million (U.S.) environmental miracle — arguably the biggest water-reclamation project in human history.

The work is at least two years from completion, but already Google Earth reveals a stunning dark green area along the *wadi* in the heart of Riyadh and, in the south, a shimmering expanse of lake.

The bigger miracles are visible on the ground. Long-absent kingfishers, falcons and herons have returned to make a permanent home, and not far from the river there are massive tanks of tilapia, a species that is native to the Middle East and now often on offer at Canadian fish counters. Soon, when the water is clean enough, the tilapia will be freed from the tanks, and Mr. Stockton and Mr. Wensley hope to taste the results for themselves.

“What a barbecue that would be,” Mr. Stockton says with a laugh. “After vigorous testing,” Mr. Wensley cautions.

At 62, Mr. Stockton has watched a lot of purified water go under the bridge. He left his native Carolina in 1969, during the Vietnam War, to join Moriyma & Teshima — attracted, he says, “by the ethical point of view shared by everyone.”

Many landscape architects redesign backyards, but he has worked on entire water systems, such as the South Saskatchewan River, whose 100-year plan is considered a reclamation benchmark, and the Niagara River corridor, now a stately strip of parkland dotted with gardens, wineries and historic towns.

Most dramatic of all was the transformation of Lake Ramsey, located at the epicentre of the mining Mordor known as Sudbury, Ont. Thanks to cleaner smelting and refining technologies and to Inco Ltd.'s Superstack (which disperses emissions more widely), the Sudbury skies brightened, allowing Moriyma & Teshima to concentrate on cleansing the water and bringing back aquatic life. In 1992, Sudbury received a United Nations award for the lake, where tourists now fish for walleye and bass.

The *wadi* project sprang from the firm's award-winning architectural work on Saudi Arabia's national museum, a curving edifice of golden limestone surrounded by 83 acres of pools, palms and walkways that opened in 1999. Invited to discuss major changes for the city as a whole, Mr. Stockton outlined the benefits of cleaning up the river, and was given the green light. No competition, no fuss.

He and Mr. Wensley, 36, started work in July 2001, putting in long hours amid aerial photos and maps of the *wadi* that line their Toronto office. Only a month after the Sept. 11, 2001, terrorist attacks, they flew to Riyadh to take stock. “On that first trip together, Drew and I felt like medieval cathedral builders,” Mr. Stockton recalls. “We saw that it would be a huge job and we would never live to see the end of the work, but we knew it would be incredible.”

They spent a week driving the length of the *wadi*, mostly in 50-degree temperatures. “You drink lots of warm tea, and stay in the air-conditioned car as long as you possibly can,” Mr. Wensley says.

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Riyadh receives only 100 millimetres (about four inches) of rain a year, but it comes all at once and, as they drove, the Canadians saw evidence of destructive flash floods. (Last March, a sudden rain sent a metre-high wave through the wadi at 60 kilometres an hour, knocking over construction



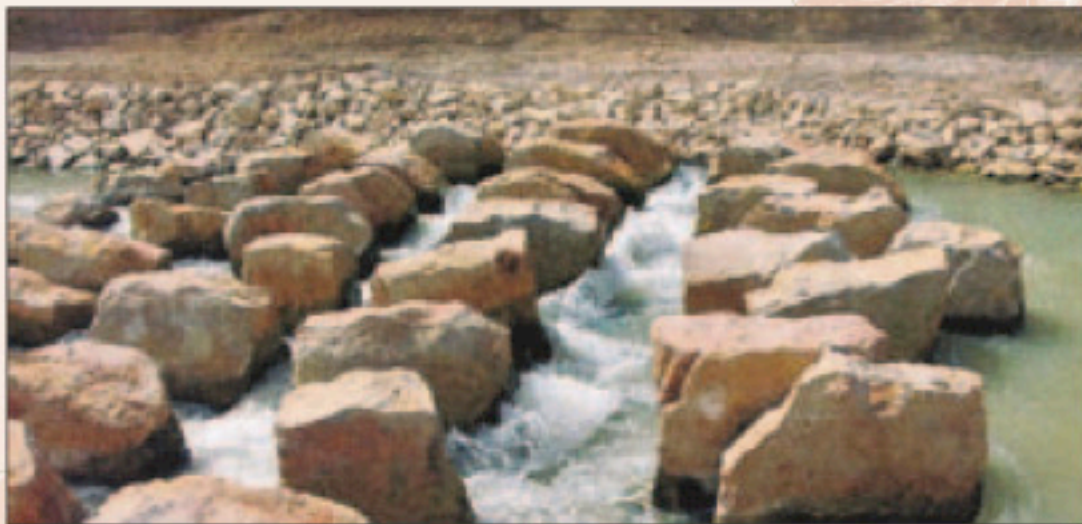
Before the reclamation project began, Wadi Hanifah was often treated as a garbage dump.



1 The abandoned village of Addiriyyah will become a formal archeological preserve.



2 Native plants cultivated in greenhouses will be replanted along the wadi's length.



3 Artificial weirs help aerate urban runoff before it undergoes filtration.



4 Construction crews install limestone facing in a massive filtration reservoir in Riyadh.



5 The Al-Hair Dam controls water levels in a series of lakes at the wadi's southern end.



6 Reclaimed wetlands and massive irrigation projects dot the southern end of the wadi.

WADI HANIFAH

The 120-km-long seasonal river originates in the Tuwaiq highlands north of Riyadh and drains a catchment area of 4,500 square kilometres.

The wadi flows for several weeks a year in the rainy season, sometimes bursting its banks when flash floods hit. Most of the year, however, it is dry.

NORTHERN HIGHLANDS

The wadi bed north of Riyadh, where seasonal rains flow relatively unpolluted, has been a rich agricultural area for centuries and boasts some of the region's most valuable land.

It was from this power base that the Al-Saud family rose to prominence in the late 18th century, eventually becoming the ruling dynasty when the Kingdom of Saudi Arabia was formed in 1932.

GREENHOUSE COMPLEX

Plants native to Wadi Hanifah are being raised in a greenhouse nursery complex in the Diplomatic Quarter. Regrowth will be introduced in ‘cells’ — small sections of replanting that will seed the area around them, eventually filling in the wadi bed with greenery.

Some of these plants — particularly mosses and water grasses — are key to naturally filtering Riyadh's polluted runoff. Others are expected to lure native animals, such as grey herons and desert foxes, back to the area.

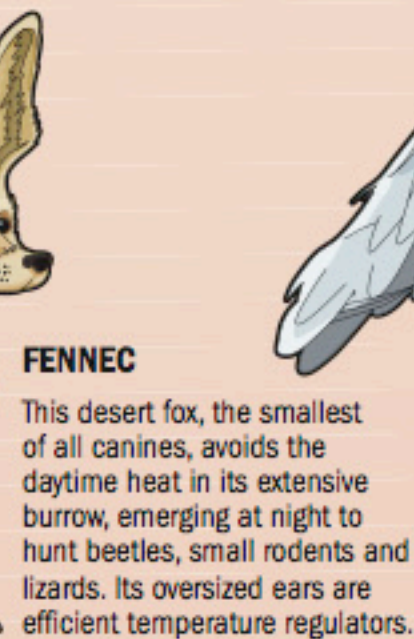
TANNERY

One of several polluters that have been reprimanded or shut down for discharging untreated effluent — laced with toxins such as the carcinogen trivalent chromium — directly into the wadi.



A DESERT HABITAT FLOURISHES AGAIN

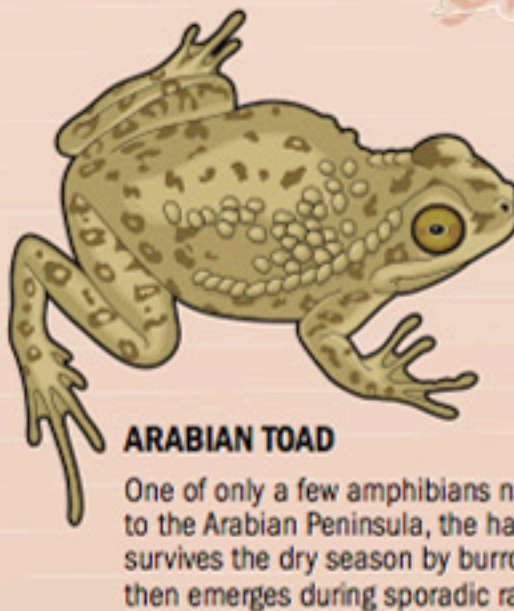
Wadi Hanifah is the main waterway in Saudi Arabia's arid interior and has always been a unique environmental preserve and a stopover for migratory birds. Pollution and urban sprawl have taken a severe toll on local wildlife but, with the reclamation project, some species that were nearly lost are returning to the rejuvenated watercourse.



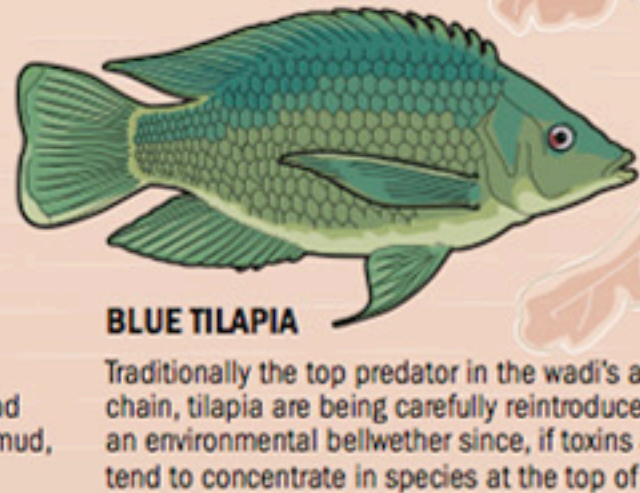
FENNEC
This desert fox, the smallest of all canines, avoids the daytime heat in its extensive burrow, emerging at night to hunt beetles, small rodents and lizards. Its oversized ears are efficient temperature regulators.



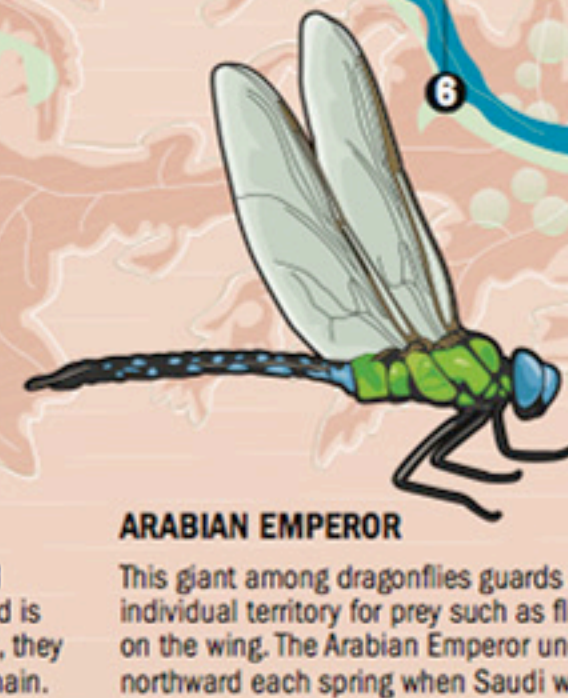
GREY HERON
This species breeds in colonies in trees close to wetlands or in reed beds. It feeds in shallow water, slowly stalking fish or frogs or waiting motionless for hours before spearing its prey with its long, sharp bill.



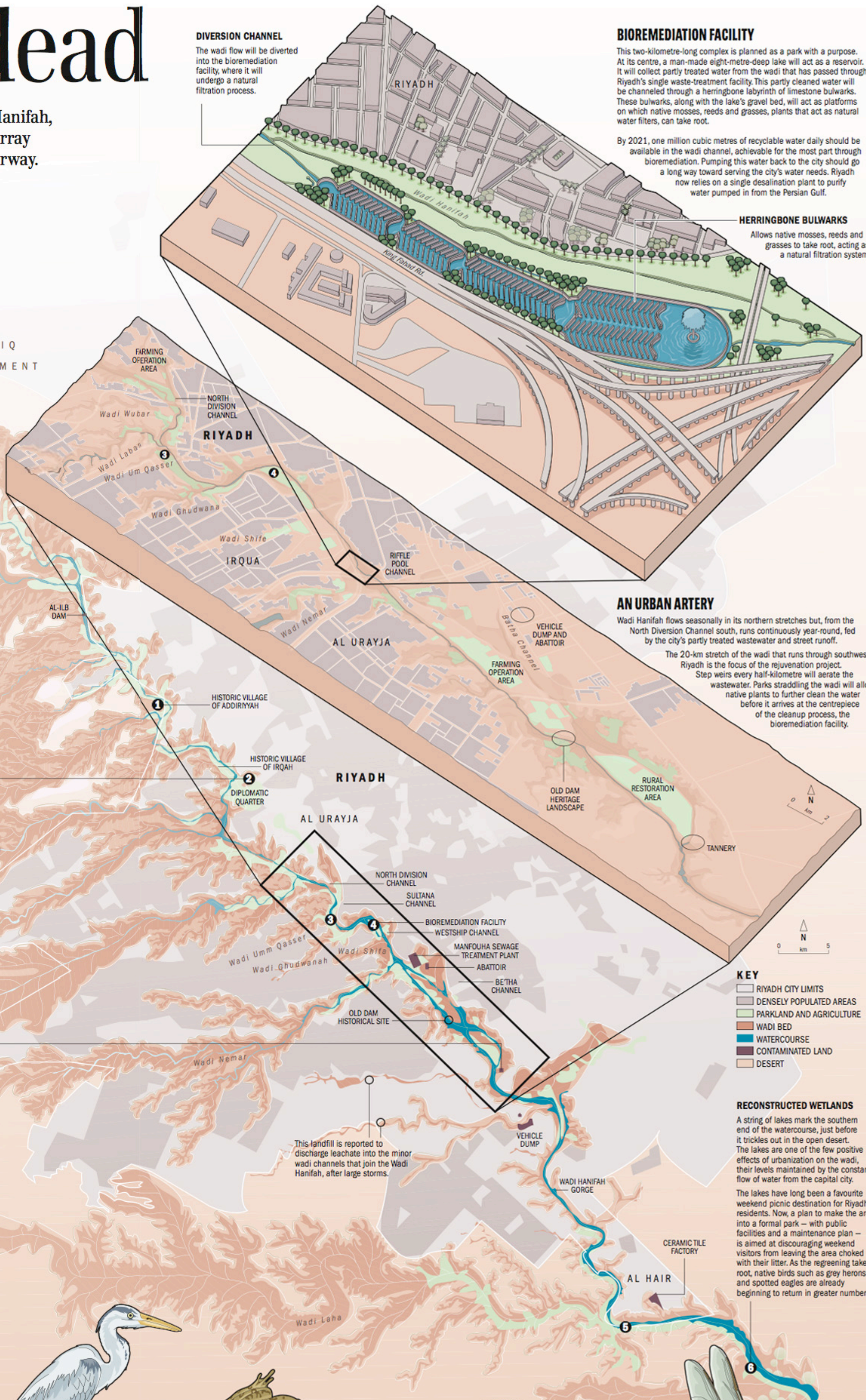
ARABIAN TOAD
One of only a few amphibians native to the Arabian Peninsula, the hardy Arabian toad survives the dry season by burrowing into the mud, then emerges during sporadic rains to breed.



BLUE TILAPIA
Traditionally the top predator in the wadi's aquatic food chain, tilapia are being carefully reintroduced. The breed is an environmental bellwether since, if toxins are present, they tend to concentrate in species at the top of the food chain.



ARABIAN EMPEROR
This giant among dragonflies guards and constantly patrols its individual territory for prey such as flies, catching and eating them on the wing. The Arabian Emperor undertakes a long migration northward each spring when Saudi watercourses begin to dry up.



DIVERSION CHANNEL

The wadi flow will be diverted into the bioremediation facility, where it will undergo a natural filtration process.

BIOREMEDIATION FACILITY

This two-kilometre-long complex is planned as a park with a purpose. At its centre, a man-made eight-metre-deep lake will act as a reservoir. It will collect partly treated water from the wadi that has passed through Riyadh's single waste-treatment facility. This partly cleaned water will be channelled through a herringbone labyrinth of limestone bulwarks. These bulwarks, along with the lake's gravel bed, will act as platforms on which native mosses, reeds and grasses, plants that act as natural water filters, can take root.

By 2021, one million cubic metres of recyclable water daily should be available in the wadi channel, achievable for the most part through bioremediation. Pumping this water back to the city should go a long way toward serving the city's water needs. Riyadh now relies on a single desalination plant to purify water pumped in from the Persian Gulf.

HERRINGBONE BULWARKS

Allows native mosses, reeds and grasses to take root, acting as a natural filtration system.

AN URBAN ARTERY

Wadi Hanifah flows seasonally in its northern stretches but, from the North Division Channel south, runs continuously year-round, fed by the city's partly treated wastewater and street runoff.

The 20-km stretch of the wadi that runs through southwest Riyadh is the focus of the rejuvenation project. Step weirs every half-kilometre will aerate the wastewater. Parks straddling the wadi will allow native plants to further clean the water before it arrives at the centrepiece of the cleanup process, the bioremediation facility.

KEY
RIYADH CITY LIMITS
DENSELY POPULATED AREAS
PARKLAND AND AGRICULTURE
WADI BED
WATERCOURSE
CONTAMINATED LAND
DESERT

RECONSTRUCTED WETLANDS

A string of lakes mark the southern end of the watercourse, just before it trickles out in the open desert. The lakes are one of the few positive effects of urbanization on the wadi, their levels maintained by the constant flow of water from the capital city.

The lakes have long been a favourite weekend picnic destination for Riyadh residents. Now a plan to make the area into a formal park — with public facilities and a maintenance plan — is aimed at discouraging weekend visitors from leaving the area choked with their litter. As the regreening takes root, native birds such as grey herons and spotted eagles are already beginning to return in greater numbers.

equipment and leaving the ground so mucky that work was delayed for a week.) They also noted that not only was Riyadh a barren-looking place, the *wadi* was dirtiest where it ran through the capital. “It was a toilet — no, worse,” Mr. Stockton says. “A place people did not want to ever go.” Mr. Wensley adds, “There was so much garbage in the stream, birds were walking across it.”

The Canadians worked on their master plan seven days a week for 17 weeks. They had conducted an inventory of habitats and plants, and decided that the first challenge was to restore the trees, grasses and shrubs clinging to life along the *wadi*. They proposed establishing a series of plant nurseries. “We wanted to capture the seeds from the same gene pool that had always existed,” Mr. Stockton says.

They divided the project into five zones, and fought the flash flooding by widening the *wadi*, reducing the slope of its banks and building catchment areas to contain the extra water. They even had to determine the size of the rocks needed to line the channels: about 200 mm in diameter — big enough not to be swept away and small enough to provide habitat for small organisms.

To improve water quality, they started monitoring farm and industrial dumping, and looking for leaky septic tanks. Within Riyadh, they had to remove vast quantities of construction rubble from the stream. The *wadi* receives all of the city's wastewater — a million cubic metres a day — and in time it will have to be able to cleanse that much, so the water can be reused by the city. (Riyadh's drinking water comes from desalination plants fed by the sea, but the *wadi* provides everything else.)

Once the river has left the city, most of the work consists of making its course more natural and improving shoreline and water quality of its southern “lakes district,” for the sake of fish, birds, and mammals such as foxes and desert cats. With the help of Google Earth, you can see saw-tooth structures on one stretch of water that mark the concrete “bioremediation cells” in which harmful bacteria are killed off and unwanted chemicals removed. The technology is managed and monitored from Canada.

For two years, Joy Kennedy, a water-quality specialist with Nelson Environmental, has been tracking the *wadi*'s water chemistry from her office in Winnipeg. “There is still lots of grey water,” she says. “But some things have made a huge difference — such as closing a tannery.”

Last year, while studying Nelson's data, Mr. Stockton and Mr. Wensley noticed a spike in toxins. Aerial photographs revealed a plume of white sludge coming from a mammoth tanning factory. When further testing revealed the sludge to be carcinogenic, the problem was dealt with quickly, Saudi-style: “We had the ADA make them stop,” Mr. Wensley says. (Since the pyramids were built, architects have found that working with absolute rulers has its advantages. “It's a top-down situation,” Mr. Wensley notes. “If we were trying this in Toronto, we'd still be arguing about the master plan.”)

A similar bolt from above is about to strike a Riyadh abattoir, which has been dumping blood and guts into the river. “It may cost somebody his job,” Mr. Stockton says, “but it's the right thing to do.”

The Canadians are not above rolling up their sleeves from time to time. They have been known to pick up shovels on occasion and work alongside some of the thousands of labourers employed on the project. “We want them to know that we recognize their efforts,” Mr. Wensley says.

This kind of rigour helped the reclamation project to win the Washington-based Waterfront Center's top honour for planning in 2003. “The jury was stunned at the project's environmental sensitivity,” says Ann Breen, co-director of the centre, adding that the project “could become a model for many other countries.”

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What do the Saudi people think? Because the public has so few avenues for free expression, it's hard to say. But unlike Western-led developments that have sparked dissent in Afghanistan and Iraq, this project springs from a local initiative. “I believe the design will be very good when it is complete,” says Abdullah Alkaff, senior electrical engineer with the ADA. “If they can reduce the pollution, if things go smoothly, they will give Riyadh a new location, people will go there and get used to it. I am sure people will like it.”

There are already signs that he is right. Riyadh is reorienting itself to its waterway — the value of real estate near the *wadi* has gone up tenfold, and Saudi scientists have gone canoeing on the river. Admittedly, they were working, but families may do so for pleasure very soon.

“We're planning to be finished by 2008, *Inshallah*,” Mr. Stockton says, using the Arabic term for “God willing.”

He calls it “a wonderful expression,” but Mr. Wensley quietly adds that he has been told that it also can mean “not a chance.”

Val Ross is a senior writer for *The Globe and Mail's* Review section.

SOURCES: MORIYAMA & TESHIMA PLANNERS LTD.; MOHAMMAD AL-SAAD AND YILDIRIM YAVUZ; WADI HANIFAH DEVELOPMENT PLAN (2004); ARRIYADH DEVELOPMENT AUTHORITY

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