

A large, light-colored rock sign stands in the foreground of a golf course. The sign features the name "RIO VERDE" in a stylized, brown, serif font. The word "RIO" is positioned above "VERDE", and a green, leafy branch graphic is integrated between them. Below the name, the slogan "Golf...and a whole lot more." is written in a simple, black, sans-serif font. The sign is surrounded by desert landscaping, including small cacti and succulents. In the background, a lush green golf course stretches out, with a large, mature tree on the right. Beyond the course, a rugged, rocky landscape leads up to a range of blue mountains under a clear sky.

**RIO
VERDE**

Golf...and a whole lot more.

WASTE WATER TREATMENT AND USE OF RECLAIMED WATER

ELIMINATE SALINITY IN THE WASTEWATER STREAM

by : Hailey Baker
Jessie Davidson
Tammie Garrett
Channing Schoneberger

PROJECT PARAMETERS

- Community partnership with the Rio Verde Community
- The Challenge Area: Waste Water Treatment and the Use of Reclaimed Water
- Our Objective: To reduce the salinity levels entering into the waster water stream
- Questions
 - What is the salt being used for?
 - How is it getting into the waste stream?
 - How do we stop it?

PROJECT OVERVIEW

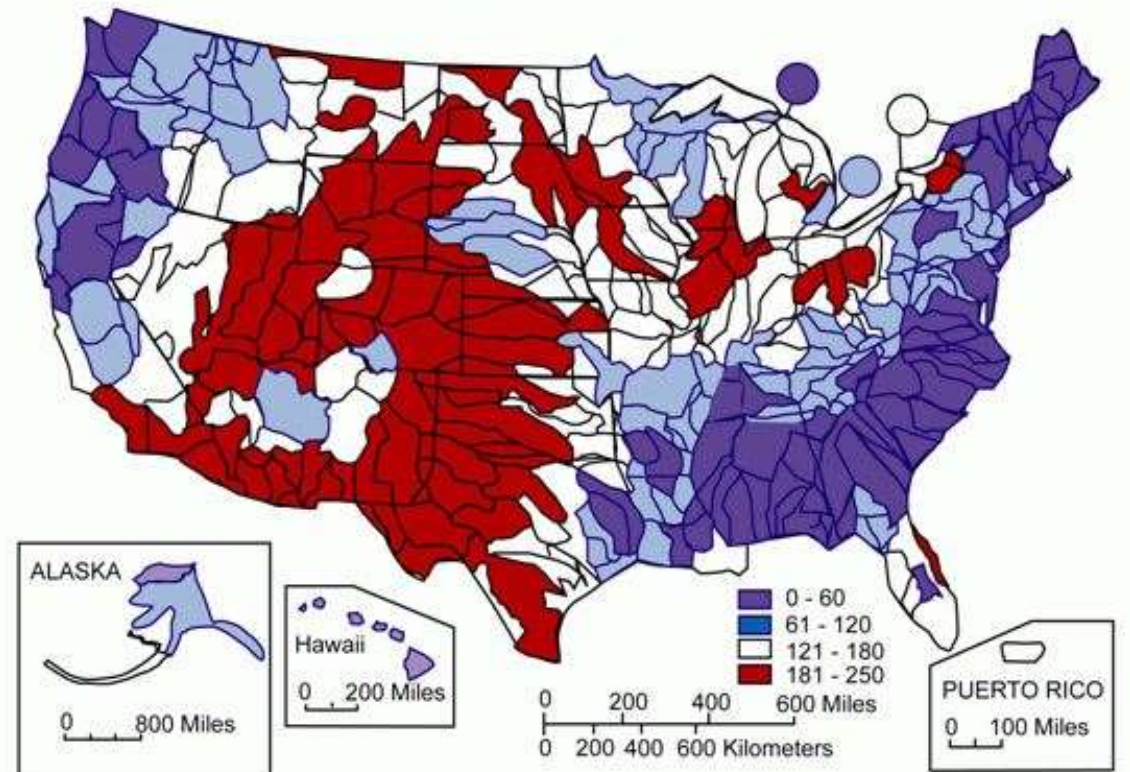
WHAT IS THE SALT BE USE FOR?

HARD WATER

- Water hardness is measured by the amount of dissolved calcium and magnesium.

Classification	mg/l or ppm	grains/gal
Soft	0 – 17.1	0 - 1
Slightly Hard	17.1 - 60	1 - 3.5
Moderately Hard	60 - 120	3.5 - 7.0
Hard	120 – 180	7.0 10.5
Very Hard	180 & Over	10.5 & Over

CONCENTRATION OF HARDNESS AS CALCIUM CARBONATE, IN MILLIGRAMS PER LITER.



Mean hardness as calcium carbonate at NASQAN water-monitoring sites during 1975 water year.

Colors represent site data representing streamflow from the hydrologic-unit rea.

(Map edited by USEPA, 2005)

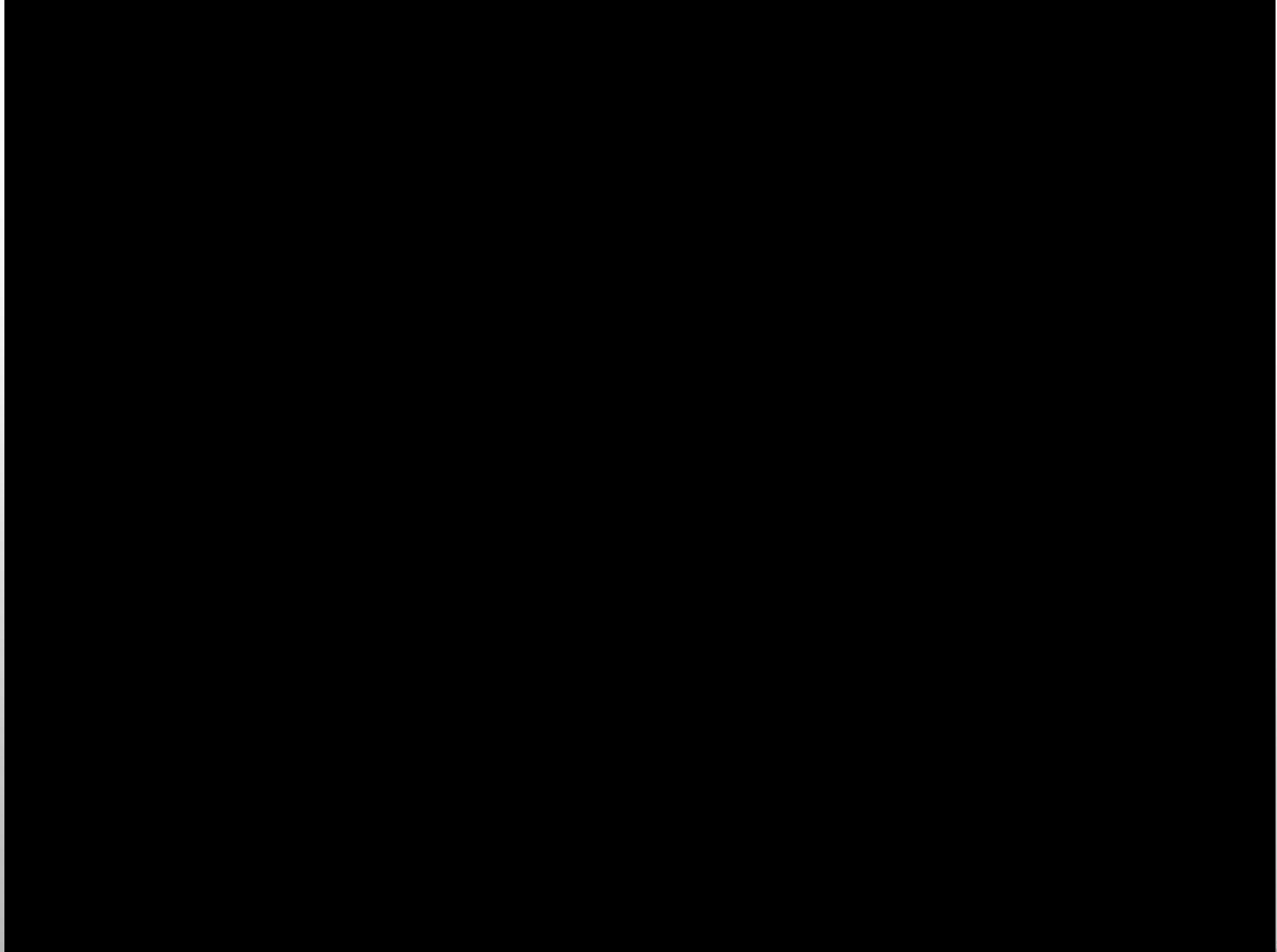
IS HARD WATER A PROBLEM? MAYBE NOT

- Natural hard water :
 - Contains Calcium, Magnesium, and Iron
 - Helps to fight and prevent certain heart and cardiovascular diseases
 - Part of a healthy diet

IS HARD WATER A PROBLEM? MAYBE NOT OR, MAYBE IT IS!

- Pro's of Natural Hard Water :
 - Contains Calcium, Magnesium, and Iron
 - Helps to fight and prevent certain heart and cardiovascular diseases
 - Part of a healthy diet
- Con's of Natural Hard Water:
 - Correlation with eczema
 - Dry sticky feeling left on the skin and dull hair (scum build up)
 - Taste
 - Reduces the efficiency and life expectancy of household appliances and clothes
- Softened Water
 - Greatly reduced or no scum build up
 - Mostly void of Calcium, Magnesium, and Iron
 - Maintains the efficiency and life expectancy of household appliances and clothes

HOW DOES THE WATER SOFTENER WORK?



HOW DOES THE WATER SOFTENER WORK?

TexasWaterSoftener.com



SALTLESS WATER SOFTENER



HOW HAS THE PROJECT PROGRESSED?



Meeting with
Sal and
Team Heads
at Rio Verde
Community

Meeting with
Mike Kleminski,
owner of Rio
Verde Utilities
(in charge of
both water
input and
water output)

Research (data
collected from
Mike, Internet
research,
Audubon
Society
contact)

Today!

RESULTS AND FINDINGS

- THE PORTABLE EXCHANGE WATER SOFTENING SYSTEM DOES MORE HARM THAN GOOD, AND MOVES THE PROBLEM OF WASTEWATER ELSEWHERE (DOES NOT TRULY TAKE CARE OF THE PROBLEM)
- SALT-LESS WATER SOFTENING IS A MORE ENVIRONMENTALLY-FRIENDLY OPTION
- POLICY CHANGE IN THE CURRENT SUSTAINABILITY MARKERS: TRACK SALINITY IN WATER AS A WAY TO TRACK IMPACT OF THE CHOSEN WATER SOFTENER



PORTABLE EXCHANGE VS SALT-LESS SYSTEMS



PORTABLE EXCHANGE

- \$35 - \$48 PER MONTH; ACTUAL UNIT IS AROUND \$600 (CONTROLLED BY THE COMPANY)
- PAYING FOR SERVICE; BUSINESS COMES OUT, REPLACES USED PE UNIT WITH A NEW ONE, TAKES THE USED ONE TO THEIR FACILITY AND RECHARGE IT THERE
- EXTERNALITY OF MOVING SALTY WASTEWATER OFF-SITE

SALT-LESS WATER SOFTENING

- EXAMPLE: NUVO H2O
- MORE ECO-FRIENDLY, LESS SALT IN THE WATER
- ~\$640 FOR INSTALLATION, NEW FILTER EVERY 3 – 6 MONTHS; \$80 FOR NEW FILTER
- COST COMES OUT TO BE VERY SIMILAR TO THE PE PROCESS, BUT MORE ECO-FRIENDLY (MADE OF RECYCLABLE PARTS, FILTRATION INCLUDED, CITRA CHARGE A MORE ENVIRONMENTALLY-FRIENDLY)

IGNORANCE IS NOT BLISS

- BIGGEST PROBLEM WITH POPULARIZING THE USE OF RECLAIMED WATER IS PUBLIC OPINION SURROUNDING IT
- MOST PEOPLE THINK IT IS UNSAFE, UNSANITARY/TOO HIGH OF RISKS
 - "TOILET TO TAP"
- MOST RECLAIMED WATER IS HIGHER IN QUALITY THAN IS REQUIRED FOR MOST APPLICATIONS
- RIO VERDE COMMUNITY ALREADY OPEN TO USING RECLAIMED WATER IS A GOOD START

POPULAR OPINION RULES THE DAY

- GAINING A COMMUNITY BACKING FOR A DIFFERENT SYSTEM WILL MAKE IT EASIER TO IMPLEMENT SOMETHING NEW
- EDUCATE THE COMMUNITY MEMBERS
- AGAIN ALREADY OPEN TO RECLAIMED WATER
 - SHOULDN'T BE HARD TO GAIN POPULAR SUPPORT
- SAME BENEFITS/RISKS JUST BETTER FOR THE ENVIRONMENT
- KEEP THE PUBLIC EDUCATED

A wide-angle photograph of a golf course green. The green is vibrant green and features a central orange flag on a white pole. The green is surrounded by several sand traps, some of which are partially filled with sand. The background is filled with a dense line of trees, including palm trees and cacti, under a bright, slightly hazy sky. The overall scene is peaceful and well-maintained.

IT'S ALL ABOUT THAT GREEN

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- UP-FRONT COST APPEARS TO BE MORE FOR THE HOMEOWNER, SINCE THE UNIT IS ACTUALLY INSTALLED AND OWNED BY THE RESIDENTS (RATHER THAN BEING CONTROLLED BY COMPANY)
- OVER TIME, INVESTMENT COMES OUT TO BE VERY SIMILAR
- OVERCOME THE INITIAL INVESTMENT FOR LONG-TERM SUSTAINABLE BENEFIT

Blue	75.7/139	412	508	400	397	212	432	543	178	427	3509	431	546	186	367	421	539	218	408	432	3548	7057	
White	71.9/134	382	490	379	370	197	413	511	154	389	3285	407	523	166	348	399	520	196	384	402	3345	6630	
Green	68.2/126	352	462	358	343	182	391	416	130	357	3075	343	412	146	330	273	411	174	360	297	2786	5789	
Par		4	5	4	4	3	4	5	3	4	36	4	5	3	4	4	5	3	4	4	36	72	
Handicap		14	4	12	10	16	2	6	18	8		9	3	17	11	5	1	15	13	7		Hcp	Net

HOW DO WE KEEP SCORE?

POLICY OR POLICE

+/-

Red	69.4/120	258	377	267	264	164	308	412	103	303	2456	276	408	122	252	269	404	128	277	291	2427	4883
Par		4	5	4	4	3	4	5	3	4	36	4	5	3	4	4	5	3	4	4	36	72
Handicap		12	4	10	14	16	6	2	18	8		13	3	17	9	5	1	15	7	11		

Date: _____ Score: _____ Attach: _____

How Do We Keep Score?

POLICY OR POLICE

POLICY

- INCENTIVES TO REMOVE SOFTENERS USING SALT
- POLICY THAT ONCE A SOFTENER NEEDS REPLACING, NO NEW SALT SOFTENERS
- VOLUNTARY REGISTRATION OF HOUSEHOLD SOFTENER UNITS
- INCENTIVES TO INSTALL NO-SALT SOFTENERS

POLICE

- HOME TO HOME INSPECTION AND REGISTRATION OF SALT SOFTENER SYSTEMS
- MANDATORY SCHEDULED REPLACEMENT OF SALT SYSTEMS TO NO-SALT SYSTEMS
- MONETARY INCENTIVE TO CHANGE (FINES)

How Do We Keep Score?

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CHALLENGES AND UNKNOWNNS

How many water softeners are still in the community?

Lack of usable data

From The Well Of Information

(Works Cited)

- APPLIED ECONOMICS (2003). MARICOPA ASSOCIATION OF GOVERNMENTS REGIONAL GROWING SMARTER IMPLEMENTATION: WASTEWATER TREATMENT. WEB. [HTTP://WWW.AZMAG.GOV/DOCUMENTS/PDF/CMS.RESOURCE/WASTEWATER-TREATMENT.PDF](http://www.azmag.gov/documents/pdf/cms.resource/wastewater-treatment.pdf)
- CENTRAL ARIZONA SALINITY PROJECT (2004). "SURVEY OF WATER SOFTENER PENETRATION INTO THE RESIDENTIAL MARKET IN THE PHOENIX METROPOLITAN AREA ". INSIGHTS & SOLUTIONS INC. WEB.
- CHEN, Y.-T., & CHEN, C.-C. (2014, MARCH). THE OPTIMAL REUSE OF RECLAIMED WATER: A MATHEMATICAL MODEL ANALYSIS. WATER RESOUR MANAGE, 28, 2035-2048. DOI:10.1007/S11269-014-0595-1
- CITY OF CHANDLER PLANNING AND DEVELOPMENT. (SEPT 2008). BUILDOUT AND BEYOND: WATER, WASTEWATER, RECLAIMED WATER MASTER PLAN UPDATE & EXECUTIVE SUMMARY. CHANDLER: CITY OF CHANDLER CITY COUNCIL.
- CONKLE, J. L., WHITE, J. R., & METCALFE, C. D. (2008). REDUCTION OF PHARMACEUTICALLY ACTIVE COMPOUNDS BY A LAGOON WETLAND WASTEWATER TREATMENT SYSTEM IN SOUTHEAST LOUISIANA. CHEMOSPHERE, 73(11), 1741-1748.
- CULLIGAN OF THE RIO GRANDE VALLEY. [HTTP://WWW.CULLIGANRGV.COM/INDEX.PHP](http://www.culliganrgv.com/index.php) MOLINOS-SENANTE, M., HERNÁNDEZ-SANCHO, F., & SALA-GARRIDO, R. (2010). ECONOMIC FEASIBILITY STUDY FOR WASTEWATER TREATMENT: A COST-BENEFIT ANALYSIS. SCIENCE OF THE TOTAL ENVIRONMENT, 408(20), 4396-4402.
- FOREST, N., & WIEK, A. (2015, MAY). SUCCESS FACTORS AND STRATEGIES FOR SUSTAINABILITY TRANSITIONS OF SMALL-SCALE COMMUNITIES – EVIDENCE FROM A CROSS-CASE ANALYSIS. ENVIRONMENTAL INNOVATION AND, 22-40. DOI:DX.DOI.ORG/10.1016/J.EIST.2015.05.005
- FORREST, N., & WIEK, A. (2014, JANUARY). LEARNING FROM SUCCESS—TOWARD EVIDENCE-INFORMED SUSTAINABILITY TRANSITIONS IN. ENVIRONMENTAL INNOVATION AND SOCIETAL TRANSITIONS COMMUNITIES, 66-88. DOI:DX.DOI.ORG/10.1016/J.EIST.2014.01.003
- MARICOPA COUNTY PLANNING AND DEVELOPMENT DEPARTMENT. (2016, 02 18). RIO VERDE FOOTHILLS AREA PLAN. RETRIEVED FROM PLANNING AND DEVELOPMENT DEPARTMENT: [HTTP://WWW.MARICOPA.GOV/PLANNING/RESOURCES/PLANS/AREALANDUSEPLAN/RIOVERDEFOOTHILLSAREAPLAN.ASPX](http://www.maricopa.gov/planning/resources/plans/arealanduseplan/rioverdefoothillsareaplan.aspx)
- MCLAIN, J. E., & WILLIAMS, C. F. (2014, MARCH). SUSTAINABILITY OF WATER RECLAMATION LONG-TERM RECHARGE WITH RECLAIMED WASTEWATER DOES NOT ENHANCE ANTIBIOTIC RESISTANCE IN SEDIMENT BACTERIA. SUSTAINABILITY, 6, 1313-1327. DOI:10.3390/SU6031313
- MUGA, H. E., & MIHELICIC, J. R. (2008). SUSTAINABILITY OF WASTEWATER TREATMENT TECHNOLOGIES. JOURNAL OF ENVIRONMENTAL MANAGEMENT, 88(3), 437-447.
- PLANNING AND ZONING COMMISSION FOR THE CITY OF CHANDLER. (2008). BUILD-OUT AND BEYOND: CITY OF CHANDLER GENERAL PLAN 2008. CHANDLER: CITY OF CHANDLER CITY COUNCIL. RETRIEVED FROM [HTTP://WWW.CHANDLERAZ.GOV](http://www.chandleraz.gov)
- ROBILLARD, PAUL D. SHARPE, WILLIAM E. SWISTOCK, BRYAN R. (2016). "WATER SOFTENING". PENN STATE COLLEGE OF AGRICULTURAL SCIENCES. WEB. [HTTP://EXTENSION.PSU.EDU/NATURAL-RESOURCES/WATER/DRINKING-WATER/WATER-TESTING/WATER-TREATMENT/WATER-SOFTENING](http://extension.psu.edu/natural-resources/water/drinking-water/water-testing/water-treatment/water-softening).
- WANG, C., & GARDINALI, P. R. (2013, FEB). DETECTION AND OCCURRENCE OF MICROCONSTITUENTS IN RECLAIMED WATER USED FOR IRRIGATION – A POTENTIALLY OVERLOOKED SOURCE. ANAL BIOANAL CHEM, 405, 5925-5935. DOI:DOI 10.1007/S00216-013-6799-Z
- WANG, F.-H., QIAO, M., LV, Z.-E., GUO, G.-X., JIA, Y., SU, Y.-H., & ZHU, Y.-G. (2014, JUNE). IMPACT OF RECLAIMED WATER IRRIGATION ON ANTIBIOTIC RESISTANCE IN PUBLIC PARKS, BEIJING, CHINA. ENVIRONMENTAL POLLUTION, 184, 247-253. DOI:HTTP://DX.DOI.ORG/10.1016/J.ENVPOL.2013.08.038