# Wastewater Characterization Study

Prepared for

United States Section, International Boundary and Water Commission (USIBWC)

Under Contract IBM09D0010, Task Order 14T0008

Prepared by

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ADEQ | Arizona Department of Environmental Quality |
| APP | Aquifer Protection Permit |
| AZPDES | Arizona Pollutant Discharge Elimination System |
| $BOD_5$ | 5-day biochemical oxygen demand |
| CBOD | carbonaceous biochemical oxygen demand |
| CFR | Code of Federal Regulations (U.S.) |
| CILA | Comision Internacional de Limites y Aguas (Mexico IBWC) |
| COD | chemical oxygen demand |
| EPA/USEPA | U.S. Environmental Protection Agency |
| HEM | hexane extractable material (oil & grease) |
| IOI | International Outfall Interceptor |
| MAHA | maximum allowable headworks allocation |
| MAHL | maximum allowable headworks loading |
| mgd | million gallons per day |
| NIWTP | Nogales International Wastewater Treatment Plant |
| OOMAPAS | Organismo Operador Municipal de Agua Potable, Alcantarillado y Saneamiento de Nogales, Sonora |
| N | nitrogen |
| POC | pollutant of concern |
| SVOC | semi-volatile organic compound |
| TDS | total dissolved solids |
| TKN | Total Kjehldahl Nitrogen |
| TMDL | total daily maximum load |
| TOC | total organic carbon |
| TSS | total suspended solids |
| TTO | total toxic organics |
| USIBWC | United States Section, International Boundary and Water Commission |
| VOC | volatile organic compound |

# 1.0 INTRODUCTION

The City of Nogales, Arizona and the International Boundary and Water Commission, United States Section (USIBWC) co-own the Nogales International Wastewater Treatment Plant (NIWTP). The NIWTP treats domestic, commercial, and industrial flows from Nogales and Rio Rico, Arizona and Heroica Nogales (H. Nogales), Sonora, Mexico. The City of Nogales, Arizona has an approximate population of 21,000, while the community of Rio Rico, Arizona comprises a population of 19,000. Per the 2010 census, the City of Nogales, Sonora has a population of 212,533 and the total municipality has a population of 220,292. Currently, the USIBWC operates the NIWTP with approximately 75 percent of the plant's influent generated in Mexico and the remainder generated in Nogales and Rio Rico, Arizona. The majority of industrial discharges into the system are located in Sonora.

In 2009, the NIWTP was upgraded from advanced primary to secondary treatment in order to comply with regulatory water quality standards for discharge to the Santa Cruz River. To address the effects of industrial discharges, the USIBWC issued resolution number 6, as contained in Minute No. 276, "that the Governments of the United States and Mexico, in conformity with their own national legislation, take appropriate actions to prevent the discharge of untreated industrial wastewater into the international trunkline to preserve the efficiency of the Nogales International Sewage Treatment Plant." As such, in conformance with the U.S. Clean Water Act, the NIWTP was required by the AZPDES permit to develop mass influent loading objectives for pollutants that may cause or contribute to interference, pass through, or other problems at the treatment plant. The resulting report presented new Maximum Allowable Headworks Loadings (MAHLs) to satisfy this requirement for the new upgraded plant. The report was used to establish the pretreatment pollutants of concern (POCs) identified in Table 5 of the 2014 AZPDES permit. To assist in compliance with the MAHLs, the cities of Nogales, Arizona and Nogales, Sonora, have instituted local limits for industrial discharges to their respective sanitary sewers and have instituted sampling programs.

The purpose of this wastewater characterization study is to provide a plan for sampling and analysis of the wastewater throughout the sanitary collection system to obtain baseline data for an expanded list of pollutants of concern (POCs). The characterization results will assist in further identifying locations of concern and any additional pollutants that may require control or could interfere with wastewater operations. It is beyond the scope of this program to identify and/or quantify individual sources.

As an initial step in developing this characterization study, TRC presented an overview of the wastewater characterization study development at kick-off meeting in Rio Rico, Arizona attended by representatives of USIBWC, OOMAPAS, ADEQ, and the cities of Nogales, Arizona and Nogales, Sonora. The presentation included lists of the proposed constituents of concern (COCs) for the study, the majority of which reflected the AZPDES permit parameters, and the approach to developing the study which included the following elements:

- Identifying areas of significant industrial discharges on both sides of the border,
- Determining optimum sample locations extending from sources to the treatment plants,
- From source significance and variability, determining sampling duration, frequency, and analytical constituents, which may be reduced over time, and
- Developing a sampling schedule (locations, analyses, frequency, and duration).

TRC requested the following information from the participants:

- Layout (GIS data) for the sewer system from both the US and Mexico, including major industrial sources and lift stations,
- The locations and procedures used to collect the quarterly sampling,
- Identification of any changes or additions to the industrial users identified in the MAHA,
- Any additional data collected around the recommendations of the MAHA, including any BOD, TSS and ammonia removal across the WWTP,
- A list of all the sampling and flow monitoring equipment available and that which has been requested by OOMAPAS or others, and
- Contacts for the analytical labs to be used to coordinate analytical methods.

The participants asked that the analyses be limited to those required for the sources, where possible, and that the sampling and flow equipment specified not be limited to what is currently available. Subsequently, the following information was provided:

- Hans Huth of ADEQ provided some background documents and a composite of the MAHA quarterly sampling data for use;
- The Nogales GIS data was provided by Ernest Sinohui of GMA Inc, contractor to the City of Nogales, Arizona;
- The Reporte Anual de Pretratamiento Industrial y Comercial 2011 was provided by Roger Kohn of the USEPA;
- Information on available sampling equipment was provided by Lee Jacobs and Daniel Arimende of the City of Nogales, Arizona; and
- Information on the Nogales sewer system was provided in GIS and Autocad by the OOMAPAS of Nogales, Sonora, through the Mexican section of the IBWC (CILA).

## 2.0 IDENTIFICATION OF POLLUTANTS OF CONCERN

The POCs for the study have been selected by considering the following sources:

- AZPDES Permit issued March 2014
- Maximum Allowable Headworks Allocations (MAHA) updated November 2014
- Quarterly sampling results of the border International Outfall Interceptor (IOI) and treatment plant influent
- Results from the Industrial and Commercial Pretreatment Reports for H. Nogales, Sonora by Organismo Operador Municipal de Agua Potable, Alcantarillado y Saneamiento de Nogales, Sonora (OOMAPAS)
- USEPA Industrial Pretreatment Standards for identified industrial categories
- Arizona Aquifer Protection Permit
- Arizona Water Quality Standards
- ADEQ TMDLs for Santa Cruz River and Nogales Wash
- The parameters listed in the Mexico pretreatment standards in NOM-002-SEMARNAT-1996

The parameters covered in each of these sources are provided in Appendix A and cover both conventional and non-conventional pollutants, including a large number of organic compounds. These parameters have been screened for the following priorities to compile a base list of POCs for the characterization:

- Inclusion in more than one program;
- Detection in sampling events;
- Similarity of tests, e.g., BOD5, COD, TOC; and
- Test methods that provide results for multiple compounds.

Based upon these criteria, the selected POCs are provided in Table 1 along with their analytical methods, sample type, required containers, and preservatives. The analytical methods provided are approved USEPA methods for water and wastewater analysis as identified in 40 CFR 136. A list of contents for a typical lab pack to conduct these analyses is shown in Table 2. Table 1 should be provided to the analytical lab for their concurrence and preparation of lab packs. The actual analytical methods and lab pack contents will depend upon the analytical lab's procedures.

Upon completion of the first round of sampling, any POCs which are consistently below detection levels can be eliminated from analysis in subsequent sampling rounds.

## 3.0 IDENTIFICATION OF SAMPLE LOCATIONS

The principal sewer main for both cities runs from south to north with laterals collecting wastewater from industrial/commercial areas and residential areas as shown on Figure 1. The majority of industrial dischargers, approximately 121, are located in H. Nogales and can be classified as listed in Table 3. These include such industrial categories as transportation equipment cleaning, metal finishing, metal molding and casting, electroplating, and paper. Of the 121 industries, 117 reportedly discharge process wastewater to the sewer system. As these industries include specific POCs, as shown in Appendix A, these locations will be isolated as much as possible for sampling. In addition, the commercial dischargers in Nogales, AZ are located near the intersection of East Calle Sonora and Tuscon-Nogales Highway as shown on Figure 2.

The sample locations for the study have been selected to most cost-effectively observe the effects of the different industrial areas. It is beyond the scope of the characterization study and available resources to take samples of each of the industrial sources. To accomplish the sampling, the twelve (12) sample locations identified on Figures 3 and 4 and listed in Table 4 have been selected. These locations will allow observation of the POCs along the sewer system and selected branches. Since the largest number of industrial users is in H. Nogales, eight (8) of the locations are located in Mexico. These locations correspond to locations where industrial discharges enter the main sewer. In Nogales, Arizona, four (4) locations have been identified: the International Outfall Interceptor (IOI) manhole MH1 and the NIWTP Influent which are sampled in the quarterly MAHA sampling and manholes upstream and downstream of the identified industrial/commercial zone.

# 4.0 SAMPLE COLLECTION AND FLOW MEASUREMENT

Both composite and grab samples will be required for analysis of the selected POCs as shown in Table 1. In general, sampling procedures found in EPA's Industrial User Inspection and Sampling Manual for POTWs, 1994 and NMX-AA-003-1980 will be followed. The following describes the particular collection protocol for these samples.

## 4.1 Composite Samples

Most lab analyses will be performed on composite samples (see Table 1). Composite samples will be collected using either an ISCO or SIGMA autosampler to collect a 24-hour composite sample from each location. As the flow within the sewer will vary over the 24-hour sample time, it would be desired that the composite sample be flow-weighted as opposed to time-weighted. The samplers and flow modules/meters listed in Table 7 are compatible to allow connection.

The autosamplers and flow modules listed in Table 7 reflect those that are currently used by the Public Works Department of the City of Nogales, Arizona. Other similar equipment can be used with the following main criteria:

Autosampler

- Able to be installed within a manhole,
- Programmable to collect either a time- or flow-weighted composite sample,
- Use a 2.5+ gallon glass collection bottle with ice,
- Suction lift compatible with all sewer depths,
- Battery powered,
- Interface with the flow module/meter,
- NEMA 4x, 6P controller enclosure,
- Automatic rinsing for each sample,
- Use 3/8 inch (1 cm) Teflon (PTFE)-lined tubing which can be easily changed and cleaned, and
- Stainless steel strainer.

Flow Module/Meter

- Automatic measure and store velocity and flow data,
- NEMA 4x, 6P enclosure,
- Battery powered,
- Interface with autosampler,
- Easy installation within sewer manhole, and
- Compatible with sewer diameters of 6 inch (15 cm) to 30 inch (76 cm).

Since multiple analyses will be run from the composite, the sample will be collected in a clean 2.5-gallon (9.5-liter) or greater glass bottle chilled with ice. The autosampler will be programmed to collect at least 2 gallons (9 liters) over the 24 hours sample collection. Prior to starting each sample collection, an equipment blank sample will be collected by running DI water through the sampler and collecting in the sample bottles specified in Table 2. At the end of the collection period, the autosampler will be turned off and the composite sample divided among the lab sample containers containing preservative. The glass bottle should be swirled to suspend any solids and mix the contents. Using a clean, 1-liter Pyrex® beaker or other clean container with a pour spout, transfer the composite sample to each of the lab containers being sure to swirl the collection jug before each transfer. Do not overfill any sample container as that will dilute the preservative.

### 4.2 Grab Samples

For those analyses requiring grab samples, the samples must be collected from the manhole using a clean glass container. The oil and grease sample must be collected in the sample jar. Lower the container into the manhole being careful not to touch the sides. Collect a sample from the water at the bottom of the manhole and fill each of the lab containers which contain preservative as required. Do not overfill any sample container as that will dilute the preservative. In order to better observe daily variations, grab samples are to be taken three times per day at approximately 8 AM, 12 PM and 4 PM.

### 4.3 Flow Measurement

Flow measurements will be conducted with a portable velocity/flow module/meter at the time of the composite sample collection. Area velocity meters, such as ISCO 2150 Flow Meter, are designed to measure flow in sewer pipe. The area velocity sensor for the meter should be installed in the manhole prior to setting up the autosampler with flow data collected throughout the 24-hour sampling period. In addition, instantaneous flow readings should be recorded when grab samples are collected.

## 5.0 QUALITY ASSURANCE/QUALITY CONTROL

In order to assure the quality of the data collected, the following procedures will be followed in sample collection:

- All sampling equipment will be cleaned between sample collections by scrubbing with a soap solution, such as an Alconox solution, thoroughly rinsed with clean water, then a final rinse with deionized or distilled water. Tubing used in the autosampler will be changed out before each sampling event. PTFE-lined tubing can be cleaned and reused.
- All laboratory sample bottles will be provided by the laboratory with pre-measured preservative. The bottles are to be labeled for the analysis and the preservative.
- All sample bottles are to be labeled in the field with a unique sample number, the sample name, location, date and time of sample, the name of the sampler, and the analysis to be performed, if not preprinted. Labels should be provided by the lab. This same information is to be recorded in a bound field notebook along with any field observations.
- The following quality control samples will be taken:
  - Trip blanks – For each sample shipment/cooler, a trip blank of DI water should be provided by the lab for analysis of VOCs.
  - Field blanks – For each sample shipment/cooler, a field blank for VOC analysis will be collected using DI water.
  - Equipment blanks – Prior to starting each composite sampling, a sample of DI water will be run through the sampler and collected for SVOCs and metals analysis.
  - Duplicates – Duplicate samples for each analysis will be collected for each 20 samples collected.
- Upon completing collection of the samples from a sample location, a Chain of Custody provided by the lab will be completed and signed. All samples will be placed into a cooler with frozen Blue Ice or a sealed bag of ice to maintain the samples at ≤ 6°C. The cooler will be strapped with tape and a signed seal placed between the lid and body of the cooler. The cooler will be either delivered or shipped to the lab for next day delivery.

## 6.0 SAMPLING SCHEDULE

As wastewater flows and characteristics can vary over time, the sampling schedule must take these variations into consideration. Of particular concern are the industrial discharges which vary based on production schedules. Hence, variations can occur during the week, month and season. To accommodate these variations, the schedule consists of collecting samples at a particular location over several weeks on sequential days of the week. Due to limited resources available and to reasonably handle the sampling, the schedule calls for sampling four (4) locations at a time in both Nogales and H. Nogales. Each location would be sampled over one day per week for seven weeks in order to cover all seven days of the week and a period of over one month. This schedule is to be repeated three (3) times which will cover a single year. This sampling schedule is shown on Tables 5 and 6 for H. Nogales, Sonora and Nogales, Arizona, respectively, and shown graphically in Figure 5. The resources required for the sampling are listed in Table 7.

# TABLES

# TABLE 1

## *POLLUTANTS OF CONCERN (POCS)*

| Parameter | Analytical Methods | Sample Type | Sample Container[8] | Sample Volume | Preservative | Max. Hold Time | Ref. |
|---|---|---|---|---|---|---|---|
| Carbonaceous Biochemical Oxygen Demand (CBOD) | 5210B – 2007 / NMX-AA-028-SCFI-2001 | 24-hr Composite | P, FP, G | 1 L (32 oz.) | Cool, ≤ 6°C | 48 hr | 7 |
| Total Suspended Solids (TSS) | EPA 160.2 / NMX-AA-034-SCFI-2001 | 24-hr Composite | P, FP, G | 250 mL (8 oz.) | Cool, ≤ 6°C | 7 days | 1 |
| Oil & Grease (Hexane Extractable Material, HEM; Soxhlet Extraction) | EPA 1664 / NMX-AA-005 | Grab | G | 1 L (32 oz.) | Cool to ≤ 6°C, HCl or $H_2SO_4$ to pH<2 | 28 days | 3 |
| Ammonia (as N) | EPA 350.3 / NMX-AA-026-SCFI-2001 | 24-hr Composite | P, FP, G | 500 mL (16 oz.) | Cool, ≤ 6°C, $H_2SO_4$ to pH<2 | 28 days | 1 |
| Nitrate/Nitrite (as N) | EPA 300.1-1 / NMX-AA-079-SCFI-2001 & NMX-AA-099-SCFI-2006 | 24-hr Composite | P, FP, G | 250 mL (8 oz.) | Cool, ≤ 6°C, $H_2SO_4$ to pH<2 | 28 days | 2 |
| Nitrogen, Total Kjeldahl (TKN) | EPA 350.1 / NMX-AA-026-SCFI-2010 | 24-hr Composite | P, FP, G | 1 L (32 oz.) | Cool, ≤ 6°C, $H_2SO_4$ to pH<2 | 28 days | 1 |
| Phosphorus, Total | EPA 365 / NMX-AA-029-SCFI-2001 | 24-hr Composite | P, FP, G | 1 L (32 oz.) | Cool, ≤ 6°C, $H_2SO_4$ to pH<2 | 28 days | 1 |
| Cyanide, Total | EPA 335.2 / NMX-AA-058-SCFI-2001 | Grab | P, FP, G | 1 L (32 oz.) | Cool, ≤ 6°C, NaOH to pH>10 | 14 days | 1 |

| Parameter | Analytical Methods | Sample Type | Sample Container[8] | Sample Volume | Preservative | Max. Hold Time | Ref. |
|---|---|---|---|---|---|---|---|
| Fluoride | EPA 300.1-1 / NMX-AA-077-SCFI-2001 | 24-hr Composite | P | 250 mL (8 oz.) | None | 28 days | 1 |
| Metals (Antimony, Arsenic, Barium, Beryllium, Cadmium, Total Chromium, Copper, Iron, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Thallium, Uranium, Zinc) | EPA 200.8 / NMX-AA-051-SCFI-2001 | 24-hr Composite | P, FP, G | 1 L (32 oz.) | $HNO_3$ to pH<2, or at least 24 hrs prior to analysis | 6 mo. | 1 |
| Boron | EPA 200.8 / NMX-AA-063-SCFI-2001 | 24-hr Composite | P, FP, Quartz | 250 mL (8 oz.) | $HNO_3$ to pH<2 | 6 mo. | 1 |
| Chromium (VI) | EPA 200.8 / NMX-AA-044-SCFI-2001 | 24-hr Composite | P, FP, G | 250 mL (8 oz.) | Cool, ≤ 6°C, pH=9.3-9.7 | 24 hr | 1 |
| Mercury | EPA 245.1 / NMX-AA-051-SCFI-2001 | 24-hr Composite | FP, G; and FP-lined cap | 1 L (32 oz.) | 5 mL/L 12N HCl or 5 mL/L BrCl | 28 days | 4 |
| Semi-volatile Organic Compounds (SVOCs) | EPA 625 | 24-hr Composite | G, FP-lined cap | 2 - 1 L (32 oz.) | Cool, ≤ 6°C, 0.008% $Na_2S_2O_3$, store in dark | 7 days until extraction, 40 days after extraction | 5 |
| Volatile Organic Compounds (VOCs) | EPA 624 | Grab | G, FP-lined septum | 3 – 40 mL | Cool, ≤ 6°C, 0.008% $Na_2S_2O_3$ | 14 days | 5 |
| Other Organics (alachlor, atrazine, chlordane, chlorpyrifos, di(2-ethyl)adipate, hexachlorocyclohexane (α,β,δ), lindane, methoxychlor, permethrin, simazine, toxaphene) | EPA 525.2, 625, 608 / NMX-AA-071-1981, | Grab | G, FP-lined cap | 1 L (32 oz.) | Cool, ≤ 6°C, pH 5-9 | 7 days until extraction, 40 days after extraction | 6 |

1 – U.S. EPA. May 1994. Methods for the Determination of Metals in Environmental Samples, Supplement I, EPA/600/R-94/111; or U.S. EPA. August 1993. Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100.

2 – US EPA. Revision 1.0, 1997, including errata cover sheet April 27, 1999. Determination of Inorganic Ions in Drinking Water by Ion Chromatography

3 – Method 1664 Rev. B is the revised version of EPA Method 1664 Rev. A. U.S. EPA. February 1999, Revision A. Method 1664, n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry. EPA-821-R-98-002. U.S. EPA. February 2010, Revision B. Method 1664, n-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry. EPA-821-R-10-001.

4 – Method 245.7, Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, EPA-821-R-05-001. Revision 2.0, February 2005. US EPA

5 – 40 CFR 136, Appendix A, Test Procedures for Analysis of Organic Pollutants

6 – Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary Column Gas Chromatography/Mass Spectrometry, Revision 2.0, 1995, U.S. EPA

7 – Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

8- "P" is polyethylene; "FP" is fluoropolymer (polytetrafluoroethylene (PTFE); Teflon®), or other fluoropolymer; "G" is glass.

# TABLE 2

## *TYPICAL LABPACK CONTENTS*

| Number of Containers | Sample Container & Preservative | Analytical Parameters |
|---|---|---|
| 1 | 1 L Plastic | CBOD |
| 1 | 1 L Plastic | TSS, F, Cr (VI) |
| 2 | 1 L Glass with $H_2SO_4$ | HEM |
| 1 | 1 L Plastic with $H_2SO_4$ | $NH_3$, $NO_3$/$NO_2$, TKN, P(T) |
| 1 | 250 mL with NaOH | CN |
| 1 | 1 L Plastic with $HNO_3$ | Metals – Sb, As, Ba, Be, Cd, Cr(T), Cu, Fe, Pb, Mn, Mo, Ni, Se, Ag, Tl, U, Zn, B, Hg |
| 2 | 1 L Amber Glass | SVOCs |
| 3 | 40 mL Vials with HCl | VOCs |
| 2 | 1 L Amber Glass | Other organics - alachlor, atrazine, chlordane, chlorpyrifos, di(2-ethyl)adipate, hexachlorocyclohexane (α,β,δ), lindane, methoxychlor, permethrin, simazine, toxaphene |
| 2 | 40 mL Vials with HCl | Trip blanks |
| 1 | 40 mL Vials with HCl | Field blank - VOCs |
| 1 | 1 L Plastic with $HNO_3$ | Equipment blank - Metals – Sb, As, Ba, Be, Cd, Cr(T), Cu, Fe, Pb, Mn, Mo, Ni, Se, Ag, Tl, U, Zn, B, Hg |
| 1 | 1 L Amber Glass | Equipment blank - SVOCs |
| | | |
| **19** | **Total Bottle Count** | |
| | | |

# TABLE 3

## *SUMMARY OF INDUSTRIAL DISCHARGERS*

| Industry Type | Processes with Water |
|---|---|
| **Nogales, Sonora** | |
| Communication equipment manufacturer | Antenna leak test |
| Assembly of gardening products | Leak test for plastic tanks |
| Assembly of electronics | Electronic board wash |
| Metallic coating | Galvanization, silk screening |
| Denture manufacturer | Washing dental pieces |
| Mold injection | Water coolant for plastics |
| Manufacturer of metal products | Cutting and washing metals |
| Elevator manufacturer | Wash glues |
| Railroad cargo transportation | Washing |
| Manufacturer of polystyrene products | Steam generation |
| Assembly of electronic harnesses | Leak tests |
| Extraction and refining of vegetable oil | Steam generation, washing |
| Measure pressure | Reverse osmosis process |
| Beverage bottling | Water purification |
| Metallic coating | Metallic coating process |
| Manufacturer of ink jet cartridges | Ink cartridge washing |
| Trophy manufacturer | Acrylic washing |
| Assembly of aerospace and military connectors | Washing metal |
| Assembly and disposal of medical devices | Water coolant for plastics |
| Publisher | Film development |
| Assembly of  electronics | Electroplating process |
| Manufacturer of cardboard boxes | Wash print rollers |
| Manufacturer of medical products | Cooling tower |
| **Nogales, Arizona** | |
| Produce Warehousing | Cooling tower, wash water |
| Food service | Food preparation (FOG) |
| Medical facilities | Pathology, radiology, cleaning/disinfection |
| Vehicle storage, repair, gasoline retailers | Leaks, drips and washing |
| Recycle (solid waste and used vehicles and parts) | Leaks and drips, auto fluff, dust control |

# TABLE 4

## *SAMPLING LOCATIONS*

| Location | GPS X | GPS Y |
|---|---|---|
| **Nogales, Sonora** | | |
| Colector Nuevo Nogales (5038) | 504724 | 3458234 |
| Colinas del Yaqui (4926) | 505365 | 3459292 |
| Penitenciaria (2843) | 506077 | 3461332 |
| El Greco (4620) | 506155 | 3462035 |
| Colector Jesus Garcia (4473) | 506093 | 3462635 |
| 5 de Mayo (1471) | 505820 | 3463143 |
| Tecnologico (1110) | 505260 | 3463788 |
| Reforma (139) | 505521 | 3466471 |
| **Nogales, Arizona** | | |
| MH1 | 505525 | 3466487 |
| Western Avenue | 506612 | 3468201 |
| MH42 | 506699 | 3470088 |
| Mariposa | 506229 | 3470574 |
| MH48 | 506293 | 3471014 |
| MH51 | 505740 | 3471588 |
| MH59 | 504938 | 3472374 |
| NIWTP Influent | | |

## TABLE 5

***SAMPLING SCHEDULE FOR NOGALES, SONORA***

(REPEATED 3 TIMES/YEAR)

| Week | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|
| 1 | A | B | | | | | |
| 2 | | A | B | | | | |
| 3 | | | A | B | | | |
| 4 | | | | A | B | | |
| 5 | | | | | A | B | |
| 6 | | | | | | A | B |
| 7 | | | | | | | A |
| 8 | B | | | | | | |
| 9 | C | D | | | | | |
| 10 | | C | D | | | | |
| 11 | | | C | D | | | |
| 12 | | | | C | D | | |
| 13 | | | | | C | D | |
| 14 | | | | | | C | D |
| 15 | | | | | | | C |
| 16 | D | | | | | | |

Sample Location Groups:

A – Colector Nuevo Nogales and Colinas del Yaqui

B – Penitenciaria and El Greco

C – Colector Jesus Garcia and 5 de Mayo

D – Tecnologico and Reforma

## TABLE 6

***SAMPLING SCHEDULE FOR NOGALES, ARIZONA***
(REPEATED 3 TIMES/YEAR)

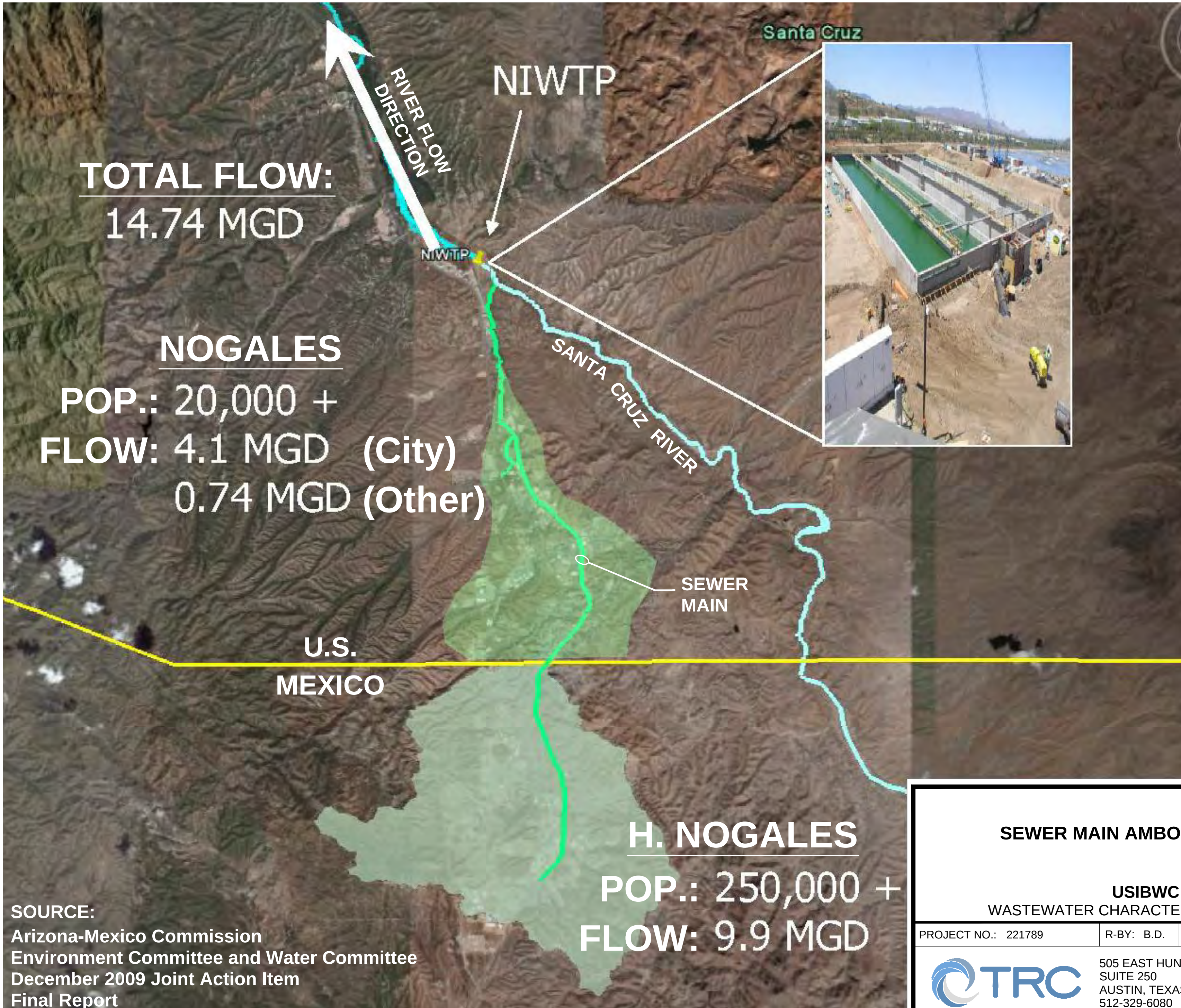
| Week | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|
| 1 | A | B | | | | | |
| 2 | | A | B | | | | |
| 3 | | | A | B | | | |
| 4 | | | | A | B | | |
| 5 | | | | | A | B | |
| 6 | | | | | | A | B |
| 7 | | | | | | | A |
| 8 | B | | | | | | |
| 9 | C | D | | | | | |
| 10 | | C | D | | | | |
| 11 | | | C | D | | | |
| 12 | | | | C | D | | |
| 13 | | | | | C | D | |
| 14 | | | | | | C | D |
| 15 | | | | | | | C |
| 16 | D | | | | | | |
| Sample Location Groups:<br>A – MH1 and Western Avenue<br>B – MH42 and Mariposa<br>C – MH48 and MH51<br>D – MH59 and NIWTP Influent | | | | | | | |

# TABLE 7

## *RESOURCES REQUIRED PER ROUND OF SAMPLING IN TABLES 5 & 6*

| City | Resource | Number |
|---|---|---|
| Nogales, Sonora | Sampling Personnel | 2 |
| | Portable Composite Sampler (ISCO Model 6712 or equivalent) with 9.5 L (2.5 gal.) glass sample bottle | 4 |
| | Portable Flow Module or Meter (ISCO Model 2150 or equivalent) | 4 |
| | Laboratory sample kits (to be provided by lab) | 56 |
| Nogales, Arizona | Sampling Personnel | 2 |
| | Portable Composite Sampler (ISCO Model 6712 or equivalent) with 9.5 L (2.5 gal.) glass sample bottle | 4 |
| | Portable Flow Module or Meter (ISCO Model 2150 or equivalent) | 4 |
| | Laboratory sample kits (to be provided by lab) | 56 |

# FIGURES




**SEWER MAIN AMBOS NOGALES**

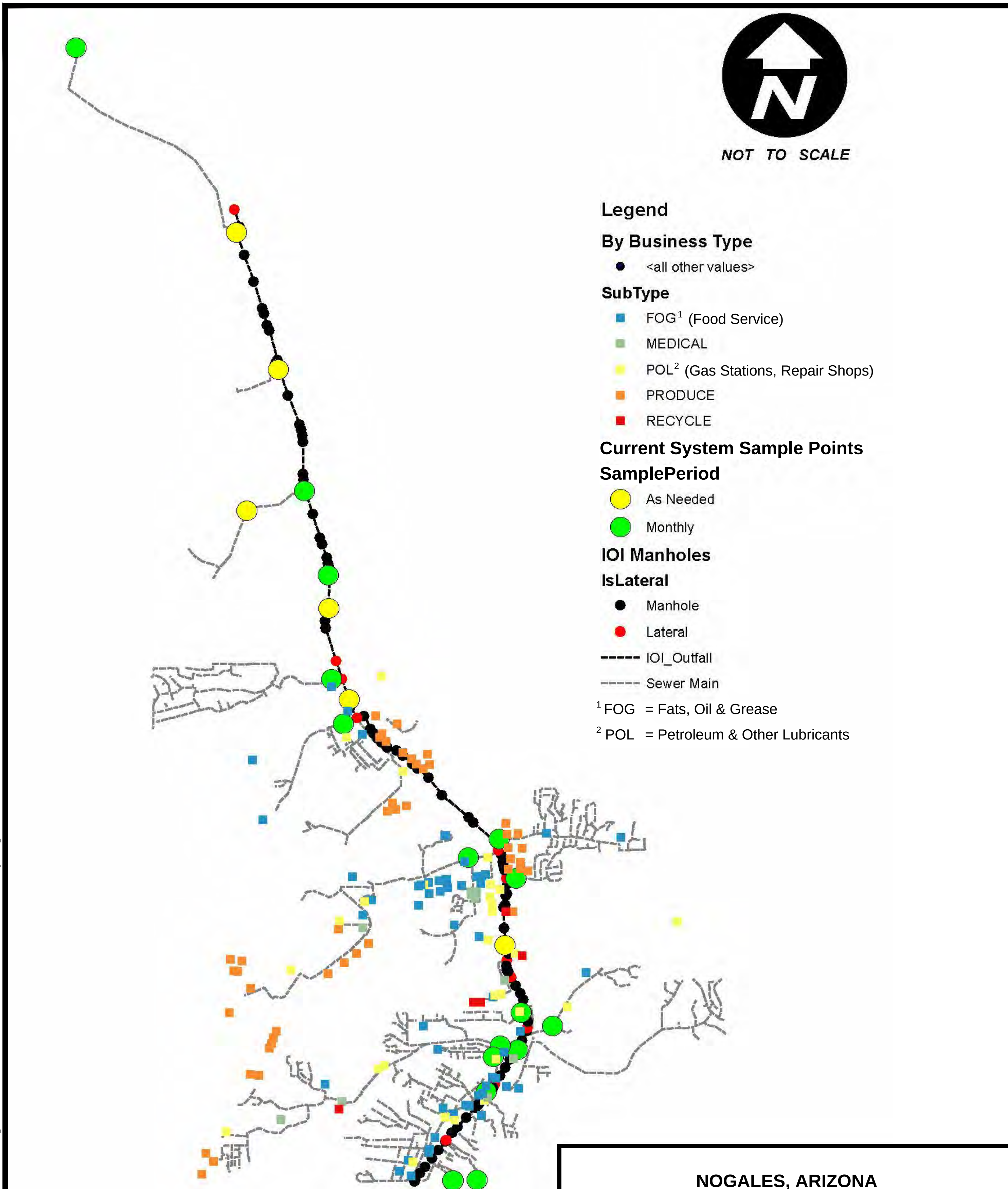
**USIBWC**
WASTEWATER CHARACTERIZATION STUDY

| PROJECT NO.: 221789 | R-BY: B.D. | DATE: 11/12/2014 | D-BY: O.F. |
|---|---|---|---|

TRC
505 EAST HUNTLAND DRIVE
SUITE 250
AUSTIN, TEXAS 78752
512-329-6080

FIGURE
**1**

HOU M:\ACAD-TRC\DRAFTING\USIBWC\ Figs -USIBWC- Wastewater Characterization Study.dwg 11/19/14




**NOGALES, ARIZONA**
**COMMERCIAL / INDUSTRIAL FACILITIES**

**USIBWC**
WASTEWATER CHARACTERIZATION STUDY

| PROJECT NO.: 221789 | R-BY: B.D. | DATE: 03/19/2015 | D-BY: O.F. |
|---|---|---|---|

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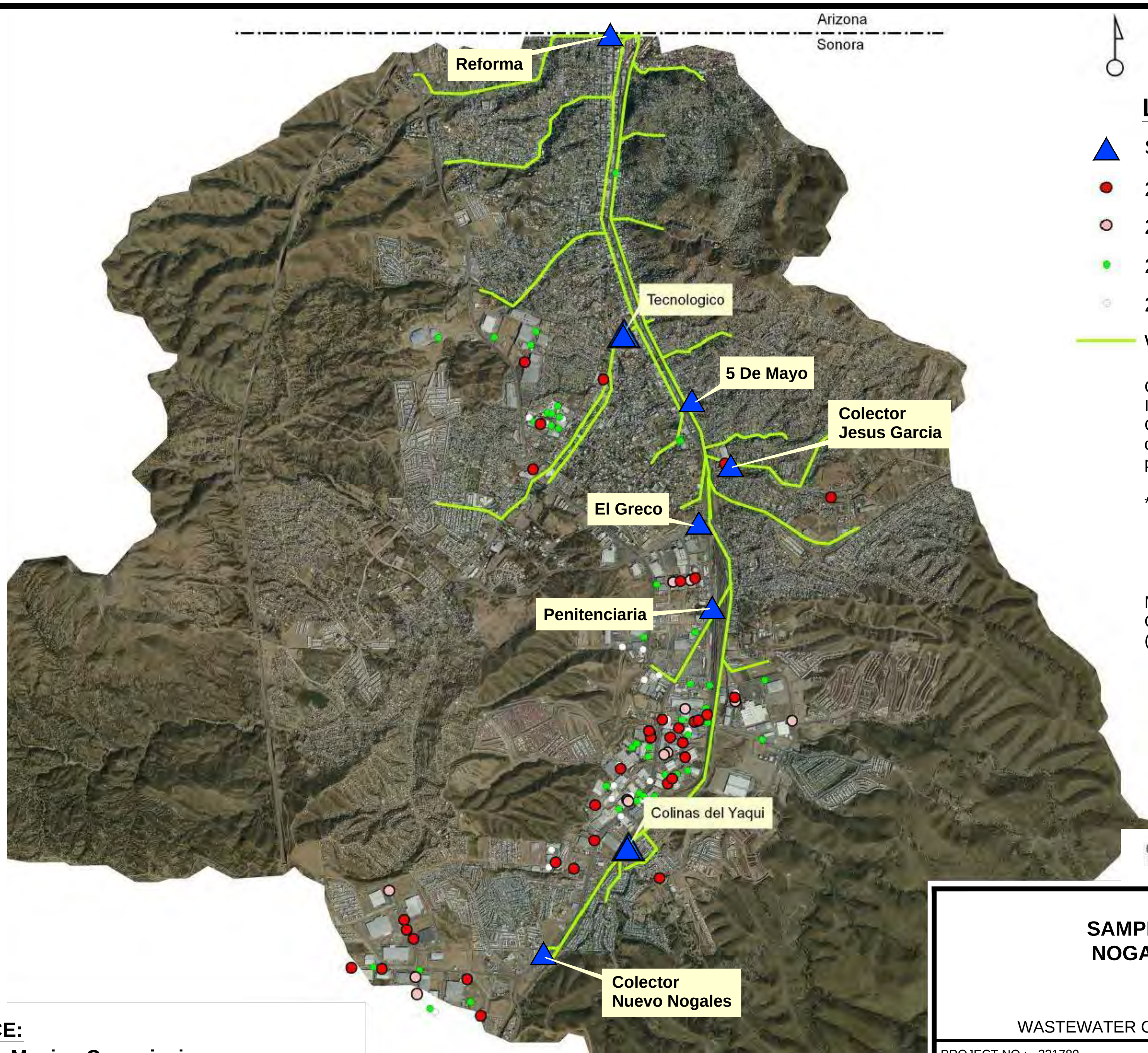
FIGURE
**2**

HOU M:\ACAD-TRC\DRAFTING\USIBWC\ Figs 1-4 -USIBWC- Wastewater Characterization Study.dwg 03/19/15




**LEGEND**

- Sample Locations
- 2010 GPS Facilities
- 2010 GPS Facilities
- 2010 GPS Permitted Facilities*
- 2010 GPS Facilities Closed
- Wastewater Collectors

GPS Facilities:
Industrial facilities located by their Global Positioning System (GPS) data from Nogales, Sonora pretreatment database.

*Not all known industrial facilities are shown given missing GPS data not reflected in the Nogales, Sonora 2009 pretreatment database.

MAP LAST UPDATED:
October 8, 2010 by Hans Huth;
(520-628-6711)

0 250 500 1,000 1,500 2,000 Meters

**SOURCE:**
**Arizona-Mexico Commission**
**Environment Committee and Water Committee**
**December 2009 Joint Action Item**
**Final Report**

**SAMPLE LOCATIONS**
**NOGALES, SONORA**

**USIBWC**
WASTEWATER CHARACTERIZATION STUDY

| PROJECT NO.: 221789 | R-BY: B.D. | DATE: 11/12/2014 | D-BY: O.F. |
|---|---|---|---|

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AUSTIN, TEXAS 78752
512-329-6080

FIGURE
**3**

HOU M:\ACAD-TRC\DRAFTING\USIBWC\ Figs 1-4 -USIBWC- Wastewater Characterization Study.dwg 03/30/15


**SAMPLE LOCATIONS**
**NOGALES, ARIZONA**

**USIBWC**
WASTEWATER CHARACTERIZATION STUDY

| PROJECT NO.: 221789 | R-BY: B.D. | DATE: 03/19/2015 | D-BY: O.F. |
|---|---|---|---|

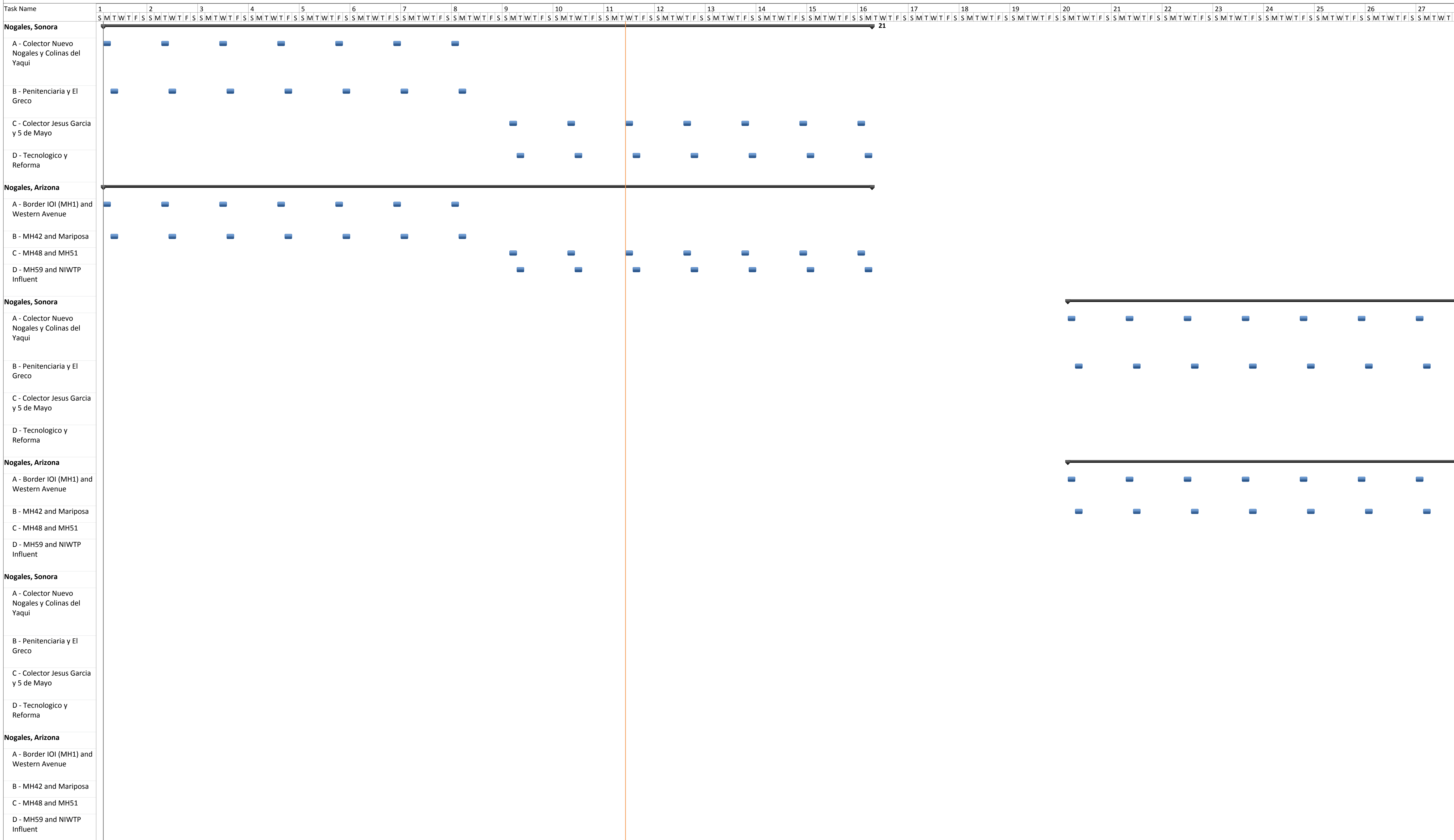
TRC

505 EAST HUNTLAND DRIVE
SUITE 250
AUSTIN, TEXAS 78752
512-329-6080

FIGURE
**4**

HOU M:\ACAD-TRC\DRAFTING\USIBWC\ Figs 1-4 -USIBWC- Wastewater Characterization Study.dwg 03/19/15

**Wastewater Characterization Study for Ambos Nogales**
**International Boundary and Water Commission**

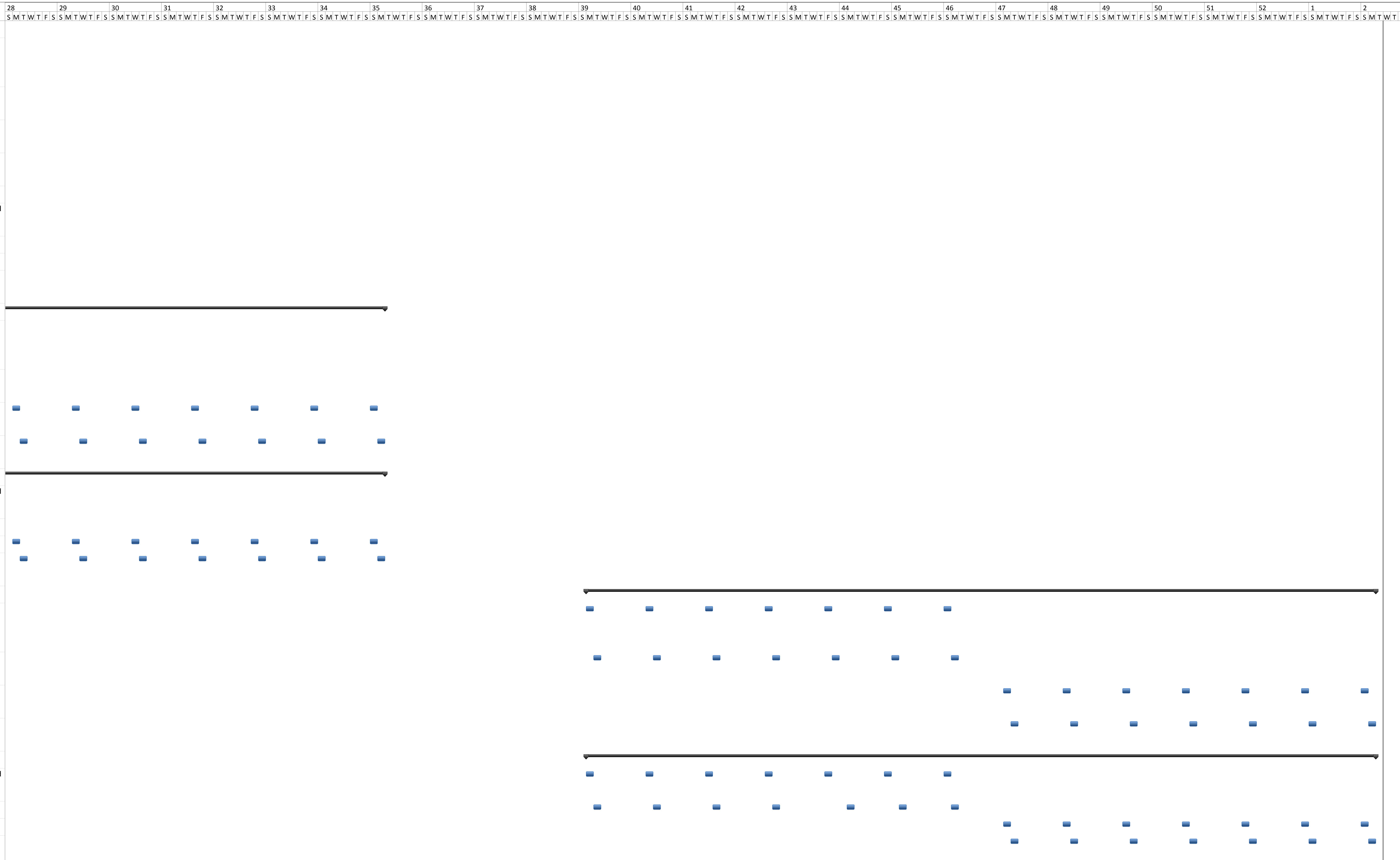



Project: Figure 5 -Wastewater Characterization Schedule for Ambos Nogales r
Date: Wed 3/18/15

Task | Milestone | Summary | Project Summary | External Milestone | Progress

**Wastewater Characterization Study for Ambos Nogales**
**International Boundary and Water Commission**

| Task Name |
|---|
| **Nogales, Sonora** |
| A - Colector Nuevo Nogales y Colinas del Yaqui |
| B - Penitenciaria y El Greco |
| C - Colector Jesus Garcia y 5 de Mayo |
| D - Tecnologico y Reforma |
| **Nogales, Arizona** |
| A - Border IOI (MH1) and Western Avenue |
| B - MH42 and Mariposa |
| C - MH48 and MH51 |
| D - MH59 and NIWTP Influent |
| **Nogales, Sonora** |
| A - Colector Nuevo Nogales y Colinas del Yaqui |
| B - Penitenciaria y El Greco |
| C - Colector Jesus Garcia y 5 de Mayo |
| D - Tecnologico y Reforma |
| **Nogales, Arizona** |
| A - Border IOI (MH1) and Western Avenue |
| B - MH42 and Mariposa |
| C - MH48 and MH51 |
| D - MH59 and NIWTP Influent |
| **Nogales, Sonora** |
| A - Colector Nuevo Nogales y Colinas del Yaqui |
| B - Penitenciaria y El Greco |
| C - Colector Jesus Garcia y 5 de Mayo |
| D - Tecnologico y Reforma |
| **Nogales, Arizona** |
| A - Border IOI (MH1) and Western Avenue |
| B - MH42 and Mariposa |
| C - MH48 and MH51 |
| D - MH59 and NIWTP Influent |




Project: Figure 5 -Wastewater Characterization Schedule for Ambos Nogales r
Date: Wed 3/18/15

Task | Milestone | Summary | Project Summary | External Milestone | Progress

# APPENDIX A

# Conventional and Inorganic Pollutants

| | |
|---|---|
| • Carbonaceous Biochemical Oxygen Demand (CBOD)[1,5] | • Phosphorus[1] |
| • Total Suspended Solids (TSS)[1,5] | • Total Dissolved Solids (TDS)[1,3] |
| • pH[1,2,3] | • Chemical Oxygen Demand (COD) |
| • Oil & Grease (Hexane Extractable Material, HEM)[1] | • Total Organic Carbon (TOC)[3] |
| • Ammonia (as N)[1,2,5] | • Cyanide[1,3,4,5] |
| • Nitrate/Nitrite (as N)[1,3] | • Sulfide[1,2] |
| • Nitrogen, Total Kjeldahl (TKN)[1,3] | • Fluoride[1,2,3,5] |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards
[3] Aquifer Protection Permit
[4] Quarterly Sampling
[5] MAHA Pollutant of Concern

# Metals (EPA 200.8)

| | |
|---|---|
| • Antimony[1,2,4] | • Lead[1,2,4,5,6] |
| • Arsenic[1,2,4,5,6] | • Manganese[1,2,4] |
| • Barium[1,4] | • Mercury[1,2,3,4,6] |
| • Beryllium[1,4] | • Molybdenum[6] |
| • Boron[1] | • Nickel[1,2,4,6] |
| • Cadmium[1,2,4,5,6] | • Selenium[1,4,5,6] |
| • Chromium (VI)[1,2] | • Silver[1,2,5,6] |
| • Chromium (total)[1,4,5,6] | • Thallium[1,4] |
| • Copper[1,2,5,6] | • Uranium[1] |
| • Iron[1,2,4,5] | • Zinc[1,2,5,6] |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards
[3] EPA 245.7
[4] Aquifer Protection Permit
[5] Quarterly Sampling
[6] MAHA Pollutant of Concern

# SVOCs (EPA 625)

| | | |
|---|---|---|
| • Acenaphthene[1,2] | • Butyl benzyl phthalate[1,2] | • 1,4-Dichlorobenzene[1,2,3,4] |
| • Aldrin[1,2] | • Chlordane[1,2] | • 3,3'-Dichlorobenzidine[1,2] |
| • Anthracene[1] | • p-Chloro-m-cresol[1,2] | • p,p'- Dichlorodiphenyltrichloroethane (DDT) and metabolites (DDD) and (DDE)[1,2] |
| • Benzidine[1,2] | • 2-Chloronaphthalene[1] | • 1,2-Dichloroethane[2] |
| • Benzo(a)anthracene[1] | • p-Chlorodiphenyl ether[1] | • 2,4-Dichlorophenol[1,2] |
| • Benzo(a)pyrene[1] | • 2-Chlorophenol[1,2] | • Dieldrin[1,2] |
| • Benzo(ghi)perylene[1] | • Chrysene[1] | • Diethyl phthalate[2] |
| • Benzo(k)fluoranthene[1] | • Dibenzo(a,h)anthracene[1] | • Di (2-ethylhexyl) phthalate[1,2] |
| • 3,4-Benzofluoranthene[1] | • Di-n-butyl phthalate[1,2] | • 2,4-Dimethylphenol[1,2] |
| • Bis(2-chloroethoxy) methane[1] | • Di-n-octyl phthalate[1] | • Dimethyl phthalate[2] |
| • Bis(2-chloroethyl) ether[1,2] | • 1,2-Dichlorobenzene[2,3] | • 4,6-Dinitro-o-cresol[1,2] |
| • Bis(2-chloroisopropyl) ether[1] | • 1,3-Dichlorobenzene[2] | • 2,4-Dinitrophenol[1,2] |
| • p-Bromodiphenyl ether[1,2] | | |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards
[3] Aquifer Protection Permit
[4] MAHA Pollutant of Concern

# SVOCs (EPA 625) (cont'd)

| | | |
|---|---|---|
| • 2,4-Dinitrotoluene[1,2] | • Hexachlorobenzene[1,2,3] | • N-nitrosodimethylamine[1] |
| • 2,6-Dinitrotoluene[1,2] | • Hexachlorobutadiene[1,2] | • N-nitrosodi-n-phenylamine[1,2] |
| • 1,2-Diphenylhydrazine[1,2] | • Hexachlorocyclopentadiene[1,2] | • Pentachlorophenol[1,2,4] |
| • Endosulfan (Total)[1,2] | • Hexachloroethane[1,2] | • Phenanthrene[1,2,4] |
| • Endrin[1,2] | • Indeno(1,2,3-cd)pyrene[1,2] | • Phenol[1,2] |
| • Endosulfan sulfate[1,2] | • Isophorone[1,2] | • Polychlorinatedbiphenyls (PCBs)[1,2] |
| • Endrin aldehyde[1,2] | • Naphthalene[1,2] | • Pyrene[1] |
| • Fluorene[1] | • Nitrobenzene[1,2] | • Toxaphene[1,2] |
| • Fluoranthene[1,2] | • 2-Nitrophenol[1] | • 1,2,4-Trichlorobenzene[1,2,3] |
| • Heptachlor[1,2] | • 4-Nitrophenol[1,2] | • 2,4,6-Trichlorophenol[1,2] |
| • Heptachlor epoxide[1,2] | • N-nitrosodi-n-propylamine[1] | |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards
[3] Aquifer Protection Permit
[4] Quarterly Sampling

# VOCs (Method 624)

| | | |
|---|---|---|
| • Benzene[1,2,3] | • Dibromochloromethane[1] | • Methylene chloride[1,4] |
| • Bromomethane[1,2] | • 1,1-Dichloroethane[1] | • Styrene[1,2,3] |
| • Bromoform[1,2] | • 1,2-Dichloroethane[1,3] | • Tetrachloroethylene[1,2,3] |
| • Bromodichloromethane[1] | • 1,1-Dichloroethylene[1,2,3] | • 1,1,2,2-Tetrachloroethane[1,2] |
| • Carbon tetrachloride[1,2,3] | • 1,2-cis-Dichloroethylene[2,3] | • Toluene[1,2,3] |
| • Chlorobenzene[1,2,3] | • trans-1,2-Dichloroethylene[1,2,3] | • 1,1,1-Trichloroethane[1,2,3] |
| • Chloroethane[1] | • Dichloromethane[2,3] | • 1,1,2-Trichloroethane[1,2,3] |
| • 2-Chloroethyl vinyl ether[1,2] | • 1,2-Dichloropropane[1,2,3] | • Trichloroethylene[1,2,3] |
| • Chloroform[1,2] | • 1,3-Dichloropropene[1,2] | • Vinyl chloride[1,3] |
| • Chloromethane[1,2] | • Ethylbenzene[1,2,3] | • Xylenes[1,2,3] |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards
[3] Aquifer Protection Permit
[4] Quarterly Sampling

# Organics (Methods 525.2, 625, 608)

| | |
|---|---|
| • Alachlor[1,2] | • Hexachlorocyclohexane delta[1,2] |
| • Atrazine[1,2] | • Hexachlorocyclohexane gamma[1,2] (lindane) |
| • Chlordane[1,2] | • Methoxychlor[1,2] |
| • Chlorpyrifos[1,2] | • Permethrin[1,2] |
| • Di(2-ethyl)adipate[1,2] | • Simazine[1,2] |
| • Hexachlorocyclohexane alpha[1,2] | • Toxaphene[1,2] |
| • Hexachlorocyclohexane beta[1,2] | |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards

# Other Pollutants (not proposed for analysis)

| | |
|---|---|
| METHOD 603 | • Carbofuran[1,2] – METHOD 531 |
| • Acrolein[1,2] | • Chloropyrifos[1,2] – METHOD 508 |
| • Acrylonitrile[1,2] | • Delapon[1,2] – METHOD 515.4 |
| METHOD 613 | • Dinoseb[1,2] – METHOD 515.4 |
| • 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)[1,2] | • Pichloram[1,2] – METHOD 515.4 |
| METHOD 614 | • 2-(2,4,5-Trichlorophenoxy) propionic acid [1,2] – METHOD 515.4 |
| • Malathion[1,2] | • Mirex[1,2] – METHOD 617 |
| • Parathion[1,2] | • Diquat[1,2] – METHOD 549.2 |
| METHOD 615 | • Paraquat[1,2] – METHOD 549.2 |
| • 2,4-Dichlorophenoxyacetic acid (2,4-D)[1,2] | • 1,2-Dibromo-3-chloropropane (DBCP) [1,2] – METHOD 504.1 |
| | • EDB[1] – METHOD 504.1 |
| • 2,3,7,8-Tetrachlorodibenzo-p-dioxin[1] – METHOD 1613B | • Endothall[1] – METHOD 548.1 |
| • Guthion[1,2] – METHOD NA | • Glyphosate[1] – METHOD 547 |
| • Tributyltin[1,2] – METHOD NA | • Oxamyl[1] – METHOD 531.1 |
| | • Total Trihalomethanes[1,3] – METHOD 501.2/524.2 |

[1] Permit-Based Constituents
[2] Numeric Water Quality Standards
[3] Aquifer Protection Permit

# Industrial Users from MAHA

## Railroad Cargo Transportation Washing

| Transportation Equipment Cleaning Point Source Category (40 CFR 442) Chemical or Petroleum Cargos |
| --- |
| Chemical or Petroleum Cargos |
| Non-polar material (SGT-HEM) |
| Fluoranthene |
| Phenanthrene |

# Industrial Users from MAHA

**Communication Equipment Manufacturer, Metallic Coating, Manufacturer of Metal Products, Metallic Coating, Assembly of Aerospace and Military Connectors**

| Metal Finishing Point Source Category (40 CFR 433) |
|---|
| Cadmium (Total, T) |
| Chromium (T) |
| Copper (T) |
| Lead (T) |
| Nickel (T) |
| Silver (T) |
| Zinc (T) |
| Cyanide (T) |
| Total Toxic Organics ,TTO |
| Cyanide (Amenable) |

# Industrial Users from MAHA

**Communication Equipment Manufacturer, Metallic Coating, Manufacturer of Metal Products, Metallic Coating, Assembly of Aerospace and Military Connectors**

| Metal Molding and Casting Point Source Category (40 CFR 464) |
| --- |
| Copper (T) |
| Lead (T) |
| Zinc (T) |
| Total phenols |
| TTO |
| Oil and grease |

# Industrial Users from MAHA

## Assembly of Electronics

| Electroplating Point Source Category (40 CFR 413) |
|---|
| CN, T |
| Cu |
| Ni |
| Cr |
| Zn |
| Pb |
| Cd |
| Total metals |
| TTO |

# Industrial Users from MAHA

## Manufacturer of Cardboard Boxes

| The Pulp, Paper, and Paperboard Point Source Category (40 CFR 430) |
|---|
| Pentachlorophenol |
| Trichlorophenol |