Source Characterization of Metals in Ambos Nogales Wastewater

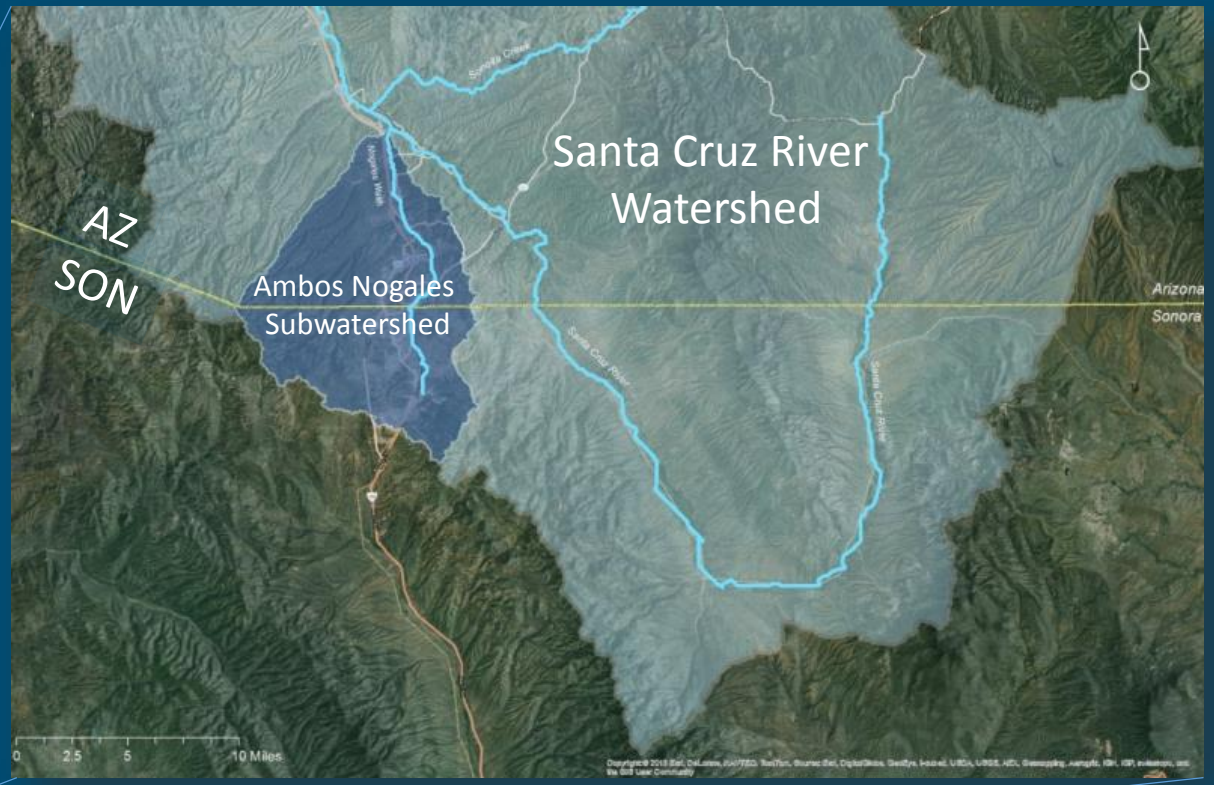
EPA Border 2020 Project Summary

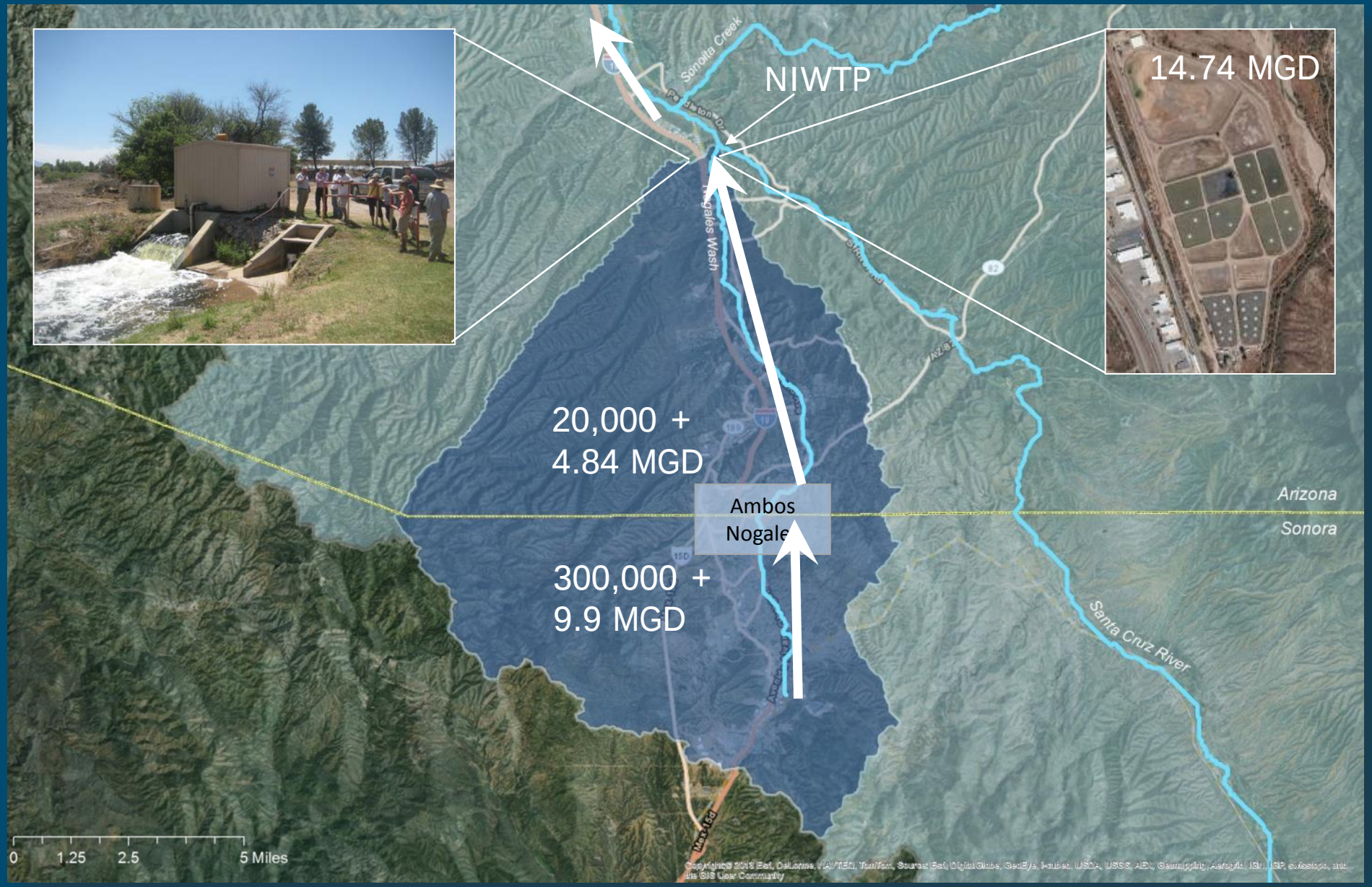
Southeast Arizona Citizens Forum Board
Rio Rico, Arizona
September 13, 2018

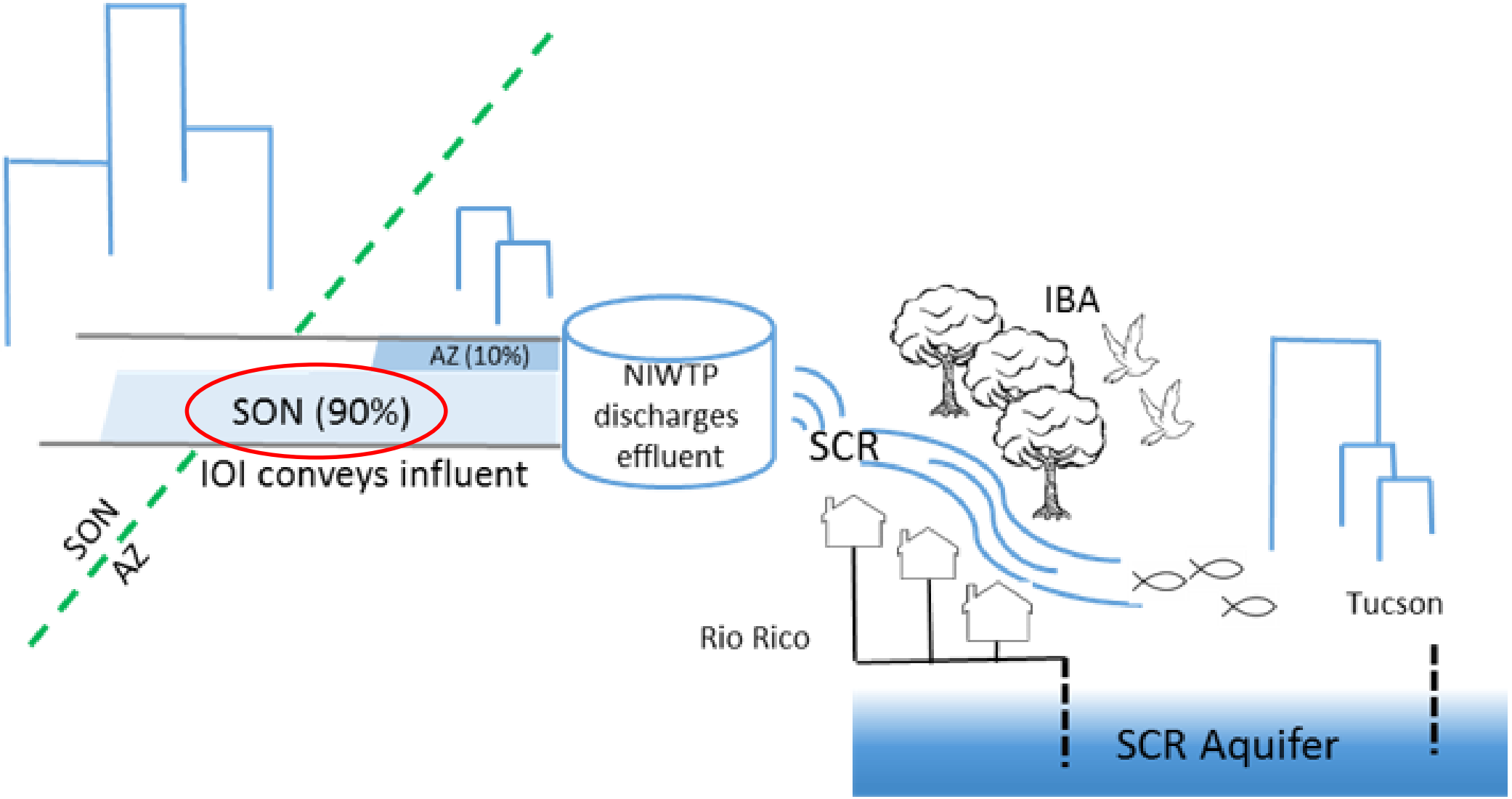
M.S. Hans Huth
Associate Hydrologist
Arizona Department of Environmental Quality (ADEQ)
Watershed Protection Unit

Q.B. Veronica Meranza
Administrador del Programa Pretratamiento Municipal
Organismo Operador de Agua Potable, Alcantarillado y Saneamiento
Nogales, Sonora

Phoenix
Tucson
Arizona
Sonora
Ambos
Nogales
0
50
100
200 Miles


Santa Cruz River
Watershed
AZ
SON
Ambos Nogales
Subwatershed
Arizona
Sonora
0
2.5
5
10 Miles


NIWTP
14.74 MGD
Sonoita Creek
Nogales Wash
20,000 +
4.84 MGD
Ambos
Nogales
300,000 +
9.9 MGD
Arizona
Sonora
Santa Cruz River
0
1.25
2.5
5 Miles


AZ (10%)
SON (90%)
IOI conveys influent
SON
AZ
NIWTP
discharges
effluent
SCR
IBA
Rio Rico
Tucson
SCR Aquifer

Valuable for property and development

USGS Study on Ecosystem Services of effluent to border region

Water **2013**, *5*, 852-874; doi:10.3390/w5030852

OPEN ACCESS

water

ISSN 2073-4441

www.mdpi.com/journal/water

Article

Framing Scenarios of Binational Water Policy with a Tool to Visualize, Quantify and Valuate Changes in Ecosystem Services

Laura M. Norman [1,*], Miguel L. Villarreal [1], Rewati Niraula [2], Thomas Meixner [2], George Frisvold [3] and William Labiosa [4]

Value of Effluent from Nogales, Sonora:

- Contribution of riparian corridor to real estate values: $11M
- Value of effluent for domestic water supply: $1.61M
- Value of recharge to the SCAMA is estimated to be $513K

If we neglect impacts on real estate values and just look at domestic water and recharge value, 12 MGD of effluent is valued at $2.12 M / year.

Monitoring

NIWTP
Nickel
Chromium
Copper
Zinc
Effluent
Headworks
Manhole 1
Arizona
Sonora
Sonoita Creek
Wales Wash
0
1.25
2.5
5 Miles

Monitoring

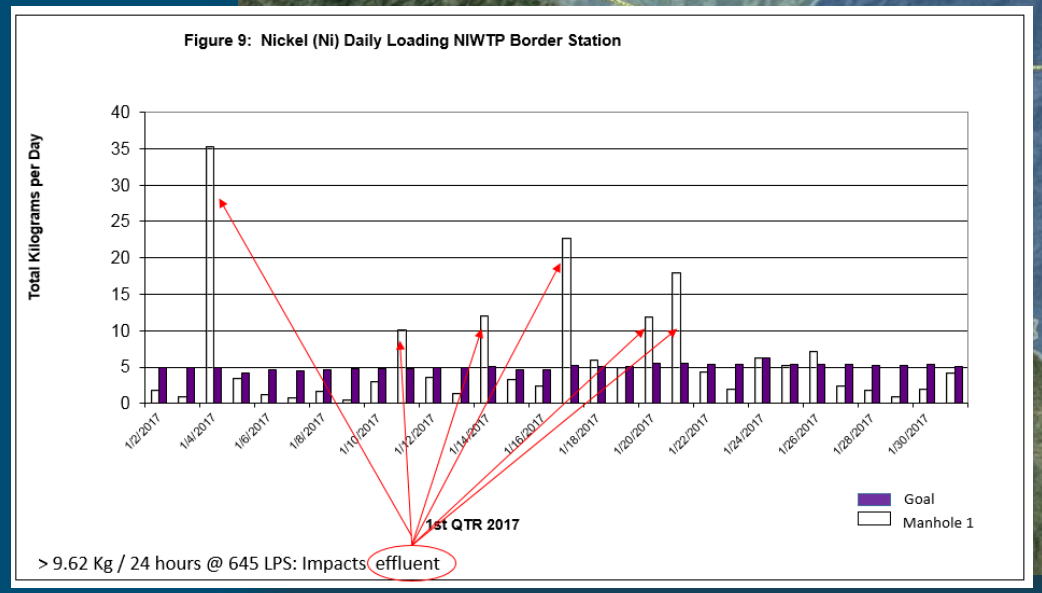
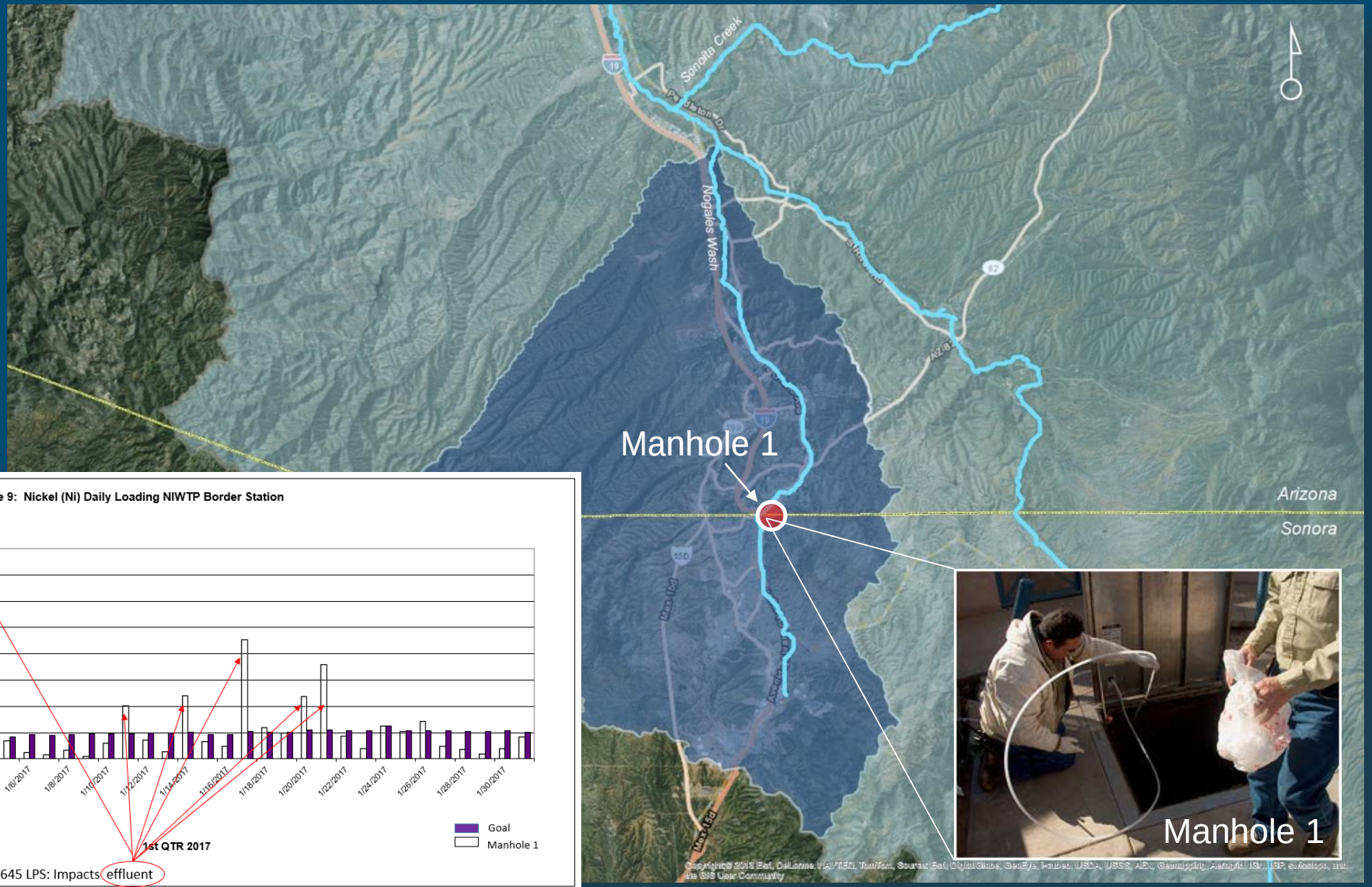
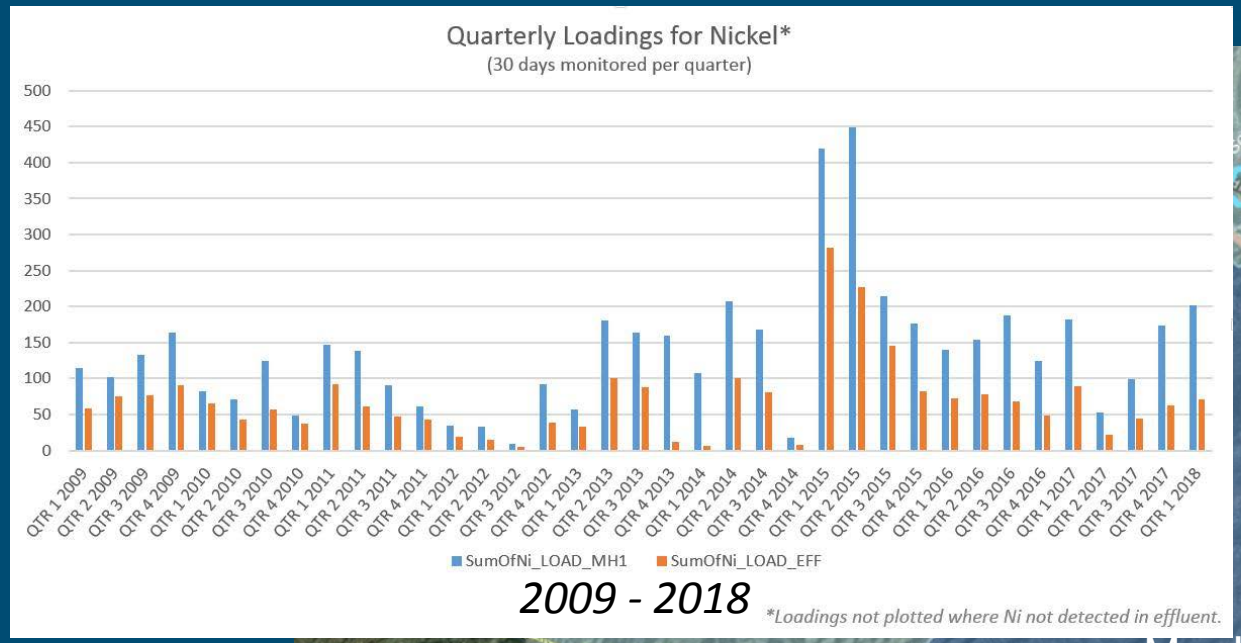
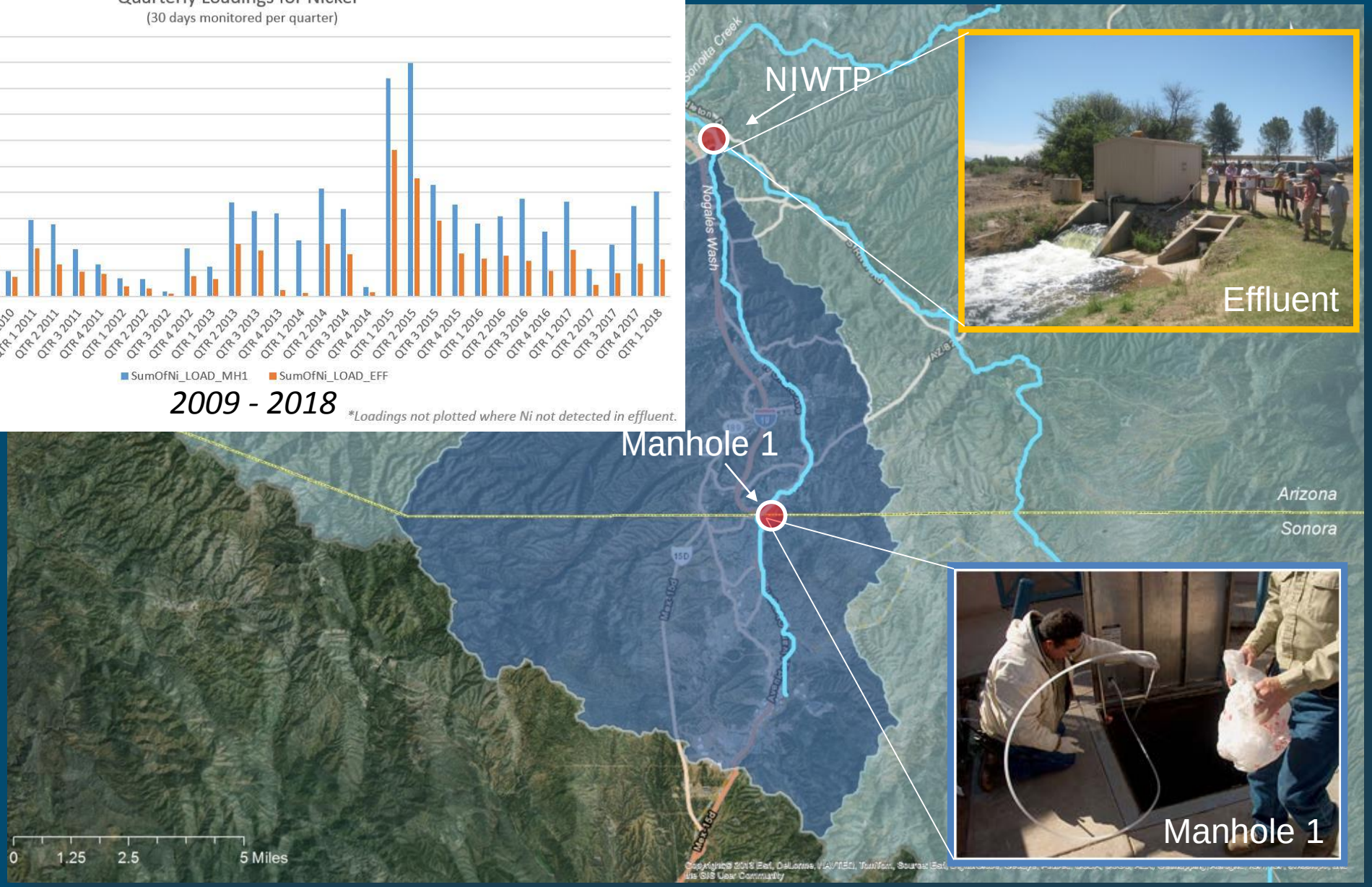


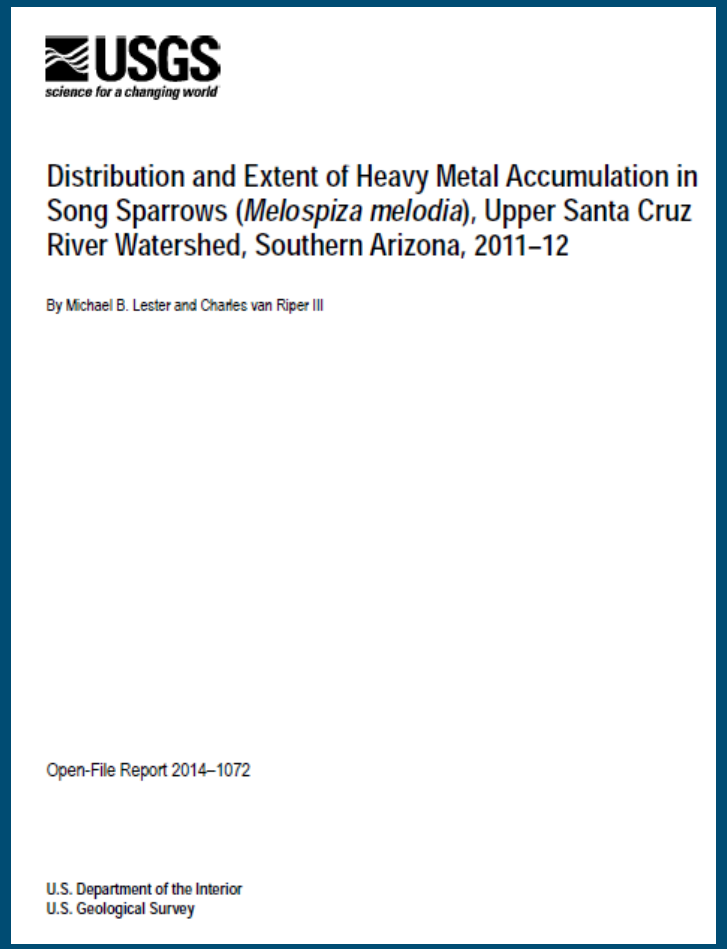
Figure 9: Nickel (Ni) Daily Loading NIWTP Border Station
Total Kilograms per Day
40
35
30
25
20
15
10
5
0
1/2/2017
1/4/2017
1/6/2017
1/8/2017
1/10/2017
1/12/2017
1/14/2017
1/16/2017
1/18/2017
1/20/2017
1/22/2017
1/24/2017
1/26/2017
1/28/2017
1/30/2017
1st QTR 2017
Goal
Manhole 1
> 9.62 Kg / 24 hours @ 645 LPS: Impacts effluent


Sonoita Creek
Nogales Wash
Manhole 1
Arizona
Sonora
Manhole 1


Quarterly Loadings for Nickel*
(30 days monitored per quarter)
Kg
500
450
400
350
300
250
200
150
100
50
0
QTR 1 2009
QTR 2 2009
QTR 3 2009
QTR 4 2009
QTR 1 2010
QTR 2 2010
QTR 3 2010
QTR 4 2010
QTR 1 2011
QTR 2 2011
QTR 3 2011
QTR 4 2011
QTR 1 2012
QTR 2 2012
QTR 3 2012
QTR 4 2012
QTR 1 2013
QTR 2 2013
QTR 3 2013
QTR 4 2013
QTR 1 2014
QTR 2 2014
QTR 3 2014
QTR 4 2014
QTR 1 2015
QTR 2 2015
QTR 3 2015
QTR 4 2015
QTR 1 2016
QTR 2 2016
QTR 3 2016
QTR 4 2016
QTR 1 2017
QTR 2 2017
QTR 3 2017
QTR 4 2017
QTR 1 2018
SumOfNi_LOAD_MH1
SumOfNi_LOAD_EFF
2009 - 2018
*Loadings not plotted where Ni not detected in effluent.


NIWTP
Nogales Wash
Effluent
Manhole 1
Arizona
Sonora
0
1.25
2.5
5 Miles
Manhole 1

Monitoring



USGS
science for a changing world

Distribution and Extent of Heavy Metal Accumulation in Song Sparrows (*Melospiza melodia*), Upper Santa Cruz River Watershed, Southern Arizona, 2011–12

By Michael B. Lester and Charles van Riper III

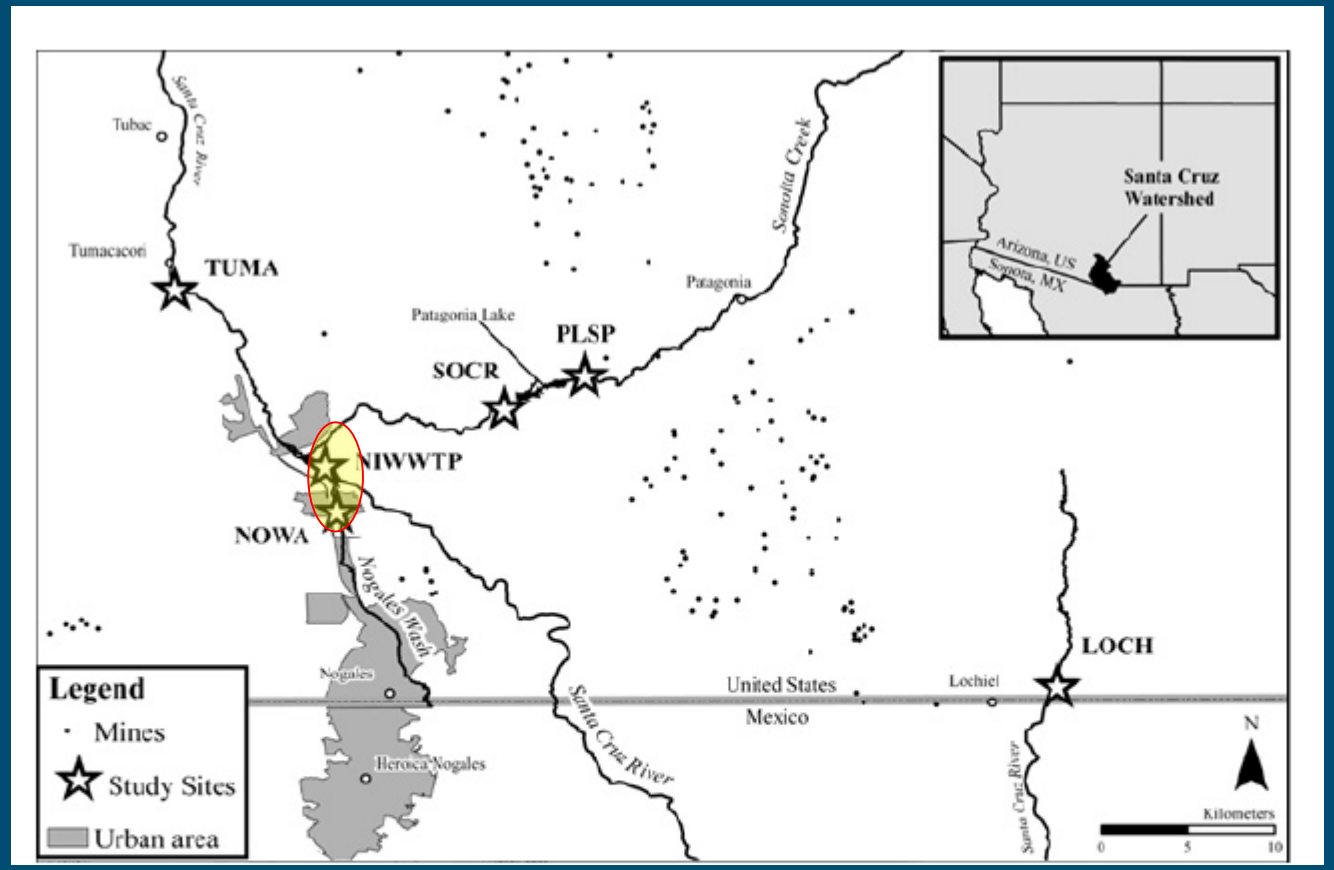
Open-File Report 2014–1072

U.S. Department of the Interior
U.S. Geological Survey

"Song Sparrows (*Melospiza melodia*; fig. 1) provide an ideal subject for studying the extent of contaminant exposure because their non-migratory habits in the Southwest (Davis and Arcese, 1999) will mean that any contaminants they may have did not come from other locations, such as wintering grounds."

Monitoring

Monitoring



"Mean concentrations were highest at the NIWWTP site, most notably for Cd and Ni. Mean concentrations of Mo also were one of the highest in 2011, and Cr both years, although they did not exceed background levels. However, Cd and Ni exceeded background concentrations in Song Sparrow feathers at the treatment plant. Cadmium is a non-essential mineral that can cause bone or kidney damage when exposure is high or long term. Both metals are also known carcinogens (Kakkar and Jaffery, 2005). The high Cd and Ni concentrations in feathers at the treatment plant were likely a result of industry in urban Nogales, as wastewater containing these metals was pumped from Nogales to the treatment plant."

Monitoring

FOSCR's December 4, 2014 Public Meeting – Environmental Justice Grant for Point of Use Water Quality

- Samples were collected from 20+ homes served by private wells located within a one mile buffer of the Nogales Wash and the Santa Cruz River. Samples were collected at the point of use over a two year period during the wet and dry seasons.
- Samples analyzed for arsenic, cadmium, chromium, copper, lead, nitrate, mercury, gram negative bacteria, E.coli, PFOS, PFOA, and sucralose. Results were compared to EPA MCLs and health-based guidelines where applicable.
- Results showed MCL exceedances for arsenic and nitrate in 16-36% of the sites sampled, depending on wet or dry time of sampling. Arsenic is a naturally occurring contaminant. Nitrate exceedances are suspected to be associated with agricultural activities.
- E.Coli was also detected above MCL between 13 and 41 percent of wells sampled, depending on the time of sampling. Exceedances were higher during wet conditions.
- There were no exceedances for metals.
- There were no HBGL exceedances for PFOS, PFOA, or sucralose.
- No correlations were made between well depth, well location relative to water courses, and water quality. Where E.Coli was detected, it is suspected to be associated with contamination from septic systems, but this is not confirmed.
- Recommendations are focused on residents analyzing their water annually for constituents of concern, and installing water filtration systems where appropriate.

Whole Effluent Toxicity (WET) Testing

Whole Effluent Toxicity (WET) Testing

INTERNATIONAL BOUNDARY AND WATER COMMISSION
UNITED STATES AND MEXICO

OFFICE OF THE COMMISSIONER
UNITED STATES SECTION

August 11, 2016

Ms. Marcia Colquitt
Manager
Arizona Department of Environmental Quality
Water Quality Compliance Enforcement Unit
1110 West Washington Street
Phoenix, Arizona 85007

WET Failures

Re: Nogales International Wastewater Treatment Plant Toxicity Identification Evaluation.

Dear Ms. Colquitt:

The International Boundary and Water Commission, United States Section (USIBWC) under Arizona Pollutant Discharge Elimination System permit AZ0025607 is notifying the Arizona Department of Environmental Quality (ADEQ) that the USIBWC will be initiating a Toxicity Identification Evaluation (TIE), phase I pursuant to Part IV, Section D.3 and 4 of the permit.

The Nogales International Wastewater Treatment Plant (NIWTP) had a failure for reproduction for *Ceriodaphnia dubia* in May 2016. The USIBWC then began a series of Whole Effluent Toxicity testing every 2 weeks for 4 testing cycles. During the expanded series of testing, the NIWTP again experienced a failure for reproduction for *C. dubia*.

Nickel Hazards to Fish, Wildlife, and Invertebrates

Biological Science Report USGS/BRD/BSR-1998-0001
April 1998

Contaminant Hazard Reviews
Report No. 34

NICKEL HAZARDS TO FISH, WILDLIFE, AND INVERTEBRATES: A SYNOPTIC REVIEW

by
Ronald Eisler

Patuxent Wildlife Research Center
U.S. Geological Survey
Laurel, MD 20708

Nickel Hazards to Fish, Wildlife, and Invertebrates

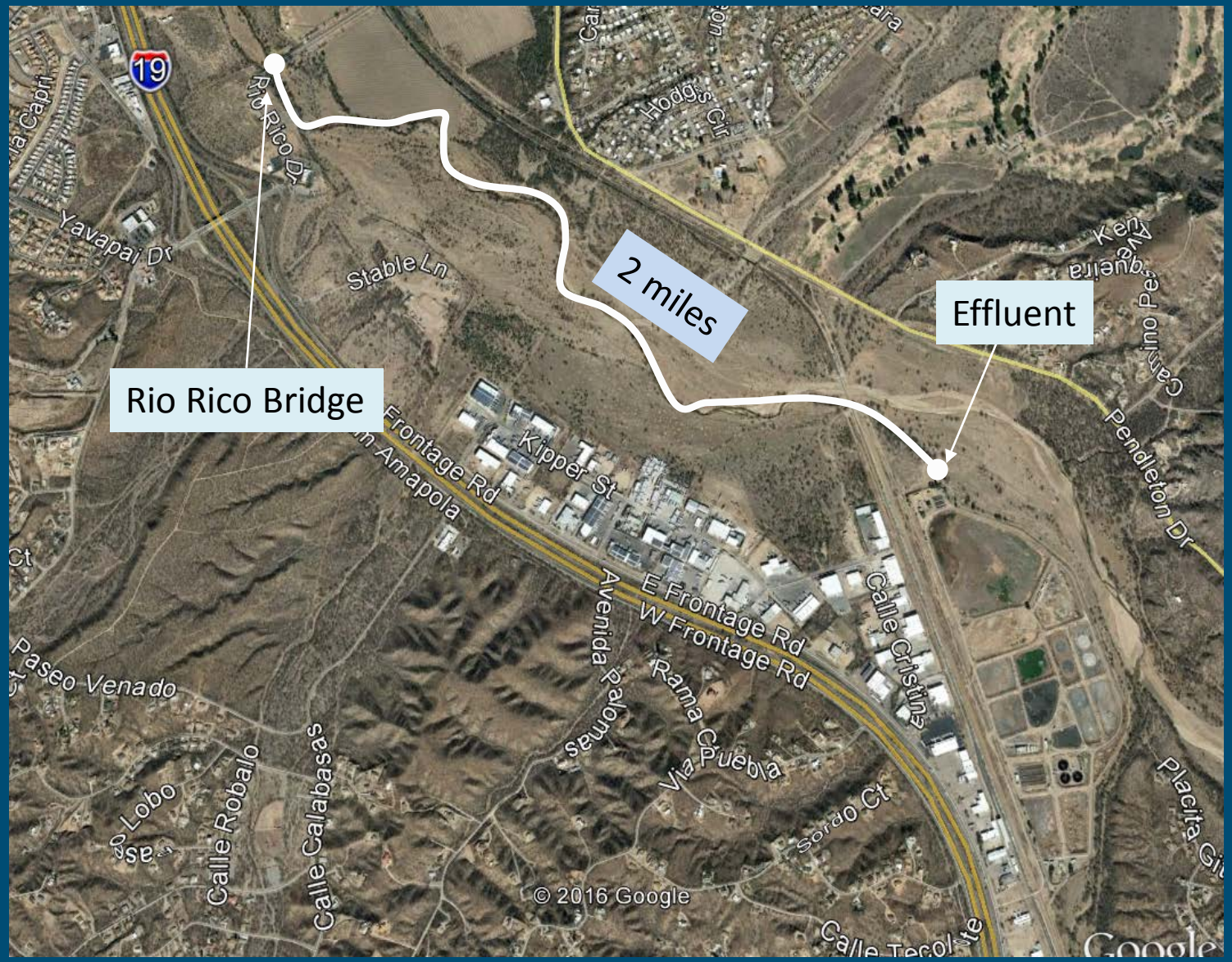
To protect freshwater plants and animals against nickel, a proposed range of less than 25 to 96 μg total recoverable Ni/L is recommended by various authorities (Table 10). This range will protect most species of freshwater biota; however, certain species have reduced survival within this range, including embryos of rainbow trout (*Oncorhynchus mykiss*) at 11 μg/L (Birge and Black 1980), daphnids (*Ceriodaphnia dubia*) at 13 μg/L (Schubauer-Berrigan et al. 1993), and embryos of the narrow-mouthed toad (*Gastrophryne carolinensis*) at 50 μg/L (Birge and Black 1980; USEPA 1980). Mixtures of metals are additive or more-than-additive in toxicity and, in some cases, will exceed the recommended water quality criteria based on the individual metals. Such additive effects were demonstrated for daphnids and rainbow trout using water quality criteria developed in the

Table 7. Taxonomic group, organism, dose, and other variables	Effect	Reference[a]
Daphnid, *Ceriodaphnia dubia*		
13 μg/L	LC50 (48 h) at pH 8.0-8.5*	13**
>200 μg/L	LC50 (48 h) at pH 6.0-6.5	13

*LC50 is the lethal concentration required to kill 50% of the population.

**World Health Organization (WHO). 1991. Nickel. Environmental Health Criteria 108. 383 pp.

2015-16 Ambient Monitoring Data



IBWC Ambient Monitoring Data
2015 AZPDES Permit Requirement

PERMIT NO. AZ0025607
NOGALES INTERNATIONAL WASTEWATER TREATMENT PLANT
AMBIENT SURFACE WATER QUALITY MONITORING RESULTS 2015

PARAMETER	Santa Cruz River U.S. of NIWTP outfall				Rio Rico Highway Bridge				Santa Gertrudis			
	QTR 1	QTR 2	QTR 3	QTR 4	QTR 1	QTR 2	QTR 3	QTR 4	QTR 1	QTR 2	QTR 3	QTR 4
Flow rate (CFS)	N.M.	NO FLOW	NO FLOW	NO FLOW	N.M.	9.0	30.0	9.5	N.M.	9.0	15.0	9.0
Dissolved Oxygen (mg/l)	N.M.				N.M.	6.9	6.1	7.07	N.M.	6.1	5.9	8.72
PH (S.U.)	N.M.				N.M.	7.9	7.3	8.33	N.M.	7.9	6.9	8.8
Temperature (Celsius)	N.M.				N.M.	26.0	23.3	14.2	N.M.	24.5	22.0	12.6
Electrical Conductivity	N.M.				N.M.	697.5	664.1	767.6	N.M.	785.6	673.9	757.6
Chlorine, Total Residual (µg/l)	N.M.				N.M.	N.M.	N.M.	0.02	N.M.	N.M.	N.M.	0.01
Ammonia as N (mg/l)	N.R.				N.R.	2.33	< 1	3.55	N.R.	< 1	< 1	< 1
Nitrate/Nitrite as N (mg/l)	N.R.				N.R.	5.14	8.81	4.22	N.R.	1.61	4.22	4.6
Nitrogen, Total Kjeldahl (mg/l)	N.R.				N.R.	3.13	1.34	4.6	N.R.	< 1	1.07	< 1
Carbonaceous Oxygen Demand (mg/l)	N.R.				N.R.	2	< 2	2	N.R.	< 2	4	2
Phosphorus (mg/l)	N.R.				N.R.	2.42	1.62	2.85	N.R.	0.57	1.06	1.57
Orthophosphorus (mg/l)	N.R.				N.R.	2.35	1.48	2.82	N.R.	0.52	0.66	1.54
Chlorophyll (µg/l)	N.R.				N.R.	1.59	1.36	0.75	N.R.	4.09	1.28	0.37
Cadmium, total (µg/l)	N.M.				N.M.	0.4	< 0.1	< 0.1	N.M.	0.6	0.2	0.1
Cadmium, disolved (µg/l)	N.M.				N.M.	< 0.1	< 0.1	< 0.1	N.M.	0.4	< 0.1	0.6
Chromium, total (µg/l)	N.M.				N.M.	11	< 5	< 5	N.M.	< 5	< 5	< 5
Chromium, disolved (µg/l)	N.M.				N.M.	< 5	< 5	< 5	N.M.	< 5	< 5	< 5
Copper, total (µg/l)	N.M.				N.M.	40	< 10	< 10	N.M.	< 10	< 10	< 10
Copper, disolved (µg/l)	N.M.				N.M.	< 10	< 10	< 10	N.M.	< 10	< 10	< 10
Nickel, total (µg/l)	N.M.				N.M.	150	30	70	N.M.	< 20	< 20	20
Nickel, disolved (µg/l)	N.M.				N.M.	100	30	70	N.M.	< 20	< 20	20
Zinc, total (µg/l)	N.M.				N.M.	170	20	40	N.M.	< 20	30	< 20
Zinc, disolved (µg/l)	N.M.				N.M.	40	< 20	30	N.M.	< 20	< 20	20
Hardness (mg/l)	N.M.				N.M.	174	167	167	N.M.	264	207	207

IBWC Ambient Monitoring Data
2016 AZPDES Permit Requirement

PERMIT NO. AZ0025607
NOGALES INTERNATIONAL WASTEWATER TREATMENT PLANT
AMBIENT SURFACE WATER QUALITY MONITORING RESULTS 2016

PARAMETER	Santa Cruz River U.S. of NIWTP outfall				Rio Rico Highway Bridge				Santa Gertrudis			
	QTR 1	QTR 2	QTR 3	QTR 4	QTR 1	QTR 2	QTR 3	QTR 4	QTR 1	QTR 2	QTR 3	QTR 4
Flow rate (CFS)	NO FLOW	NO FLOW	NO FLOW	NO FLOW	10	7.0	5.0	12.0	9	6.5	5.0	12.0
Dissolved Oxygen (mg/l)					7.69	7.78	6.83	8.32	8.24	8.41	6.41	8.9
PH (S.U.)					7.74	7.87	7.8	7.87	7.76	7.96	7.76	7.7
Temperature (Celsius)					13.1	20.2	27.3	12.4	12.9	17.9	24.3	11.4
Electrical Conductivity					739.4	752.8	786.4	732.3	750.4	777.4	816.4	751.3
Chlorine, Total Residual (µg/l)					60	30	0	N.M.	50	30	0	N.M.
Ammonia as N (mg/l)					< 1.0	N.R.	< 1.0	< 1.0	< 1.0	N.R.	< 1.0	< 1.0
Nitrate/Nitrite as N (mg/l)					5.67	N.R.	17.2	10.2	3.34	N.R.	6.67	6.12
Nitrogen, Total Kjeldahl (mg/l)					< 1.0	N.R.	1.14	< 1.0	< 1.0	N.R.	<1.0	< 1.0
Carbonaceous Oxygen Demand (mg/l)					2	N.R.	2	2	2	N.R.	3	2
Phosphorus (mg/l)					1.82	N.R.	3.97	1.94	0.87	N.R.	1.3	1.36
Orthophosphorus (mg/l)					1.75	N.R.	3.81	2.15	0.88	N.R.	1.24	1.34
Chlorophyll (µg/l)					1.87	N.R.	2.43	0.85	1.28	N.R.	0.64	0.85
Cadmium, total (µg/l)					< 0.1	< 0.1	< 0.1	0.3	0.2	0.1	0.4	<0.1
Cadmium, disolved (µg/l)					< 0.1	< 0.1	0.1	0.1	0.2	0.1	0.2	<0.1
Chromium, total (µg/l)					< 5	< 5	< 5	< 5	< 5	< 5	< 5	<5
Chromium, disolved (µg/l)					< 5	< 5	< 5	< 5	< 5	< 5	< 5	<5
Copper, total (µg/l)					< 10	< 10	10	< 10	< 10	< 10	< 10	<10
Copper, disolved (µg/l)					< 10	30	< 10	< 10	< 10	< 10	< 10	<10
Nickel, total (µg/l)					30	40	30	40	< 20	< 20	< 20	<20
Nickel, disolved (µg/l)					30	40	30	40	< 20	< 20	< 20	<20
Zinc, total (µg/l)					20	30	40	50	< 20	20	< 20	<20
Zinc, disolved (µg/l)					30	30	40	40	< 20	20	< 20	<20
Hardness (mg/l)					154	159	162	163	202	256	244	213

Stormwater Challenges

Photo courtesy of
M.I. Claudia Gil Anaya
M.U. Edgar Castellanos

RHEMA
HORARIO DE
Reuniones
Farmacias
CENTRO NATURISTA
OBESIDAD
358

BILLARES
ELIAS

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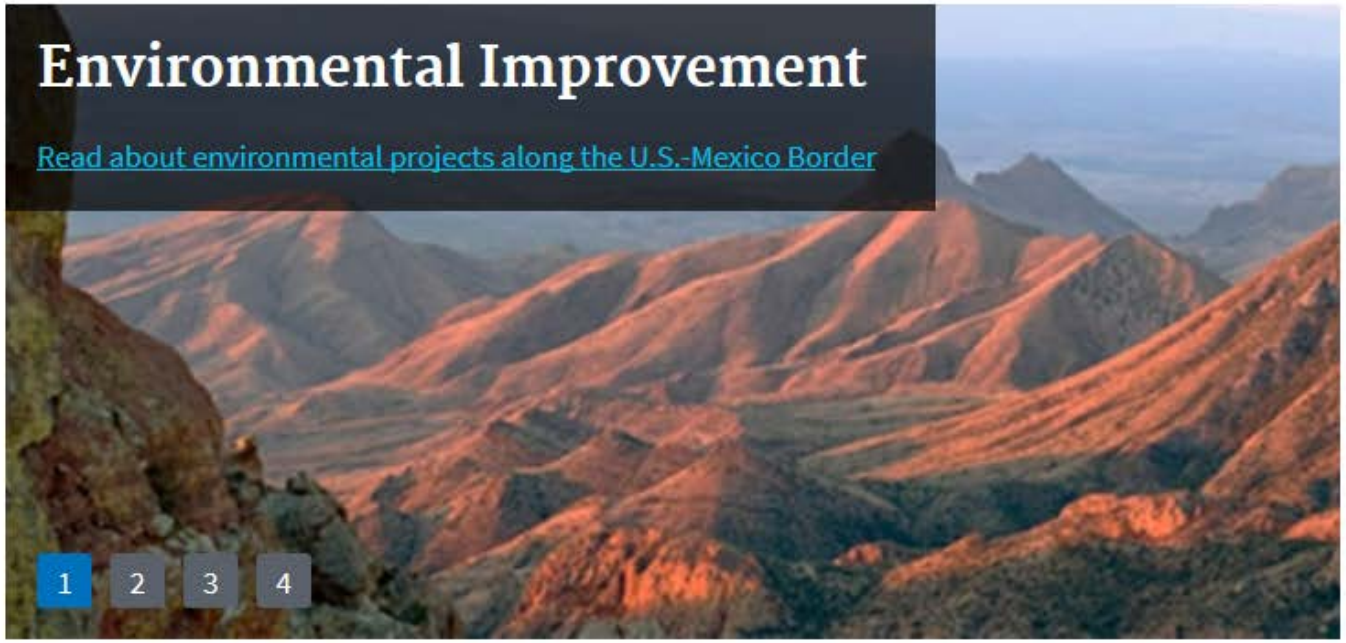
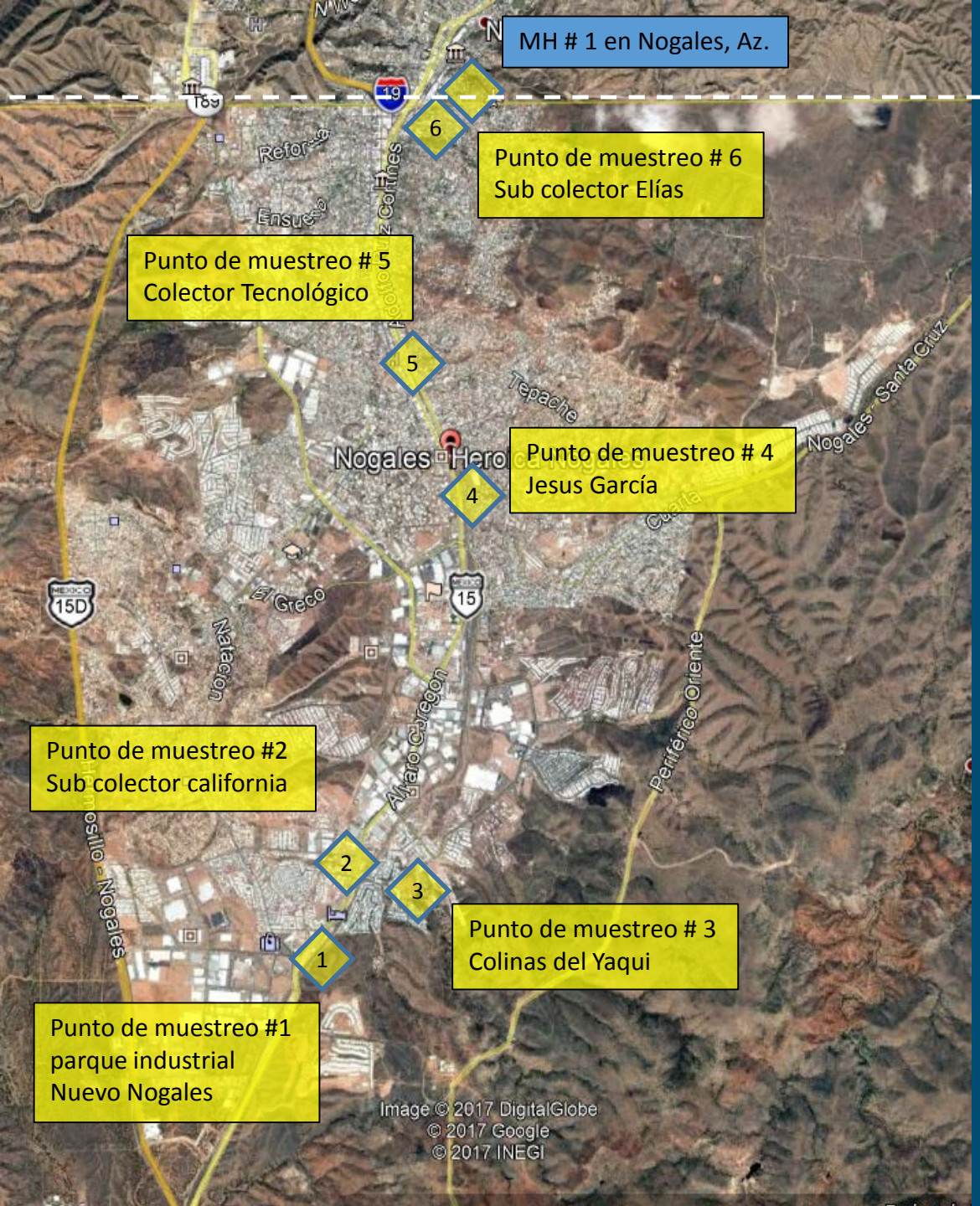


Border News

- Funding: BEIF Region 6 Prioritization Process EXIT
- BEIF Region 6 Workshops
- Region 6 Border Program Newsletter (Nov 2016 – March 2017)
- U.S. EPA – BHC Accomplishments Report (2015-2016)

100%



Nogales, Sonora
Potable Water and Wastewater Utility
OOMAPAS-NS

PLAN DE TRABAJO

Organismo Operador de Agua Potable y Alcantarillado y Saneamiento de Nogales, Sonora (OOMAPAS-NS)

NOMBRE DEL PROMOTOR: M.U. Cesar Octavio Campa Delgado

I. Título del proyecto: "Caracterización de Fuentes Contaminantes en Aguas Residuales de Nogales, Sonora".

II. Antecedentes/Problema identificado

Desde varias décadas atrás, la Planta Internacional de Tratamiento de Aguas Residuales (PITAR) proporciona servicio a las comunidades de Ambos Nogales. A partir del año 2009, la sección Americana de la Comisión Internacional de las Aguas (IBWC) ha comunicado altos niveles de metales con origen de Sonora que exceden las tolerancias para la operación eficiente de la PITAR. Monitoreos de aguas residuales por IBWC en el emisor central sugiere que Nogales, Sonora es la fuente principal de cobre, cromo, níquel, y zinc. La planta no tiene la capacidad para tratar metales. Esto crea impactos a la calidad de lodos biológicos y excedencias de normativas para la protección de vida acuática en el Rio Santa Cruz. Ejemplos específicos de estos impactos se han compartido por el Departamento de Calidad Ambiental de Arizona (ADEQ) en las reuniones binacionales técnicas coordinadas por IBWC y en reuniones con la Asociación de Profesionales de Seguridad Ambiental (APSA) en Nogales, Sonora.

Border 2020 Proposal – Partner Leveraging

City of Phoenix
WATER SERVICES DEPARTMENT
ENVIRONMENTAL SERVICES DIVISION
Quality Reliability Value

On behalf of City of Phoenix, I am confirming our sup
"Wastewater Contamination Source Characterizati
Nogales, Sonora Potable Water and Wastewate
associated with high costs for water quality an
with analyses of up to 40 samples for total
yield 0.50 mg/l or higher. Our Compliance
Services.

al entitled
submitted by the
and the challenges
project stakeholders
r samples expected to
a Department of Health

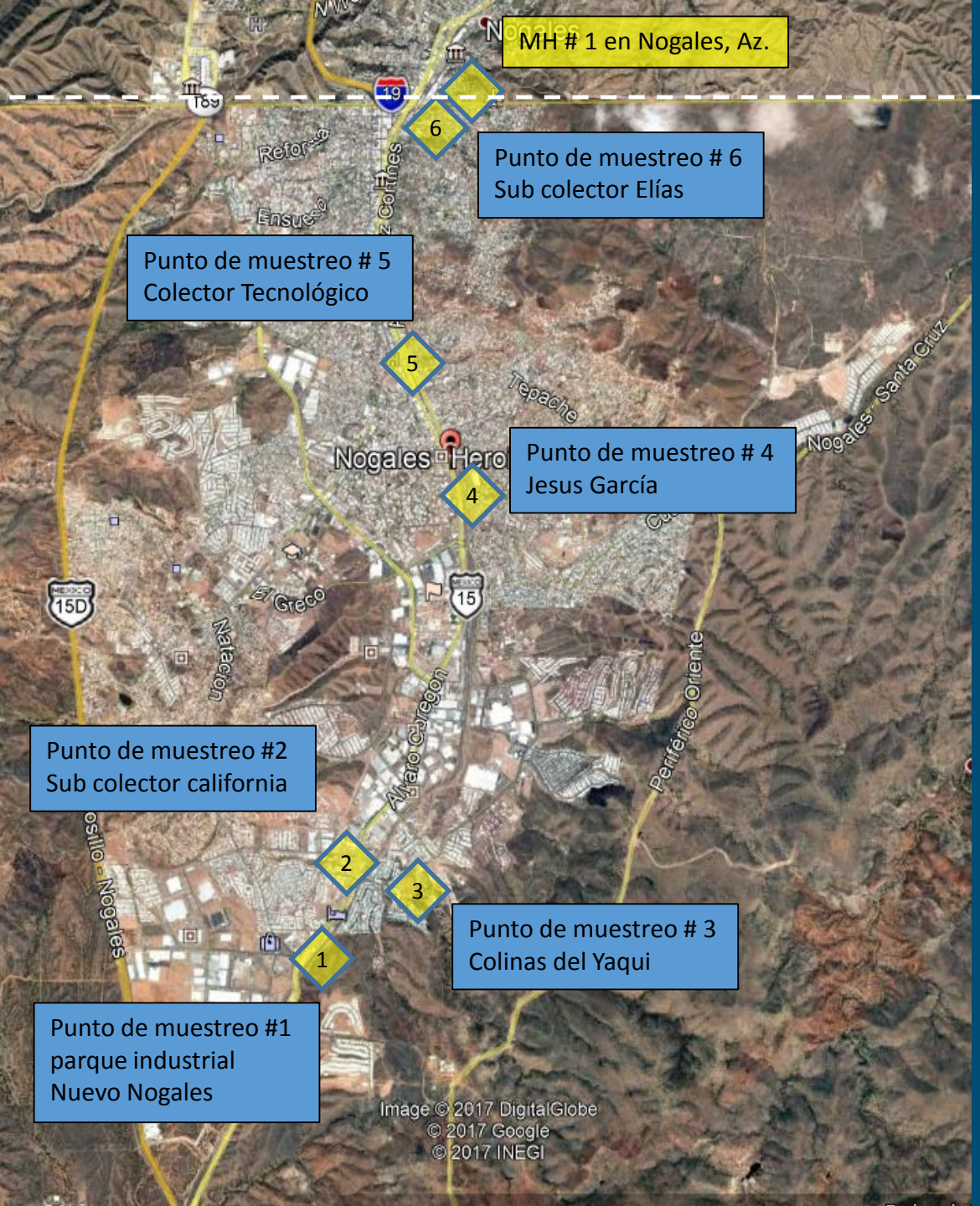
PIMA COUNTY
WASTEWATER RECLAMATION
201 NORTH STONE AVENUE
TUCSON, ARIZONA 85701-1207

(OOMAPAS-NS). We
We are pleased to
chromium, coppe
certified by the
EPA Metho

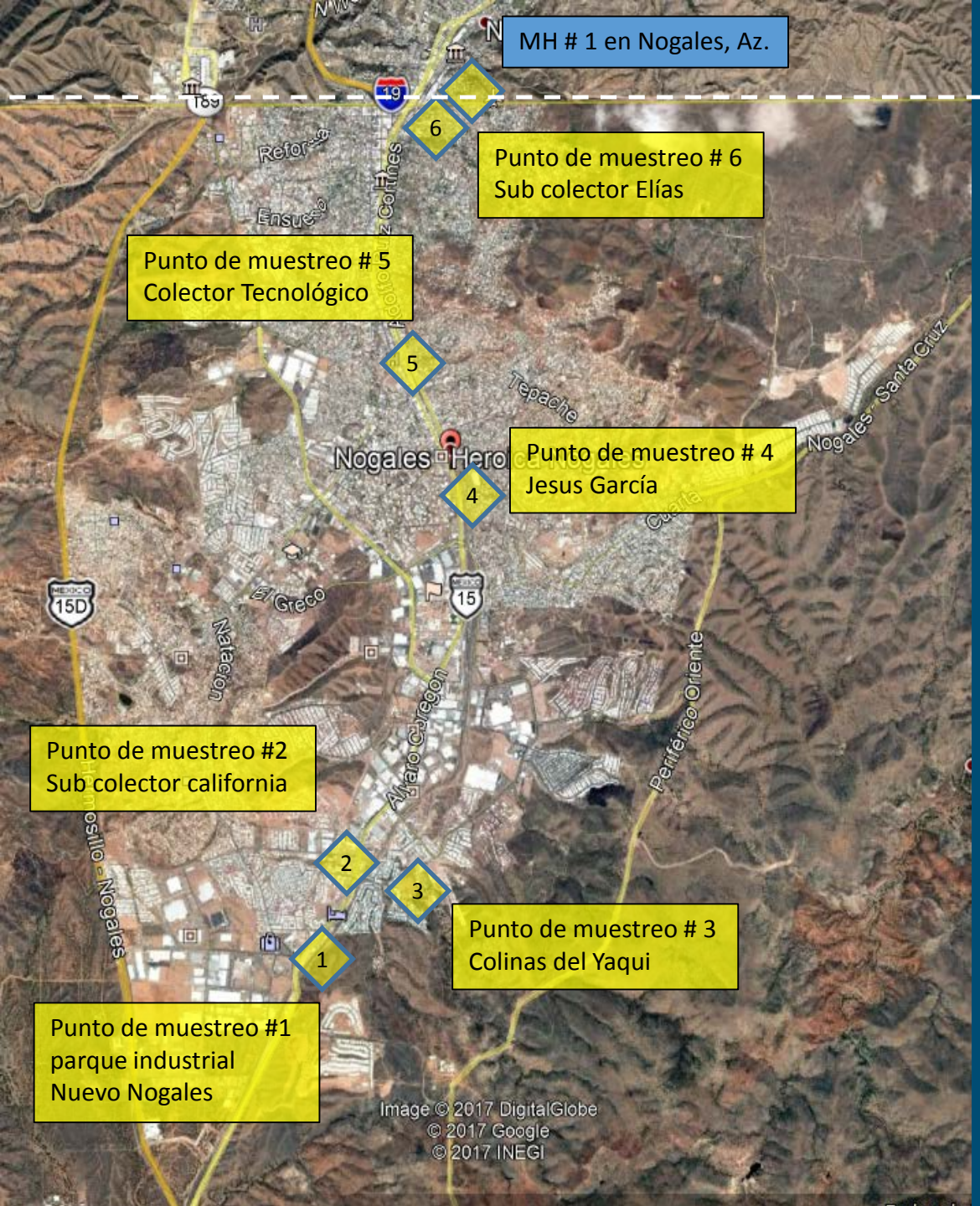
ated with high costs for water quality analyses.
olders with analyses of up to 40 samples for total
pected to yield 0.50 mg/l or higher. Our laboratory is
ervices for Inductively Coupled Plasma (ICP) analyses by

ADH ethod 200.7 with results coming in at 0.5 ppm or greater

Proposal selected for funding!



U.S. International Boundary and Water Commission



Nogales, Sonora
Potable Water and Wastewater Utility
OOMAPAS-NS

PLAN DE TRABAJO

Organismo Operador de Agua Potable y Alcantarillado y Saneamiento de Nogales, Sonora (OOMAPAS-NS)

NOMBRE DEL PROMOTOR: M.U. Cesar Octavio Campa Delgado

I. Título del proyecto: "Caracterización de Fuentes Contaminantes en Aguas Residuales de Nogales, Sonora".

II. Antecedentes/Problema identificado

Desde varias décadas atrás, la Planta Internacional de Tratamiento de Aguas Residuales (PITAR) proporciona servicio a las comunidades de Ambos Nogales. A partir del año 2009, la sección Americana de la Comisión Internacional de las Aguas (IBWC) ha comunicado altos niveles de metales con origen de Sonora que exceden las tolerancias para la operación eficiente de la PITAR. Monitoreos de aguas residuales por IBWC en el emisor central sugiere que Nogales, Sonora es la fuente principal de cobre, cromo, níquel, y zinc. La planta no tiene la capacidad para tratar metales. Esto crea impactos a la calidad de lodos biológicos y excedencias de normativas para la protección de vida acuática en el Rio Santa Cruz. Ejemplos específicos de estos impactos se han compartido por el Departamento de Calidad Ambiental de Arizona (ADEQ) en las reuniones binacionales técnicas coordinadas por IBWC y en reuniones con la Asociación de Profesionales de Seguridad Ambiental (APSA) en Nogales, Sonora.

Monitoring in Mexico

Video

Duplicates and Lab Notations

Pima County and City of Phoenix Laboratory Reports

May 28 – June 10, 2018

4 Duplicates submitted to Pima County

14 of 16 parameters were within 10%

2 of 16 were marginally above 10%

- 1 nickel duplicate had a difference of 14%
- 1 copper duplicate had a difference of 11%

June 11 – June 25, 2018

4 Duplicates submitted to City of Phoenix

16 of 16 parameters were within 10%

Lab Notations

- Some samples required dilution due to high concentrations thus raising the method reporting limit (MRL)
- Concentration was estimated for some sample (Analyte was detected below laboratory minimum reporting limit (MRL), but above MDL)

Duplicates and Lab Notations

Nogales, Sonora Potable Water and Wastewater Utility

June 26 – June 30

Final results provided, but duplicates and QA reports pending.
These will be summarized in final project report for the EPA.

Three Autosamplers Moved through Six Sites

Nogales, Sonora Potable Water and Wastewater Utility

(Results are preliminary – awaiting final report from OOMAPAS-NS)

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Cr	Nuevo Nogales	324	304	184	534	227	604	33.4	135	197	755		906	1700																216	141	51	44	73
Cr	California	2.82	3.91	42.2	203	6.81	3.78	3.9	35.9	99.2	7.24	8	298	7.91																				
Cr	Colinas		710	929	444	499	113	70	197	134	53.7	35.2	626	142																172	51	38	16	57
Cr	Jesus Garcias														14	0	0	0	0				0	0	0	0	0	0	0					
Cr	Tecnologico														0	0	0	0	0				0	0	0	0	0	0	0	0	0	11	20	9
Cr	Elias														9	14	10	10	20				14	15	20	8	25	8	16					

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Cu	Nuevo Nogales	793	276	312	861	761	3040	118	502	226	331		1940	4110																440	290	792	0	853
Cu	California	20.3	18.5	32.3	31.2	23.2	15.2	24.3	31.2	59.4	22.4	20.6	33.1	33.2																				
Cu	Colinas		38.3	293	185	131	49.5	48.1	78	30.3	20.9	18.8	99.4	46.8																60	30	0	662	70
Cu	Jesus Garcias														40	30	10	30	30				30	20	20	20	30	20	20					
Cu	Tecnologico														20	30	20	20	20				10	0	30	30	40	30	20	50	50	13	0	0
Cu	Elias														30	40	30	30	60				150	160	50	50	90	20	130					

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Ni	Nuevo Nogales	778	593	338	1680	446	1750	125	769	226	2260		1900	3710																710	1290	3598	1554	4314
Ni	California	0	0	12.6	20.7	6.47	0	0	27	42.5	7.61	5.57	36.8	5.44																				
Ni	Colinas		417	534	274	168	33.9	42	108	111	43.2	116	699	95.3																80	50	1190	1309	4185
Ni	Jesus Garcias														0	0	0	0	0				0	0	0	0	0	0	0					
Ni	Tecnologico														0	0	0	0	0				0	0	0	0	0	0	0	0	0	969	944	919
Ni	Elias														0	80	0	20	160				20	0	70	80	60	60	110					

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Zn	Nuevo Nogales	273	174	153	243	142	330	117	161	158	173		289	569																190	0	120	90	110
Zn	California	162	150	230	184	129	139	191	179	243	158	157	149	246																				
Zn	Colinas		475	4940	2260	1900	838	754	876	515	302	305	63900	2190																720	270	180	42	120
Zn	Jesus Garcias														180	230	210	220	240				330	190	190	240	280	200	240					
Zn	Tecnologico														240	240	320	180	250				90	0	210	210	200	200	210	290	240	90	90	110
Zn	Elias														170	190	200	190	210				190	200	190	170	240	160	180					

Ranked Industrial Park Results

Nogales, Sonora Potable Water and Wastewater Utility

Cr

Chromium	# Samples	Average	Median	StdDev
Nuevo Nog	17	378	216	414
Colinas	17	252	134	272
California	13	56	8	89
Elias	16	14	14	5
Technologico	17	3	0	6
Jesus Garcia	12	1	0	4

Results in parts per billion

(Results are preliminary – awaiting final report from OOMAPAS-NS)

Ranked Industrial Park Results

Cu

Nogales, Sonora Potable Water and Wastewater Utility

Copper	# Samples	Average	Median	StdDev
Nuevo Nog	17	920	502	1076
Colinas	17	109	50	155
Elias	16	70	50	48
California	13	28	24	11
Jesus Garcia	12	25	25	8
Technologico	17	23	20	15

Results in parts per billion

(Results are preliminary – awaiting final report from OOMAPAS-NS)

Ranked Industrial Park Results

Ni

Nogales, Sonora Potable Water and Wastewater Utility

Nickel	# Samples	Average	Median	StdDev
Nuevo Nog	17	1532	1290	1250
Colinas	17	556	116	985
Technologico	17	167	0	360
Elias	16	55	60	48
California	13	13	6	14
Jesus Garcia	12	0	0	0

Results in parts per billion

(Results are preliminary – awaiting final report from OOMAPAS-NS)

Ranked Industrial Park Results

Zn

Nogales, Sonora Potable Water and Wastewater Utility

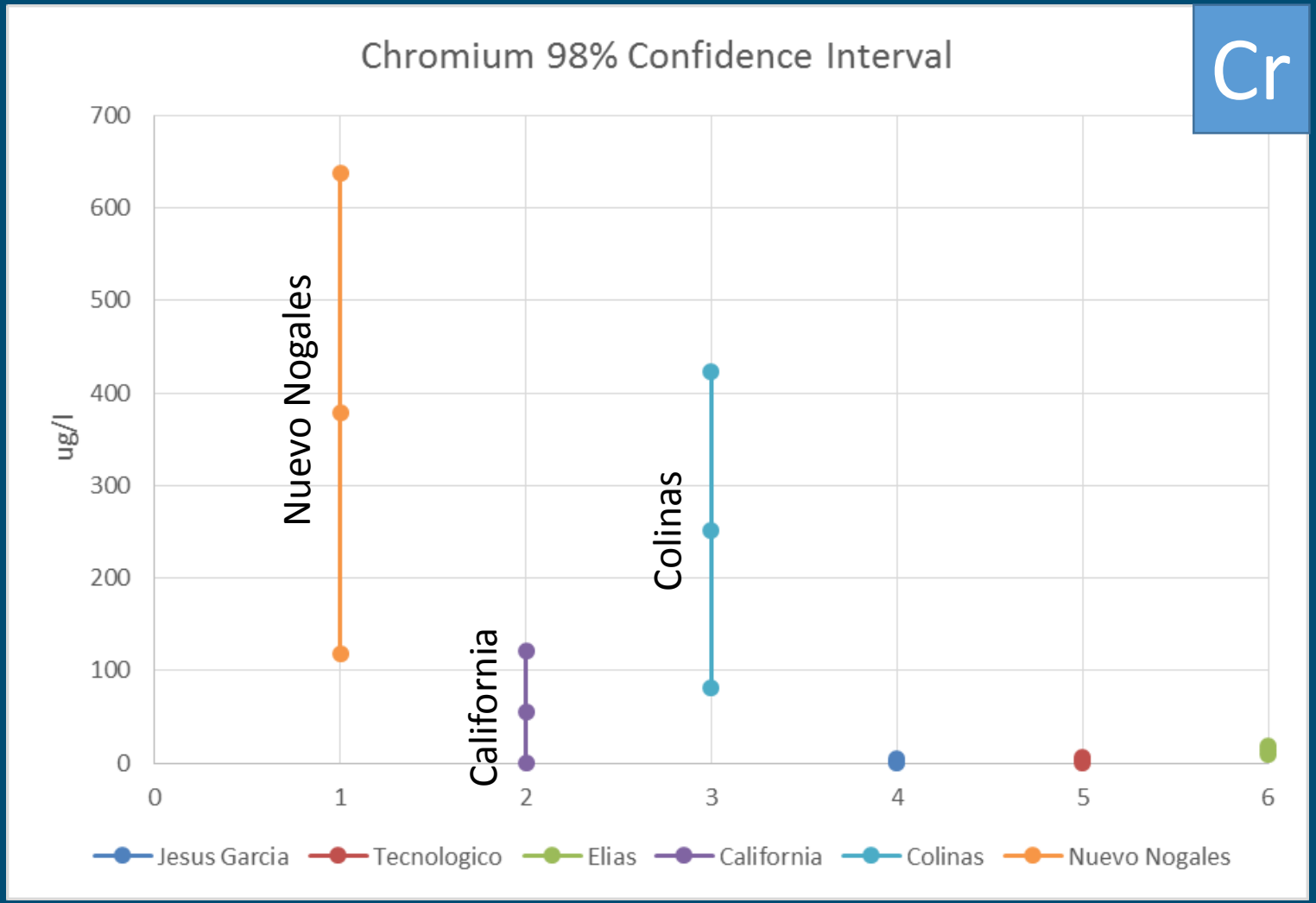
Zinc	# Samples	Average	Median	StdDev
Colinas	17	4740	720	14837
Jesus Garcia	12	229	225	41
Nuevo Nog	17	194	161	122
Elias	16	191	190	20
Technologico	17	186	210	81
California	13	178	162	38

Results in parts per billion

(Results are preliminary – awaiting final report from OOMAPAS-NS)

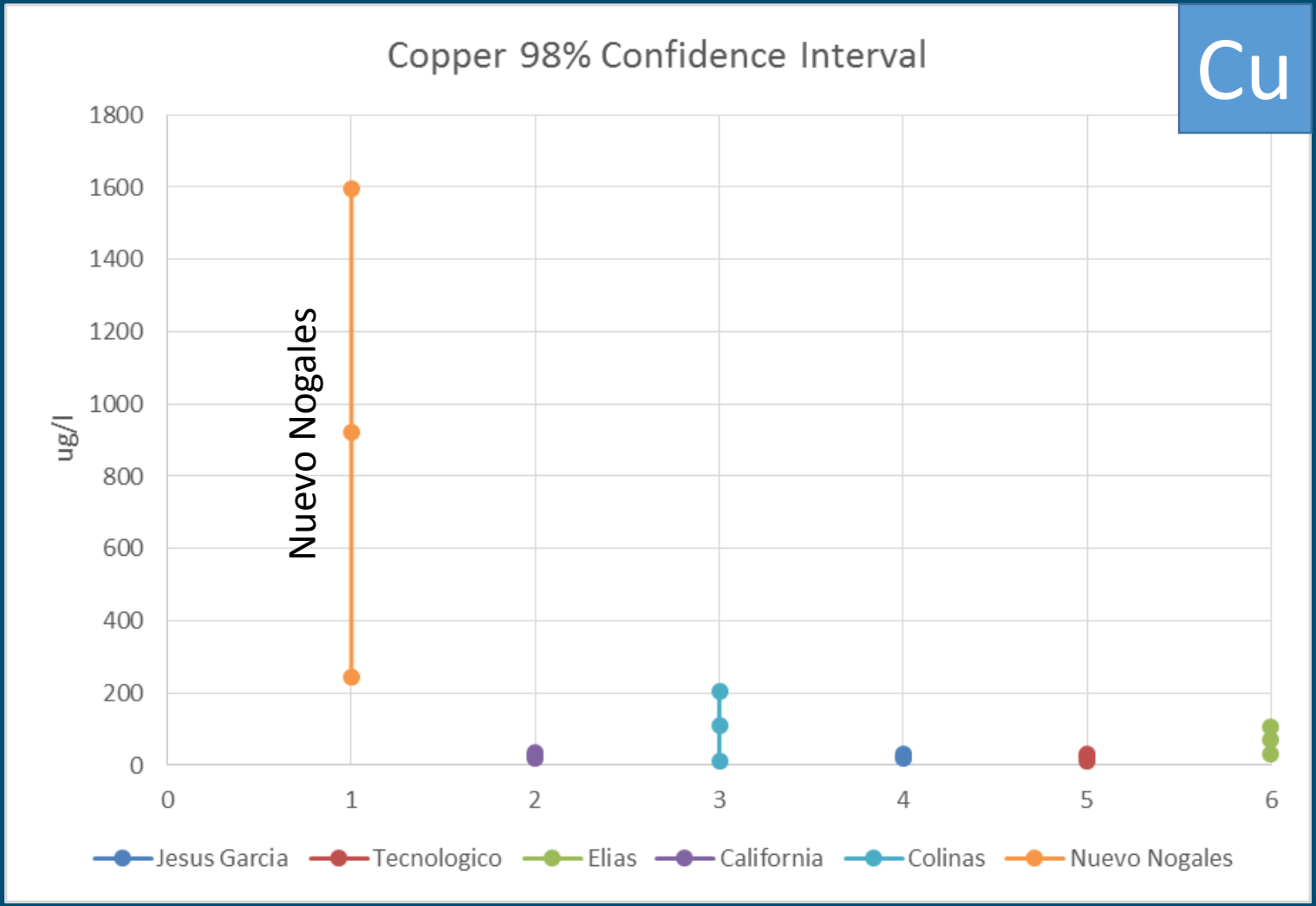
Three Autosamplers Moved through Six Sites

Nogales, Sonora Potable Water and Wastewater Utility



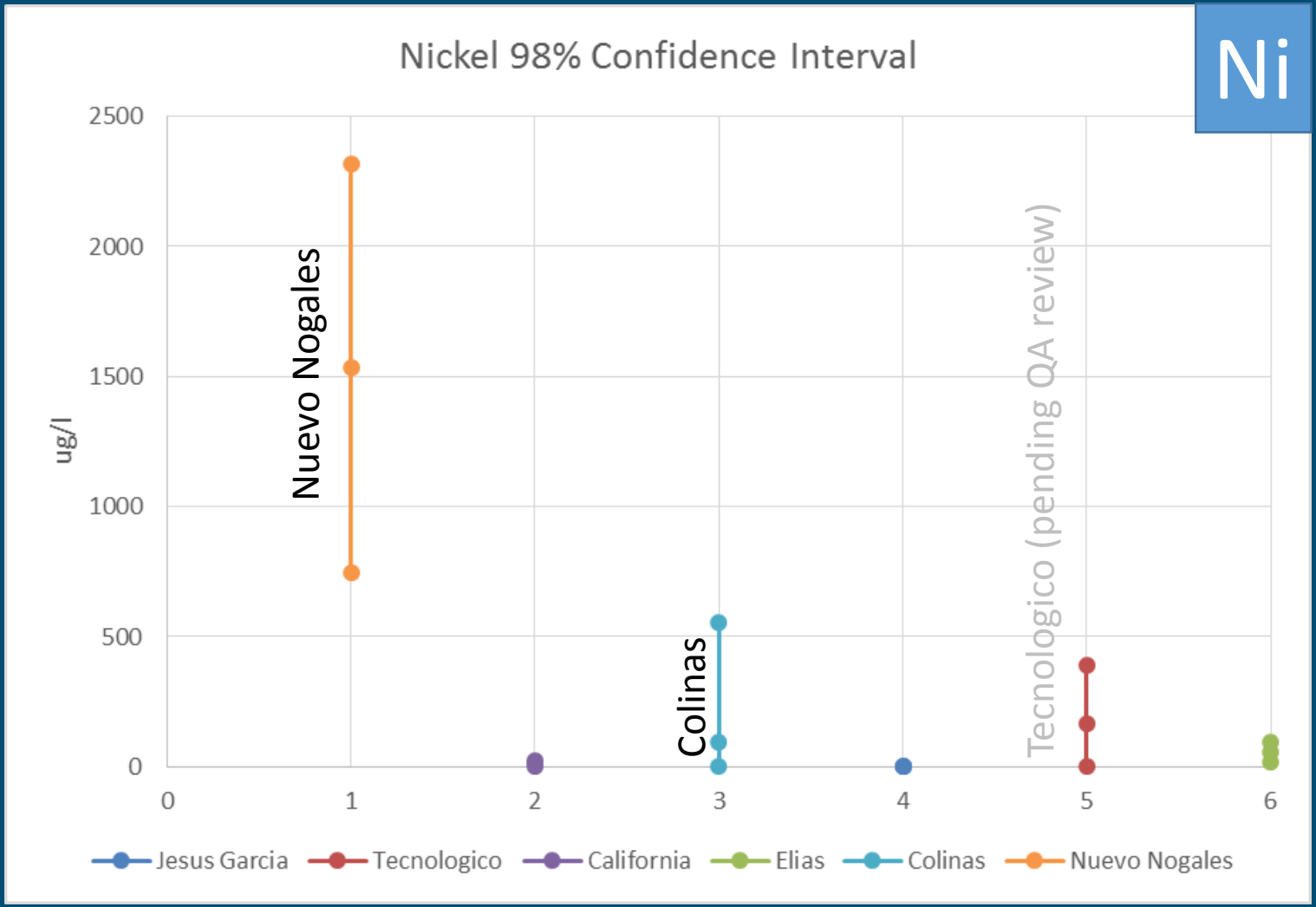
Three Autosamplers Moved through Six Sites

Nogales, Sonora Potable Water and Wastewater Utility



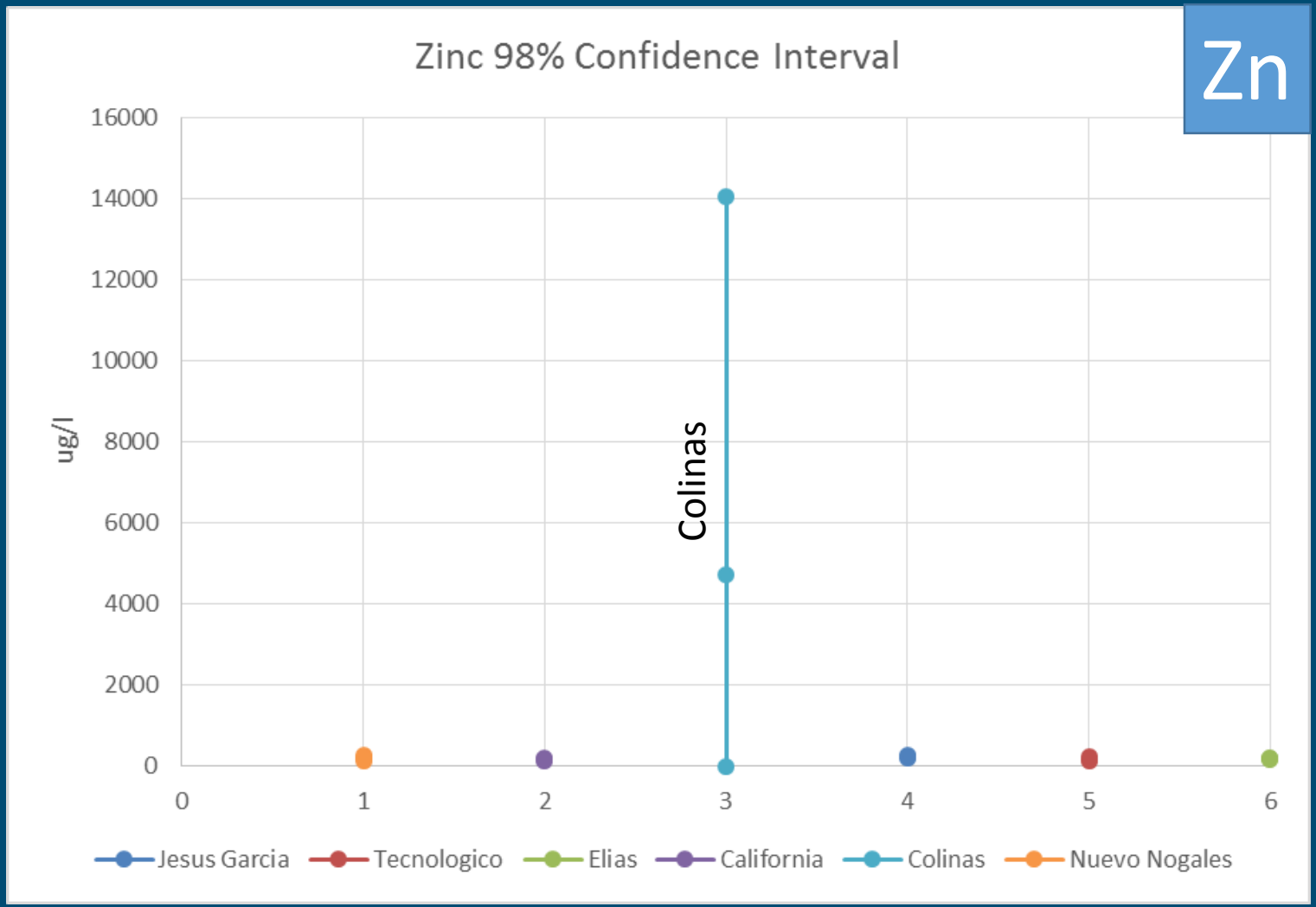
Three Autosamplers Moved through Six Sites

Nogales, Sonora Potable Water and Wastewater Utility

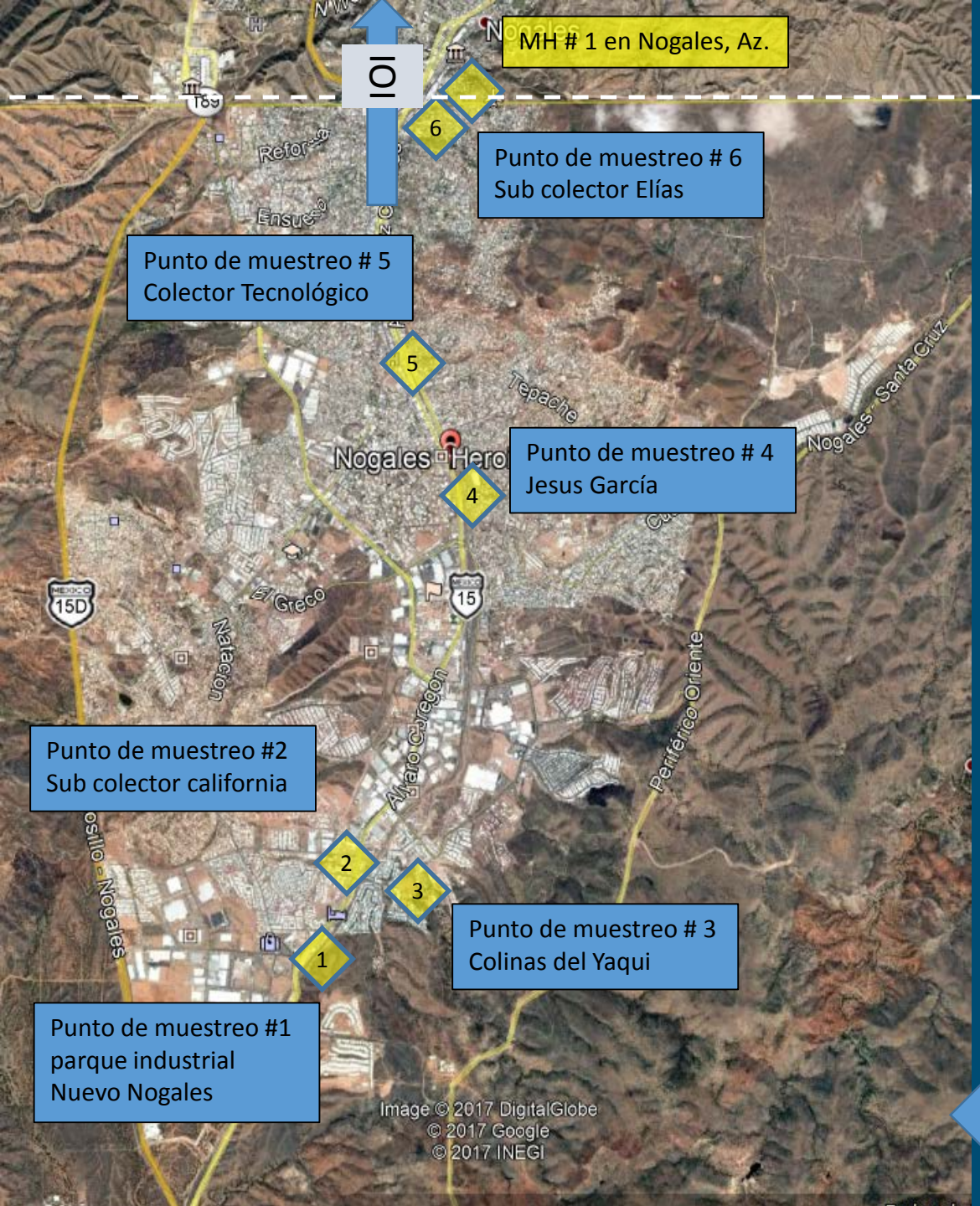


Three Autosamplers Moved through Six Sites

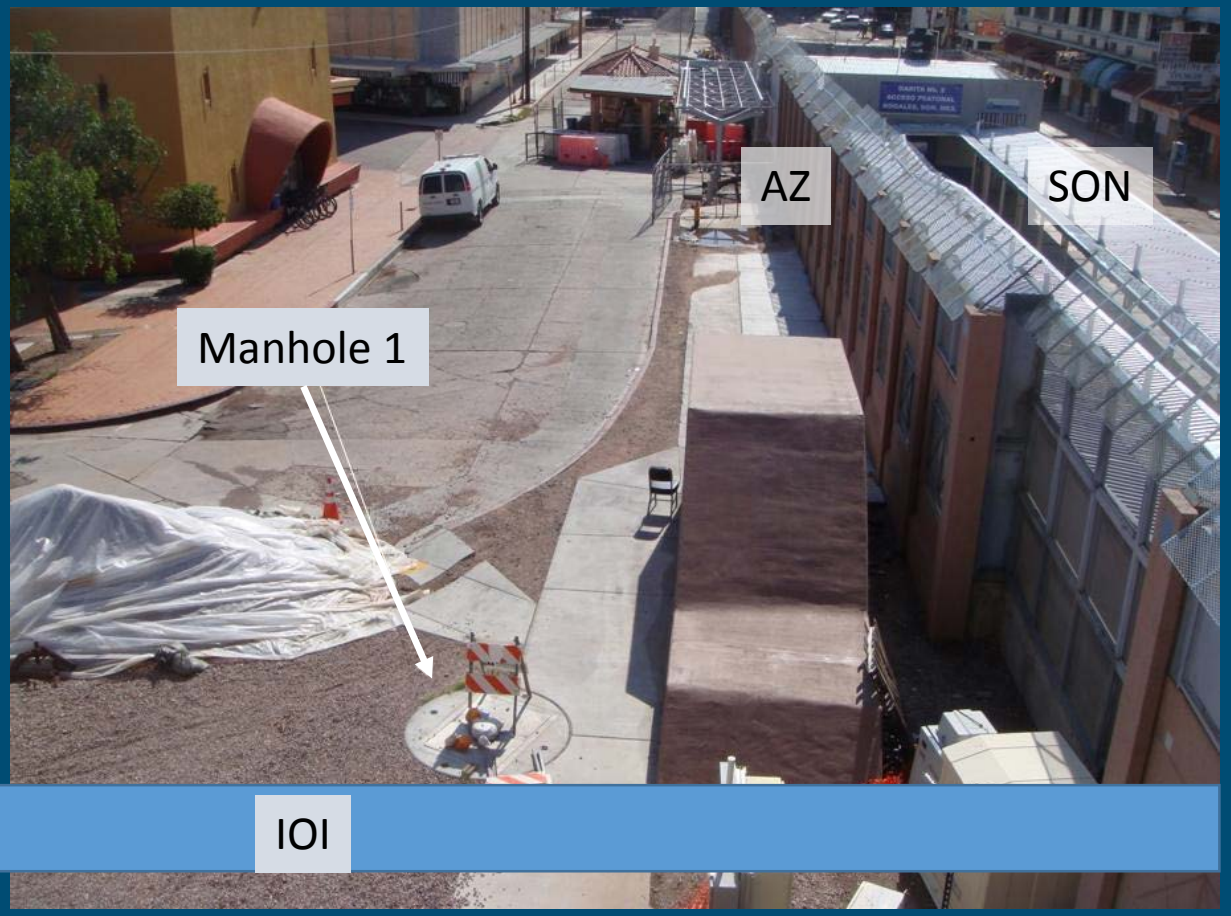
Nogales, Sonora Potable Water and Wastewater Utility



Cr, Cu, Ni, Zn, others



U.S. International Boundary and Water Commission



Three Autosamplers Moved through Six Sites

Nogales, Sonora Potable Water and Wastewater Utility

IBWC Concurrent Monitoring

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Cr	Nuevo Nogales	324	304	184	534	227	604	33.4	135	197	755		906	1700																216	141	51	44	73
Cr	California	2.82	3.91	42.2	203	6.81	3.78	3.9	35.9	99.2	7.24	8	298	7.91																				
Cr	Colinas		710	929	444	499	113	70	197	134	53.7	35.2	626	142																172	51	38	16	57
Cr	Jesus Garcias														14	0	0	0	0				0	0	0	0	0	0	0					
Cr	Tecnologico														0	0	0	0	0				0	0	0	0	0	0	0	0	0	11	20	9
Cr	Elias														9	14	10	10	20				14	15	20	8	25	8	16					

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Cu	Nuevo Nogales	793	276	312	861	761	3040	118	502	226	331		1940	4110																440	290	792	0	853
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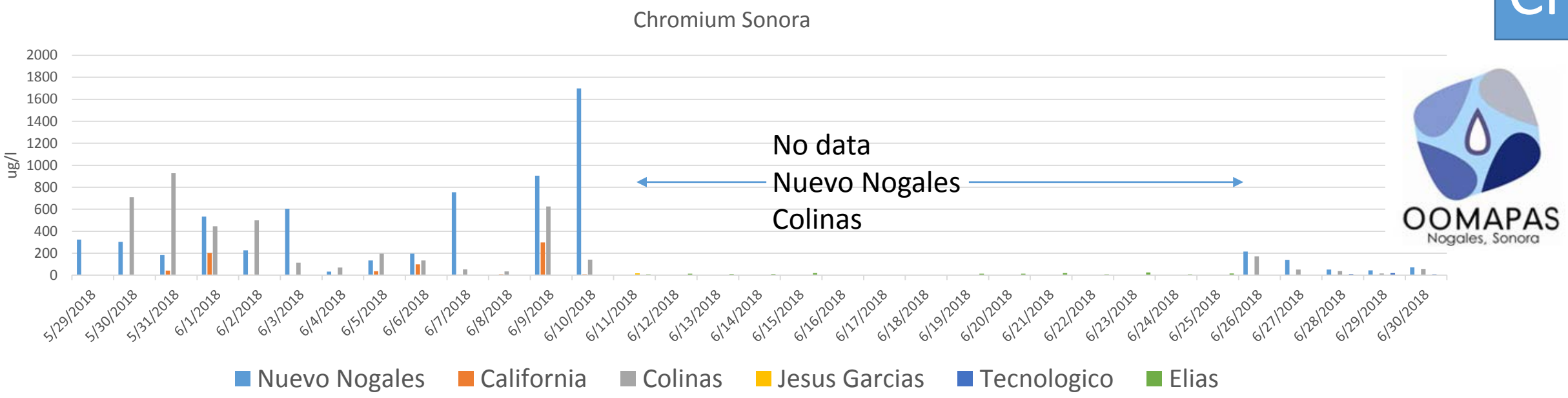
Cu	Colinas		38.3	293	185	131	49.5	48.1	78	30.3	20.9	18.8	99.4	46.8																60	30	0	662	70
Cu	Jesus Garcias														40	30	10	30	30				30	20	20	20	30	20	20					
Cu	Tecnologico														20	30	20	20	20				10	0	30	30	40	30	20	50	50	13	0	0
Cu	Elias														30	40	30	30	60				150	160	50	50	90	20	130					

	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Ni	Nuevo Nogales	778	593	338	1680	446	1750	125	769	226	2260		1900	3710																710	1290	3598	1554	4314
Ni	California	0	0	12.6	20.7	6.47	0	0	27	42.5	7.61	5.57	36.8	5.44																				
Ni	Colinas		417	534	274	168	33.9	42	108	111	43.2	116	699	95.3																80	50	1190	1309	4185
Ni	Jesus Garcias														0	0	0	0	0				0	0	0	0	0	0	0					
Ni	Tecnologico														0	0	0	0	0				0	0	0	0	0	0	0	0	0	969	944	919
Ni	Elias														0	80	0	20	160				20	0	70	80	60	60	110					

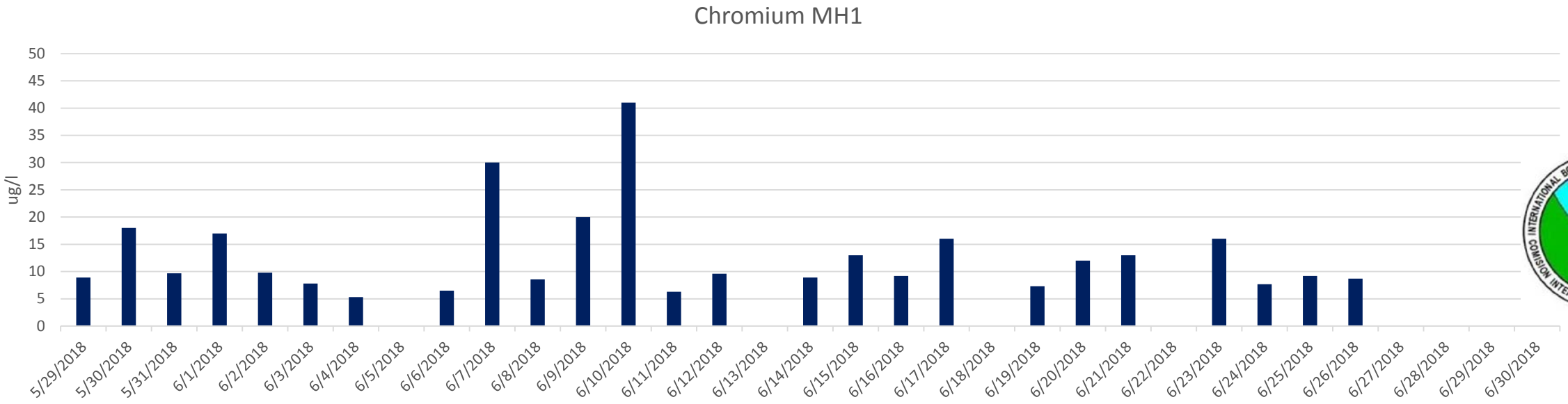
	Facility	5/29/2018	5/30/2018	5/31/2018	6/1/2018	6/2/2018	6/3/2018	6/4/2018	6/5/2018	6/6/2018	6/7/2018	6/8/2018	6/9/2018	6/10/2018	6/11/2018	6/12/2018	6/13/2018	6/14/2018	6/15/2018	6/16/2018	6/17/2018	6/18/2018	6/19/2018	6/20/2018	6/21/2018	6/22/2018	6/23/2018	6/24/2018	6/25/2018	6/26/2018	6/27/2018	6/28/2018	6/29/2018	6/30/2018
Zn	Nuevo Nogales	273	174	153	243	142	330	117	161	158	173		289	569																190	0	120	90	110
Zn	California	162	150	230	184	129	139	191	179	243	158	157	149	246																				
Zn	Colinas		475	4940	2260	1900	838	754	876	515	302	305	63900	2190																720	270	180	42	120
Zn	Jesus Garcias														180	230	210	220	240				330	190	190	240	280	200	240					
Zn	Tecnologico														240	240	320	180	250				90	0	210	210	200	200	210	290	240	90	90	110
Zn	Elias														170	190	200	190	210				190	200	190	170	240	160	180					

IBWC Sampling at Manhole 1

Cr



OOMAPAS
Nogales, Sonora



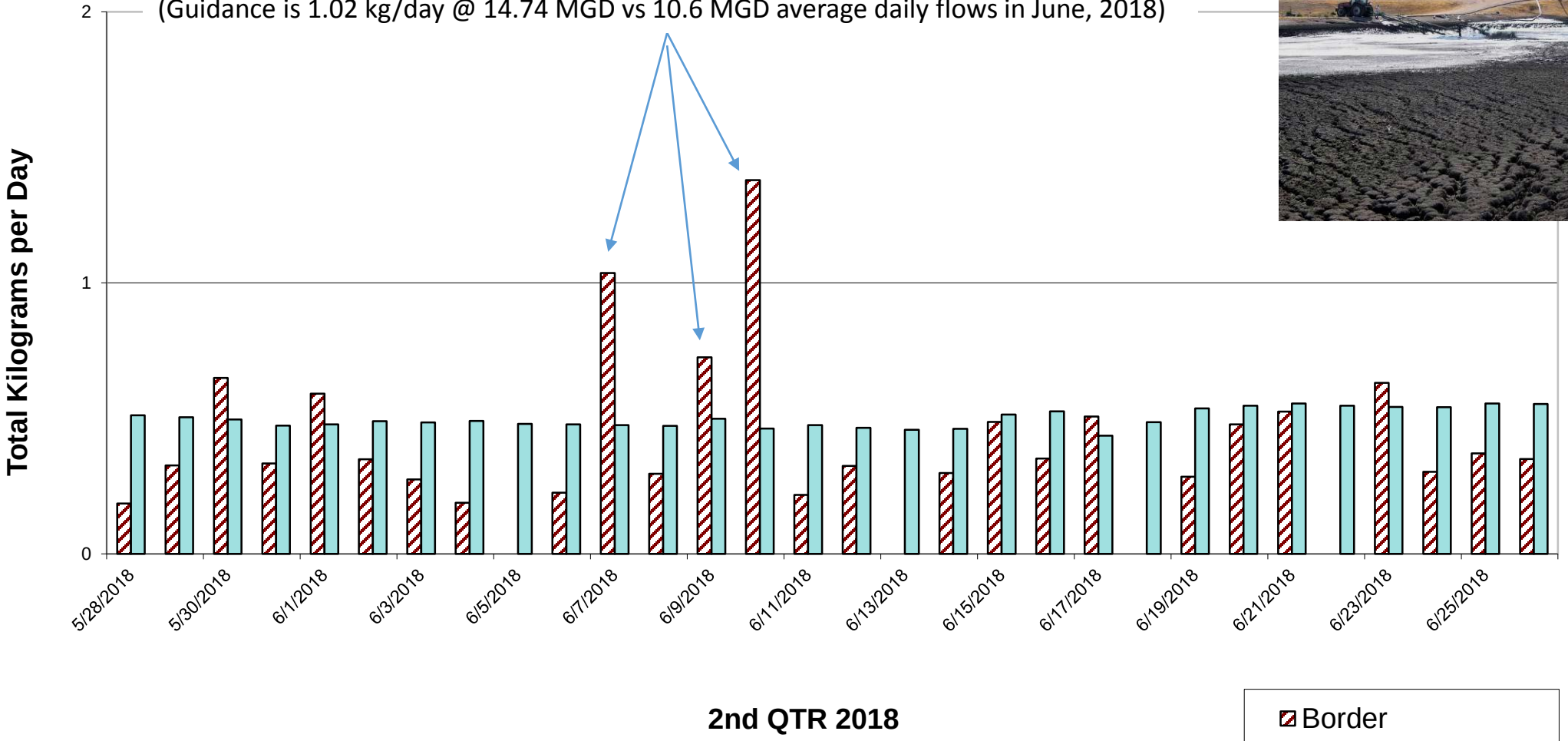
COMISION INTERNACIONAL DE LIMITES Y AGUAS
INTERNATIONAL BOUNDARY AND WATER COMMISSION

Cr

FIGURE 4: Chromium (Cr) Daily Loading NIWTP Border Station

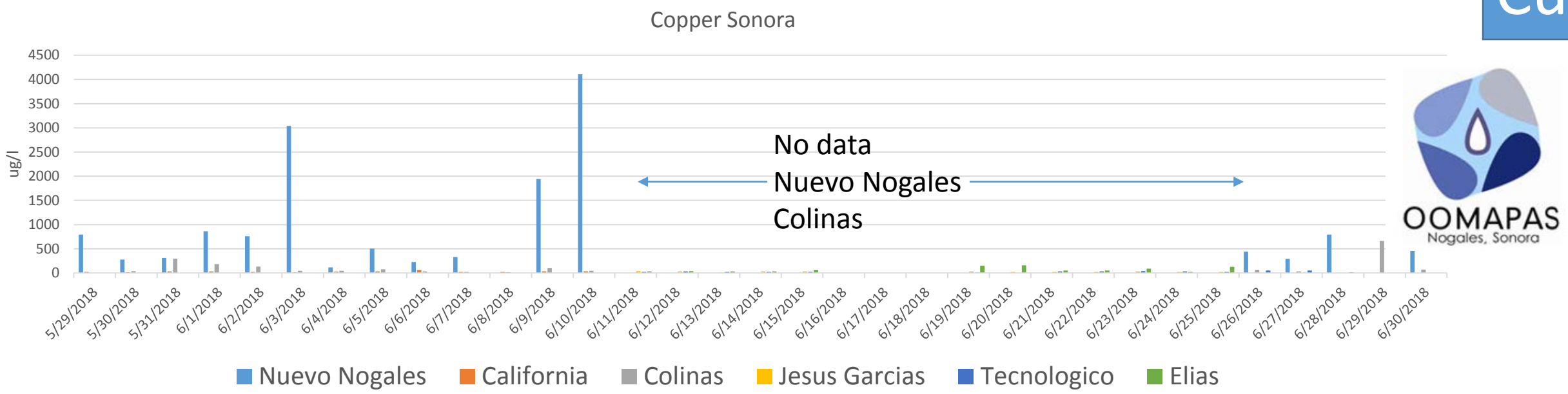
Of concern for protecting **biosolids quality**

(Guidance is 1.02 kg/day @ 14.74 MGD vs 10.6 MGD average daily flows in June, 2018)



Correlated to Nuevo Nogales, California, Colinas

Cu


Copper Sonora
ug/l
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5/29/2018
5/30/2018
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6/1/2018
6/2/2018
6/3/2018
6/4/2018
6/5/2018
6/6/2018
6/7/2018
6/8/2018
6/9/2018
6/10/2018
6/11/2018
6/12/2018
6/13/2018
6/14/2018
6/15/2018
6/16/2018
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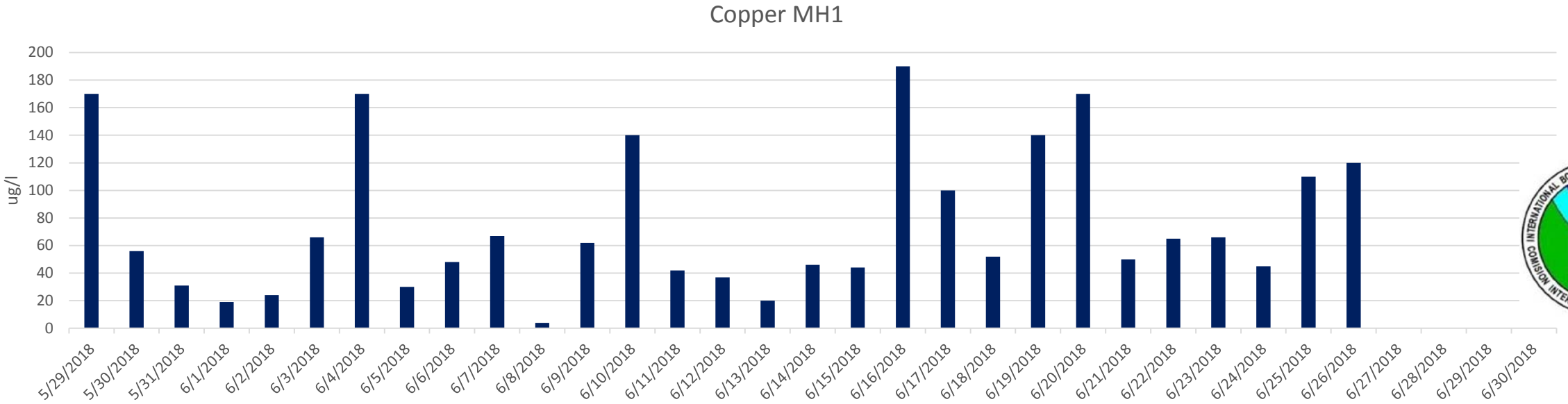
6/18/2018
6/19/2018
6/20/2018
6/21/2018
6/22/2018
6/23/2018
6/24/2018
6/25/2018
6/26/2018
6/27/2018
6/28/2018
6/29/2018
6/30/2018
No data
Nuevo Nogales
Colinas
Nuevo Nogales
California
Colinas
Jesus Garcias
Tecnologico
Elias


Copper MH1
ug/l
200
180
160
140
120
100
80
60
40
20
0
5/29/2018
5/30/2018
5/31/2018
6/1/2018
6/2/2018
6/3/2018
6/4/2018
6/5/2018
6/6/2018
6/7/2018
6/8/2018
6/9/2018
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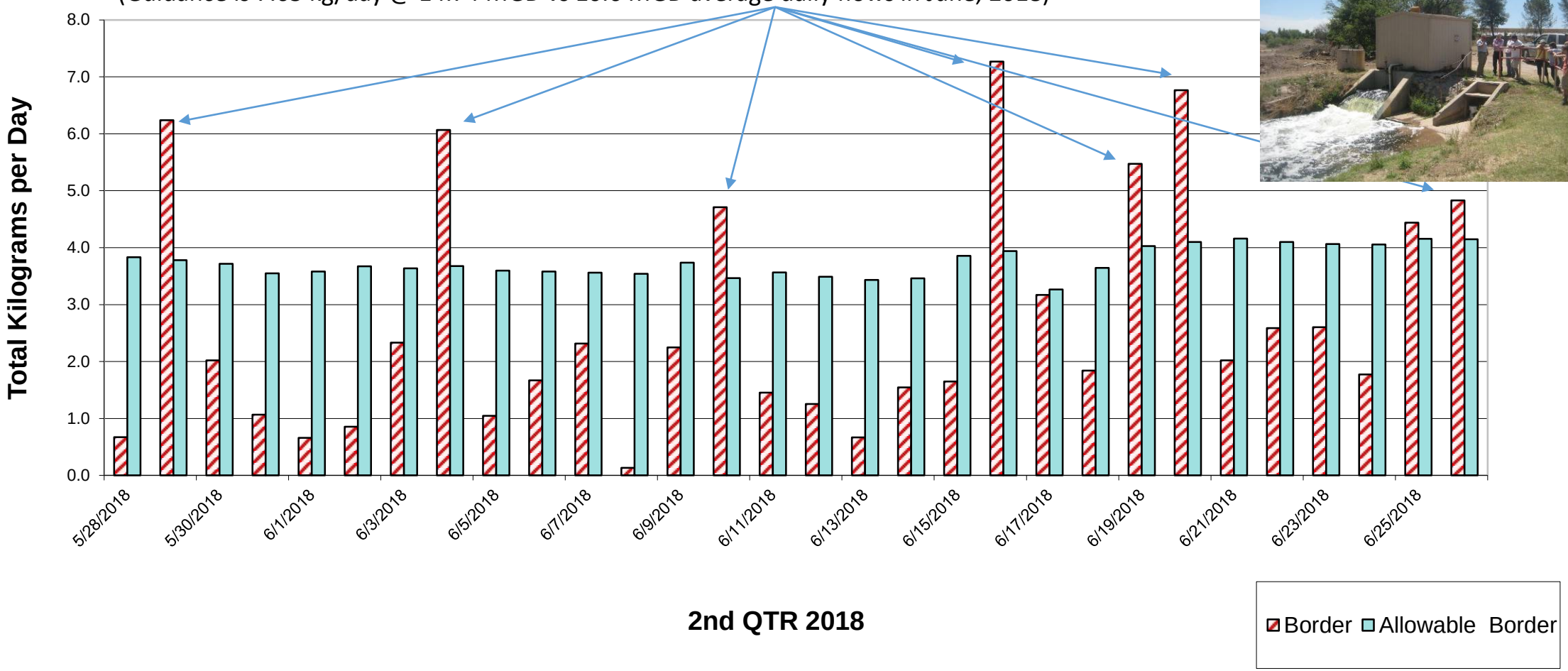
6/25/2018
6/26/2018
6/27/2018
6/28/2018
6/29/2018
6/30/2018

Cu

FIGURE 5: Copper (Cu) Daily Loading NIWTP Border Station

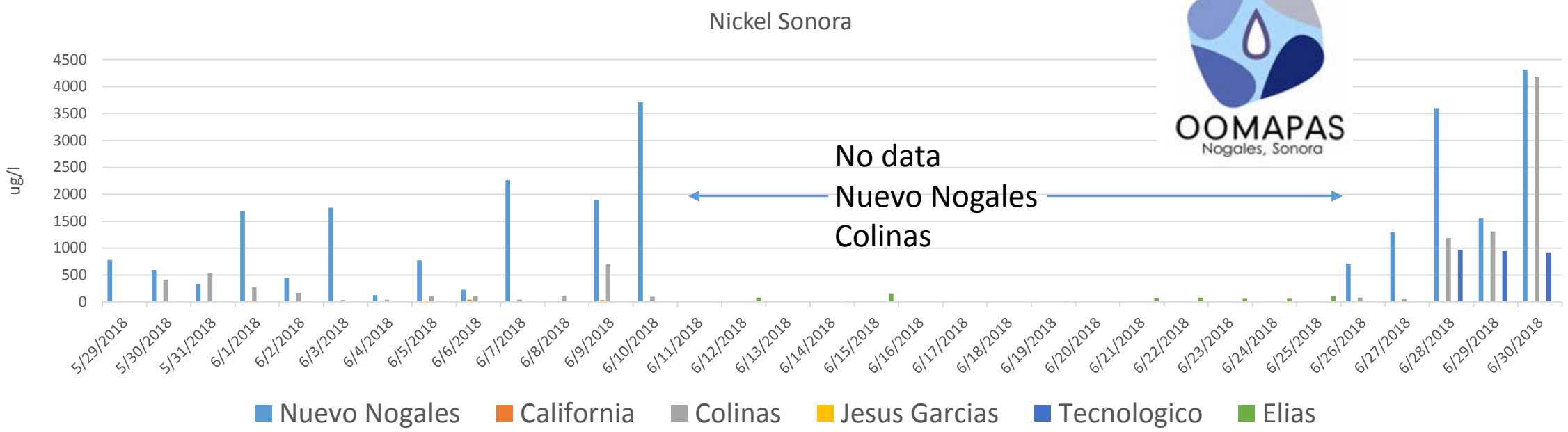
Of concern for protecting **effluent quality**

(Guidance is 7.65 kg/day @ 14.74 MGD vs 10.6 MGD average daily flows in June, 2018)



Correlated to Nuevo Nogales

Ni


Nickel Sonora
ug/l
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5/29/2018
5/30/2018
5/31/2018
6/1/2018
6/2/2018
6/3/2018
6/4/2018
6/5/2018
6/6/2018
6/7/2018
6/8/2018
6/9/2018
6/10/2018
6/11/2018
6/12/2018
6/13/2018
6/14/2018
6/15/2018
6/16/2018
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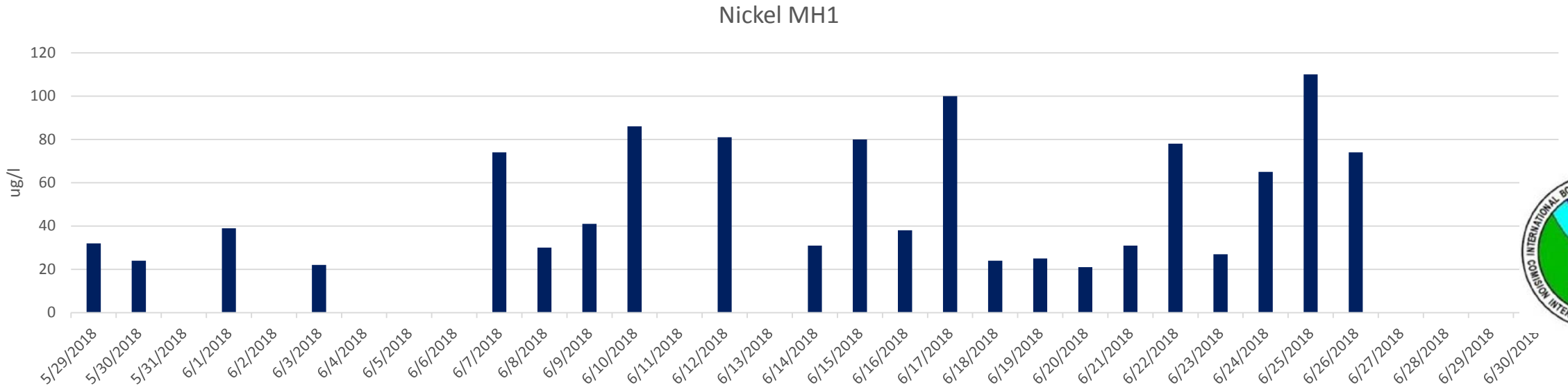
6/19/2018
6/20/2018
6/21/2018
6/22/2018
6/23/2018
6/24/2018
6/25/2018
6/26/2018
6/27/2018
6/28/2018
6/29/2018
6/30/2018
No data
Nuevo Nogales
Colinas
Nuevo Nogales
California
Colinas
Jesus Garcias
Tecnologico
Elias


Nickel MH1
ug/l
120
100
80
60
40
20
0
5/29/2018
5/30/2018
5/31/2018
6/1/2018
6/2/2018
6/3/2018
6/4/2018
6/5/2018
6/6/2018
6/7/2018
6/8/2018
6/9/2018
6/10/2018
6/11/2018
6/12/2018
6/13/2018
6/14/2018
6/15/2018
6/16/2018
6/17/2018
6/18/2018
6/19/2018
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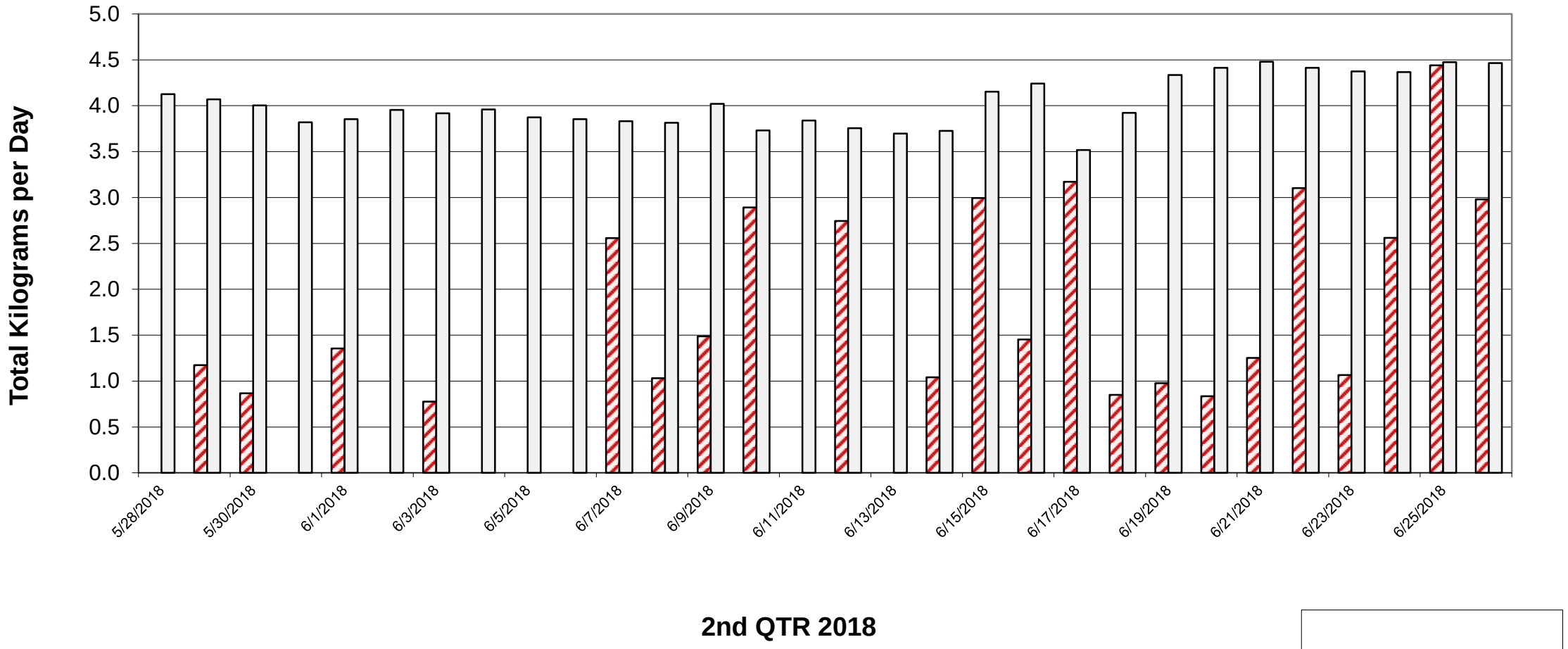
6/23/2018
6/24/2018
6/25/2018
6/26/2018
6/27/2018
6/28/2018
6/29/2018
6/30/2018

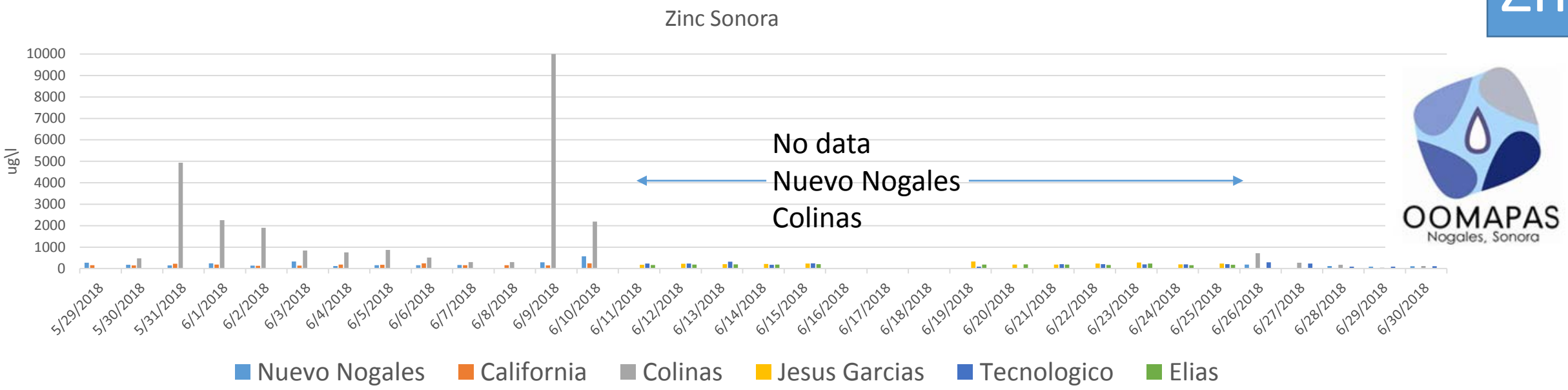
Ni

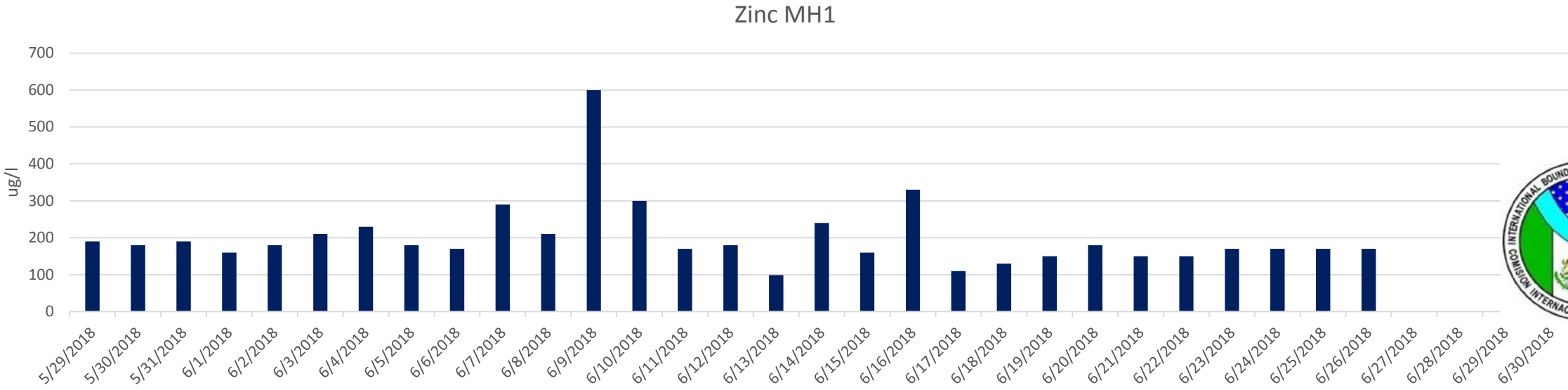
Figure 9: Nickel (Ni) Daily Loading NIWTP Border Station



Correlated to Nuevo Nogales, Colinas

Zn


Zinc Sonora
ug\l
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
No data
Nuevo Nogales
Colinas
5/29/2018
5/30/2018
5/31/2018
6/1/2018
6/2/2018
6/3/2018
6/4/2018
6/5/2018
6/6/2018
6/7/2018
6/8/2018
6/9/2018
6/10/2018
6/11/2018
6/12/2018
6/13/2018
6/14/2018
6/15/2018
6/16/2018
6/17/2018
6/18/2018
6/19/2018
6/20/2018
6/21/2018
6/22/2018
6/23/2018
6/24/2018
6/25/2018
6/26/2018
6/27/2018
6/28/2018
6/29/2018
6/30/2018
Nuevo Nogales
California
Colinas
Jesus Garcias
Tecnologico
Elias


Zinc MH1
ug/l
700
600
500
400
300
200
100
0
5/29/2018
5/30/2018
5/31/2018
6/1/2018
6/2/2018
6/3/2018
6/4/2018
6/5/2018
6/6/2018
6/7/2018
6/8/2018
6/9/2018
6/10/2018
6/11/2018
6/12/2018
6/13/2018
6/14/2018
6/15/2018
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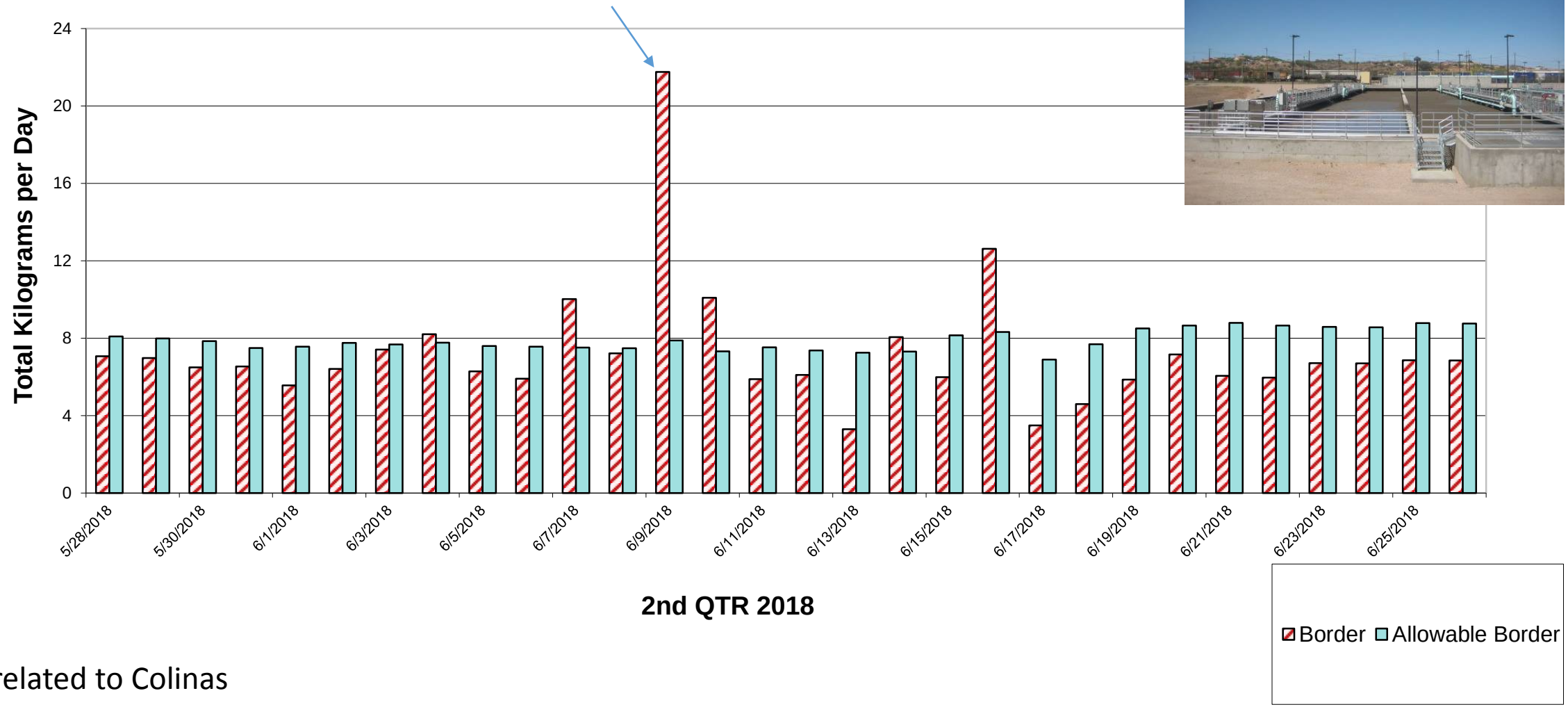
6/29/2018
6/30/2018

Zn

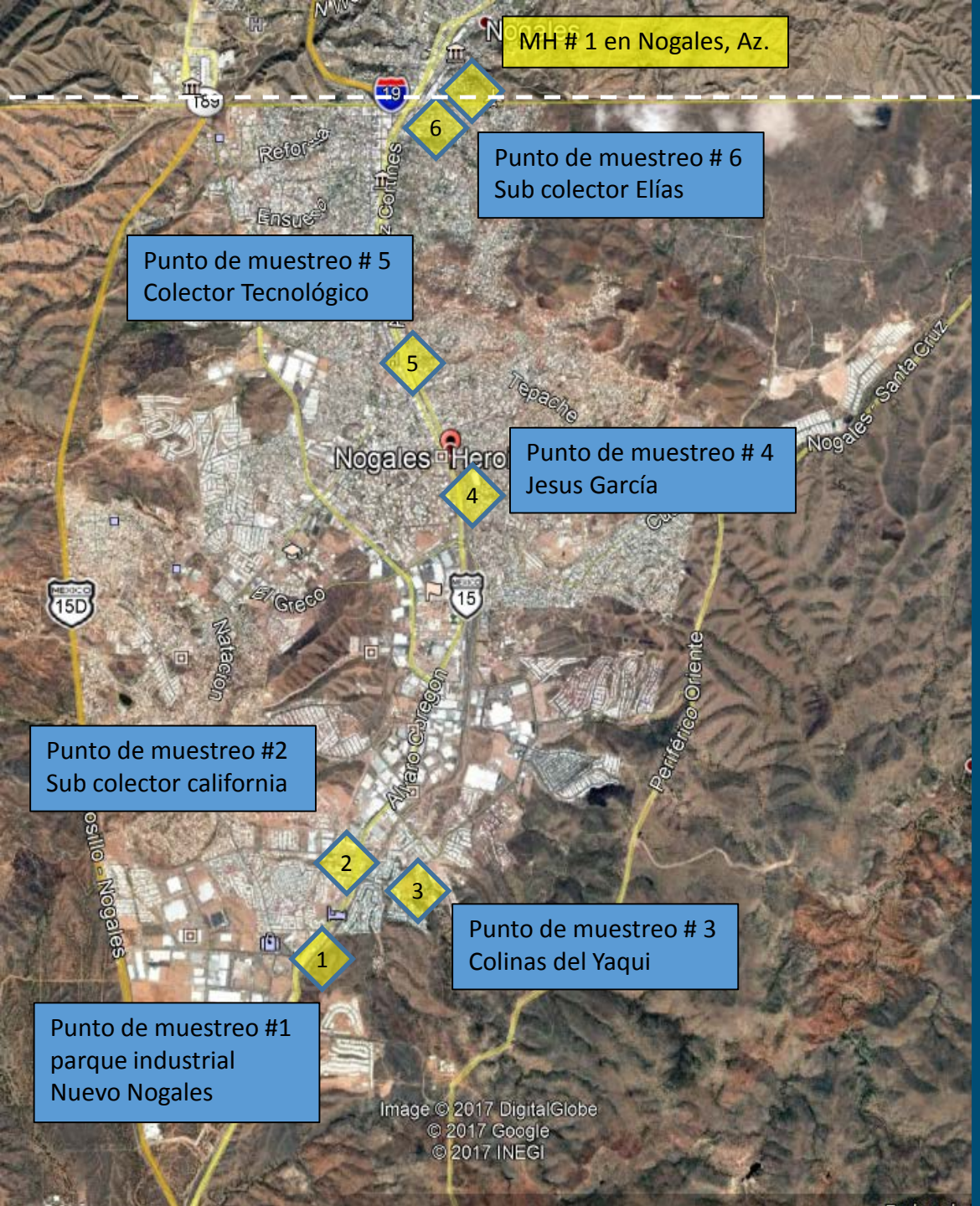
FIGURE 12: Zinc (Zn) Daily Loading NIWTP Border Station

Of concern for protecting **plant microbiology**

(Guidance is 16.17 kg/day @ 14.74 MGD vs 10.6 MGD average daily flows in June, 2018)



Correlated to Colinas



Conclusions

During the month of June 2018, IBWC's monitoring at MH1 witnessed intermittent levels of metals that approached or exceeded guidance for protecting NIWTP biosolids, NIWTP microbiology, and effluent quality.

Monitoring conducted by OOMAPAS with support from US partners identified source industrial parks whose discharges correlated with metal loadings at MH1.

Increased visibility by OOMAPAS within the community *may* have contributed to the lowest nickel loadings measured at MH1 since 2012.

Nogales, Sonora
Potable Water and Wastewater Utility
OOMAPAS-NS

Priority Areas

Parque Nuevo Nogales

– chromium, copper, and nickel

Colinas del Yaqui

– chromium, zinc

California

– chromium

Recommended Actions

1. Investigate options for providing laboratory support for OOMAPAS monitoring of candidate facilitates.
   (Samples must be analyzed in Mexican Certified labs for compliance action, so one option is purchase credits for OOMAPAS at certified labs in Mexico.)

2. Investigate process for Mexican certification of any US labs willing to support this effort moving forward (Pima County, City of Phoenix, private?).

Thank You!

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