N3B-Los Alamos
600 6th Street
Los Alamos, New Mexico 87544
(505) 661-5918

Environmental Management
Los Alamos Field Office
P.O. Box 1663, MS M984
Los Alamos, New Mexico 87545
(505) 665-5658/FAX (505) 606-2132

Date: JUL 1 5 2019
Refer To: N3B-19-0200

Dorothy Brown
U.S. Environmental Protection Agency, Region 6
NPDES/Wetlands Review Section (6WD-PN)
Permitting & Water Quality Branch
1201 Elm Street, Suite 500
Dallas, Texas 75270-2102

Isaac Chen
U.S. Environmental Protection Agency, Region 6
Permitting Section (6WQ-NP)
Permitting & Water Quality Branch
1201 Elm Street, Suite 500
Dallas, Texas 75270-2102

Subject: Revised NPDES Permit No. NM0030759 Individual Permit Renewal Application Package

Dear Ms. Brown and Mr. Chen:

Please find enclosed one hard copy with electronic files of the National Pollutant Discharge Elimination System (NPDES) Permit No. NM0030759 Individual Storm Water Permit (IP) Renewal Application for storm water discharges from solid waste management units (SWMUs) and areas of concern (AOC) at Los Alamos National Laboratory. This application is being submitted by the U.S. Department of Energy (DOE) and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) (the Permittees) in accordance with the requirements of the Clean Water Act. The specific changes proposed for the draft Permit associated with the renewed application fall into the following categories: (1) substantive changes to reflect new information from investigations and analyses conducted under the Compliance Order on Consent and Individual Permit storm water collection, (2) organizational changes to clarify, improve, and facilitate understanding of requirements of the IP, and (3) non-substantive changes and corrections of minor typographical errors. These proposed changes are provided in Attachment 1 of the IP renewal application package, and supporting justification for the proposed changes is provided in the main text, as well as Attachments 2 through 5.

This package completely replaces the 2014 NPDES Permit No. NM0030759 Individual Storm Water Permit Renewal Application, and the 2015 supplement to the 2014 IP Renewal Application. Please rely solely on this new submittal in renewing the Permit and withdraw the 2014 application and 2015 supplement. This package includes the following.

- Volume 1: Revised NPDES Individual Permit Renewal Application; Attachment 1 (proposed changes); Attachment 2, "Development of Background Threshold Values for Storm Water Runoff on the Pajarito Plateau, New Mexico" (2019 Revision)

- Volume 2: EPA form 1; EPA form 2F sections I through III
- Volume 3: EPA form 2F sections V through X (Attachments 4 and 5 on CD)

In the interest of earning stakeholder support and gathering stakeholder input, the Permittees pursued an interactive process in the development of this IP renewal application. As a means to inform and engage the stakeholders, as well as to solicit dialog on each topic, the Permittees conducted a series of five webinars, each addressing an important aspect of the Permit. This process resulted in the development of preliminary Permit language, which was then shared for comment with stakeholders. The resulting application incorporates stakeholder input provided throughout this process. The enhancements proposed in the IP renewal application will resolve uncertainties about compliance needs remaining under the 2010 IP requirements. We consider it vital that the U.S. Environmental Protection Agency (EPA) incorporate these changes into the renewed IP. The key elements are described below.

We have worked closely with the New Mexico Environment Department Surface Water Quality Bureau (NMED-SWQB) over the past several years to better understand and incorporate requirements specified in its 2015 §401 certification. One of the most notable requirements of the §401 certification that is incorporated into the IP renewal package is the new sampling implementation plan (SIP), which will annually evaluate all Sites to verify/identify pollutants of concern (POCs) and sampling locations. Initially, these determinations will be formalized in the SIP document to be submitted within 1 year of the Permit effective date. SIP updates will be submitted annually thereafter.

Another key element of the proposed changes to the 2015 draft Permit involves the use of storm water and soil background/screening levels for certain POCs. We have worked closely with stakeholders to refine these details, which are now being proposed with the rationale provided in Volume I (sections 8.4 and 9.1.2), and the scientific basis provided in Attachment 2. Accounting for background will allow efficient identification of pollutants attributable to the environment that are beyond the control of the Permittees. The Background Characterization Framework (BCF), developed by N3B in collaboration with NMED and EPA, provides a sound scientific approach that EPA could use in other NPDES permits and non-point source programs. Within the next 30 days, a revised storm water background characterization report that incorporates an additional year (2018) of background sampling data will be submitted.

Also incorporated into this application are a number of Site deletion requests. The rationale for these requests are described in Volume 1, sections 9.4 through 9.8; in each case N3B has relied on the criteria required for inclusion of Sites in the 2010 IP.

Finally, N3B has agreed to implementing a new long-term stewardship (LTS) program for Sites that satisfy criteria prescribed for storm water inspection and maintenance of related controls. N3B's commitment to the LTS program is contingent upon EPA accepting the proposed Site Specific Demonstration approach described in Volume 1, section 9.1.2; the inspection and maintenance criteria described in Volume 1, section 9.3; and the red-line strikeout language in the 2015 Draft IP found in Volume 1, Attachment 1.

The Permittees are requesting that EPA allow time in the renewed permit for the aluminum water quality and toxicity studies (Volume 1, section 9.13) to be completed, reviewed, and accepted, and the new methods that will come out of the research adopted, before further compliance activities based solely on aluminum are required. These studies are currently underway with results expected in late 2019.

Please note that during the collaborative renewal application process for this IP, N3B developed target action levels (TALs) for copper, lead, and zinc based on best available science, as represented in the biotic ligand model (BLM). N3B has removed BLM-based TALs from this submittal, but the BLM-based approach is described in Volume 1, section 8.3.4, for the record. For copper, these TALs were based directly on EPA's nationally recommended aquatic life criteria for copper, which are BLM-based. Other states and jurisdictions have successfully adopted BLM-based aquatic life criteria for copper. N3B withdrew a proposed request for BLM-based TALs from this submittal in order to be responsive to the feedback it received from stakeholders and will instead propose BLM-based, site-specific water quality criteria for the protection of aquatic life through the New Mexico rulemaking process.

If you have any questions, please contact Steve Veenis at (505) 309-1362 (steve.veenis@em-la.doe.gov) or David Rhodes at (505) 665-5325 (david.rhodes@em.doe.gov). We look forward to receiving the public comment draft of the renewed IP and the draft fact sheet.

Sincerely,

Glenn Morgan
President and Program Manager
N3B-Los Alamos

Sincerely,

Douglas Hintze
Manager
Environmental Management
Los Alamos Field Office

Enclosure(s): One hard copy with electronic files - Revised National Pollutant Discharge Elimination System Individual Permit Renewal Application Package (EM2019-0009)

Cy: (letter with hard-copy enclosure[s])
Sarah Holcomb, NMED-SWQB
Steve Veenis, N3B

Cy: (letter and CD/DVD enclosure[s])
Isaac Chen, EPA Region 6
Carol Johnson, EPA Region 6
Curry Jones, EPA Region 6
Laurie King, EPA Region 6
Brent Larsen, EPA Region 6
Renea Ryland, EPA Region 6
Harry Burgess, Los Alamos County (2 copies)
Shelly Lemon, NMED-SWQB
Steve Yanicak, NMED-DOE-OB
emla.docs@em.doe.gov

N3B Records
Public Reading Room (EPRR)
PRS Website

Cy: (letter emailed without enclosure[s])
Mona Tates, EPA Region 6
Peter Maggiore, NA-LA
Arturo Duran, EM-LA
David Nickless, EM-LA
David Rhodes, EM-LA
Cheryl Rodriguez, EM-LA
Ben Underwood, EM-LA
Don Carlson, N3B
Emily Day, N3B
Erich Evered, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Frazer Lockhart, N3B
Glenn Morgan, N3B
Bruce Robinson, N3B
Amanda White, N3B

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Sent To
Dorothy Brown USEPA R6 NPDES/Wetlands Permits Section (6WQ-PW)
Street and Apt. No., or PO Box No.
1201 Elm street Suite 500
City, State, ZIP+4®
Dallas TX 75270-2102

PS Form 3800, April 2015 PSN 7530-02-000-9047 See Reverse for Instructions

June 2019
EM2019-0009

Revised National Pollutant Discharge Elimination System Individual Permit Renewal Application Package

N3B Los Alamos

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Attachments

Attachment 1	Proposed Changes to the 2015 Draft Individual Permit, Redline Strikeout Version and Changes Accepted Version
Attachment 2	Windward 2018 Background Threshold Value Report
Attachment 3	Environmental Protection Agency Form 1 and National Pollutant Discharge Elimination System Form 2F
Attachment 4	Analytical Storm Water Data (on CD included with this document)
Attachment 5	Biological Data (on CD included with this document)

ACRONYMS AND ABBREVIATIONS

ACA	accelerated corrective action
AEA	Atomic Energy Act
AGA	adjusted gross alpha
AOC	area of concern
AST	aboveground storage tank
ATAL	average target action level
AWQC	ambient water quality criteria (EPA)
BCM	baseline control measure
bgs	below ground surface
BLM	biotic ligand model
BMP	best management practice
BOD	biochemical oxygen demand
BTV	background threshold value
BV	background value
CFR	Code of Federal Regulations
CGP	Construction General Permit (NPDES)
CME	corrective measures evaluation
CMI	corrective measures implementation
CMP	corrugated metal pipe
CMR	Chemistry and Metallurgy Research (building)
COC	certificate of completion
Consent Order	Compliance Order on Consent (NMED)
COD	chemical oxygen demand
COPC	chemical of potential concern
CPC	Climate Prediction Center
cpm	counts per minute
CWA	Clean Water Act
CWWTP	central wastewater treatment plant
D&D	decontamination and decommissioning
DL	detectable level
DOE	Department of Energy (U.S.)
DOE OB	Department of Energy Oversight Bureau (NMED)
DP	Delta Prime
DQO/DQA	data quality objective/data quality assessment
DRO	diesel range organics
DU	depleted uranium
EDTA	ethylenediaminetetraacetic acid
EM-LA	Environmental Management Los Alamos Field Office (DOE)

ENSO	El Niño Southern Oscillation
Envirocare	Envirocare of Utah, Inc.
EPA	Environmental Protection Agency (U.S.)
EPT	Ephemeroptera, Plecoptera, and Trichoptera
EQL	estimated quantitation limit
ER	Environmental Restoration Project
FV	fallout value
FY	fiscal year
GIS	geographic information system
gpm	gallons per minute
GWQB	Ground Water Quality Bureau (NMED)
HAZMAT	hazardous material
HE	high explosives
HH-OO	human health-organism only
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HNS	hexanitrostilbene
HPS	High Priority Site
HRL	Health Research Laboratory
HSWA	Hazardous and Solid Waste Amendment
HWA	Hazardous Waste Act (New Mexico)
HWB	Hazardous Waste Bureau
HYPO	high power (reactor)
IA	interim action
IID	independently and identically distributed
IM	interim measure
IP	Individual Permit (NM0030759)
ISGP	industrial storm water general permit
IWQC	instantaneous water quality criteria
Laboratory	Los Alamos National Laboratory
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC (now Triad)
LASL	Los Alamos Scientific Laboratory
LASCP	Los Alamos Site Characterization Program
LLW	low-level waste
LOPO	low power (reactor)
LTS	long-term stewardship
MD	munitions debris
MDA	material disposal area

MDL	method detection limit
MEC	munitions and explosives of concern
MLLW	mixed low-level waste
MPS	Medium Priority Site
MQL	maximum quantitation level
MSGP	Multi-Sector General Permit
MTAL	maximum target action level
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
n/a	not applicable
na	not available
N/A	not analyzed
NES	nuclear environmental site
NFA	no further action
NM	New Mexico
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSSUP	Nuclear Materials Safeguards and Security Upgrades Project
NNSA	National Nuclear Security Administration
NPDES	National Pollutant Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration
NTISV	nontraditional in situ vitrification
OD	open detonation
ODEQ	Oregon Department of Environmental Quality
OU	operable unit
OEW	ordnance and explosive waste
OWR	Omega West Reactor
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	perchloroethylene (also tetrachloroethylene)
PBX	plastic-bonded explosive
Permittees	DOE and N3B
PETN	pentaerythritol tetranitrate
PHERMEX	Pulsed High-Energy Radiographic Machine Emitting X-rays
PMR	permit modification request
POC	pollutant of concern
PRS	Potential Release Sites (Laboratory database)
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act

RDX	Royal Demolition Explosive
RFI	RCRA facility investigation
RLW	radioactive liquid waste
RLWTF	Radioactive Liquid Waste Treatment Facility
SAA	satellite accumulation area
SAL	screening action level
SDPPP	Site Discharge Pollution Prevention Plan
SEP	supplemental environmental project
SERF	Sanitary Effluent Reclamation Facility
SIP	sampling implementation plan
SMA	site monitoring area
SOP	standard operating procedure
SSC	suspended sediment concentration
SSD	Site-Specific Demonstration
SSL	soil screening level
SSWQC	site-specific water quality criteria
SUPO	super power (reactor)
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWPPP	Storm Water Pollution Prevention Plan
SWQB	Storm Water Quality Bureau (NMED)
SWSC	Sanitary Wastewater Systems Consolidation (plant)
TA	technical area
TAL	target action level
TATB	triaminotrinitrobenzene
TCA	trichloroethane
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TNT	trinitrotoluene(2,4,6-)
TPH	total petroleum hydrocarbon
TRU	transuranic
TSCA	Toxic Substances Control Act
TSTA	Tritium System Test Assembly
TSS	total suspended solids
TU	toxic unit
UTL	upper tolerance limit
URL	unassigned land release
USFS	U.S. Forest Service

USGS	U.S. Geological Survey
UXO	unexploded ordnance
VCA	voluntary corrective action
VCP	vitrified clay pipe
VCM	voluntary corrective measure
VOC	volatile organic compound
WAD	weak acid dissociable
WBR	Water Boiler Reactor
WET	whole effluent toxicity
WQA	Water Quality Act
WQC	water-quality criteria
WQS	water quality standard(s)
WWTP	wastewater treatment plant

1.0 INTRODUCTION AND BACKGROUND

This section provides information regarding the scope and content of this renewal application for the Individual National Pollutant Discharge Elimination System (NPDES) Storm Water Permit (Permit No. NM0030759). This updated Individual Permit (IP) application package replaces the 2014 version submitted on March 27, 2014, and the February 10, 2015, supplement provided by the Permittees, the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) for Los Alamos National Laboratory (LANL or the Laboratory) in Los Alamos, New Mexico. In early 2018, Newport News Nuclear BWXT-Los Alamos, LLC (N3B) and the DOE Environmental Management Los Alamos Field Office (EM-LA) became the new Permittees to this permit. U.S. Environmental Protection Agency (EPA) Region 6 and New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB) personnel agreed that the Permittees name change and other changed conditions described in this document warrant submittal of this renewal application package. Additionally, the Permittees will be working with the National Nuclear Security Administration (NNSA) Los Alamos Field Office and their operating contractor at LANL to conduct work under this permit.

2.0 APPLICATION OBJECTIVES AND SCOPE

EPA issued the current NPDES IP to the original Permittees on February 13, 2009. The IP became effective on April 1, 2009, but was subsequently modified on September 30, 2010, becoming effective on November 1, 2010, and expiring March 31, 2014. The Laboratory submitted its application for permit renewal on March 27, 2014, and submitted supplemental information on February 10, 2015. EPA Region 6 issued a draft IP in May 2015 and NMED issued its Clean Water Act §401 Certification of the draft IP on July 21, 2015. EPA administratively continued the September 2010 permit (as specified in the fact sheet issued with the 2015 IP draft) because the 2015 IP draft has not been finalized, and EPA has not incorporated draft conditions of the NMED §401 Certification.

The IP is intended to regulate storm water discharges associated with legacy industrial activities from 405 specified solid waste management units (SWMUs) and/or areas of concern (AOCs) (collectively referred to as “Sites”) that have also been regulated under the 2016 Compliance Order on Consent (Consent Order) issued under the New Mexico Hazardous Waste Act and Solid Waste Act. Storm water monitoring compliance and corrective action requirements are based on water samples collected at Site monitoring areas (SMAs).

The majority of the Sites covered by the IP are remotely located and are not associated with current active Laboratory operations. Storm water discharges associated with current industrial activities at the Laboratory are excluded from the IP and are covered by the EPA Multi-Sector General Permit (MSGP), which was reissued in 2015 (EPA 2015, 700252). Industrial wastewater and cooling water discharges are regulated by a third NPDES permit at LANL (No. NM0028355). Discharges from some outfalls regulated by the MSGP and wastewater permits may affect certain Sites regulated by the IP.

This IP renewal application package discusses specific proposed changes to the 2015 draft IP. These changes fall into the following categories: (1) substantive changes to reflect substantial new information from investigations and analysis conducted under the Resource Conservation and Recovery Act (RCRA) Consent Order; (2) organizational changes to clarify, improve, and facilitate understanding of IP requirements; (3) new and substantial information related to compliance history, changed conditions, and streamlined compliance pathways; and (4) nonsubstantive changes and minor typographical errors. These changes are provided in a redline-strikeout version of the 2015 draft IP (Attachment 1) and are described in section 9 of this document. Section 9 provides justification for changes to the 2015 draft IP (Attachment 1) and the two are meant to be read together. The other sections of this document provide updated background information to support the justifications for changes in section 9.

3.0 SITE ORGANIZATION

The Laboratory occupies approximately 36 mi^2 on DOE lands, which encompass the majority of the regulated Sites. Certain legacy Sites are within the greater Los Alamos townsite and on surrounding private lands. The general vicinity of the Laboratory, townsite, and surrounding area is known geographically as the Pajarito Plateau (Figure 1). Table 1 lists the seven major watersheds and associated canyons in north to south order, the SMA name, the Site name, and the name of the receiving water. The information and data in this IP renewal application are grouped according to the following hierarchy, starting at the watershed level:

- Watershed: One of the seven major watersheds on the Pajarito Plateau where the SMAs and their associated Sites are located;
- Canyon: Significant canyon system within the watershed;
- SMA: The Sites are grouped into subwatersheds called SMAs (note that a Site may be assigned to more than one SMA based upon drainage patterns);
- Site: A uniquely numbered SWMU or AOC;
- Receiving Water: Identified for the SMA or Site, either the significant canyon system or a named significant tributary to a canyon to which that SMA/Site drains; and
- Assessment Unit: Stream reach in the “2018–2020 State of New Mexico Clean Water Act Section 303(d)/305(b) Integrated Report” (NMED 2018, 700253) that the SMA subwatershed drains to.

State of New Mexico water quality standards identify two segments of water bodies associated with the Laboratory: 20.6.4.126 and 128 New Mexico Administrative Code (NMAC), which are defined as perennial and ephemeral/intermittent waters, respectively. A number of other waters are associated with other areas of the Pajarito Plateau, including the watersheds in Los Alamos County, the townsite, and other areas not included in Sections 126 or 128, and thus are considered unclassified NMAC 20.6.4.98 segments.

4.0 INDIVIDUAL PERMIT APPLICATION FORMS

This IP renewal application provides EPA Form 1, General Information, and NPDES Form 2F, Application for Permit to Discharge Storm Water Discharges Associated with Industrial Activity. Attachment 3 contains these EPA forms.

4.1 EPA Form 1

EPA Form 1 presents general information such as the nature of the business, name, mailing address, location, and existing permit numbers regarding EPA environmental programs that apply to the Laboratory. Since the original IP application submittal in 2008 and the 2014 application, several personnel changes at both DOE and the Laboratory have resulted in changes to the delegated signatory authority. These changes are reflected on EPA Form 1.

4.2 NPDES Form 2F

Form 2F is the component of this IP renewal application that requests the following specific information and data:

- Section I – “Outfall” Locations
- Section II – Improvements
- Section III – Site Drainage Maps
- Section IV – Narrative Description of Pollutant Sources
- Section V – Non-Stormwater Discharges
- Section VI – Significant Leaks or Spills
- Section VII – Discharge Information
- Section VIII – Biological Toxicity Testing Data
- Section IX – Contract Analysis Information
- Section X – Certification

New and updated information replacing that submitted in the 2014 application is provided for all sections of Form 2F.

Because of the nature and extent of Laboratory facility data and information, the standard Form 2F format for providing data and information was modified. Supporting tables and figures have been provided to meet Form 2F requirements. A narrative description of the data and information organization are also provided for each section.

5.0 BACKGROUND

General background information regarding facility operations, terrestrial ecology, geology, climate, and hydrology is provided below.

5.1 Facility Description

The Laboratory and the associated communities of Los Alamos and White Rock are located in Los Alamos County in north-central New Mexico approximately 60 mi north-northeast of Albuquerque and 20 mi northwest of Santa Fe (Figure 1). The 36-mi^2 facility is situated on the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep east-to-west oriented canyons cut by predominately ephemeral and intermittent streams. The mesa tops range in elevation from approximately 7800 ft on the flanks of the Jemez Mountains to about 6200 ft at their eastern termination above the Rio Grande Canyon.

The land surrounding the Laboratory is largely undeveloped. Public access to much of the facility is limited for safety and security reasons. Large tracts of surrounding land are held by the U.S. Forest Service (Santa Fe National Forest), the Bureau of Land Management, the U.S. Department of the Interior (Bandelier National Monument), the General Services Administration, and the Pueblo de San Ildefonso (Figure 2).

The communities closest to the Laboratory are the Los Alamos townsite, located just to the north of the main Laboratory complex, and White Rock, located a few miles to the east-southeast. Los Alamos County had an estimated population of 18,738 as of 2017. About one-third of Laboratory employees commute from other counties.

5.2 Laboratory Research Activities

The Laboratory's original mission to design, develop, and test nuclear weapons has broadened to address changes in technologies, priorities, and the global community. The Laboratory's current mission is to develop and apply science and technology according to the following:

- ensure the safety and reliability of the United States' nuclear deterrent,
- reduce global threats, and
- foster energy security by developing clean, sustainable energy sources.

Extensive basic research programs in physics, chemistry, metallurgy, mathematics, computers, earth sciences, and electronics support these efforts.

5.3 Terrestrial Ecology

Five vegetation zones exist within the Laboratory (Balice et al. 2000, 700239). In general, these zones have developed from variability in elevation, temperature, and moisture along the approximately 12 mi-wide, 5000-ft elevation gradient from the Rio Grande to the western edge of the site. The five zones include juniper-savanna, piñon-juniper woodlands, spruce-fir, ponderosa pine forests, and mixed-conifer forests. While mixed conifer forests are prevalent at higher elevations to the west of the Laboratory, within the site this vegetation zone is restricted to cooler north-facing canyon slopes. In addition, the ecosystems in and around the Laboratory tend to be fire-prone because of the semiarid environment and density of lightning strikes during the monsoon season, thus these ecosystems are largely fire-adapted.

5.4 Geologic Setting

The Pajarito Plateau is capped by Bandelier Tuff, a geologic deposit that formed as the result of volcanic eruptions that occurred in the Jemez Mountains 1.2 to 1.6 million years ago. The tuff is more than 1000 ft thick in the western part of the plateau and thins eastward to about 260 ft adjacent to the Rio Grande (Broxton et al. 1995, 050121).

On the western part of the Pajarito Plateau, the Bandelier Tuff overlaps the Tschicoma Formation, which consists of older volcanic rocks that form the Jemez Mountains (Self et al. 1996, 700240). The Puye Formation conglomerate rock underlies the Bandelier Tuff beneath the central and eastern portions of the plateau. The Cerros del Rio basalt flows interfinger with the Puye Formation conglomerate beneath the Laboratory. These formations, which are over 3300 ft thick, overlie the sediments of the Santa Fe Group, which extend across the Rio Grande Valley. The Bandelier Tuff is the primary exposed geologic unit, and the soils and sediments derived from it exhibit unique geochemistry (e.g., high concentrations of aluminum and uranium) that has been shown to impact surface waters of the Pajarito Plateau (LANL 2013, 239557).

5.5 Climate and Hydrologic Setting

5.5.1 Climate

Los Alamos County has a temperate, semiarid mountain climate. Large differences in locally observed temperature and precipitation exist because of the 1000-ft elevation change across the Laboratory site and the complex topography. Four distinct seasons occur in Los Alamos County. Winters are generally mild, with occasional winter storms. Spring is the windiest season. Summer is the rainy season, with frequent afternoon thunderstorms. New Mexico receives up to half of its annual rainfall during the summer monsoon season. Fall is typically dry, cool, and calm.

New Mexico's current drought has spanned the years 1998 through 2018, with near-average precipitation years occurring from 2004 to 2010. In Los Alamos, the highest summertime (June, July, August) average temperature on record was documented during June 2018 and the second highest during July 2018. For New Mexico, the 2011 and 2012 calendar years were the driest and warmest 2-yr period on record (weather records go back to 1895), and calendar year 2012 was the warmest on record and the second driest (only 1956 was drier). This was most likely the result of the El Niño Southern Oscillation (ENSO) La Niña pattern governing the weather during 2011 and 2012. Fortunately, 2013 was wetter with around normal statewide precipitation and an extremely wet September. Even with the above-average precipitation in 2013, the normal-to-below-normal precipitation and consistently below-normal snowfall over the past 15 yr have resulted in very severe drought conditions throughout New Mexico (http://weathermachine.lanl.gov). Climate Prediction Center's (CPC's) U.S. Seasonal Drought Outlook for October 2018 through January 2019 indicates the current drought will improve but remain as a result of the above average temperature and precipitation typically observed during CPC's predicted ENSO El Niño winter (https://www.cpc.ncep.noaa.gov).

Current drought conditions increase Los Alamos County's susceptibility to wildfire. Recent large wildfires occurring near the Laboratory include the Cerro Grande fire of 2000, the Las Conchas fire of 2011, and the El Cajete fire in 2017.

The Las Conchas fire in June 2011, which was started by a tree falling on a power line, burned 157,000 acres in the Jemez Mountains of north-central New Mexico, was the second largest fire in recorded history for the state, and threatened areas upstream from the Los Alamos townsite and the Laboratory. The fire and related back burns burned approximately 133 acres of DOE property. The northeastern edge of the Las Conchas fire perimeter burned into the Cerro Grande fire area. Concentrated areas of high-burn severity occurred near Frijoles and Santa Clara Canyons on the Pajarito Plateau, extending across several vegetation zones, from the flat valleys of the Valle Grande at nearly 9000 ft in elevation, eastward over mountainous areas of the Sierra de los Valles, across the Pajarito Plateau with its rugged fingerlike mesa and canyon topography, and down to elevations below 6000 ft near the Rio Grande.

5.5.2 Hydrologic Setting

The Laboratory lies in the upper Rio Grande watershed denoted by the U.S. Geological Survey 8-digit hydrologic unit code 13020101 (http://water.usgs.gov/wsc/reg/13.html). The upper Rio Grande is a large watershed (approximately 7500 mi^2) that generally flows from north to south. The New Mexico portion of the watershed is within seven counties: Rio Arriba, Taos, Santa Fe, Los Alamos, Sandoval, Mora, and San Miguel.

The Rio Grande is the largest river in New Mexico, and the Rio Chama is its largest tributary within the state. Historically, stream flow in these rivers was influenced by spring snowmelt (April through June) and summer monsoon thunderstorms (July and August). This natural stream-flow pattern has been altered and regulated by reservoirs on the main stem and tributaries that diminish sediment transport and store water for later use, primarily for irrigation. In addition to the precipitation and reservoir-controlled fluctuations, baseflow is maintained by regional groundwater recharge from the Rio Grande basin.

The quality of storm water runoff from most Laboratory facilities is rigorously monitored through several programs. Surface water on the Pajarito Plateau is extremely limited, and no drinking water systems rely on surface water. The Laboratory is located in an approximately 36-mi^2 portion of the Pajarito Plateau drained by a large number of canyons and streams. Surface water flows downstream to the Rio Grande through relatively small channels situated in the bottom of canyons that have cut into the plateau surface (erodible Bandelier Tuff). A few canyons contain relatively short segments of perennial to intermittent streams that flow year round or during part of the year because of spring sources from mountain front recharge or NPDES-permitted outfalls associated with the Laboratory. However, most of the canyons originating on the plateau have ephemeral streams with flow limited to periods of short duration in response to intense monsoonal storm events. Because of the intensity of these events and the sparse vegetative cover, storm water runoff can carry substantial amounts of sediment. Any naturally occurring, landscape-associated constituents, such as aluminum and uranium, are also present in sediment entrained in the runoff. Developed landscapes within the Laboratory boundary include parking lots, roads, and structures ranging in origin from the 1940s to present day. The Buckman Direct Diversion Project that supplies a percentage of the drinking water supply to the City of Santa Fe is located along the Rio Grande. Storm water that discharges from Los Alamos and Pueblo Canyon watershed may ultimately reach the Rio Grande above the Buckman Direct Diversion intake. An early notification system is in place that alerts Buckman Direct Diversion staff that a discharge has occurred from either Los Alamos or Pueblo Canyon.

Areas of the Laboratory receive storm water runoff from the adjacent Los Alamos townsite. The basic footprint of the developed portions of the townsite has changed little over decades. Retail stores, county government operations, and businesses are concentrated together downtown and are situated on a mesa top within a zone roughly 2 to 3 mi across. Away from the commercial center, land use transitions to a residential mix of apartment complexes and single-family houses. The townsite has been laid out in this general configuration since the 1960s. A portion of this development was built on ground that once housed research activities of the Manhattan Project. Buildings from that earlier era were removed, and several rounds of remediation of the surface have been performed; remaining SWMUs and AOCs have been delineated and are under investigation by the Laboratory under the March 2016 Consent Order issued by NMED. Most of the townsite area has long been covered with imported fill dirt, new buildings, pavement, or parks, in essence forming caps over the original ground.

High-burn severity watersheds have increased the propensity for flash flooding, erosion, and the transport of debris, ash, and sediment. Wildfire-impacted watersheds include the Rio Grande to the east and the Jemez River to the west of burn areas. Following the Las Conchas fire, locations within the canyons were armored to protect them from future catastrophic erosion. Post–Las Conchas fire storm events in July and August 2011 mobilized sediment, ash, and other pyrolysis products from the burned sites into nearby tributaries. Numerous bridge and culvert crossings on NM 4 and other roadways were impacted by the effects of post-wildfire flooding and debris flows. Post-fire burn severity conditions are considered to be recovered since the Las Conchas fire occurred.

The IP Program uses precipitation data collected from a seasonal rain gage network (12 rain gages deployed between the months of April and November) and LANL meteorological towers (5 rain gages) to determine compliance-triggering rain events and to optimize inspection and sample retrieval for surface water monitoring sites where precipitation likely resulted in runoff (Figure 3). Table 2 shows precipitation depth estimates for 24-hr duration storms with 95^{th} percentile, 2-, 3-, 5-, 10-, 25-, 50-, and 100-yr return periods for the rain gages that the IP Program utilizes. A summary of the storm events and total precipitation between 2011 and 2018 are shown in Figures 4 and 5, respectively.

Between September 10 and 17, 2013, New Mexico and Colorado received a historically large amount of precipitation. Los Alamos County received between 200% and 600% of the normal precipitation for this time period, and the Laboratory received approximately 450% percent of its average precipitation for September (Figures 6 and 7). As a result, the Laboratory experienced severe flooding from the greater-than-1000-yr return period storm event that occurred between September 12 and 13, 2013. With antecedent saturated soil conditions from the greater-than-100-yr return period on September 10, 2013, flooding caused significant damage to the Laboratory's environmental infrastructure requiring significant repair. Damage included access roads, stream gaging stations, watershed controls, and control measures installed under the IP. Since the September 2013 storm event, areas within South Ancho and Chaquehui Canyon experienced a storm event in late July 2018, having a total precipitation depth slightly greater than a 25-yr, 24-hr return period storm event.

6.0 RELATIONSHIP OF INDIVIDUAL PERMIT TO THE RCRA CONSENT ORDER

In March 2005, NMED issued a Consent Order under the New Mexico Hazardous Waste Act and the RCRA of 1976, as amended to address investigation, cleanup, including corrective action obligations for hazardous and mixed wastes, and hazardous constituents released or disposed of in SWMUs and AOCs located at the Laboratory. The RCRA Consent Order fulfills the corrective action requirements in §3004(u) and §3008(h) of RCRA for addressing SWMUs and AOCs. The RCRA Consent Order was renegotiated and reissued in 2016.

The Sites regulated under the IP are a subset of the SWMUs and AOCs that are being addressed under the RCRA Consent Order. The selection of SWMUs and AOCs for inclusion in the IP was based on historical information and any storm water, sediment, and soil data available at the time the Permit application was submitted. A Site that has met the definition of a SWMU or AOC was evaluated for inclusion in the current IP based on the following criteria: (1) the SWMU/AOC is exposed to storm water (e.g., not capped or subsurface), (2) the SWMU/AOC contains "significant industrial material" (e.g., not cleaned up or has contamination in place), and (3) the SWMU/AOC potentially impacts surface water. The selection of Sites for inclusion in the IP ended in early 2008 with the final supplemental information submittal.

The investigation and remediation of SWMUs and AOCs under the RCRA Consent Order began before the effective date of the IP and continues concurrently with implementation of the permit, which began in November 2010. The identification and investigation of SWMUs and AOCs is an iterative process. The initial identification process is conservative—that is, it errs on the side of inclusion if there is any indication in the record of a possible historical release of hazardous wastes or hazardous constituents. The RCRA Consent Order requires initial investigations to run broad, conservative analytical scans regardless of what the historical reviews indicate may have been released. As a result, all soil samples in the first phase of investigations under the Consent Order are typically analyzed for EPA target analyte list metals, total cyanide, volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls (PCBs), nitrate, and perchlorate.

6.1 RCRA Consent Order Certificates of Completion

Phased investigations proceed under the Consent Order until the nature and extent of contamination from any historical release at a SWMU or AOC have been defined in all relevant media. If the risk assessment demonstrates that the site poses no unacceptable risk to human health or the environment under current and reasonably foreseeable future land use, the Permittees will submit a request for a certificate of completion (COC) with or without controls, as appropriate. The Permittees may perform remediation activities and confirmation sampling before they request a COC.

On the other hand, if the risk assessment demonstrates that a site may pose a potential risk to human health or the environment, the Permittees may be required to prepare a corrective measures evaluation (CME) report. Typically, a CME may be required for Sites with buried waste, vadose zone contamination, and/or groundwater contamination. The CME is used to identify, develop, and evaluate potential remedial alternatives for removal, containment, and/or treatment of contamination. Upon approval of the CME report, NMED will select a remedy or remedies for the Site and issue a Statement of Basis for public comment. NMED will select a final remedy and issue a response to public comments within 90 days or other appropriate time after the conclusion of the public comment period. The RCRA Consent Order also provides an opportunity for public hearing.

NMED and DOE entered into a framework agreement in January 2012 for the realignment of environmental priorities at the Laboratory. Under the framework agreement, NMED and DOE agreed to review characterization efforts undertaken to date pursuant to the RCRA Consent Order to identify those Sites where the nature and extent of contamination have been adequately characterized. Pursuant to the framework agreement, the Laboratory reviewed its data evaluation process with respect to EPA guidance and the framework agreement principles and concluded that this process could be revised to more efficiently complete site characterization, while providing full protection of human health and the environment. Specifically, the process for evaluating data to define extent of contamination was revised to provide a greater emphasis on risk reduction, consistent with EPA corrective action guidance.

This data evaluation process is being performed by the Permittees by aggregate area. An aggregate area is defined in the RCRA Consent Order as "an area within a single watershed or canyon made up of one or more SWMUs or AOCs and the media affected or potentially affected by releases from those SWMUs or AOCs, and for which the investigation or remediation, in part or in entirety, is conducted for the area as a whole in order to address area-wide contamination, ecological risk assessment, and other factors." The objectives of this data evaluation process are to determine if a SWMU or AOC is currently eligible for a COC with or without controls or if additional investigation is required. The results of the data evaluation for each aggregate area are summarized in a supplemental investigation report, which is submitted to NMED for review and approval. Once NMED has approved a supplemental investigation report, the Permittees will submit requests for COCs to NMED for eligible SWMUs or AOCs. The IP Sites in each of these aggregate areas are shown in Table 3.

7.0 NPDES-PERMITTED SITES

7.1 Current Permit

The following is a brief overview of the key conditions in the current IP. Detailed information on all submittals to EPA under the IP, including but not limited to, monitoring results, storm water controls, inspection reports, and corrective action certifications, is available on the public IP website (http://www.lanl.gov/community-environment/environmental-stewardship/protection/compliance/individual-permit-stormwater/index.php).

The IP treats a Site as an "industrial activity" that may create a "point-source discharge" and directs the Permittees to monitor storm water releases from Sites at specified sampling points known as SMAs. An SMA is a single drainage area that can include more than one Site. In addition, storm water from a Site may discharge to multiple drainage areas and, thus, may be associated with multiple SMAs.

The IP contains nonnumeric technology-based effluent limitations, coupled with a comprehensive, coordinated inspection and monitoring program, to minimize pollutants in the Permittees' storm water releases associated with historical industrial activities from specified SWMUs and AOCs. The Permittees are required to implement site-specific control measures (including best management practices [BMPs]) to address the nonnumeric technology-based effluent limits, as necessary, to minimize pollutants in any storm water discharges.

Part I.A describes the nonnumeric technology-based effluent limitations required under the IP to minimize pollutants in any storm water discharges. The erosion and sedimentation and run-on and runoff controls identified in Part I.A were installed as baseline control measures within the first 6 months of the effective date of the 2010 IP, and certifications of completion were submitted to EPA.

The IP establishes target action levels (TALs) that are equivalent to New Mexico State water-quality criteria. These TALs are used as benchmarks to determine the effectiveness of control measures implemented under the Permit. That is, confirmation monitoring sample results for an SMA are compared with applicable TALs. If one or more confirmation monitoring result exceeds a TAL, the Permittees must take corrective action by a specific deadline.

Figure 8 illustrates key activities in the IP and shows the steps involved in the corrective action process**.** The Permit compliance status for the 2018 annual reporting period is provided in Table 4 and summarized in Table 5 and Figure 9.

Part I.E.2(a) through (d) of the IP define the following four possible paths for "completion of corrective action":

- Enhanced controls have produced analytical results from confirmation sampling demonstrating that pollutant concentrations for all pollutants of concern at a Site are at or below applicable TALs;
- Control measures that totally retain and prevent the discharge of storm water have been installed at the Site;
- Control measures that totally eliminate exposure of pollutants to storm water have been installed at the Site; or
- The Site has achieved RCRA corrective action complete with or without controls status or a COC under the RCRA Consent Order.

As of December 31, 2018, corrective action under the IP has been completed at 84 Sites:

- Six completion of corrective action certifications have been submitted based upon pollutant concentrations for all pollutants of concern to be at or below applicable TALs after installation of enhanced controls.
- No completion of corrective action certifications have been submitted based upon total retention.
- Sixteen completion of corrective action certifications have been submitted based upon elimination of exposure to pollutants.
- Sixty-two completion of corrective action certifications have been submitted based upon the receipt of a COC under the RCRA Consent Order.

The Permittees may seek to place a Site or Sites into alternative compliance when they have installed baseline control measures to minimize pollutants in storm water discharges but are unable to certify completion of corrective action under Part I.E.2(a) through (d), individually or collectively. Part I.E.3(b) of the Permit requires the Permittees to file a written request with EPA within 6 mo before the applicable deadlines for completion of corrective action. If EPA grants the alternative compliance request in whole or in part, it will issue a new individually tailored work plan for the Site or Sites. EPA will also extend the compliance deadline for completion of corrective action, as necessary, to implement this work plan. If EPA denies the alternative compliance request, it will promptly notify the Permittees of the specifics of its decision and of the time frame under which completion of corrective action must be completed under Parts I.E.2(a) through I.E.2(d).

As of December 31, 2018, Permittees submitted five alternative compliance requests to EPA:

- On April 30, 2013, the Permittees submitted a request for alternative compliance for Sites 03-013(a) and 03-052(f), monitored at S-SMA-0.25, and at Site 03-056(c) within S-SMA-2.
- On April 21, 2014, for site 50-006(d), monitored at M-SMA-7.9.
- On May 6, 2015, for 19 Sites exceeding TALs for gross alpha radioactivity.
- On May 6, 2015, for 52 Sites exceeding TALs from nonpoint sources.
- On February 26, 2016, for 17 Sites exceeding TALs from nonpoint sources.

A total of 9891 Permit-required inspections and 12,068 sampling equipment inspections have been performed since the effective date of the IP. The IP contains the following six inspection requirements:

- Part I.G.2, post-storm inspections of control measures at any Site affected by a “storm rain event.”
- Part I.G.1, site-specific annual erosion inspections to evaluate any changes of conditions affecting erosion.
- Part I.G.1, site-specific significant event inspections after notice of a significant event that could impact the control measures.
- Part I.E.1, visual inspections for all Sites at SMAs where TAL exceedances are observed.
- Part I.I.1, weekly remediation construction activity inspections to ensure sediment and runoff control measures are maintained in good order.
- Part I.D.3, sampler inspections to collect water and to maintain samplers in operating condition.

The IP contains the following six reporting and certification requirements:

- Part I.F.4, Site Discharge Pollution Prevention Plan (SDPPP), describes the historical industrial activities that led the Site to be included in the IP, summarizes the available data regarding the nature and extent of any surface contamination related to the historical activities, and identifies the structural control practices implemented or that will be implemented to prevent the pollutants of concern from impacting storm water runoff quality. The SDPPP also describes other relevant information, such as monitoring results, inspections and maintenance, and procedures. The SDPPP is updated annually, with current and past SDPPPs available on the public IP website.
- Part I.H.2, Annual Report, provides an annual “snap shot” of site-specific compliance status for the previous year. This report summarizes monitoring results; identifies constituents that exceed TALs; describes baseline and enhanced control measures installed during the year; describes corrective actions that are planned and implemented; identifies Sites that have certified completion of corrective action; highlights any change of compliance status from the previous

Annual Report; provides lists of requests for EPA approval; and summarizes inspections performed under Parts I.G.1, I.G.2, and I.E.1. Current and past Annual Reports are available on the public IP website. Future Annual Reports will be part of the SDPPP (see section 9.14).

- Part I.H.1, Compliance Status Reports, is organized by SMA, and the report is updated annually. This report includes the SMA ID number, pollutants of concern greater than applicable TALs, target control measure completion dates, and actual control measure completion dates. Current and past Compliance Status Reports are available on the public IP website. Future Compliance Status Reports will be part of the SDPPP (see section 9.14).
- Part II.B, Target Action Level Exceedance Reports, requires reports be submitted to EPA within 24 hours after the Permittees receive validated data confirming a TAL exceedance. Reports are available on the public IP website. Permittees are requesting this requirement be removed from the Permit (see section 9.15).
- Part I.E.l(c), Construction Certifications, requires the Permittees to certify the completion of the installation of control measures within 30 days of completion of the installation of all such measures at the Site. Certifications are available on the public IP website.
- Part I.E.2, Completion of Corrective Action Certifications, requires certifications be submitted to EPA upon completion of corrective action activities at a Site or Sites with one or more TAL exceedances. Certifications are available on the public IP website.

Part I.I.7(c) of the IP establishes a requirement for public meetings to be held approximately every 6 mo. Public meetings are advertised through the email notification process and in local newspapers. The agenda and presentations for these meetings are available on the public IP website.

7.2 Storm Water Data

The initial monitoring requirements and frequency of sampling for each pollutant of concern (POC) following installation and implementation of baseline control measures (BCMs) vary on a site-by-site basis, as specified in Part I.D of the Permit. BCMs were installed and implemented within 6 mo of the November 1, 2010, effective date of the Permit at 63 SMAs listed in Appendix E, Table E-2, of the Permit. BCMs were installed within 6 mo of the effective date of the Permit at 187 SMAs not listed in Appendix E, Table E-2. Table 6 summarizes the counts of SMAs and samples collected by year in confirmation monitoring.

As of December 31, 2018, a baseline confirmation monitoring sample had not been collected at 79 SMAs because there was no measurable discharge. A baseline monitoring sample was collected but no TAL was exceeded at 10 SMAs. Permittees observed exceedances of TALs during baseline monitoring at 161 SMAs.

Following an exceedance of a TAL during baseline monitoring, an analysis of alternative corrective action options is conducted. As of December 31, 2018, analysis of alternatives is ongoing at 9 SMAs. Where the analysis of alternatives was completed, enhanced control measures were installed and implemented at 42 SMAs in 2012, at 10 SMAs in 2013, at 12 SMAs in 2014, at 37 SMAs in 2015, at 2 SMAs in 2016, at 2 SMAs in 2017, and at no SMAs in 2018. Monitoring of storm water associated with these enhanced controls was completed on December 31, 2018:

- at 39 of these SMAs with the collection of two confirmation monitoring samples or certification of completion of corrective action under Part I.E.2 of the Permit,

- at 6 SMAs with a force majeure request because completion of corrective action is expected under Part I.E.2(d) of the Permit, but the RCRA “corrective action complete without controls/corrective action complete with controls” status or a COC under NMED’s Consent Order has been requested but has not been received from NMED, and
- at 43 SMAs with an alternative compliance request under Part I.E.3 of the Permit.

Corrective action monitoring is ongoing at 52 SMAs. Tables 7 and 8 summarize average target action level (ATAL) and maximum target action level (MTAL) exceedances for all confirmation monitoring samples collected through December 31, 2018, respectively.

8.0 NEW AND SUBSTANTIAL INFORMATION

This section describes types of information and data that should be taken into account by EPA as it develops the renewed IP. Some information and data were submitted as part of the 2014 renewal application, but additional data and information have been developed since the 2014 submittal. Much of this information was discussed with staff from EPA and NMED during the series of webinars held in 2018 (see section 9.0).

8.1 Existing TALs are Highly Conservative for Certain Metal and Organic POCs

The existing 2010 IP TALs are highly conservative screening levels, so exceedances of TALs by SMA water quality constituents do not necessarily indicate immediate or significant risks to aquatic life. The following factors illustrate the multiple levels of conservative uncertainty included in the TALs:

1. The 2010 IP TALs are mostly based on EPA-recommended ambient water quality criteria (AWQC) (or state-equivalents), which provide a level of protection intended to support a broad array of aquatic life in perennial water bodies throughout the United States (Stephen et al. 1985, 700270). The majority of receiving waters in the Laboratory vicinity are ephemeral streams, which are highly unlikely to contain the types or diversity of aquatic species (e.g., fish and certain invertebrates) that are included in the species sensitivity distributions used to derive AWQC. Recent and historical survey data for aquatic life and other relevant biological and/or toxicology information collected by LANL are summarized in section 8.5 and included in NPDES Form 2F, Section VIII of this IP renewal application. Form 2F, Section VIII, Table VIII-6 provides a list of ecological risk assessments available via the Canyon Investigation Reports. These reports provide some initial information that can be augmented with more recent aquatic life survey data and used to inform which aquatic life receptors are present. Documented presence or absence of sensitive taxa may have important implications relating to the appropriateness of applying existing, generic AWQC that are intended to protect a broad range of taxa in perennial waters as the basis of IP TALs in the context of Pajarito Plateau waters.
2. EPA provides guidance for the recalculation of national AWQC where local aquatic communities and/or sensitivities are significantly different than those encompassed by EPA or state AWQC (EPA 1997, 700282). The guidance procedures are recognized methods for site-specific AWQC development in New Mexico Water Quality Standards (WQS) (20.6.4.10 NMAC). The 2010 IP TALs have not been adjusted to account for resident or absent species (e.g., fish and invertebrates). The New Mexico and EPA AWQC for copper and zinc are driven largely by invertebrates such as zooplankton, which may be absent in ephemeral waters. The impact on the state/EPA acute AWQC for copper and zinc of deleting fish and invertebrate species is exemplified in the Arizona AWQC for ephemeral waters (see section 8.2.3). As noted in section 8.5, biological sampling of invertebrate communities in Pajarito Plateau streams indicates that some areas support zooplankton species (e.g., cladocerans and ostracods) and invertebrates generally considered to be sensitive to pollution (e.g., Ephemeroptera, Plecoptera, and Trichoptera [EPT]), but the presence of fish has not been documented.

3. Aquatic communities in waters with elevated concentrations of naturally occurring, yet potentially toxic, constituents—some of which are essential micronutrients (e.g., metals such as copper and zinc)—may exhibit an increased tolerance to such exposures, making generic AWQC more stringent than necessary to provide the intended level of protection. Furthermore, generic AWQC may not adequately consider the bioavailability or toxicological relevance of forms of potentially toxic constituents (e.g., aluminum in aluminosilicates should not be considered bioavailable, but neither total recoverable nor "dissolved" sample preparation methods make this distinction). The Permittees have been engaged in characterizing the surface water background concentrations of a number of POCs in storm water runoff from undeveloped and developed watersheds (see section 8.4).
4. Exposure conditions and water chemistry in ambient waters, especially ephemeral and intermittent waters, are also expected to differ significantly from the conditions used in laboratory-based toxicity tests to derive AWQC. As a result, the exposures and bioavailability of potential toxicants in surface waters may not be accurately reflected by the AWQC. Employing the water effect ratio is a well-known means of adjusting AWQC based on metals bioavailability, as acknowledged in EPA guidance (EPA 1994, 700274) and New Mexico WQS (Paragraph 4 of Subsection D of 20.6.4.10 NMAC). EPA's nationally recommended AWQC for copper (EPA 2007, 700258) are based on the biotic ligand model (BLM) and more accurately account for copper bioavailability than do the longstanding hardness-based AWQC. The Permittees have developed BLM-based MTALs for copper, lead, and zinc, and these MTALs are proposed to replace the IP MTALs (i.e., those used in the 2010 IP and proposed by EPA in the 2015 draft IP) (see section 8.3.4).
5. Realistic environmental exposure durations during storm water flows, especially in ephemeral and intermittent waters, are expected to last only a matter of hours rather than the 2 to 7 days (depending on the standardized test and test organism) typically represented in laboratory exposures.
6. The 2010 IP TALs for organic chemicals such as PCBs are based on nationally recommended human health water quality criteria, which depend largely on accepted rates for cancer risk and fish consumption. An absence of receptors such as fish and humans catching and consuming fish from ephemeral and intermittent waters of the Pajarito Plateau makes such TALs inherently over-protective. Furthermore, human exposures to PCBs via fish from the Rio Grande are limited because of highly intermittent surface water flows from the main canyons to the Rio Grande. While it is understood that the New Mexico WQSs "tributary rule" is intended to protect downstream waters, the inherently limited flow frequency of such ephemeral/intermittent waters is an unaccounted for variable that may need to be taken into account. Alternatively, the New Mexico AWQC for the protection of wildlife habitat may be a more realistic basis for IP TALs for organic and other POCs in ephemeral streams (see section 8.7).
7. For aluminum, several significant factors contribute to the uncertainty and problems associated with the 2010 IP MTAL:

   a. The New Mexico hardness-based AWQC that replace the previous static AWQC is based on the outdated EPA 1988 AWQC.
   b. Dissolved (2010 IP MTAL) versus total recoverable (current New Mexico WQS) measurement basis.
   c. Aluminum (dissolved or total recoverable) from naturally occurring aluminosilicate particles in typical Pajarito Plateau surface waters is non-bioavailable.
   d. Absence of potentially toxic aluminum hydroxide precipitates.

   During the past few years, the Permittees and NMED have been engaged in a special study to address these issues. The outcome of this effort should be used by EPA either to determine a more appropriate MTAL for aluminum, or to eliminate the MTAL entirely (see sections 8.3.3 and 9.13).

8.2 Relevance of 2010 IP TALs as Storm Water Control Measure Effectiveness Monitoring Benchmarks

For the various POCs, the 2010 IP established numeric TALs that "are not by themselves effluent limitations, but are benchmarks to determine the effectiveness of control measures." In other words, EPA intended the TALs to function as water quality screening levels for POCs, much like the benchmarks used in other types of NPDES storm water permits to determine whether various types of corrective action are potentially needed or whether those installed require adjustments. However, EPA's 2010 IP TALs are "…based on and equivalent to New Mexico State water quality criteria" (i.e., the numeric criteria contained in 20.6.4.900 NMAC).

This approach makes the 2010 IP TALs somewhat analogous to water quality-based effluent limits, which set limits based on AWQC after considering effluent and ambient water quality variability and dilution, if available. Yet, the notion of storm water benchmarks to monitor the effectiveness of BMPs conveys a wholly different concept, one more akin to technology-based effluent limits, that encompass a performance envelope for a particular type or group of constructed or manufactured treatment systems. Technology-based effluent limits, or similar federal numeric effluent limit guidelines, are typically characterized by physical/chemical/biological treatment processes and site-specific design capabilities, largely irrespective of AWQC. To provide contrast with the 2010 IP TALs, some examples of longstanding storm water monitoring effectiveness benchmarks used in other states' NPDES permits are discussed in sections 8.2.1 through 8.2.3.

8.2.1 Washington's Copper and Zinc NPDES Industrial Storm Water Monitoring and Compliance Benchmarks

The Washington industrial storm water copper benchmark is threefold higher than the 2010 IP MTAL. For nearly a decade, the Washington NPDES industrial storm water general permit (ISGP) total recoverable copper benchmarks have been 14 and 32 µg/L for the western and eastern portions of the state, respectively, and have been applicable to more than 1000 industrial storm water Permittees (Ecology 2005, 700290). The Western Washington total recoverable copper benchmark converts to a dissolved[1] copper concentration of 13.4 µg/L, which is 3.1 times greater than the 2010 IP TAL of 4.3 µg/L for dissolved copper. The two benchmarks are based on different hardness characteristics of receiving waters on the two sides of Washington's Cascade Range and were established based on a Monte Carlo approach (Herrera Environmental Consultants 2009, 700266) that took into account ambient receiving water hardness, dissolved copper, and total suspended solids[2], as well as a 5:1 dilution factor and 10% frequency of exceeding the state hardness-based AWQC. The hardness range used for the Western Washington copper benchmark is comparable to that for Pajarito Plateau waters. Despite origins akin to a water quality-based effluent limit, the copper benchmarks have been used as reasonable indicators of BMP effectiveness, representing a reasonable expectation of effluent quality achievable using typical storm water BMPs and a threshold for determining the need for corrective actions. Similarly, when

[1] Using the EPA conversion factor of 0.96 for acute copper AWQC EPA (U.S. Environmental Protection Agency), June 1996. "The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion," EPA 823-B-96-007, Office of Water, Washington, D.C. (EPA 1996, 700276).

[2] Total suspended solid data were used to determine translators for converting the AWQC (always expressed as dissolved metal) to a total recoverable basis for use in NPDES permits per EPA regulations. The translator can be determined from observed dissolved metal fractions ibid. or estimated from total suspended solid using an approach like Washington's partitioning equations Ecology (Washington State Department of Ecology), January 2015. "Water Quality Program Permit Writer's Manual," Publication no. 92-109, Washington State Department of Ecology, Olympia, Washington. (Ecology 2015, 700292).

converted to a dissolved basis[3], the Washington ISGP total recoverable zinc benchmark is 2.7 times greater than the 42 µg/L 2010 IP MTAL for dissolved zinc[4].

8.2.2 Oregon's Copper and Zinc NPDES Industrial Storm Water Monitoring and Compliance Benchmarks

Since 2012, the Oregon 1200-Z NPDES permit has employed total recoverable copper and zinc benchmarks, applicable to more than 1000 industrial storm water Permittees (https://www.oregon.gov/deq/filterpermitsdocs/final1200zpermit.pdf). Using the conservative EPA conversion factor of 0.96, the Oregon 1200-Z total recoverable copper benchmark of 20 µg/L converts to 19.2 µg/L as dissolved copper, a value 4.5 times greater than the 2010 IP TAL of 4.3 µg/L for dissolved copper. The 1200-Z copper benchmark is a technology-based value established by Oregon Department of Environmental Quality (ODEQ) via an evaluation of BMP effectiveness using influent/effluent data for a number of typical storm water BMPs (State of Oregon DEQ 2011, 700251). Oregon adopted BLM-based copper AWQC statewide in 2016 and generated potential BLM-based copper benchmarks ranging from 11 to 50 µg/L for use in the 1200-Z (State of Oregon DEQ 2017, 700285). However, ODEQ opted to continue using the technology-based total recoverable copper benchmark of 20 µg/L because of its attainability (demonstrated by the 1200-Z Permittees) (State of Oregon DEQ 2017, 700285). The 1200-Z total recoverable zinc benchmark[5] of 120 µg/L is based on AWQC and, like the Washington ISGP benchmark, is nearly a factor of three greater than the 2010 IP MTAL for dissolved zinc when converted to a dissolved basis.

8.2.3 Arizona's NPDES Storm Water Benchmarks for Ephemeral Waters

The Permittees are providing information regarding Arizona's NPDES industrial storm water monitoring benchmarks for ephemeral waters for reference and comparison with the IP storm water monitoring benchmarks. Arizona ephemeral AWQC[6] are used as storm water monitoring benchmarks for the statewide NPDES permit for storm water discharges associated with industrial activities (Permit No. AZMSGP2010-002); this permit is similar to EPA's MSGP 2010 and MSGP 2015 in that it specifies hardness-based metals benchmarks, but unique in that it specifies ephemeral waters benchmarks (see Table 9, source: Table 2 of Arizona's 2010 MSGP). Figure 10 compares Arizona's ephemeral acute AWQC for copper and zinc with New Mexico's current AWQC for these metals. Using the 30-mg/L hardness basis of the 2010 IP metals TALs, the Arizona ephemeral AWQC for copper and zinc would be 7.5 and 401 µg/L, respectively, and the Arizona MSGP ephemeral waters benchmarks would be 12.1 and

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[3] Using the EPA conversion factor of 0.978 for acute zinc AWQC EPA (U.S. Environmental Protection Agency), June 1996. "The Metals Translator: Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion," EPA 823-B-96-007, Office of Water, Washington, D.C. (EPA 1996, 700276).

[4] A total recoverable zinc benchmark of 200 µg/L was developed in 2009 for the Washington ISGP using the same process as for copper in Herrera Environmental Consultants, February 9, 2009. "Analysis Report, Water Quality Risk Evaluation for Proposed Benchmarks/Action Levels in the Industrial Stormwater General Permit," document prepared for Washington State Department of Ecology by Herrera Environmental Consultants, Seattle, Washington. (Herrera Environmental Consultants 2009, 700266). However, the existing 117 µg/L total recoverable zinc benchmark (based on AWQC) was retained because of its demonstrated attainability by Permittees and thus used as a reasonable expectation of BMP performance.

[5] The Oregon 1200-Z NPDES permit has total recoverable zinc benchmarks of 120 µg/L that are applicable to the two major receiving water groups that include the Columbia River and Portland Harbor (Willamette River). A higher total recoverable zinc benchmark of 240 µg/L applies to a large number of Permittees discharging industrial storm water to the Columbia River Slough near Portland Oregon.

[6] Arizona's water quality standards for surface waters specify numeric criteria for the protection of aquatic life in ephemeral waters (18 AAC.11. Art. 1). The ephemeral AWQC apply to seven metals and pentachlorophenol. These criteria were adopted by Arizona and approved by the EPA (Title 18, Chapter 11 of the Arizona Administrative Code).

618 µg/L, respectively. These potential TAL alternatives would be 2 to 3 times higher than the 2010 IP TAL for copper and 10 to 15 times higher than the 2010 IP TAL for zinc, respectively.

Based on discussions with current Arizona Department of Environmental Quality staff, the method for deriving the ephemeral AWQC is not readily available (Windward 2016, 700237); however, it was suggested that the metals criteria for ephemeral waters were recalculated based on the exclusion of toxicity data for fish and zooplankton species from the datasets used by the EPA to derive its AWQC. The Arizona ephemeral AWQC provide plausible, and potentially more realistic, benchmarks for storm water monitoring than do the broader statewide and nationally recommended AWQC because the hydrology and ecology of Arizona is similar to the Pajarito Plateau's. Such statewide and national AWQC are likely highly over-conservative for ephemeral waters, where aquatic life compositions are much more limited than those used to derive statewide and national AWQC.

Ephemeral waters are always expected to lack fish species (see section 8.5 for more information); therefore, deleting toxicity data for fish when calculating AWQC for ephemeral waters is, in general, appropriate. The species retained in calculations still present some uncertainty as to their actual presence or absence in typical ephemeral waters, although it is plausible that they might be reasonable surrogates for species present that lack metal toxicity data.

8.3 Proposed Changes to the 2010 IP TALs

This section describes the proposed changes to the 2010 IP TALs and provides supporting rationale based on new information not available at the time of the 2014 IP application submittal, as well as refined approaches previously recommended in the 2014 IP renewal application. The proposed changes are described below and include corrections to errors and inconsistencies, updated MTALs for several metals based on new hardness data, and rationale for a changed ATAL for total PCBs[7]. The proposed metals MTALs are provided in Table 10 and their basis is described in following subsections. These changes, if incorporated, will provide clarity for implementation of TALs where ambiguity currently exists.

8.3.1 Correcting Errors and Inconsistencies

The following errors and inconsistencies have been noted between the 2010 IP and 2015 draft IP:

1. Gross Alpha: As noted in LANL's comments on the 2015 draft IP (EPA 2015, 700485)and 2015 NMED §401 Certification, differences exist regarding the basis of gross alpha measurement (i.e., adjusted gross alpha (AGA) versus non-AGA) (see section 8.6).
2. Manganese: NMED stipulated that manganese monitoring should be included in the IP[8]. As noted in LANL's comments on the 2015 NMED §401 Certification, no need for such monitoring has been demonstrated. Although a manganese TAL was not included in the 2010 IP, the Permittees collected dissolved manganese data at 23 SMAs in 2017 and 2018 (Table 11). Among the SMA data, no maximum measured concentrations exceeded the New Mexico AWQC, and the highest observed

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[7] The total PCB ATAL (0.00064 µg/L) is currently based on a human heath cancer risk and exposure to PCBs via fish consumption (related to fishing in the Rio Grande). Section 8.7 describes the shortcomings of the existing rationale for applying that value as the ATAL for LANL's IP. The wildlife habitat criterion (0.014 µg/L) is being proposed for ephemeral streams and the human health-organism only (HH-OO) aquatic life criterion (0.00064 µg/L) is being proposed for intermittent or perennial streams.

[8] Under Condition No. 2 in the 2015 NMED §401 Certification, NMED stipulated that manganese monitoring should be included and should use a TAL based on New Mexico WQS. EPA included manganese and MTALs ranging from 1616 to 3124 µg/L in Appendix F to the 2015 draft IP Fact Sheet (EPA 2015, 700485). However, Condition No. 1 of the 2015 NMED §401 Certification stipulated that the sampling implementation plan process implement related monitoring as needed based on review of historic site information.

value among the SMA data was less than one-half the AWQC value calculated at the canyon-specific hardness corresponding with the proposed revised Appendix F to the 2015 draft IP. At present, there are no sites where manganese has been identified as a potential POC based on historical knowledge. Because of a lack of historical evidence suggesting a significant source of manganese, as well as a lack of exceedance of the New Mexico AWQC for manganese, the Permittees request that manganese not be added as a POC to the IP as a requirement for monitoring. Rather, it is recommended that the corrective action screening process be used to further evaluate manganese (i.e., by characterizing soil data), and that the annual monitoring plan be updated as appropriate based on the outcome of the corrective action screening process.

3. Mercury: The 2015 draft IP listed both total and dissolved mercury TALs, while the 2010 IP specified only total mercury. No rationale has been provided to justify the addition of dissolved mercury and so it should be deleted. The total mercury standard for the wildlife habitat use, 0.77 µg/L, alone, is more stringent than any dissolved mercury criteria in 20.6.4.900 NMAC.

4. Cyanide: For measurement of cyanide, the 2010 IP specified the weak acid dissociable (WAD) method, which includes sample distillation under slightly acidic conditions (pH 4.5 to 6.0) that do not liberate cyanide (CN^-) from strong metal-cyanide complexes (Ghosh et al. 2006, 700481). Because cyanide toxicity to aquatic organisms is largely due to the dissociation of metallocyanide or organic complexes from free cyanide (e.g., hydrogen cyanide [HCN] and CN^-), measurement of total cyanide—which includes cyanide from strong metal-cyanide complexes—overestimates bioavailable cyanide concentrations (Gensemer et al. 2006, 700482). In the EPA's recommended 304(a) guidance document for cyanide (EPA 1984, 700250), it states that, "The Agency [EPA] is considering development and approval of methods for a measurement such as free cyanide. Until available, however, EPA recommends applying criteria using the total cyanide method" (EPA 1984, 700250). The document further states that "These criteria may be overly protective when based on the total cyanide method." EPA has subsequently approved a method (EPA 2010, 700249) that can differentiate bioavailable cyanide (free or WAD cyanide) from the total. Furthermore, EPA "believes that a measurement such as free cyanide would provide a more scientifically correct basis upon which to establish criteria for cyanide" because the "criteria were developed on this basis" (EPA 1984, 700250). Because the WAD method provides a better estimate of free cyanide, a change to the total recoverable basis specified in the 2015 draft IP should not be made in the renewed IP. Additionally, EPA updated the human health-organism only (HH-OO) criteria (EPA 2015, 700248) for cyanide to 400 µg/L, more than double the current New Mexico HH-OO criteria of 140 µg/L. New Mexico has not updated its standards to reflect these changes.

5. Chromium: As noted in LANL's comments on the 2015 NMED §401 Certification, the Permittees have requested that chromium III in the Appendix F table in the 2015 draft IP be replaced with chromium VI to be consistent with the TAL table in the body of the IP. The Permittees disagree with NMED's request that "Cr-III should be added back to the TAL list in Part I.B, with a reference to Appendix F for the hardness based values." Chromium III was not included in EPA's 2015 draft IP TAL table. The majority of chromium in storm water is in the form of chromium III, which is in equilibrium with atmospheric oxygen (Richard and Bourg 1991, 107034; Kotas and Stasicka 2000, 700246). Chromium VI, when accumulated at high concentrations, is the most toxic form of chromium to bacteria, plants, and animals (Richard and Bourg 1991, 107034). Chromium III is relatively insoluble in neutral pH waters (Richard and Bourg 1991, 107034) and is attached to the sediment fraction that will be removed through filtration (LANL 2016, 601432). New Mexico's aquatic life criterion for chromium applies to chromium III specifically, as opposed to chromium VI or a combination of the two. Because of the difficulty and cost associated with measuring individual chromium species in surface water samples, the Permittees typically measure total dissolved chromium (i.e., the sum of dissolved chromium III and dissolved chromium VI). The comparison of total dissolved chromium to the hardness-dependent chromium MTAL, which is based on New Mexico's chromium III AWQC, is thus conservative.

8.3.2 Hardness Updates

The 2010 IP provided single-value TALs for each metal[9]. Recognizing hardness differences among receiving waters, the 2015 draft IP (Appendix F) proposed 25 watershed-specific TALs for the same metals that, like the TALs in the 2010 IP, are based on New Mexico acute AWQC. Additional hardness data[10] have been collected at the relevant receiving water streamflow gaging stations since the hardness dataset used for the 2015 draft IP was collected and those additional data should be considered. Consequently, as part of this IP renewal application, Appendix F of the 2015 draft IP has been revised with new, proposed MTALs based on updated geometric mean hardness values (Table 10). In addition to updating the hardness and the hardness-dependent MTALs, the Permittees are proposing to reduce the number of watersheds from 25 to 7, thus simplifying the IP implementation. The hardness values within these 7 watersheds are similar.

8.3.3 Aluminum Measurement and Compliance Issues

This section describes relevant issues pertaining to sample preparation methods for aluminum in natural surface waters and use of aluminum AWQC for derivation of MTALs. New data and recent evaluations demonstrate the uncertainties, flaws, and shortcomings associated with how potential water quality issues related to aluminum are assessed. These issues are particularly relevant on the Pajarito Plateau, where storm water samples typically contain elevated concentrations of aluminum-bearing suspended solids (receiving waters and SMAs). Recent updates to national aluminum AWQC (described below) have incorporated bioavailability considerations (based on results from laboratory toxicity tests). Despite updates and improvements to AWQC, quantification of toxicologically relevant forms of aluminum in surface waters remains a concern. The following provides a summary of this issue and examples using data from surface waters in the LANL vicinity.

Since the inception of confirmation monitoring under the 2010 IP, 29 of the 170 SMAs (i.e., 17%) with dissolved aluminum data (0.45-μm filtered) have exceeded the 2010 MTAL of 750 mg/L for dissolved aluminum. This MTAL is based on the 1988 nationally recommended acute AWQC for aluminum, which is applicable in waters with pH 6.5 to 9.0 (EPA 1988, 700273). While the magnitude of the 2010 MTAL for aluminum was based on the EPA acute AWQC, the measurement basis was dissolved rather than total recoverable. In the 1988 EPA AWQC document (EPA 1988, 700273), issues pertaining to the appropriate sample preparation method for aluminum in natural waters are discussed in detail; however, no improved methods are currently available.

[9] The 2010 IP metal TALs for cadmium, chromium, copper, lead, nickel, silver, and zinc were based on 30-mg/L hardness, a median of LANL gaging station data LANL (Los Alamos National Laboratory), June 2008. “Statistical Analysis of Hardness Concentration Filtered Storm Water Runoff Samples,” Los Alamos National Laboratory document LA-UR-08-03767, Los Alamos, New Mexico. (LANL 2008, 700288). Appendix F of the 2015 draft IP provided canyon-specific hardness-based TALs for the same metals, with the additions of hardness-based TALs for aluminum and manganese (based on New Mexico 2010 WQC). Manganese was not a required monitoring POC in the 2010 IP or the 2015 draft IP. The proposed “total recoverable” aluminum TAL will need reconciliation with the current NMED guidance, which calls for analysis of 10-μm filtrate if sample turbidity exceeds 30 nephelometric turbidity units, as well as the current Windward study in progress to refine the sample preparation method to exclude nontoxic aluminosilicates that may be included in filtered samples.

[10] Hardness results are based on Standard Method 2340B, which calculates hardness from measured calcium and magnesium concentrations.

Since 1988, aquatic toxicity data have been generated to improve the general understanding of aluminum bioavailability in aquatic environments. Methods are currently being evaluated for improved characterization of toxicologically relevant aluminum concentrations in natural waters. Chevron and LANL proposed standards that were adopted by WQCC for hardness-based AWQC for aluminum (discussed below), and EPA (EPA 2018, 700247) has developed new AWQC for aluminum based on multiple water chemistry characteristics (discussed below). The relevant issue is that new approaches regarding aluminum bioavailability and measurement methods are currently being considered/evaluated, which implies that MTALs derived from existing AWQC are uncertain and potentially over- or under-conservative. For example, using NMED's current hardness-based AWQC to derive MTALs, and considering unfiltered (i.e., total recoverable) aluminum, 24 of 25 SMAs (i.e., 96% of SMAs with sufficient data) exceed the EPA 2015 draft IP-proposed MTALs.

As described below, and consistent with the concerns raised by (EPA 1988, 700273), the contribution of aluminum from non-bioavailable aluminosilicates in environmental samples can be a potential problem for both filtered (i.e., dissolved) and unfiltered (i.e., total recoverable) natural water samples. It is therefore recommended that improved sample preparation methods be considered/evaluated with regard to water quality assessments pertaining to aluminum.

In evaluations completed since the 2014 IP application was submitted, LANL has shown that concentrations of aluminum measured in unfiltered samples, as well as in 10- and 0.45-µm sample filtrates from natural background locations and locations upstream and off-site are similar to those measured in similarly prepared samples collected at locations downstream from LANL. The new information is summarized below.

The current New Mexico AWQC were adopted in 2010 and are hardness based (i.e., AWQC change as a function of water hardness), but they are also based on "analysis of total recoverable aluminum in a sample that is filtered to minimize mineral phases as specified by the department." The current (2012) NMED guidance for filtration is to use a 10-µm filter if sample turbidity is greater than 30 nephelometric turbidity units (NMED 2012, 700224). Consequently, the 2015 draft IP shifted from a dissolved to a total recoverable basis for aluminum compliance monitoring. However, EPA did not reflect the NMED 2012 guidance insofar as the 10-µm pre-filtration method. Thus, at a minimum, the Permittees request that EPA include the pre-filtration step, contingent on the outcomes of the Permittees filtration and toxicity study currently underway.

Use of the total recoverable method is recognized as potentially inappropriate for aluminum in natural surface water samples, because this sample preparation method includes an acid digestion step that liberates aluminum from suspended sediment particles containing aluminosilicates (He and Ziemkiewicz 2016, 700272). NMED recognized this issue in its 2012 guidance. Previously, EPA had acknowledged that existing methods were inadequate to determine toxicologically relevant forms of aluminum in surface water samples (EPA 1988, 700273). Recent evaluations conducted by the Permittees (Windward 2018, 700230) were presented to NMED and EPA in 2018; these evaluations will be further described in a forthcoming peer-review scientific journal manuscript (in review). The results strongly indicate that neither 10-µm filtration nor finer filters sufficiently reduce the high bias contributed by nontoxic aluminosilicate particles, and also suggest that aluminosilicates may be present in operationally defined dissolved samples after 0.45-µm filtration.

EPA finalized and released new national AWQC for aluminum on December 18, 2018, and these AWQC augment valid existing toxicology data with new datasets collected over the three decades since the 1988 AWQC. The finalized 2018 EPA AWQC (EPA 2018, 700247) are based on a multiple linear regression method that employs three water chemistry variables (i.e., hardness, pH, and dissolved organic carbon).

However, the updated AWQC are based on total recoverable aluminum, and EPA has not provided additional guidance relating to nontoxic aluminum forms included in such measurements.

An evaluation of LANL gaging station (ambient receiving water) monitoring data has provided several lines of evidence that strongly indicate that total recoverable aluminum is not appropriate for analysis in environmental samples that contain elevated suspended sediment concentrations (SSCs). First, the data indicate that aluminum concentrations in samples collected in receiving waters downstream of LANL storm water discharges are similar to concentrations in upstream/natural background samples; this similarity is apparent in unfiltered (i.e., total recoverable), 10-µm, and 0.45-µm filtered samples (Figure 11). Second, regardless of sampling and AWQC basis, a high percentage of samples exceed AWQC (Figure 12)[11]. Finally, a high percentage of unfiltered, 10-µm filtered, and 0.45-µm filters samples exceed the solubility (indicated by saturation index >1) of amorphous aluminum hydroxide (Figure 13). The fact that a high percentage of 0.45-µm filtered (i.e., operationally defined as dissolved) samples exceed solubility is strongly suggestive that aluminosilicates are capable of passing through even a 0.45-µm filter. Similar observations have been reported in the scientific literature (i.e., Baalousha et al. (2006, 700255), and the potential for this issue has been mentioned by EPA (1988, 700273).

The findings shown in Figures 11 through 13 are consistent with results of a recent LANL study (LANL 2018, 700223) that suggest that nontoxic aluminosilicates are important contributors to total recoverable aluminum in samples that have been pre-filtered, and that potentially toxic, freshly precipitated amorphous aluminum hydroxide is not present in storm water samples. Additionally, recent work conducted by Rodriguez et al. (in press) provides further evidence that total recoverable aluminum concentrations are not toxicologically relevant in waters containing elevated SSC. The authors demonstrate that pH 4 extractable aluminum (which can solubilize potentially bioavailable aluminum hydroxides, while minimizing liberation of aluminum from aluminosilicates) is better able to differentiate between bioavailable and non-bioavailable (i.e., mineral) forms of aluminum.

Because it is widely understood that the total recoverable basis for quantifying aluminum concentrations in surface waters is inadequate, the Permittees has been collaborating with NMED to generate new data intended to evaluate the potential for toxicity because of aluminum in Pajarito Plateau waters (Windward 2019, 700289). Additionally, these data may demonstrate a more appropriate sampling methodology for aluminum in surface waters with naturally high SSC (i.e., consistent with Rodriguez et al. [in press]). The plan for generating these data is described in the 2018 proposed toxicity testing plan (Windward 2019, 700289).

Subsequently, a draft 2018 sampling and analysis plan described the details of sample collection; processing; and physical, chemical, and biological characterizations. This study commenced with preliminary collection and testing of samples at two sampling and monitoring supplemental environmental project (SEP) reference locations and the E240 (upper Pajarito Canyon near NM 501) gage station in late October 2018. In these preliminary tests, no toxicity to *Ceriodaphnia dubia* was observed in the raw samples, nor in samples spiked with channel sediments to simulate approximately 500-mg/L SSC. The observed aluminum concentrations (preliminary results) generally fell within the ranges of historic observations for total recoverable (unfiltered) and dissolved (0.45-µm filtered) aluminum at these locations and at the undeveloped natural background locations (total aluminum: 16,800 µg/L at E240; 3810 µg/L at Burnt Mesa; 1390 µg/L at Ponderosa; 0.45-µm filtered aluminum: 15.7 µg/L at E240; 1230 µg/L at Burnt Mesa; 376 µg/L at Ponderosa). Additional analyses of aluminum concentrations after

[11] Comparison of aluminum concentrations in individual samples with associated AWQC is accomplished by calculating the quotient: reported aluminum concentration/associated AWQC, which is referred to here as a “toxic unit.”

acidification to pH 4 and 0.45-μm filtration will also be provided. The study will be completed in the 2019 monitoring season and results will be reported to EPA and NMED with recommendations.

Because this important work will not be completed in time for EPA to consider it in the renewed IP, and because the work is critical to help guide the selection of more appropriate sample preparation methods, the Permittees request that EPA include a compliance schedule item related to aluminum in the renewed IP (see section 9.13).

8.3.4 BLM-Based Metals AWQC

This section describes new information related to AWQC for metals based on the BLM. In early 2018, LANL's subcontractor developed a data quality objective/data quality assessment (DQO/DQA) document that evaluated a large water quality dataset for Pajarito Plateau surface waters to determine BLM-based AWQC outcomes for surface waters upstream, within, and downstream of LANL and the Los Alamos townsite (Windward 2019, 700289).

The BLM is a recognized tool for evaluating the bioavailability and potential toxicity of various metals (e.g., aluminum, cadmium, copper, lead, nickel, and zinc). The BLM can also be used to develop AWQC for metals that are consistent with EPA guidelines (Stephen et al. 1985, 700270), such as those criteria EPA developed in its 2007 update of its nationally recommended copper AWQC (EPA 2007, 700258). The states of Oregon and Idaho recently adopted BLM-based copper AWQC statewide to replace former (EPA 1996, 700275) hardness-based AWQC for copper (State of Oregon DEQ 2016, 700284). In accordance with EPA (Stephen et al. 1985, 700270), proposed BLM-based AWQC for lead and zinc have also been developed (DeForest and Van Genderen 2012, 700259; DeForest et al. 2017, 700260); proposed BLM-based zinc AWQC were provided to EPA in 2006 but are still pending review.

The BLM improves upon hardness-based approaches for evaluating metal toxicity and bioavailability, or for deriving AWQC, by incorporating additional water quality variables, such as dissolved organic carbon, that can bind metals and thereby decrease bioavailable metal concentrations. The BLM employs 11 water quality variables, some of which may be estimated where relative model sensitivity is low, as recognized in (EPA 2016, 700280). Use of the BLM is recognized nationally and internationally as a sufficiently rigorous and scientifically advanced means of generating bioavailability-based AWQC.

The state of New Mexico, like many other states, has partially adopted the EPA BLM-based copper AWQC (2007, 700258), although its use is limited to an option for generating site-specific water quality criteria (SSWQC) for copper (20.6.4.10 NMAC). Therefore, a state or federal agency or private entity in New Mexico would have to gather and evaluate sufficient datasets for water bodies of interest and propose SSWQC for adoption by the New Mexico Water Quality Control Commission. Such SSWQC are subject to state rulemaking and EPA review and approval before use as a WQS.

LANL began collecting BLM datasets several years ago in anticipation of the eventual adoption of a BLM approach for AWQC in New Mexico. Consequently, LANL has a large water quality dataset for many surface water monitoring locations on the Pajarito Plateau in the vicinity of LANL. The dataset spans 2005 to 2017 and contains data from gaging stations and background reference locations, and is further described in Windward 2018 (700230), which set the DQOs used to select appropriate datasets and determine their usability for generating BLM-based outcomes. Instantaneous water quality criteria (IWQC) were generated for each sampling location, most of which were LANL gaging stations, and pooled by major and minor canyon (Table 12). The term IWQC is generic to any water quality criteria computed from its related water quality variables (e.g., BLM or hardness) measured or estimated at a particular location and time (i.e., a sampling event). Most (70%[12]) of the BLM datasets came from sampling events related to storm water runoff, thus these datasets would be hydrologically comparable with SMA runoff data.

Comparison of BLM- and hardness-based IWQC outcomes for copper using toxic units (TUs)[13] demonstrates that the hardness-based approach generates numerous false positive AWQC exceedances relative to the more accurate BLM-based approach. As shown in Figure 14[14], of the 433 observed copper concentrations, 157 would not exceed BLM-based IWQC while exceeding hardness-based IWQC, and 259 would not exceed either IWQC. This leads to an apparent false positive rate of 38% (157/416). As also shown in Figure 14, sampling data potentially affected by forest fires do not appear to be different than other sample data. Similar comparisons for lead and zinc are provided in Windward 2018 (700230) and demonstrate that there are no true or false positives for lead, but that the false positive rate for zinc is 2.5%.

Because the BLM is the basis of EPA's nationally recommended AWQC for copper, these AWQC are considered more accurate than hardness-based AWQC. Also, because the BLM is accepted as a scientific tool for more accurately evaluating metal bioavailability in general, BLM-based AWQC for copper and proposed BLM-based AWQC for lead and zinc should be considered as replacements for the hardness-based AWQC used for MTALs in the LANL IP. NPDES compliance needs using BLM-based MTALs can differ vastly from those using the current hardness-based MTALs. Because the LANL area BLM-based IWQC were generated in accordance with EPA 1985 guidelines for AWQC, these IWQC necessarily achieve EPA's intended level of aquatic life protection. Furthermore, as discussed in section 8.1, AWQC are inherently conservative when used as generic screening levels to determine the need for corrective actions (e.g., new or updated storm water BMPs)

The potential impact of the BLM on setting new IP MTALs based on geometric mean BLM-based IWQCs for copper, lead, and zinc is clearly demonstrated by considering exceedance factor[15] comparisons (Figure 15). The geometric mean basis of the BLM IWQC is consistent with hardness-based AWQC resulting from using a geometric mean hardness value used for the 2010 IP. For copper, BLM-based median acute IWQC averaged 5-fold higher than the hardness-based 2015 draft IP MTALs, as did BLM-based median acute IWQC for zinc. For lead, the BLM-based median acute IWQC showed even greater differences from hardness-based MTALs, averaging 14- to 18-fold higher than the 2015 draft IP MTALs. In contrast to using the 2015 draft IP hardness-based MTALs, use of BLM-based MTALs would yield fewer triggers for corrective action needs under the IP (Figure 16).

In conclusion, the dataset and the improved accuracy of management decisions regarding environmental protection needs that result from using the BLM suggests a distinct ability to make more appropriate decisions and resource allocations than those permitted by hardness-based AWQC.

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[12] Of the 457 samples for which BLM IWQC were calculated, 319 are listed as stormflow (i.e., WT [n = 315]) or a combination of WT and baseflow (i.e., WS [n = 4]).

[13] Individual TUs are calculated as $TUi = \frac{Me_i}{AWQC_i}$, where Me_i represents the metal of interest in a particular sample (*i*) and $AWQC_i$ is the associated AWQC calculated for the same sample (*i*).

[14] Figure 14 is from Windward (Windward Environmental, LLC), April 27, 2018. "Data-Quality Objectives and Data Quality Assessment: Application of the Biotic Ligand Model to Generate Water Quality Criteria for Four Metals in Surface Waters of the Pajarito Plateau New Mexico," document prepared for Los Alamos National Security by Windward, Seattle, Washington. (Windward 2018, 700230) and shows TUs calculated with 433 observed copper concentrations representing 19 Pajarito Plateau water bodies upstream, within, and downstream of LANL.

[15] Exceedance factors are ratios that are calculated in the same manner as TUs.

8.4 2019 Background Threshold Value Report

Concentrations of constituents in certain storm water discharges, as well as receiving waters downstream of LANL, are influenced by upstream sources associated with background conditions related to both undeveloped and developed land on the Pajarito Plateau. Constituent concentrations are also influenced by anthropogenic baseline inputs (e.g., atmospheric deposition). The 2019 background threshold values (BTVs) report (Windward 2019, 700289) (presented in Attachment 2 and hereafter referred to as the 2019 BTV report) quantifies these varying sources in a statistically rigorous and defensible manner, thereby yielding a set of BTVs that can be compared to POC concentrations in storm water per the corrective action screening process. A 90% draft of the 2019 BTV report was provided by the Permittees to the NMED, EPA, and Communities for Clean Water stakeholder group in October 2018 for review and comment. The 2019 BTV report was finalized based on consideration of comments received through October 2018. The BTVs in the 2019 BTV report are intended to replace those presented and evaluated in earlier LANL reports (LANL 2012, 219767); however, additional data is available from 2018 SEP monitoring efforts and an update will be provided as a supplement to this IP renewal application.

The 2019 BTV report outlines a five-step background characterization framework for quantifying background conditions on the Pajarito Plateau. This framework was developed in collaboration with NMED as part of the 2017 sampling and monitoring SEP DQO/DQA document and in response to comments on the LANL 2014 draft background report. The five-step process includes the following:

Step 1. Identify sufficient independently and identically distributed (IID) populations within the dataset[16].

Step 2. Explore and describe dependencies within the dataset that may drive differences in concentrations over space or time.

Step 3. If dependencies exist, create additional subpopulations or normalize data as appropriate to meet stability requirements.

Step 4. Calculate BTVs.

Step 5. Characterize uncertainty of the BTVs calculated/quantified by this study.

The 2019 BTV report presents a range of BTVs calculated for each dataset (Table 13), specifically the geometric mean, upper percentiles (i.e., 75th, 80th, 90th, 95th percentiles), 95–95 upper tolerance limits (UTLs), 95% upper prediction limits, 95% upper simultaneous limits and maximum BTVs. BTVs are proposed for use in the Site-Specific Demonstration (SSD). BTVs calculated/quantified by the 2019 BTV report exceed IP MTALs for dissolved aluminum (undeveloped landscape), copper, zinc, and total PCBs. Additionally, although normalization to SSC makes a direct comparison difficult, BTVs are likely to exceed IP MTALs for dissolved aluminum (developed landscape), total gross alpha, and radium-226 and -228, each of which is strongly related to SSC in the background datasets through 2017. Thus, SSC would be measured concurrently for POCs with SSC-normalized BTVs. Storm water quality data is available in Attachment 4.

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[16] A population of data can be characterized by one or more theoretical distribution types, often exhibiting a single “peak” associated with the most likely value in the dataset. IID populations have little evidence of changes in concentrations over time, over space, or in relation to SSC. SSC-normalized datasets can be used to establish IID populations, when appropriate. Sufficient populations have enough samples with detected concentrations to reasonably characterize background conditions. Whether or not a population has sufficient samples is determined primarily by professional judgment based on data variability.

8.5 Biological Data

A majority of receiving waters on the Pajarito Plateau are ephemeral streams, thus they are highly unlikely to contain the types or diversity of aquatic species (e.g., fish) that are included in the species sensitivity distributions used to derive AWQC. Because the 2010 IP TALs are consistent with EPA and New Mexico AWQC for aquatic life, it may be reasonable to recalculate those AWQC based on a site-specific approach (according to the species deletion approach; (EPA 2013, 700279). Recent and historic survey data for aquatic life and other relevant biological and/or toxicology information have been collected by LANL, and those data could inform a species deletion approach to recalculating AWQC (and thus TALs) for Pajarito Plateau streams. This section describes relevant biological data collected on the Pajarito Plateau and provides brief a discussion on the implications for AWQC.

In 2017 and 2018, aquatic life surveys of surface waters within the Pajarito Plateau were performed as part of the sampling and monitoring SEP (LANL 2017, 602616). One goal of the aquatic life surveys was to determine which aquatic life species are present in ephemeral, intermittent, and perennial reference and site waters. The objectives of this study were to generate the data needed to evaluate whether existing AWQC are sufficient to provide the intended level of protection for the aquatic life communities found in the site and in reference waters on the Pajarito Plateau. The data that were collected for the 2017 and 2018 aquatic life surveys is provided in NPDES Form 2F, Section VIII of this IP renewal application. Data collection included sampling efforts for benthic macroinvertebrates, aquatic meiofauna, and aquatic vertebrates. Because of the intermittent and ephemeral nature of many watercourses on the plateau, sampling locations included ponded water and even dry bed sediments. Sampling results found in the benthos and meiofauna Metric Reports (NPDES Form 2F, Section VIII, Tables VIII-3 and VIII-5) are indicated as wet or dry, respectively (Attachment 5).

Benthic macroinvertebrate sampling followed standard protocols, primarily using kick nets samplers (NMED 2013, 700286). One subsample was collected along each of nine equidistant transects per reach, and all subsamples were composited within the reach per the standardized protocol (NMED 2013, 700286). Meiofaunal invertebrate sampling followed the approach of King (2004, 700262) and Burdett et al. (2015, 700257). The selection of sampling locations within a reach was determined by qualified personnel in the field. Sampling in perennial to intermittent reaches was conducted in standing or flowing waters with relatively fine channel sediments (i.e., sand or silt). During the 2017 and 2018 aquatic species surveys, the presence of fish and amphibians was also noted when observed. No fish were noted in Sandia Canyon during the 2017 and 2018 surveys.

Sampling of dry bed sediments (i.e., sediments lacking overlying water) and other possible refugia for invertebrates during dry periods were conducted at targeted locations using the standard protocol discussed above. Example of dry-season refugia includes shallow sediments, deep bed sediments, under cobble, leaf packs, and riparian vegetation; identifying the refugia is important for understanding the taxa that may be present (Storey and Quinn 2013, 700263). Sampling of dry season refugia decreases the likelihood of missing invertebrate taxa in the sampling of sites when there is overlying water.

Based on 2017 and 2018 aquatic life surveys of some perennial or potentially perennial waters, there appear to be locations where potentially sensitive (as well as insensitive) species are present. Dipteran larvae, which tend to be relatively tolerant of metals and other contaminants, were the dominant invertebrate group observed in both SEP reference (Burnt Mesa) and Sandia Canyon survey locations. On the other hand, Pueblo Canyon (lower reach; perennial baseflow associated with discharges from the Los Alamos County wastewater treatment facility), Calaveras Canyon (upper reach; SEP reference), and Rio Cebolla (lower reach; SEP reference) all had copepods in samples collected in 2017, and ostracods were collected in San Juan Canyon (east; SEP reference) in April and August of 2018. Copepods were also collected in Sandia Canyon’s uppermost reach, upper reach wetland, middle reach, and lower reach during the October 2017 sampling event. The cladoceran *Alona* spp. was found in Sandia Canyon wetland and the uppermost reach, and *Chydorus sphaericus* (also a cladoceran) was found in Sandia Canyon lower reach during October 2017. Cladocerans are known to be sensitive to metals, and other zooplankton such as copepods and ostracods may also be sensitive to aquatic metals. Dipterans (particularly chironomids) are also common test organisms that might be included in AWQC species sensitivity distributions. These findings indicate that these types of aquatic life can be found in perennial or potentially perennial waters of the Pajarito Plateau; thus the retention of associated toxicological data for those species or similar surrogates in AWQC species sensitivity distributions is warranted. The absence of zooplankton in ephemeral and intermittent waters remains to be determined based on additional SEP data evaluation and/or collection in those water types.

In 2009 and 2011, benthic macroinvertebrates (aquatic insects) were collected from the Rio Grande upstream and downstream of Los Alamos Canyon (Fresquez and Jacobi 2012, 700243). For the 2009 sampling, rock baskets were deployed in the Rio Grande as habitat for approximately 6 weeks to allow for colonization. After colonization, the baskets were retrieved and organisms were identified to the lowest possible taxonomic level. In 2011, kick nets were used in shallow riffle locations and organisms were identified. A total of 10 metrics were scored, including taxonomic richness and a number of biotic indices that can indicate water quality (e.g., EPT taxa). The 2009 sampling results indicated significantly higher abundances downstream and good water quality (i.e., not impaired) both upstream and downstream of the Los Alamos Canyon confluence. In 2011, there was no significant difference in upstream/downstream abundances; however, the bioassessments summary indicated slight impairment downstream of Los Alamos Canyon. Because both upstream and downstream reaches were dominated by pollution-sensitive EPT taxa, Fresquez and Jacobi suggested that the recent regimen of fire and flood (the Las Conchas fire and ensuing flash floods carrying fire-related contaminants having occurred less than 2 months before the 2011 collection) had impacted the downstream study reach, and they concluded that, “Overall, LANL influences, if any, via the [Los Alamos Canyon] system to the Rio Grande, are not significantly impacting water quality of the Rio Grande.”

Numerous historical biological studies have been conducted in LANL area waters. Appendix E-2 of the sampling and monitoring SEP (LANL 2017, 602616) provides a summary of studies from 1990 to 2008. A use attainability analysis (NMED 2007, 700287) included data from electrofishing surveys in the Sandia Canyon, Pajarito Canyon, and Cañon de Valle stream reaches. Fish were not located in those surveys. The use attainability analysis also relied on data from the U.S. Fish & Wildlife Service water quality assessment (Lusk et al. 2002, 700267) that evaluated biological, chemical, and physical characteristics of four intermittent streams within Los Alamos, Sandia, and Pajarito Canyons and in Cañon de Valle. The Lusk et al. (2002) report indicated that there was no source of fish in upstream perennial waters in the canyons surveyed. Thus, fish absence should be taken into account when considering the species sensitivity distributions behind the existing TALs and related AWQC.

Ecological risk assessments have been conducted for multiple canyon investigations conducted as part of the RCRA Consent Order. These assessments are also cited in NPDES Form 2F, Section VIII, Table VIII-6. The findings are presented in each investigation report. These assessments include toxicity testing on *Chironomus dilutus* (formerly *C. tentans*) per EPA test methods. Such testing provides a measure of potential effect on abundance and diversity of the aquatic community in the stream segments of the particular watershed. The reports indicated POC concentrations in sediment, surface water, and alluvial groundwater were either relatively stable or decreasing over time for POCs derived from Laboratory SWMUs or AOCs. Subsequent studies and data have confirmed that these temporal trends persist, indicating similar or decreased concentrations in canyon sediments compared with when the chironomid toxicity tests were first conducted. Several canyon reaches have been recently identified as impaired for aluminum (NMED 2018, 700253); however, preliminary toxicological testing similar to whole effluent toxicity testing suggests that mineral forms of aluminum arising from the local geology are nontoxic to an aluminum-sensitive test organism (Dail et al. 2018, 700238).

Several years of data for whole effluent toxicity testing have been generated for LANL's Outfall 001 using the sensitive test organism *C. dubia* following methods in EPA (2002, 700278). Of the 28 acceptable *C. dubia* 7-day survival and reproduction tests conducted since March 2015, none showed any effect on survival in full strength effluent. Of the 28 acceptable tests, reproduction was unaffected in 20 tests (71%). Of the 8 tests with an effect on reproduction, 3 test results were unreliable because of their either flat or unusual concentration response, and the other 5 test results had a very minor decrease in reproduction relative to the control organisms. These results are pertinent for the IP because Sites 03-045(b) and 03-045(c) in S-SMA-2 are also regulated as active wastewater outfalls included in LANL's NPDES Permit No. NM0028355 for industrial and sanitary outfalls. Site 03-0345(b) is NPDES-permitted Outfall 001. Site 03-0345(c) is the former Outfall 03A027 that currently flows into Outfall 001. The NPDES-permitted Outfall 001 creates the baseflow included in storm water samples at S-SMA-2. See also section 9.6.

8.6 Adjusted Gross Alpha (AGA)

Alpha-emitting radiogenic minerals are present in natural rock throughout Laboratory property and are responsible for the high gross-alpha activity in storm water. Gross-alpha measurements are performed on nonfiltered water samples that often contain high concentrations of suspended sediments, typical of storm water runoff in an arid environment. Gross-alpha exceedances of the New Mexico livestock water-quality criteria (WQC) (the basis for the 2010 IP ATAL) are routinely observed in turbid stormflow upstream of Otowi Bridge in the Rio Grande as well. In addition, natural sediments entrained in turbid storm water runoff from SWMUs distant from developed landscapes are the leading factor for routine exceedances of the 2010 IP ATAL gross alpha within the Laboratory boundary.

Alpha-emitting radionuclides associated with source, special nuclear, or byproduct material as defined in the Atomic Energy Act (AEA) or the radioactive portion of mixed waste are exempt from regulation under the Clean Water Act (CWA). Although these radionuclides may be associated with the total gross-alpha radioactivity detected in the IP samples, they are excluded from the definition of AGA radioactivity. AGA radioactivity is the sum of alpha-emitting radionuclides (measured in units of pCi/L) in a sample minus the activity of AEA-exempt alpha-emitting radionuclides in the same sample.

8.6.1 Legal Standards for AGA

Under EPA rules in 40 Code of Federal Regulations (CFR) 122.2, Definitions, the term "pollutant" is defined as "dredged spoil, solid waste … radioactive materials (except those regulated under Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 *et seq*.)… ." The note to 40 CFR 122.2 further states "[r]adioactive materials covered by the Atomic Energy Act are those encompassed in its definition of source, byproduct, or special nuclear materials. Examples of material not covered include radium and accelerator-produced isotopes." Moreover, the Energy Policy Act of 2005, Section 651(e)(1), amended the AEA to include accelerator-produced radioactive material in the definition of "by-product material."

The New Mexico Water Quality Act (WQA) and regulations are consistent with the EPA rules. The Act defines "water contaminant" to mean "any substance that could alter if discharged or spilled the physical, chemical, biological or radiological qualities of water … and does not mean source, special nuclear or by-product material as defined by the Atomic Energy Act of 1954" (New Mexico Statutes Annotated 1978, §74-6-2). The New Mexico WQS define AGA as "…total radioactivity due to alpha particle emission as inferred from measurements on a dry sample, including radium-226, but excluding radon-222 and uranium. Also excluded are source, special nuclear and by-product material as defined by the

Atomic Energy Act of 1954” [Paragraph 5 of Subsection A of 20.6.4.7 NMAC]. The New Mexico WQC for AGA is 15 pCi/L for the livestock watering designated use. Thus, for comparison with the New Mexico WQC for AGA, samples must be analyzed for all alpha emitters, after which the activity for each excluded alpha emitter (e.g., radon-222 and uranium) must be subtracted from the total gross alpha activity,

Based on these legal standards, it is clear that alpha-particle emissions from emitters that meet the AEA definition of “source,” “special nuclear,” or “byproduct” material are not to be included in measurements of AGA pursuant to the WQA and New Mexico WQS for purposes of implementation of the IP.

8.6.2 AGA Discussion

The Permittees request that EPA delete AGA as a POC from the draft IP, including the AGA TAL value of 15 µg/L under Part I.B. Although the Permittees will continue to monitor for AGA, as discussed below, the CWA or the New Mexico WQA/WQS authorizes EPA to require corrective action and impose associated compliance deadlines for completing corrective action for an exceedance of a TAL for AGA. This request is based on the following rationale.

First, by definition, the AGA includes radium-226 but excludes alpha-particle emissions that meet the definition of a “source, special nuclear and by-product material as defined by the Atomic Energy Act (AEA) of 1954” [Paragraph 5 of Subsection A of 20.6.4.7 NMAC]. In essence, EPA and the State have regulatory authority over only AGA, which is defined to include radium-226 but not AEA-exempt alpha emitters. The 2010 IP, however, already includes a TAL of 30 pCi/L for radium-226 and radium-228 consistent with the New Mexico livestock watering WQC. Therefore, as used in the 2010 IP, the regulation of AGA as a POC is duplicative of regulation of radium-226 and radium-228.

Second, as discussed below, there is substantial evidence to support the conclusion that gross-alpha emitters identified at LANL are AEA exempt. The Permittees reviewed extensive isotopic data from soil (within 3 ft of the ground surface) and water samples collected at the Sites and throughout the Laboratory that identify gross-alpha emitters and concluded that all these gross-alpha emitters are exempt from regulation under the CWA and WQA by virtue of their inclusion in the applicable AEA definitions. The isotopic data show that the following AEA gross-alpha emitters are present in storm water samples collected at SMAs: americium-241, beryllium-7, cesium-134, cesium-137,cobalt-57, cobalt-60, lead-210, lead-212, manganese-54, plutonium-238, plutonium-239/240, potassium-40, radium-226, radium-228, strontium-90, thorium-228, thorium-230, thorium-232, tritium, uranium-234, uranium-235/236, uranium-238, and zinc-65. In addition, isotopic data show AEA-exempt gross-alpha emitters from soil samples at IP Sites[17]. Indeed, the isotopic data from both storm water and soil samples collected at Permit-regulated Sites and SMAs show that the detected gross-alpha emitters are AEA-exempt as “special nuclear,” “source materials,” or “by-product” as defined, respectively, in 42 United States Code 2014(z) (source material), 2014(aa) (source material), or 2014(e) (by-product).

Regardless of how background calculations are derived, there is no disputing that gross-alpha emitters are naturally occurring in rock in and around LANL. The LANL 2014 draft storm water background report presents data that show AGA exceeded the TAL of 15 pCi/L in all 35 samples collected from a background watershed unaffected by Laboratory operations. These AGA concentrations ranged up to a maximum of 1090 pCi/L (72.6 times the New Mexico AGA WQC for livestock watering) (LANL 2014, 600770).

[17] The following AEA-exempt materials were identified from LANL soil samples at Permit-regulated Sites and SMAs: actinium-228, americium-241, bismuth-212, bismuth-214, cesium-134, cesium-137, cobalt-60, lead-212, lead-214, plutonium-238, plutonium-239/240, potassium-40, protactinium-234m, sodium-22, strontium-90, thallium-208, thorium-227, thorium-228, thorium-230, thorium-232, thorium-234, tritium, uranium-234, uranium-235, uranium-235/236, uranium-236, and uranium-238.

Third, naturally occurring background concentrations of total gross alpha in undeveloped landscapes not affected by LANL operations on the Pajarito Plateau exceed the New Mexico livestock watering AGA WQC (Windward 2019, 700289). Based on the typical (interquartile) range of suspended sediment in natural background storm water samples, 90th percentile BTV for gross alpha (which are normalized by SSC in the 2019 BTV report [(Windward 2019, 700289)]) are expected to range from 60 to 660 pCi/L. This range far exceeds the current IP ATAL of 15 pCi/L for AGA.

In summary, the gross-alpha emitters found in storm water on the Pajarito Plateau derive from Laboratory activities associated with AEA materials or from natural background sources. In either event, the gross-alpha emitters identified by isotopic analysis at the Laboratory are AEA exempt. Radium-226, a constituent included in the definition of the AGA, is already addressed in the 2010 IP. The Permittees have not been able to identify technical data or information to conclude that potential or known nonexempt AEA gross-alpha emitters exist at Sites on the Pajarito Plateau. For these reasons, monitoring for AGA and its associated TAL cannot be supported, and thus AGA should be removed from monitoring under the IP.

8.7 Polychlorinated Biphenyls (PCBs)

8.7.1 PCBs in Precipitation and Storm Water within the Upper Rio Grande Watershed

This section describes new PCB datasets and evaluations completed since the 2014 application submittal and describes the comprehensive PCB background evaluations conducted in 2010–2012 that were also covered in the 2014 application submittal. Background information about PCBs is provided below.

PCBs belong to a diverse family of human-generated organic chemicals known as chlorine-substituted hydrocarbons. PCBs were manufactured in the United States from 1929 until their manufacture was banned in 1979. They, and their breakdown intermediates, have a range of toxicities and, despite being banned, continue to be cycled globally between land, sea, and air (EPA 2011, 700254). The unique chemical properties of PCBs allow them to persist in the environment for decades, as they are resistant to chemical, microbial, and physical degradation. PCBs can be adsorbed to soil, stream sediment, and organic matter, and are transported by the same forces, aeolian or streamflow, as these natural particulates. Over time, a portion of the lighter PCB molecules volatilize and are distributed globally through the atmosphere and to land and sea as wet and dry deposition. Subsequent to the EPA phase-out of their manufacture and use, additional occult sources have been identified in consumer products such as paints and pigments, and indoor/outdoor caulks (Kohler et al. 2005, 700245; Grossman 2013, 700265). Consequently, PCBs are ubiquitous in the landscape not only near industrial centers but also in residential areas, on undeveloped lands, and even in remote polar regions and mountain snowpacks (Friedman and Selin 2016, 700264). In more northern climes, or at high elevations and in forested areas, PCBs are preferentially deposited because of temperature, cold condensation, and the forest filter effect (Nizzetto et al. 2006, 700269). According to the EPA, environmental cycling of past releases of PCBs is a major source of PCB contamination worldwide. This cycling consists of volatilization of PCBs from land and water, atmospheric dispersion, wet or dry deposition, followed by aeolian, riverine, and revolatilization transport mechanisms. Evidence of this dispersion is reported in a large body of work documenting widespread distribution of PCBs in environmental media around the world, even in the absence of point sources of PCBs (Nisbet and Sarogim 1972, 700268; Beyer and Biziuk 2009, 700256).

Because of these unique properties of PCBs, the 2010 IP differentiated between High Priority Sites, which were assumed to have Site-related PCBs exposed to storm water, and Medium Priority Sites, which were assumed not to have Site-related PCBs exposed to storm water, but to have detectable levels of PCBs, likely from atmospheric transport and deposition or from local urban sources unassociated with Sites regulated by the IP. The RCRA Consent Order soil data demonstrated that many of the Sites in the

2010 IP, including some High Priority Sites, did not have Site-related PCBs exposed to storm water. These findings highlighted the need to differentiate between PCBs in surface waters that originate from local industrial and urban sources, on the one hand, and global atmospheric deposition, or baseline PCBs on the other. Figure 17 illustrates this concept, showing the various sources of PCBs and pathways PCBs travel in the water cycle.

2012 PCB Background Report

In 2010–2012, DOE, the NMED DOE Oversight Bureau, and LANS conducted a cooperative study to characterize PCBs in certain surface waters located in the upper Rio Grande watershed and in areas in and around the Laboratory. The PCB background report provides the findings of this investigation(LANL 2012, 219767), which are summarized below.

The 2012 PCB background report presents baseline, base-flow, and storm-flow concentrations of PCBs in certain surface waters located in the upper Rio Grande watershed and within and around the Laboratory. The results of this study established the following:

- Baseline levels of PCB concentrations in precipitation and snowpack near Los Alamos, New Mexico, and from alpine peaks overlooking the northern Rio Grande watershed up to the state border with Colorado, indicated variable snowpack concentrations ranging from less than 0.1 ng/L (Red River area) to above the New Mexico HH-OO criterion of 0.64 ng/L in the Sandia Mountains snowpack near Albuquerque, New Mexico. Values in northern New Mexico snowpack, including LANL, were generally similar in magnitude, if generally a little less, than rural, more northerly climes worldwide.
- Baseline levels of PCB concentrations in storm water in northern New Mexico streams and arroyos that are tributaries to the Rio Grande and Rio Chama confirmed the ubiquity of PCBs in the environment. Total PCB concentrations were variable and ranged over 4 orders of magnitude, and often exceeded the New Mexico HH-OO criterion of 0.64 ng/L.
- The range of PCB concentrations found in the Rio Grande during base-flow (dry weather flow) and storm-flow conditions indicated that base-flow PCB concentrations were generally low, but variable, and that stormflow mobilized PCBs generating higher concentrations. PCB concentrations during stormflow showed strong correlation with suspended sediment, yet no significant longitudinal trend was apparent. Stormflow PCB concentrations often exceed the New Mexico HH-OO criterion.
- Baseline levels of PCBs in storm water from undeveloped watersheds of the Pajarito Plateau and the northeast flank of the Jemez Mountains near Los Alamos indicated that most runoff collected by LANL and NMED on the western boundary of the laboratory (upstream of LANL property) exceeded the New Mexico human health criteria. The range of PCBs in baseline and reference sites, from 0.02 to 24 ng/L, was highly variable, but well within the low end of the global range of PCBs in runoff waters. Associations between total PCB and suspended sediment were variable; strong between West Boundary baseline sites, but not so with other reference sites.
- The concentrations of PCBs in urban runoff from the Los Alamos townsite adjacent to the Laboratory ranged from 0.01 to 144 ng/L and were generally 10 to 200 times the baseline values.
- How these findings may be used to target significant sources of PCBs.

Other than wet and dry atmospheric deposition, the dominant mechanism for redistributing PCBs is sediment transport by storm water. The data do not indicate distinct contributions of PCBs from local industrial pollution sources at most locations. The total PCB concentrations in precipitation were generally low compared with more global urban areas, probably reflecting the rural nature of this study area. Levels in precipitation and snowpack samples from the upper Rio Grande watershed rank among the lowest when compared with those reported in the scientific literature for other non-pollution locations. With the possible exception of samples taken near Albuquerque, New Mexico, samples of snowpack from alpine mountains in northern New Mexico did not show a clear PCB airborne impact from the nearest municipality.

PCB Trends Since the 2012 Report and 2014 Application

Elevated PCBs in storm water samples collected at various gaging stations for major watersheds of the Pajarito Plateau are illustrated in Figure 18. In the upper canyons, PCB concentrations often exceed the chronic aquatic life and wildlife habitat criteria (20.6.4 NMAC). In particular, PCBs measured at gage station E026 (upper Los Alamos Canyon) have exceeded these criteria and illustrate baseline PCB concentrations entering the Laboratory from precipitation and runoff from the west. However, there are fewer exceedances and samples at downstream gaging stations, likely as a result of limited downstream transport of dissolved and particulate PCBs within ephemeral and intermittent flows (Figure 18). As comparison, Rio Grande PCB concentrations above and below the confluence with Los Alamos Canyon are shown in Figure 19. PCB concentrations in the Rio Grande during the monsoonal period often exceed the New Mexico HH-OO criterion. Because PCB concentrations exhibited similar ranges above and below Los Alamos Canyon, the data suggest that there has been little if any influence of storm water potentially containing PCBs from the Laboratory and the greater Los Alamos County area draining to Los Alamos Canyon. For canyons where known PCB contaminants exist, Sandia Canyon for example, intermittent flows coupled with sediment transport mitigation features have led to very few samples being able to be collected between the control structures and the receiving water (i.e., the Rio Grande) (Figure 20).

Sources of PCBs detected in surface waters may include recognizable discrete local-scale PCB sources (e.g., Site-related PCBs in surface soil) as well as ubiquitously dispersed sources. The upper ranges of PCB concentrations in baseline and Rio Grande stormflows continue to be approximately an order of magnitude larger than those for precipitation (less than 1 ng/L in precipitation and 10 ng/L to 50 ng/L in stormflows). This difference was primarily from the presence of PCBs associated with suspended sediment in runoff. Dry deposition of PCBs to forests and soil, as well as wet deposition that does not cause significant flow in the period antecedent to larger stormflows, can lead to mobilization of PCBs in excess of what can be measured in precipitation. Similarly, the upper range of PCBs in runoff from developed, urban areas (>100 ng/L) were an order or magnitude greater than PCBs in baseline and Rio Grande stormflows. The higher concentrations associated with the runoff from developed, urban areas likely resulted from the contribution of additional diffuse local sources in the urban environment (Rossi et al. 2004, 213427; Totten et al. 2006, 700271). This finding is consistent with information in the toxicological profile for PCBs published by the Agency for Toxic Substances and Disease Registry as well as numerous studies, which report that PCB concentrations in storm water in developed urban areas are higher than in rural locations.

The disparity between PCB concentrations during baseflow and stormflow periods because of the introduction and/or entrainment of suspended sediment containing PCBs can be significant. While PCB concentrations are elevated during storm water runoff events in perennial or intermittent waters, they may drop quickly to lower levels during the intervening periods of baseflow (unless baseflows are impacted by a significant pollution source). In other words, exposures to elevated levels during stormflows would be relatively short (on the order of a few hours). In some cases, exceedances of the New Mexico HH-OO criterion in perennial waters could be attributable only to stormflow periods if the assessment data set includes samples collected when runoff was occurring.

For perennial or intermittent surface waters, baseflow predominates perhaps 90% or more of the time. In contrast, surface waters during storm water runoff generally contained PCB concentrations above 5 ng/L and substantially above the New Mexico HH-OO criterion. Such concentrations were measured even in the most remote parts of the watershed and can be attributed to the increased concentrations of suspended sediments carried by surface waters during storm water runoff.

In 2019, background storm water PCB concentration data were again evaluated for the purpose of developing BTVs (Windward 2019, 700289). The dataset evaluated at that time included all available and applicable monitoring data collected between 2011 and 2017. Based on that evaluation, it was again found that the baseline and urban background conditions for PCBs in Pajarito Plateau waters exceed the IP ATAL of 0.64 ng/L by up to a factor of 100 (for the 95% UTL of the 95th percentile [95–95 UTL]). In general, PCB concentrations were similar between undeveloped and urbanized sampling locations (with UTLs of 58 and 64 ng/L, respectively). Contrary to the 2012 study findings, the 2019 BTV report found that PCBs in storm water were not statistically significantly related to suspended sediment. These results provide further support for regional aerial deposition processes as a key driver of baseline PCBs in Pajarito Plateau storm water. Slightly higher urban background PCBs (relative to undeveloped baseline PCBs) may be attributable to diffuse PCB sources (e.g., in building materials) or increased runoff of rainwater from impervious surfaces relative to undeveloped landscapes.

8.7.2 Aquatic Life Studies

LANL has also monitored PCBs in aquatic life tissue samples collected in the Rio Grande upstream and downstream of surface water inputs for the Laboratory (LANL 2017, 602616). Of the major ephemeral/intermittent drainages that cross the Laboratory, Los Alamos Canyon flows are most likely to reach the Rio Grande during significant precipitation or snowmelt events (Abeele et al. 1981, 006273), and sediments have been shown to contain elevated amounts of PCBs and radionuclides (Gallaher and Efurd 2002, 700244; LANL 2008, 105241). For these reasons, assessments are usually performed above and below the confluence of Los Alamos Canyon with the Rio Grande to evaluate impacts of LANL legacy pollutants on river biota.

Assessments of aquatic life impacts by LANL runoff have included fish tissue sampling, which can be used to evaluate bioaccumulative toxic pollutants, or assessments of potential differences in community structure and richness. Both types of assessments have been employed above and below the Los Alamos Canyon confluence with the Rio Grande, as well as bioassessments of reaches of the Rio Grande, and reservoirs above and below LANL that are part of the Rio Grande watershed. These evaluations were not included in the 2014 IP application, but are summarized below to add further supporting material context to this IP renewal application, particularly with respect to PCBs.

Macroinvertebrate Communities Above and Below the Los Alamos Canyon–Rio Grande Confluence

In 2009 and again in 2011, benthic macroinvertebrates (aquatic insects) were collected from the Rio Grande upstream and downstream of Los Alamos Canyon (Fresquez and Jacobi 2012, 700243). For the 2009 sampling, rock baskets as habitat were deployed in the Rio Grande for approximately 6 wk to allow for colonization. After colonization, the baskets were retrieved and organisms identified to the lowest possible taxonomic level. In 2011, kick nets were used in shallow riffle locations and organisms identified. A total of 10 metrics were scored, including taxonomic richness and a number of biotic indices that can indicate water quality (EPT taxa, for example). The 2009 sampling results indicated significantly higher abundances downstream and good water quality both upstream and downstream of the Los Alamos Canyon confluence (i.e., not impaired). In 2011, there was no significant difference in upstream/downstream abundances; however, the bioassessments summary indicated slight impairment downstream of Los Alamos Canyon. Because both upstream and downstream reaches were dominated by pollution-sensitive EPT taxa, the authors of this study suggested that the recent regimen of fire and flood (the Las Conchas fire occurred less than 2 mo before the 2011 collection) impacted the downstream study reach, but conclude that: "Overall, LANL influences, if any, via the [Los Alamos Canyon] system to the Rio Grande, are not significantly impacting water quality of the Rio Grande."

PCBs in Fish Tissue

In 1997, the LANL Ecology Group began measuring PCBs in fish tissue from the Rio Grande upstream and downstream of LANL. These measurements included sacrificing fish from higher trophic levels (different PCB formulations may be differently metabolized, but generally bioaccumulate) from upstream and downstream of LANL but also from reservoirs in the Rio Grande watershed (Abiquiu reservoir, upstream of LANL; Cochiti reservoir, downstream of LANL). Because early surveys used a different PCB analytical method than later studies (i.e., Aroclor rather than congener methods), comparisons through time are challenging, but a general decrease in total PCBs in fish tissue was observed between 1997 and 2002 sampling years (Gonzales and Fresquez 2008, 700242). Channel catfish (*Ictalurus punctatus*) and River carpsucker (*Carpiodes carpio*) showed similar trends with upstream catfish showing statistically higher tissue PCBs than their downstream counterparts. River carpsucker also had more tissue PCBs upstream but this was not significantly different than downstream fishes. Because of the vagile nature of fish, and because fishing for dietary consumption is likely to be higher in reservoirs than in-stream fishing in the Rio Grande, evaluations of tissue were conducted on bottom-feeding and predatory gamefish (walleye, pike, and bass) collected from Abiquiu reservoir and Cochiti reservoir (Gonzales and Fresquez 2006, 700241). Bottom-feeding fish from both reservoirs exceeded EPA's restricted consumption level of fish and were statistically higher than the collective predatory gamefishes. Fish tissue PCBs from bottom-feeding fishes from the reservoirs were statistically identical in concentration, although Cochiti had a wider range of fish tissue PCBs. For numerous reasons, homologue analysis was unable to assign known LANL PCBs as being a likely source of PCBs to gamefishes. Historical and recent PCB contaminants measured in fish tissue, for both riverine and reservoir fishes, are presented in Figures 21 and 22. The ubiquity of PCBs in the Rio Grande watershed, in fish tissues above and below LANL influences, indicate that human health exceedances are likely owing mostly (if not entirely) to atmospheric transport and urban runoff, and that baseline measures to retain PCB-laden stormflow from known point sources are minimizing, adding to this global problem. Impacts to aquatic life below LANL influences has not been demonstrated to either the macroinvertebrate or fish communities.

8.7.3 PCB Summary

Given the rare occurrences of stormflows from the Pajarito Plateau to the Rio Grande (Figure 20), lack of fish in canyon waters, and the ephemeral nature of most canyon's hydrology, the Permittees believe that New Mexico wildlife habitat criterion for PCBs is more appropriate for managing Pajarito Plateau water quality in ephemeral streams than the New Mexico HH-OO criterion. Thus, the Permittees request that the wildlife habitat criterion for PCBs (0.014 µg/L) be used as the ATAL in ephemeral reaches, instead of the current 0.00064 µg/L ATAL, which is based on the HH-OO criterion.

These findings, combined with RCRA Consent Order shallow soil data, provide the basis for the determinations provided in NPDES Form 2F, Section IV, Narrative Description of Pollutant Sources, that describe whether PCB ATAL exceedances may be wholly or partially attributable to Site-related PCBs exposed to storm water, or are affected by background contributions such as atmospheric deposition or runoff from developed, urban areas. The combination of site history, storm water data, and soil data to be reviewed during the corrective actions screening (section 9.1.2) is intended to differentiate Site-related

PCB issues that may lead to remedial actions from PCB issues related wholly or in part to anthropogenic, non-Site related influences.

9.0 PROPOSED CHANGES TO THE RENEWED DRAFT PERMIT

This section discusses specific changes to the 2015 draft IP that are proposed for the renewed IP application. These changes fall into the following categories: (1) organizational changes to clarify, improve, and facilitate understanding of requirements of the IP; (2) substantive changes to data screening, paths to completion, and other monitoring and reporting requirements of the IP; and (3) non-substantive changes and minor typographical errors. These changes are provided in a redline-strikeout version of the 2015 draft IP (Attachment 1), and specific justifications for changes are provided below. Unless otherwise stated, all references to parts of the IP in this section refer to Attachment 1.

The Permittees met with NMED and EPA during five webinars conducted in 2018 to discuss the following topics and related changes to the 2010 IP based on components of the 2015 draft IP:

- Webinar #1 – *Storm Water Background for Pajarito Plateau Storm Water*, discussion of results of the 90% draft BTV Report
- Webinar #2 – *Biotic Ligand Model (BLM) and Aluminum Filtration*, discussion of BLM results for copper, lead, zinc, and the aluminum toxicity sampling plan
- Webinar #3 – *IP Confirmation Monitoring*, discussion on potential Section C changes, Sampling Implementation Plan process, and Site-Specific Demonstration
- Webinar #4 – *IP Paths to Completion*, discussion on the tiered approach, long-term stewardship, and Site deletion
- Webinar #5 – *IP Pending Requests to EPA*, discussion on status and path forward for alternative compliance requests, certificates of completion under Consent Order, and Force Majeure requests

9.1 Sampling Implementation Plan and Site-Specific Demonstration

The Sampling Implementation Plan (SIP) was a requirement specified in Condition #1 of the 2015 NMED §401 Certification of the 2014 draft IP. The certification states that the SIP is intended to be "an ongoing evaluation of Sites based on all available information to accurately determine Site-related constituents and monitoring requirements in storm water runoff. This monitoring requirement is necessary to ensure that monitoring data is representative of Site discharges so that compliance with the water quality standards can be appropriately evaluated." As part of this requirement, the certification entailed an annual update to the SIP, with NMED and EPA review and approval required, without triggering a permit modification. The annual SIP update is intended to specify the overall monitoring program each year, including Sites, SMAs, and POCs. Although EPA has not formalized any of the certification requirements in a revised draft IP, N3B, EPA, and NMED have discussed the SIP concept extensively, including its merits and details of how it will be implemented, referred to as the SSD. As a result, N3B, NMED, and EPA wish to formalize the SSD in the renewed IP, as generally specified in the 2015 NMED §401 Certification, and with the updates proposed in this section.

9.1.1 SIP and SSD Activities Through 2018

Proactively, before receiving a renewed IP, the Permittees began implementing the SIP review, as specified in the 2015 NMED §401 Certification. The SIP Review Team consisted of representatives from the NMED SWQB, the NMED Department of Energy Oversight Bureau (DOE OB), the Permittees, and EPA Region 6 personnel when available. Between 2016 and 2018, a preliminary version of the SSD was implemented by the SIP Review Team, who conducted a review of each of the 410 Sites covered in the 2010 IP. This review process included the evaluation of available Site knowledge, including Site history, the evaluation of available soil sampling data within the top 3 ft of soil, the evaluation of upstream and downstream storm water quality data, and field visits to determine if the current SMA monitoring location was the most representative of storm water discharges from the Site(s). Maps documenting these locations were signed by members of the SIP Review Team (with the exception of NMED DOE OB, whose role was oversight). At the end of the process, 22% of the SMA monitoring locations were moved from the original locations, and only one SMA monitoring location was found to be not representative.

Where sampling locations were moved, SMA drainage boundaries were adjusted accordingly using hydrologic modeling tools in geographic information system (GIS) and general field verifications. In most cases, the SMA drainage boundary area either increased or decreased in size from the prior SMA drainage boundary. In other cases, the SMA boundary was adjusted to a more representative drainage area (e.g., an adjacent drainage path, in which case a new SMA boundary was delineated). In some instances, geographic constraints limited the ability to select a single, representative SMA sampling location. Consequently, one or more additional SMA sampling locations were selected to collect additional samples for Site(s) that may have not been fully represented by the prior SMA monitoring location. In each case, the updated SMA sampling location(s) were agreed upon by the SIP Review Team and documented as representative monitoring locations for the associated Site(s).

The process described above resulted in the confirmation of 198 SMA monitoring locations, relocation of 54 SMA monitoring locations, and addition of 29 new, investigative sampling locations (Table 14). Some SMA sampling relocations were recommended to improve chances of collecting samples and other locations were moved farther downgradient of the Site(s) to represent additional, potentially Site-contaminated, or affected, soil sample results. These relocations of SMA sampling locations were determined by the SIP Review Team not to require modification of the 2010 IP; only one SMA sampler was found to be in a non-representative location. Investigative SMA samplers were recommended in cases when the affected area was determined to be larger than originally identified, or when the SMA drainage boundary included significant impervious areas generating non-Site storm water runoff to the SMA. The signed SIP maps documenting the rational for verifying representative SMA monitoring locations and associated SMA boundaries for 410 Sites (455 Site/SMA associations as presented in Table 1) are shown on the maps provided with NPDES Form 2F, Section IIIA. In addition, the Site drainage boundaries are shown on these maps.

A SIP review was not conducted at 4 Sites because these locations have pending Site deletion requests (section 9.7), and at 1 Site because it has been identified as being listed in the 2010 IP as an administrative error (section 9.16). The relocation of SMA monitoring locations for 12 SMAs will not be implemented until the renewed IP is effective because the Sites associated with these SMAs are in a completed compliance status under the 2010 IP. Minor changes to SMA drainage boundaries have been made at 12 SMAs (26 Site/SMA associations), and changes to the SMA monitoring locations and SMA drainage boundaries have been made at 2 SMAs (3 Site/SMA associations) since the SIP review was completed because of either changes in Site condition or additional field verification of GIS modeling outputs. The recently completed SIP reviews recommended minor changes to the SMA drainage boundaries at 3 SMAs (5 Site/SMA associations), and that SMA sampling locations at 4 SMAs (7 Site/SMA associations) be relocated. These changes will be implemented in the 2019 monitoring season and documented in the annual SIP update. The current SDPPP map is presented in NPDES Form 2F, Section IIIB, for the 5 Sites excluded in the SIP review, Sites with pending SIP review recommendations, and Sites with changes since the SIP review.

9.1.2 Proposed Site-Specific Demonstration

A major outcome of the 2018 webinars and several pre- and post-meetings was further delineation of the SSD from what was described in the 2015 NMED §401 Certification. The flow diagram in Figure 23 illustrates the new SSD that was created in conjunction with EPA and NMED. The Permittees request a year from the date the new Permit is issued to perform the initial SSD. Henceforth, the SSD will be an annual process to be included in the annual SIP update.

IP Storm Water Confirmation Data

Results of confirmation storm water (SW) samples for each SMA and each POC will be screened as follows (see Part C.1(b)(i) and Figure 23):

1. SW Tier 1: When the confirmation sample result is less than the TAL, the Permittees can cease monitoring for that POC for the remainder of the permit and it is not considered as a Site-related POC.
2. SW Tier 2: When the confirmation sample result of one or more POCs exceeds the TAL but is less than the 90th percentile composite BTV, the SMA shall enter into long-term stewardship (LTS) and meet the requirements of Part G.3. However, if the BTV and the confirmation sample result are less than the TAL, SW Tier 1 applies.
3. SW Tier 3: When the confirmation sample result of one or more POCs exceeds the 90th percentile composite BTV, the SMA shall enter into corrective action per Part E. However, if the BTV and the confirmation sample result are less than the TAL, SW Tier 1 applies.

The 90th percentile composite BTV is defined as:

90th Percentile Composite BTV = %Impervious SMA Area * 90th Percentile Developed Landscape BTV +
%Pervious SMA Area * 90th Percentile Undeveloped Landscape BTV

where: the %impervious SMA area is the percent impervious, or developed, area of the SMA (i.e., parking lots, buildings, roads, etc.) as listed in NPDES Form 2F, Section VI, Table IV-1; the %pervious SMA area is the percent pervious, or undeveloped, area of the SMA (i.e., open land, grass, forests, woodlands, etc.) as listed in NPDES Form 2F, Section VI, Table IV-1; and the 90th Percentile Developed and Undeveloped Landscape BTVs are listed in Table 13, Appendix B of the redline-strikeout of the 2015 draft IP (Attachment 1), and are sourced from the 2019 BTV report (Windward 2019, 700289).

RCRA Consent Order Soil Data and Site History

RCRA Consent Order soil data are the primary source of information for determining if a Site contains significant industrial materials (i.e., not cleaned up or contamination remains in place). A significant amount of new soil data has been collected under the RCRA Consent Order since the Sites were initially evaluated for inclusion in the 2010 IP. In addition, RCRA facility investigation (RFI) data collected before 2005 have been subject to additional evaluation as RCRA Consent Order investigations have progressed and reports have been drafted.

As part of the SSD, the Permittees propose to continue evaluating soil data (i.e., from the surface to a depth of 3 ft below ground surface) from RFI and RCRA Consent Order investigations to identify inorganic and organic significant industrial materials from historical Site-related activities that are exposed to storm water runoff. The 3-ft-depth interval was selected to conservatively represent Site-related industrial materials that may potentially be exposed to erosive storm water runoff. The data to be evaluated consists of those previously reported to EPA or NMED in documents submitted under the RCRA Consent Order or RCRA permit.

The soil data evaluation process will consist of an initial screening to determine POCs potentially present as a result of Site-related activities. Concentrations of Site-related POCs in soil samples will be compared with applicable soil background concentrations for inorganics (the 95-95 UTL) and applicable residential soil screening levels (SSLs) for organics (10% of the SSL). Since there are no natural background values for anthropogenic POCs (e.g., PCBs and many other organic POCs), residential SSLs are used in the comparison. It is similar to the approach the Consent Order supplemental investigation reports are currently implementing to determine whether or not the constituent is of concern at a Site or from a release (of a significant industrial material). The pattern of detection should also be considered; for example, concentrations that increase downgradient from a Site may indicate a release of Site-related material. Constituents identified as potentially Site-related by the initial soil data screening will then be evaluated in more detail to identify if they are likely Site-related and to determine whether or not they should be added to the POCs monitored in storm water at the Site. The evaluation processes for inorganic and organic POCs are described in Figure 23.

Results of Consent Order soil data (SD) for each SMA and each POC will be screened as follows (see Part C.1(b)(ii) and Figure 23):

1. SD Tier 1: When the soil sample result is less than the 95-95 UTL BTV for inorganic POCs or less than 10% of the SSL for organic POCs and inorganic POCs with no BTV, the Permittees can cease monitoring for that POC and it is not considered as a Site-related POC. If SW Tier 1 conditions are also met, Permittees may request the Site be deleted from the Permit.
2. SD Tier 2: When the soil sample result of one or more POCs exceed the 95-95 UTL BTV for inorganic POCs or 10% of the SSL for organic POCs and inorganic POCs with no BTV, the POC shall remain or be added to storm water monitoring requirements for that SMA if it is considered as a Site-related POC.

9.2 Site Previously in Corrective Action (Part C.2)

For each SMA with Sites previously in corrective action, the following requirements apply:

1. If the Permittees have collected a confirmation sample and are currently in corrective action, shall complete the corrective action, and proceed to confirmation monitoring pursuant to Part B.
2. If the Permittees have previously installed and certified enhanced controls, they shall collect two confirmation samples if no sample has been collected, or one confirmation sample if a sample has been collected.
3. If the Permittees have submitted requests (e.g., Alternative Compliance, or force majeure) to EPA that are pending, the Permittees shall complete an SSD pursuant to Part C.1 to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TALs or BTVs.

4. If the Permittees have achieved RCRA Corrective Action Complete status under NMED Consent Order and have, by definition, collected at least one confirmation sample, the Permittees shall complete an SSD pursuant to Part C.1 to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TALs or BTVs.

For Sites with a completed SSD, the tier results of the confirmation monitoring and/or soil data comparisons shall be used to determine annual sampling requirements.

9.3 Long-Term Stewardship (Part G.3)

After the Permittees complete the SIP review and SSD, both initially and annually, Sites that are determined to be candidates for LTS will be documented in the annual SIP. The criterion for Site(s) to qualify for LTS (see also Figure 23 and section 9.1.2) is that the IP compliance SMA sample results associated with the Sites(s), for all POCs, are either greater than the TAL but less than the 90th percentile composite BTV, or less than the TAL.

As part of the LTS, the Permittees' Pollution Prevention Team will inspect and evaluate each Site and its associated controls annually and after a 3-yr, 24-hr return period storm, as measured by the nearest of the Permittees' precipitation gages (section 5.5.2). Maintenance will be performed as necessary. An assessment will be conducted at the end of the 5-yr permit cycle to determine if adjustments should be made to the LTS control measure inspection frequency and, if so, to describe such changes in subsequent IP renewal applications. In addition, a high-level inspection of the entire list of Sites in LTS will be conducted to evaluate the storm water runoff and erosion potential for each Site. The Sites in LTS will be tracked by Site, not to the individual control, and the inspection dates, maintenance dates, maintenance activities, and LTS listing date will be tracked for each Site.

9.4 Additional Paths to Completion (Part I.2)

The Permittees have discussed with EPA and NMED several additional paths to Site completion that will allow Sites to be removed from the IP. The additions or clarifications described below are proposed for addition to the renewed IP accordingly.

9.4.1 No Discharge

The Permittees propose that the renewed IP include a new condition that allows for removal of Sites from the IP if a confirmation sample has not been successfully collected at the associated SMA. The conditions of such a request are: (1) the sampler has been continuously maintained in an operable condition during a 5 year permit cycle at a representative location; and (2) rainfall equivalent to or greater than a 25-yr, 24-hr storm event has occurred, as measured by the nearest of the Permittees' precipitation gages (section 5.5.2). The Permittees would submit a request to EPA for removal of the particular SMAs and associated Site(s). In this renewed IP application, the Permittees are requesting 22 Sites (13 associated SMAs) be removed from the IP because they have met the criteria for no discharge, as discussed above, over the past 8 years of monitoring (Table 15).

9.4.2 Site-Specific Demonstration

The Permittees may submit a request to EPA that Sites be removed from the Permit if the SSD establishes that exceedances of applicable TALs or BTVs are not reasonably expected to be Site-related, for all SMAs identified as containing the Site, and for all POCs monitored at the Site. This path and related language were largely included in the 2015 draft IP and the 2015 NMED §401 Certification. section 9.1.2 and Figure 23 contain details regarding the SSD and how it will be implemented.

9.5 Non-DOE Owned Locations

Table 16 contains a list of 42 Sites (21 related SMAs) that are not on DOE property, having been transferred to non-DOE entities after issuance of RCRA COCs. A majority of these Sites are on Los Alamos County property (23 Sites), but some are on either private property (8 Sites on private property entirely, 8 Sites split between private and Los Alamos County property) or U.S. Forest Service land (2 Sites on U.S. Forest Service [USFS] land entirely, 1 Site split between USFS and Los Alamos County property). The Permittees request that these Sites, and any future Sites that are transferred to non-DOE entities, be removed from the IP. In some cases, Site access and lack of control over Sites makes implementation of IP requirements impractical.

9.6 Deferred Sites

There are currently 33 active, operational Sites (27 associated SMAs) monitored under the IP (Table 17). These Sites are extremely challenging to monitor, inspect, and maintain because of the active operations being performed. Negotiations are ongoing between DOE EM-LA and DOE NNSA to discuss the future disposition of these Sites.

On October 21, 2015, the Laboratory made a request to delete two Sites, 03-045(b) and 03-045(c), from the IP, pursuant to Part III.A.5 of the 2010 IP. These Sites are active outfalls that are permitted under the Laboratory's NPDES Permit No. NM0028355 for industrial and sanitary outfalls. Because of the existence of these Site deletion requests, 03-045(b) and 03-045(c) were not included in the SIP review. The Permittees request the removal of these Sites from the IP, as DOE NNSA will potentially be taking over storm water monitoring activities at these Sites. Negotiations are ongoing between DOE EM-LA and DOE NNSA to discuss the future disposition of these Sites.

9.7 No Significant Industrial Materials [Part I.2(b)]

On October 14, 2015, the Laboratory made a request to delete six Sites, 00-011(c), C-00-020, 16-030(c), 35-016(m), C-46-001, and 35-004(h) from the IP pursuant to Part I.I.2 of the 2010 IP. These six Sites did not use significant industrial materials or significant industrial materials were not remediated such that storm water is not impacted. The Permittees request that these Sites not be included in the renewed IP. The Permittees may propose that other Sites determined to have "no significant industrial materials" also be removed from the renewed IP.

9.8 RCRA Clean Closure [Part I.2(b)]

The Permittees request that the renewed IP incorporate specific language that allows completion of corrective action or removal of a Site, as appropriate, for Sites that have achieved RCRA "clean closure." A Site that has a certificate of clean closure is equivalent to an NMED decision that a SWMU or AOC poses no unacceptable risk to human health or the environment because hazardous waste and hazardous waste residues must be removed and soil containing or contaminated with hazardous waste or hazardous waste residues must be decontaminated or removed (40 CFR 264.178). The revised language would allow the Permittees to achieve completion of corrective action under the IP and remove a Site "through an NMED-approved Certificate of Clean Closure under the Hazardous Waste Facility Permit confirming that the Site poses no unacceptable risk to human health or the environment based upon residential soil screening levels."

Under the RCRA Consent Order, some SWMUs and AOCs are also "interim status units" under the Laboratory's Hazardous Waste Facility Permit and RCRA regulations. A number of these interim status units have undergone and completed clean closure under the Hazardous Waste Facility Permit. RCRA clean closure is a confirmation that hazardous or mixed wastes are removed from the unit, and equipment, structures, and surrounding soils are decontaminated or removed (Part 9.2.1 of Hazardous Waste Facility Permit). In addition, a number of active RCRA interim status units (i.e., firing sites) that are also Sites already regulated by the 2010 IP will be subject to RCRA closure at the end of their active life.

On October 21, 2015, the Laboratory made a request to delete four Sites, 16-010(b), 16-010(c), 16-010(d), and 16-018. These four Sites are no longer RCRA corrective action units, but are hazardous waste management units, and therefore cannot be regulated under the IP. Because of the existence of these Site deletion requests, 16-010(b), 16-010(c), 16-010(d), and 16-018 were not included in the SIP review process. This outstanding request should be implemented in the renewed IP.

9.9 Total Retention [Part E.1(c)]

The 2010 IP does not define design criteria for total retention. Without a design basis, the Permittees have not been able to use total retention as a tool for the completion of corrective action. The 3-yr, 24-hr design storm (1.19 to 1.89 in. of precipitation; depending on the location of the Site) was chosen to be both conservative and technically achievable. Total retention of the 3-yr, 24-hr storm event represents a storm water capture volume that exceeds guidance provided by the Energy Independence Security Act and regulations implemented by leading Region 6 municipalities in the field of storm water quality (EPA 2009, 700483). Despite the statistical annual risk of exceedance of the 3-yr, 24-hr storm, only 12 storms between 2010 and 2018 have exceeded the 3-yr, 24-hr storm.

9.10 Watershed Protection Approach (Part I.4)

Per the 2015 draft IP, the “EPA encourages the Permittees to voluntarily install watershed-based control measures, such as sediment barriers, to mitigate sediment or storm water runoff reaching the main channels of the canyons and/or the Rio Grande.” The concept of installing larger sediment control structures in the canyons on Laboratory property is intriguing, as these controls would act as an additional, final measure to slow storm water and retain sediment. The Permittees request that upon installation of these larger, more expensive controls, that the performance of such controls will be monitored by the Permittee below the constructed controls and reported in the SDPPP. After which, the monitoring of SMAs located upstream from the larger controls would no longer be required under the IP. The control measures at the SMAs would continue to be inspected and maintained as currently required. The performance of such watershed-based controls would need to be based on an accepted and approved monitoring approach, including methods and POCs mutually acceptable to the Permittees, NMED, EPA, and the public. Such a plan, including a compliance schedule, would also need to be specified in the revised requirement language.

9.11 Post-Storm Inspection Frequency (Part G.2)

During the past 8 yr, the Permittees have performed over 12,000 post-storm inspections per the 0.25 in. in 30 min “storm rain event” defined in the 2010 IP. The Permittees have determined that such a rainfall event is generally insufficient to produce storm water runoff (Figure 24). For rainfall in excess of 0.50 in. in 30 min, the percent of inspections where storm water runoff was documented increased from below 2% (1.3% for 0.2–0.29 in. in 30 min range; 1.8% for 0.3–0.39 in. in 30 min range; and 1.9% for 0.4–0.49 in. in 30 min range) to 3.2% for the 0.5–0.59 in. in 30 min range. Thus, 0.50 in. in 30 min is a reasonable threshold for potentially producing storm water runoff, and thus potentially performing maintenance on controls because of storm water runoff. Based on this finding, the Permittees request an increase of the post-storm inspection rainfall intensity from 0.25 in. in 30 min to 0.50 in. in 30 min such that inspections are a more efficient use of resources.

9.12 High and Medium Priority Sites

The purpose of identifying High and Medium Priority Sites in the 2010 IP (Part I.E.4) was to advance the completion of corrective actions at Sites where PCBs are potentially linked with past Site activities and significant industrial materials. The Permittees performed corrective actions per the compliance schedule of 3 yr (high priority) and 5 yr (medium priority) from the effective date of the Permit when able (i.e., when storm water compliance samples were able to be collected). The determination of whether a Site is a potential source of PCBs for the High/Medium Priority designation was based on downstream gaging station data. However, the SSD will replace this determination to establish Site-related POCs based on Site history, storm water data, and shallow soil data. Consistent with the SSD and the 2015 draft IP, the Permittees request that the High and Medium Priority Site requirements of the 2010 IP not be carried forward in the renewed IP.

9.13 Compliance Schedule Request for Aluminum (Part I.3)

In 2018, the Permittees collected data from ephemeral and intermittent waters, stream segment 20.6.4.128, leading to 8 assessment units being listed as impaired for aluminum in the “2018–2020 State of New Mexico Clean Water Act Section 303(d)/305(b) Integrated Report” (NMED 2018, 700253). One assessment unit listed in segment 20.6.4.128 fell under the category 5/5C, indicating more data are needed to confirm impairment before the development of a total maximum daily load document. Six assessment units were listed as integrated report category 5/5B, which indicated that a review of the water quality standard is required to verify the appropriate designated or existing use and/or criterion. One perennial assessment unit in standard segment 20.6.4.126 is listed as impaired for aluminum and falls under integrated report category 5/5B.

The Permittees have undertaken an extensive study of the nature and toxicity of geologic aluminum on the Pajarito Plateau. With NMED’s concurrence, background sites were established to study storm water aluminum on the plateau wherein human impacts are minimal. These investigations include evaluations of current practices utilized by the state and Permittees, as well as new approaches intended to minimize the nontoxic or mineral fraction of aluminum in surface water samples used for compliance evaluations. New Mexico’s current water quality standards allow for pre-filtration in order to “minimize mineral phases as specified by the department.” The current NMED guidance is a pre-filtration step passing water through a 10-µm nominal pore size filter; this guidance is based on a single set of samples collected from the Rio Grande near the Buckman Road surface water sampling station (NMED 2012, 700224). Because the Rio Grande had relatively little SSC at the time of sampling, NMED staff artificially enhanced the sample turbidity by manually disturbing the local riverbed sediment during sample collection. The NMED report also discussed findings in lieu of results from a similar 2010 study of the Red River conducted in northern New Mexico (Arcadis and GEI 2011, 700236). The two studies concluded that differing filter restrictions should be specified for the two river systems (i.e., 10 µm for the Rio Grande, and 5 µm for the Red River). Subsequently, preliminary data from LANL indicated that an even greater restriction may be necessary to limit nontoxic forms of aluminum in Pajarito Plateau waters (Windward 2016, 700237). Currently, N3B is engaged in further investigations of the physical chemistry, speciation, and toxicology of naturally occurring aluminum in Pajarito Plateau waters; NMED reviewed and provided comments on the 2018 toxicity testing plan (Windward 2018), and a sampling and analysis plan has been developed and is being implemented by N3B. The nature and toxicity of aluminum forms present in waters of the plateau will be better understood through these investigations, underscoring the need to incorporate the ultimate findings as part of the eventual standards review specified by the CWA Section 303(d)/305(b) Integrated Report.

Because of the on-going study of aluminum form and toxicity, and the need to review state water quality standard appropriateness, the Permittees request a Compliance Schedule of a term of 24 months. This compliance schedule will allow for the completion of the aluminum characterizations currently underway, for preparation of the final report, and for scientific peer and public review. Potential outcomes include a filtration step specific to the local geology, a mild acidification to liberate potentially reactive/toxic aluminum before measurement, or a site-specific water quality standards change petition. During the Compliance Schedule, continued monitoring of aluminum should be weighed against the possibility that it is not a Site-related constituent.

9.14 Combination of All Reports into the SDPPP

The SDPPP (2010 IP, Part F) is required annually and requires the following:

(a) Site discharge pollution prevention team members;
(b) Site descriptions;
(c) Receiving waters and wetlands;
(d) A summary of potential pollutant sources;
(e) A description of control measures;
(f) Schedules for control measure installation;
(g) Monitoring and inspection procedures; and
(h) Signature requirements.

The Compliance Status Reports (2010 IP, Part H.1) are required annually and must include, at a minimum, “the assigned outfall number, the SMA ID number, pollutants of concern greater than the applicable target action levels, targeted control measure completion date, and actual control measure completion date if control measure installation and implementation is complete.”

The Annual Report (2010 IP, Part H.2) is also required annually and must contain:

(a) For each SMA (or Site), a summary of the Site-specific compliance status during the report period;
(b) SMA and associated Outfall and Site(s) numbers/identifications;
(c) Monitoring results available during the reporting period;
(d) Identification of pollutants which exceed applicable MTAL or ATAL;
(e) Description of baseline control measures installed, including the completion date or targeted completion date;
(f) Description of corrective actions required under Part E [of the 2010 IP] to be taken or having been taken, including completion date or targeted completion date, and Progress update;
(g) Identification of Sites which meet No Exposure status;
(h) Identification of Sites which meet “corrective action complete without controls/corrective action complete with controls” under RCRA or which have been issued a Certificate of Completion under the NMED Consent Order;
(i) Highlights of any change of compliance status from the Annual Report;
(j) Lists of requests, for EPA’s approval, including any requests for change of monitoring location or Site deletion and any requests to place a Site or Sites into Part E.3 [of the 2010 IP] Alternative compliance; and
(k) A summary of inspections performed in accordance with Parts G.1 and G.2 [of the 2010 IP], as well as for any visual inspections performed under Part E.1 [of the 2010 IP].

The SIP (Part D) is required annually and must contain the sampling plan for the following year, as discussed in section 9.1.

To allow efficiency, minimize potential redundancy, and harmonize the 2010 IP SDPPP requirements with the SIP, the Permittees request that the reporting requirements in the renewed Permit allow for the combination of the Compliance Status Reports, Annual Report, and SIP into the SDPPP, to be required annually.

9.15 24-Hr TAL Exceedance Notification

Given the new structure of the SMA data screening process (the SSD, see section 9.1.2), which includes screening of compliance sample results against BTVs as well as TALs, the Permittees request that the 24-hr notification requirement for a TAL exceedance be removed from the IP. A monthly summary during the monitoring season could be provided.

9.16 Administrative Changes

A number of administrative changes have been identified since the effective date of the current 2010 IP. Notifications of these changes and errors have been made in the Annual Report and SDPPP. These changes, which are shown in the redline-strikeout version of the 2015 draft IP, Appendix A (see Attachment 1), are summarized below:

- On December 20, 2012, the Laboratory received approval from NMED to split SWMU 32-002(b) into two separate SWMUs: SWMU 32-002(b1) and SWMU 32-002(b2). The IP associates former Site 32-002(b) with LA-SMA-5.361, which is identified as Permitted Feature L017. The re-designated Sites will continue to be associated with LA-SMA-5.361 and Permitted Feature L017. The Site designation of 32-002(b) will be retired.
- On November 9, 2016, the Laboratory received approval from NMED to split SWMU 01-001(d) into three separate SWMUs: SWMU 01-001(d1), SWMU 01-001(d2), and SWMU 01-001(d3). The IP associates former Site 01-001(d) with LA-SMA-5.01, which is identified as Permitted Feature L012. The Permittees request removal of 01-001(d1) and 01-001(d2) because they are not on DOE property (see section 9.5). The re-designated Site 01-001(d3) will continue to be associated with LA-SMA-5.01 and permitted feature L012. The Site designation of 01-001(d) will be retired.
- On November 9, 2016, the Laboratory received approval from NMED to split AOC 01-003(b) into two separate SWMUs: SWMU 01-003(b1) and SWMU 01-003(b2). The IP associates former Site 01-003(b) with LA-SMA-4.1, which is identified as Permitted Feature L010. The Permittees request removal of 01-003(b1) because it is not on DOE property (see section 9.5). The re-designated Site 01-003(b2) will continue to be associated with LA-SMA-4.1 and Permitted Feature L010. The Site designation of 01-003(b) will be retired.
- On November 9, 2016, the Laboratory received approval from NMED to split SWMU 01-006(h) into three separate SWMUs: SWMU 01-006(h1), SWMU 01-006(h2), and SWMU 01-006(h3). The IP associates former Site 01-006(h) with LA-SMA-5.01, which is identified as Permitted Feature L012. The Permittees request removal of 01-006(h1), 01-006(h2), and 01-006(h3) because they are not on DOE property (see section 9.5). The Site designation of 01-006(h) will be retired.

Further review of Site descriptions and historical activities conducted at the Sites since the effective date of the 2010 IP identified the following discrepancies, which should be corrected and reflected in the renewed IP:

- A typographical error in the IP Appendix B incorrectly identifies Site 46-004(e2) as part of CDB-SMA-0.55. This Site is within the drainage area of CDB-SMA-0.25.
- Review of the SWMUs and AOCs within the SMA drainage area of W-SMA-7 has identified that Appendix B of the IP identified Site 16-026(h2) as incorrectly associated with industrial materials to be monitored at the SMA. The correct Site intended for monitoring is 16-029(e).
- Review of the SWMUs within the SMA drainage area of CDV-SMA-6.02 and the monitoring constituents in Appendix B of the IP identified that Sites 14-002(d) and 14-002(e) did not manage or release industrial materials and were incorrectly identified as the Sites to be monitored under the IP. The Site intended for monitoring is 14-002(c).
- Review of the SWMUs within the SMA drainage area of PJ-SMA-5.1 and the monitoring constituents in Appendix B of the IP identified that SWMU 22-016 was not exposed to storm water and was incorrectly identified as the Site to be monitored under the IP. The Site intended for monitoring is 22-010(b).
- Review of the Site descriptions and activities conducted at SWMUs and AOCs within the SMA drainage area of PJ-SMA-4.05 identified that Site 09-004(g) was not exposed to storm water and was incorrectly identified as the Site to be monitored under the IP. The Site intended for monitoring is 09-005(g).
- Review of the existing GIS shapefiles, Site history, and activities conducted at SWMUs and AOCs in the SMA drainage area within the area of PT-SMA-1.7 identified that Site 15-006(a) is not associated with industrial materials and the monitoring constituents of Appendix B of the IP and was incorrectly identified as the Site to be monitored under the IP. The Site intended for monitoring is 15-003.

In an effort to be more representative of the locations of the Sites under this Permit, Sites are no longer grouped by SMA but are listed individually as “Outfalls.” The Sites are represented geographically as points (e.g., a POC release point such as a current or historical constructed outfall), lines (e.g., drainage lines), and polygons (e.g. firing sites). The centroid of each Site boundary was calculated using GIS for those Sites that occupied an area. The centroid is the geometric mean of the shape, which allows a discrete latitude and longitude to be calculated per Site. This new Site location is provided in NPDES Form 2F, Section I.

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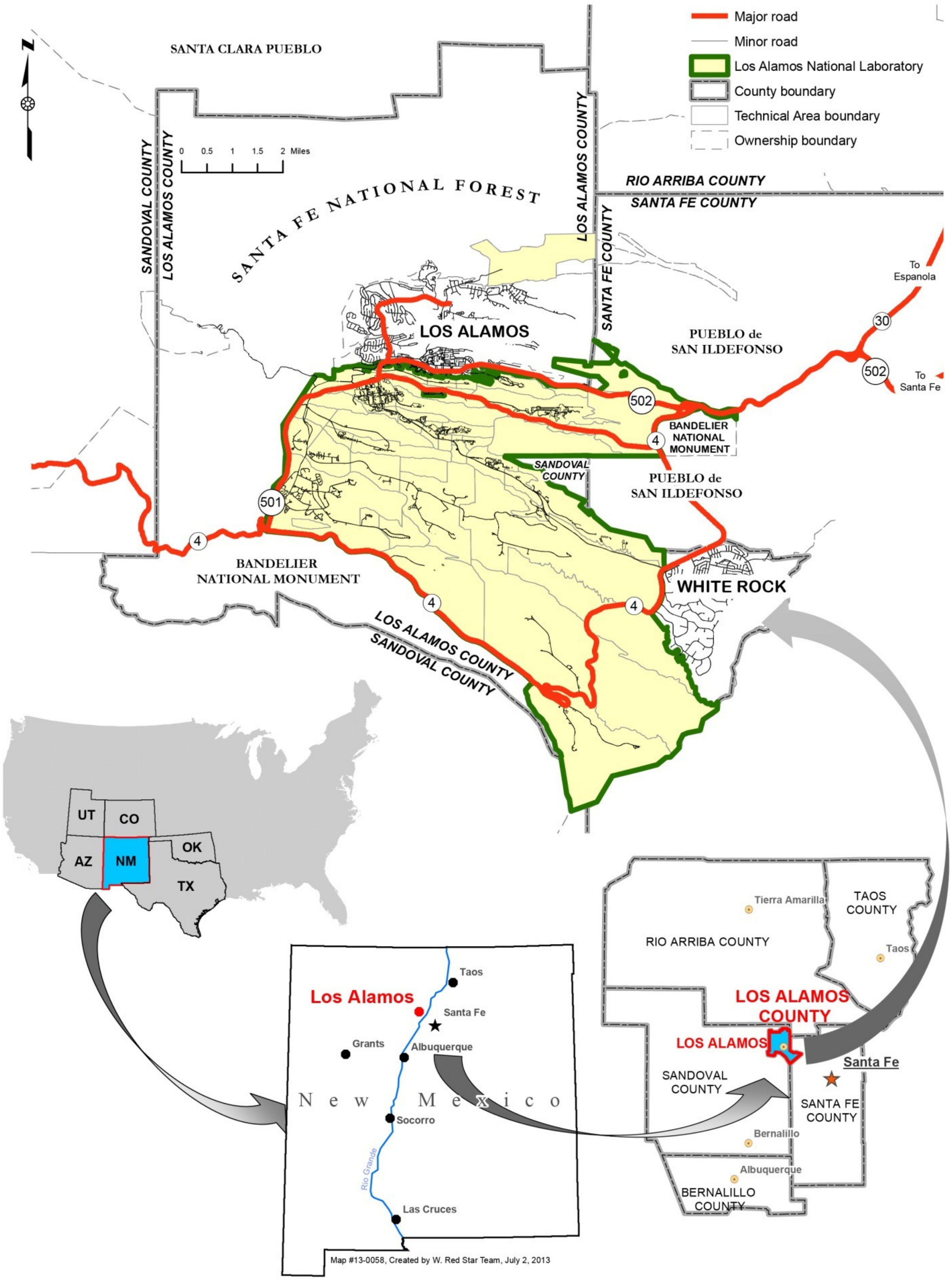


Figure 1 Regional location of the Laboratory

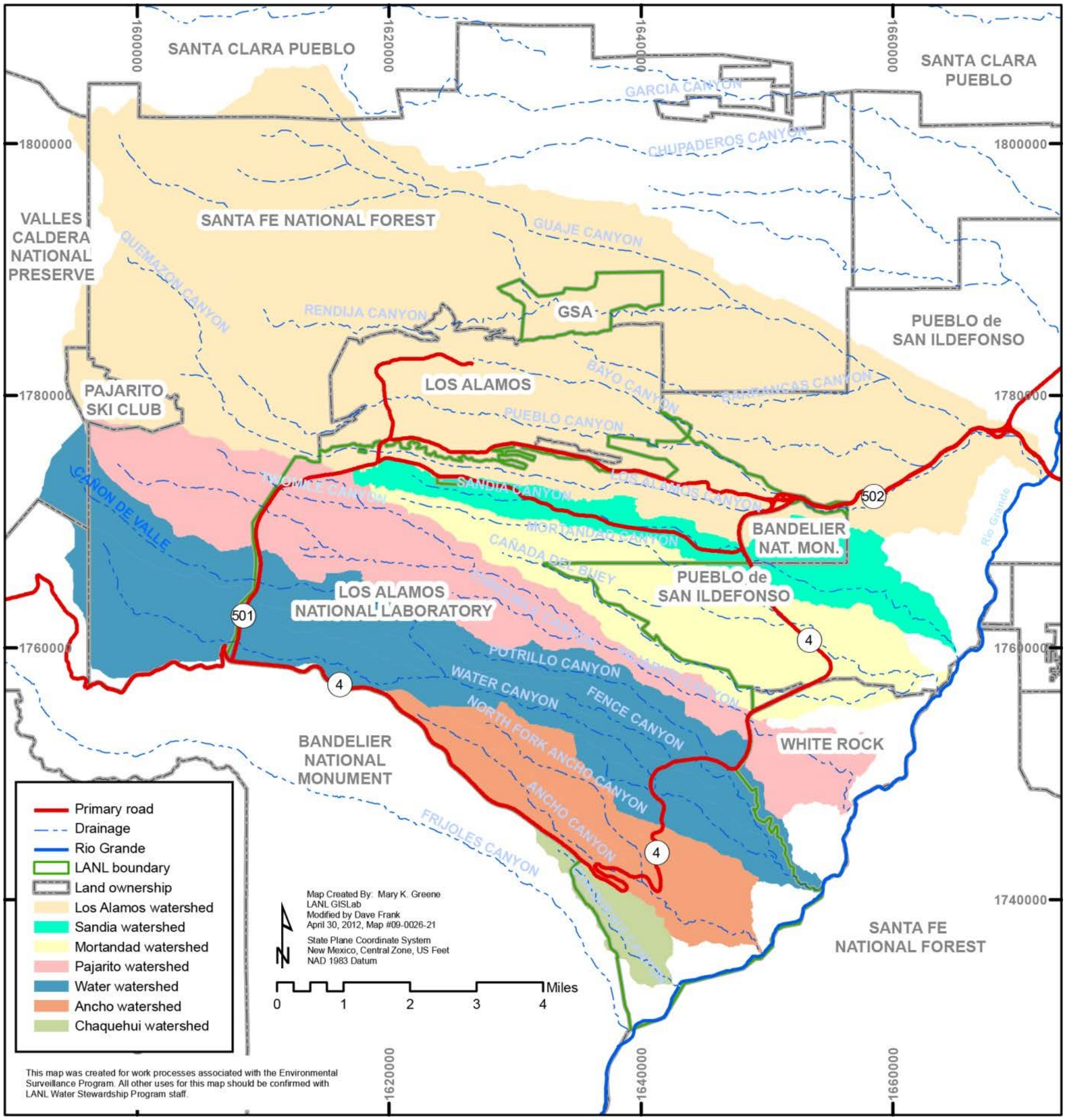


Figure 2 Location of the Laboratory and surrounding landholdings

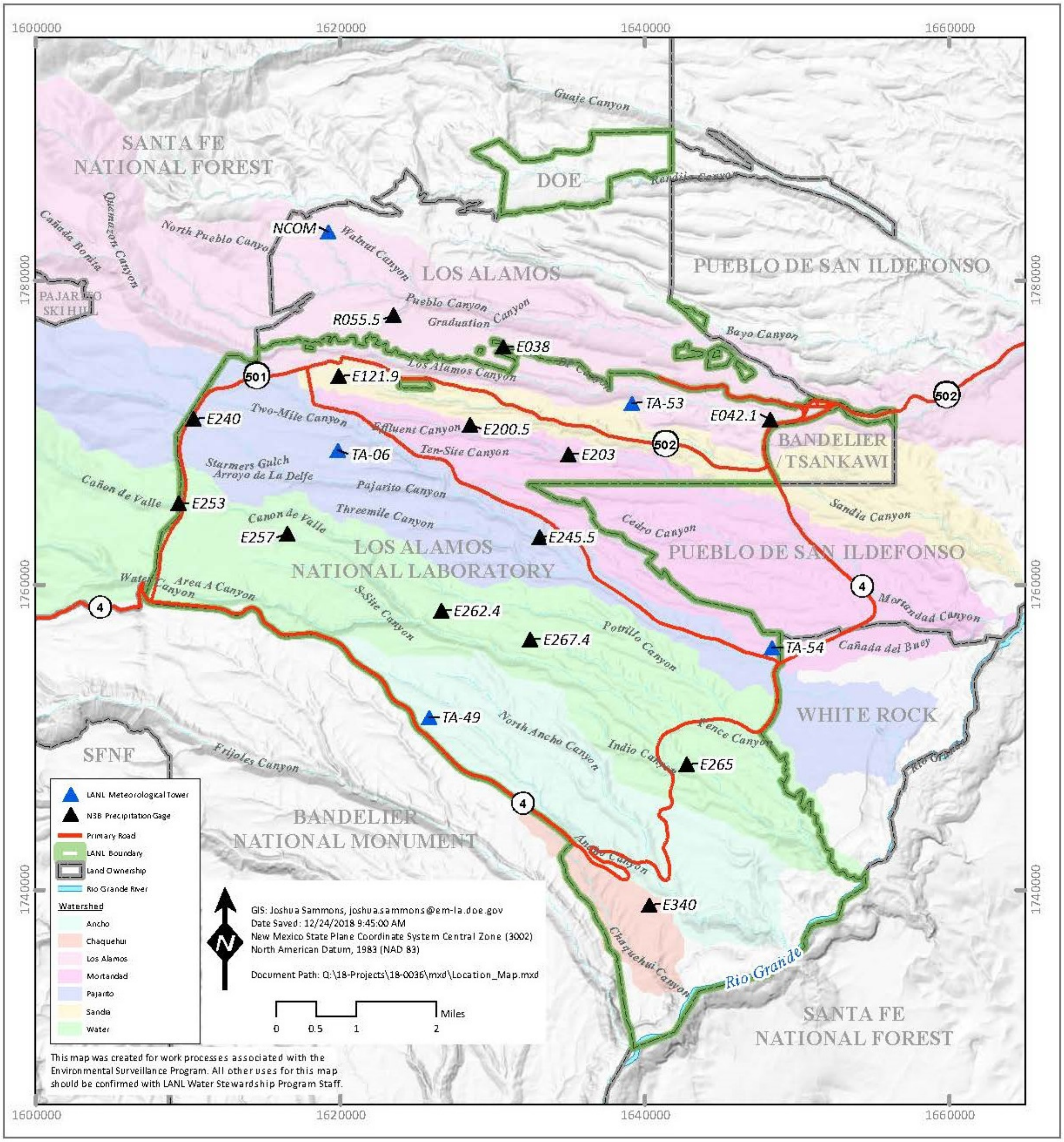
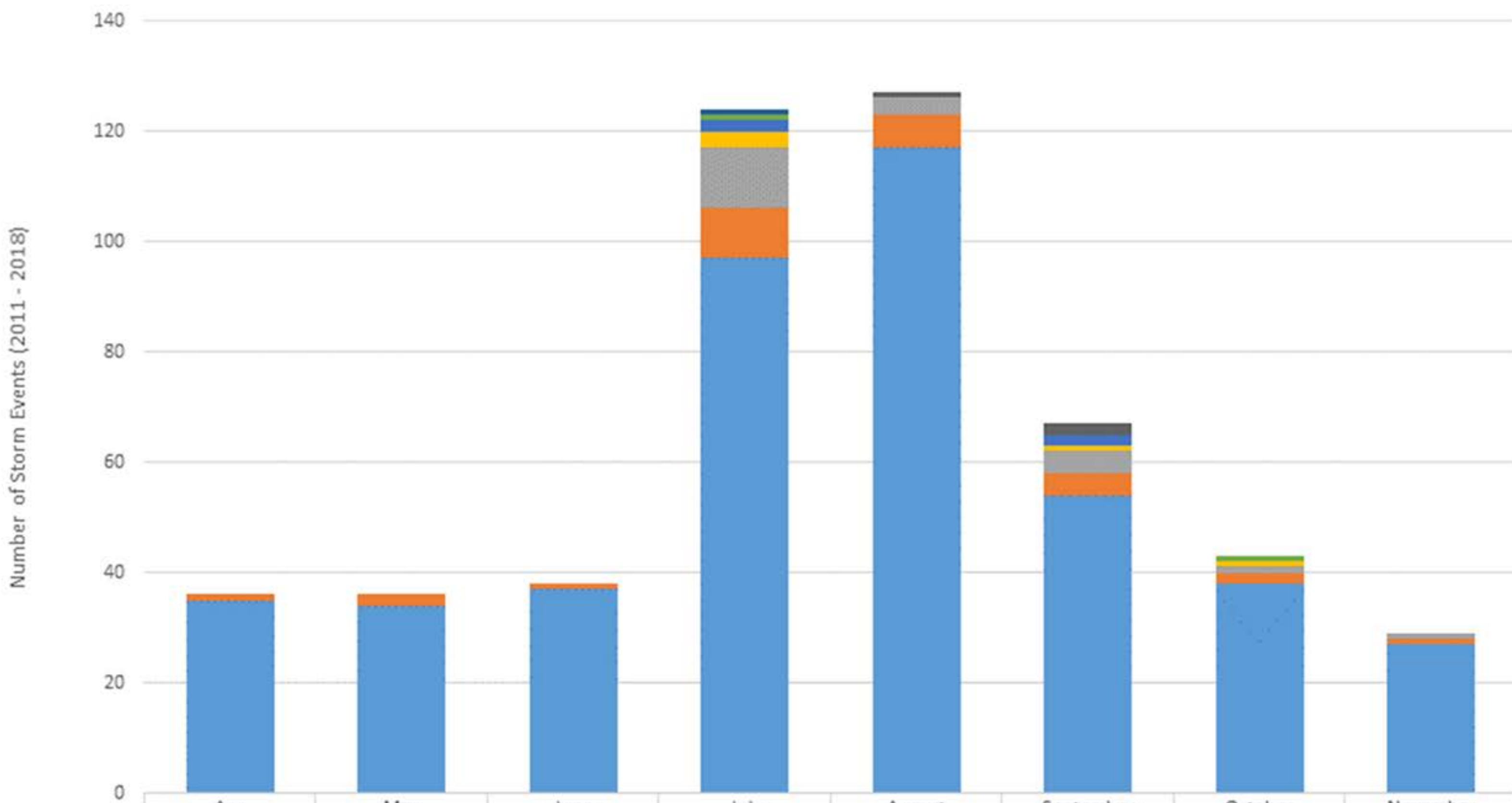


Figure 3 IP Program rain gage network



	Apr	May	June	July	August	September	October	November
p > 100					1	2		
50 < p < 100								
25 < p < 50				1				
10 < p < 25				1			1	
5 < p < 10				2		2		
3 < p < 5				3		1	1	
2 < p < 3				11	3	4	1	1
95th < p < 2	1	2	1	9	6	4	2	1
< 95th	35	34	37	97	117	54	38	27

Figure 4 **IP Program storm events, April through November, 2011–2018**

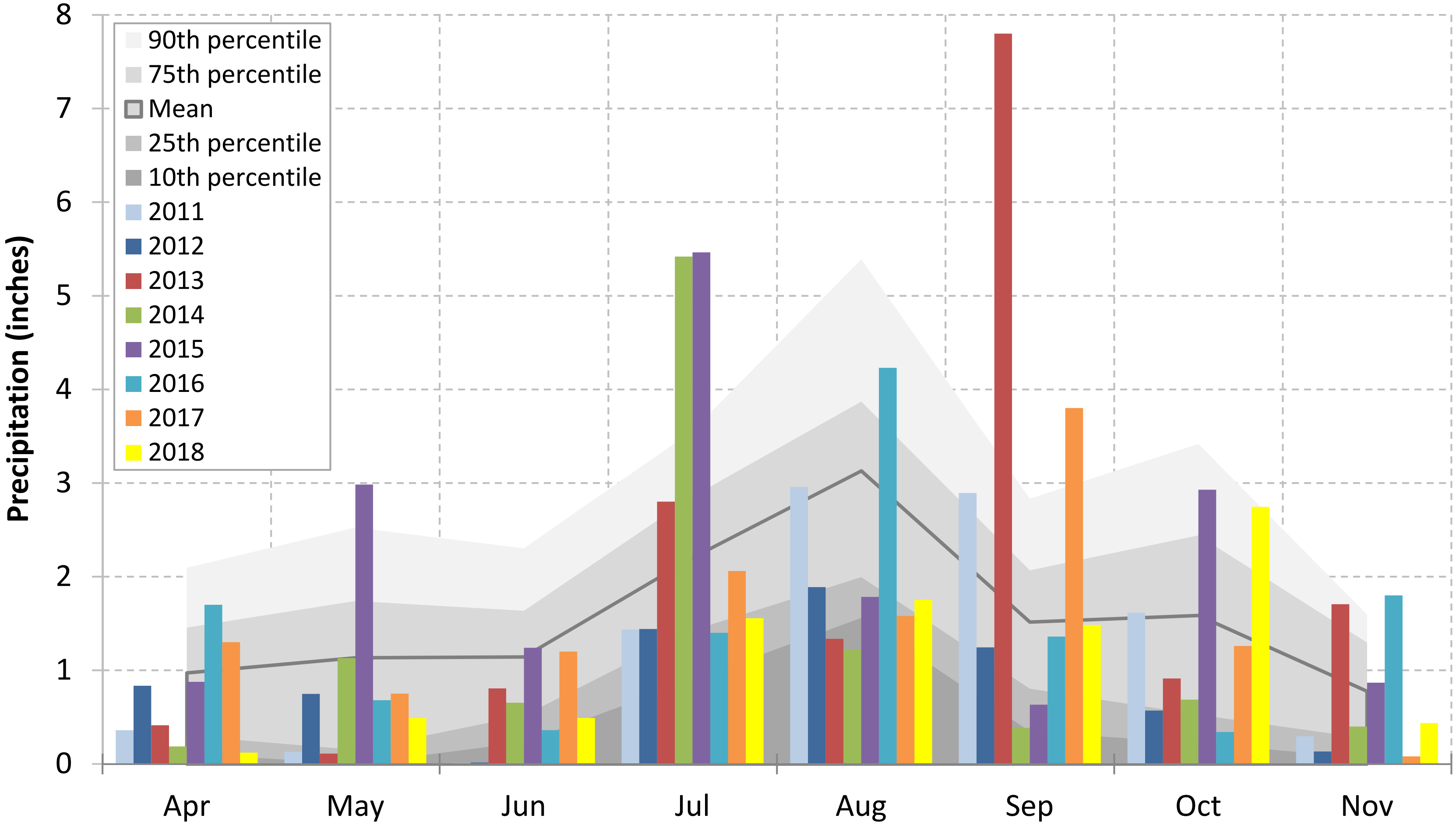


Figure 5 **Total precipitation for April through November of 2011 through 2018 (Laboratory meteorological tower data averaged over the Laboratory). Mean and percentiles are based on data from 1992 to 2010.**

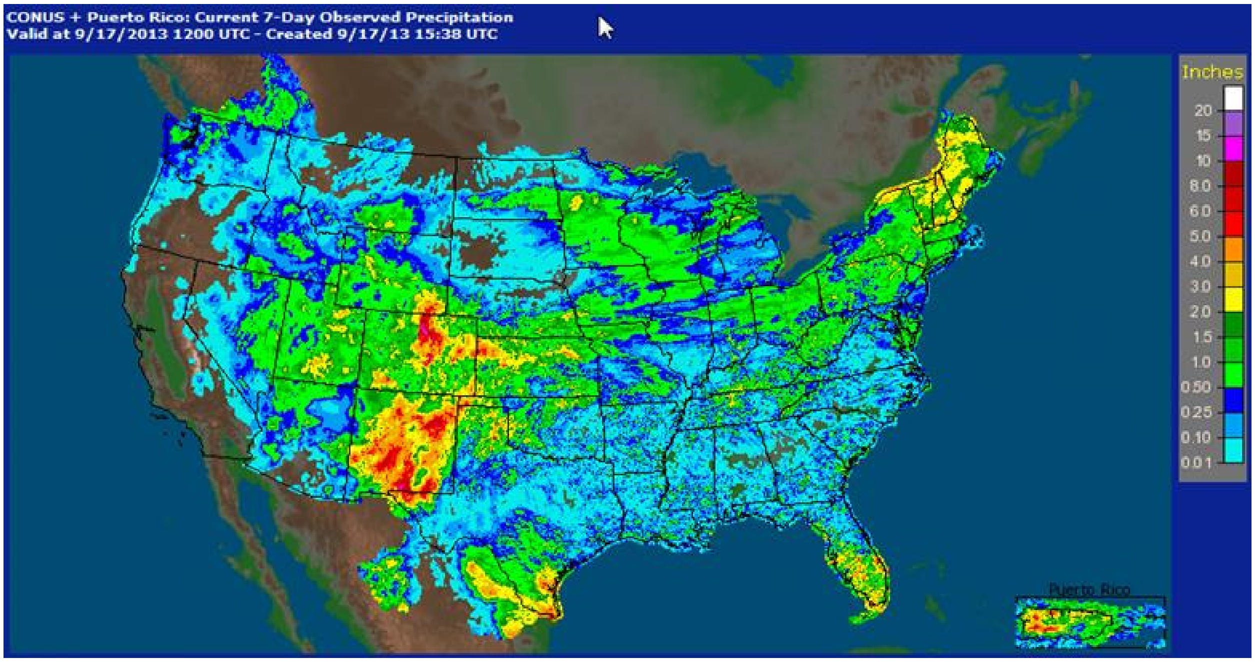


Figure 6 **Observed precipitation for the continental United States for September 10 to September 17, 2013 (Source: NOAA)**

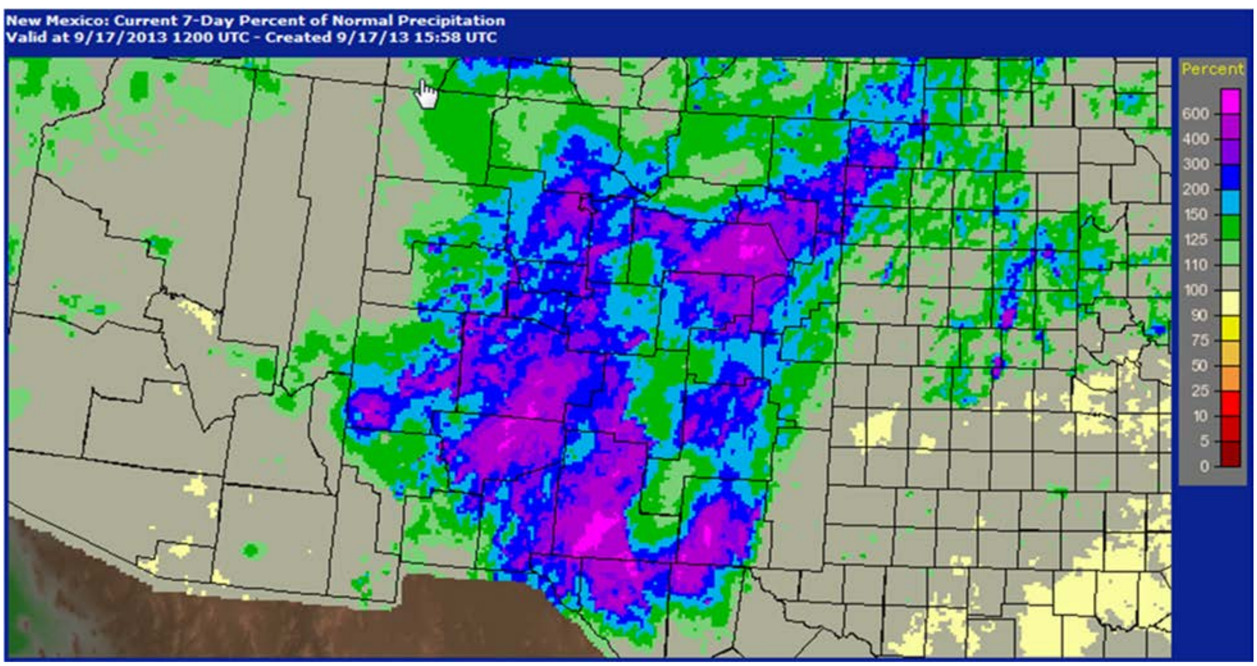


Figure 7 **Observed precipitation for New Mexico and Colorado for September 10 to September 17, 2013 (Source: NOAA)**

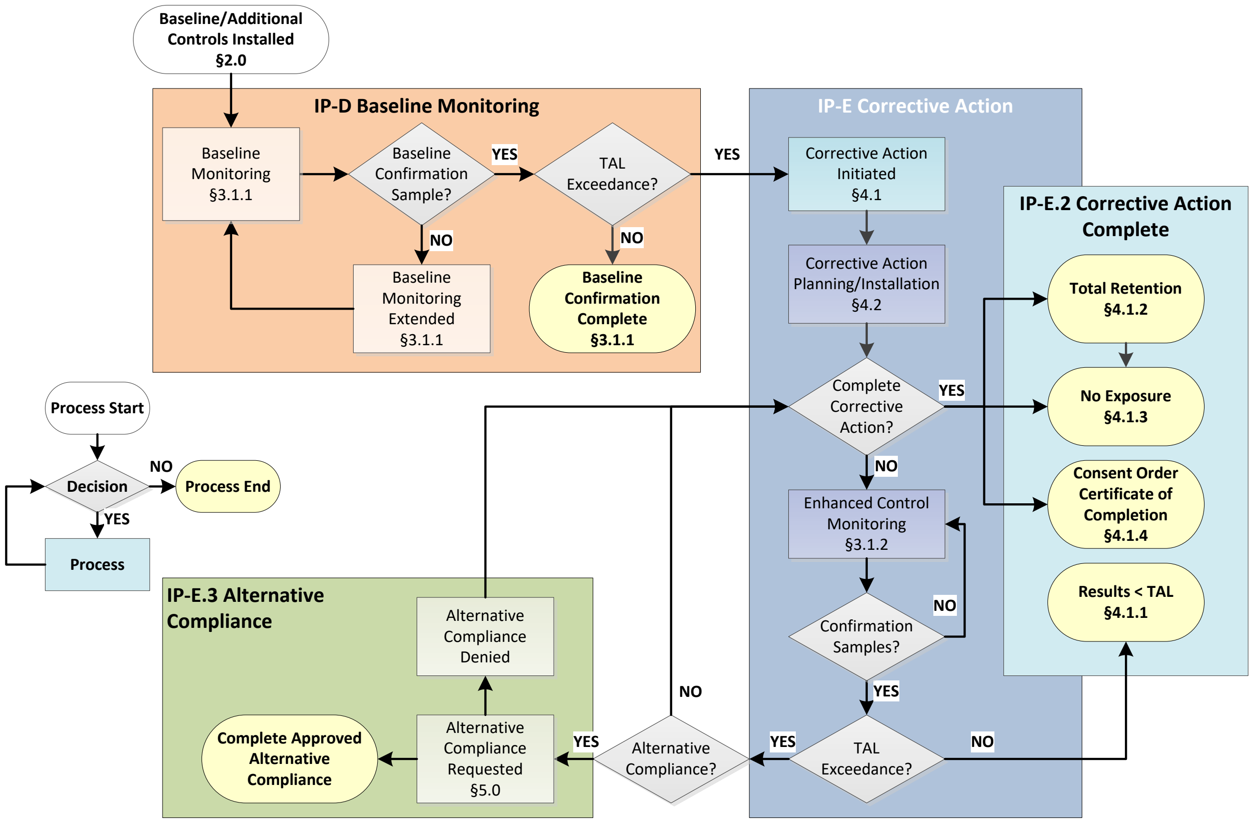


Figure 8 Permit compliance road map

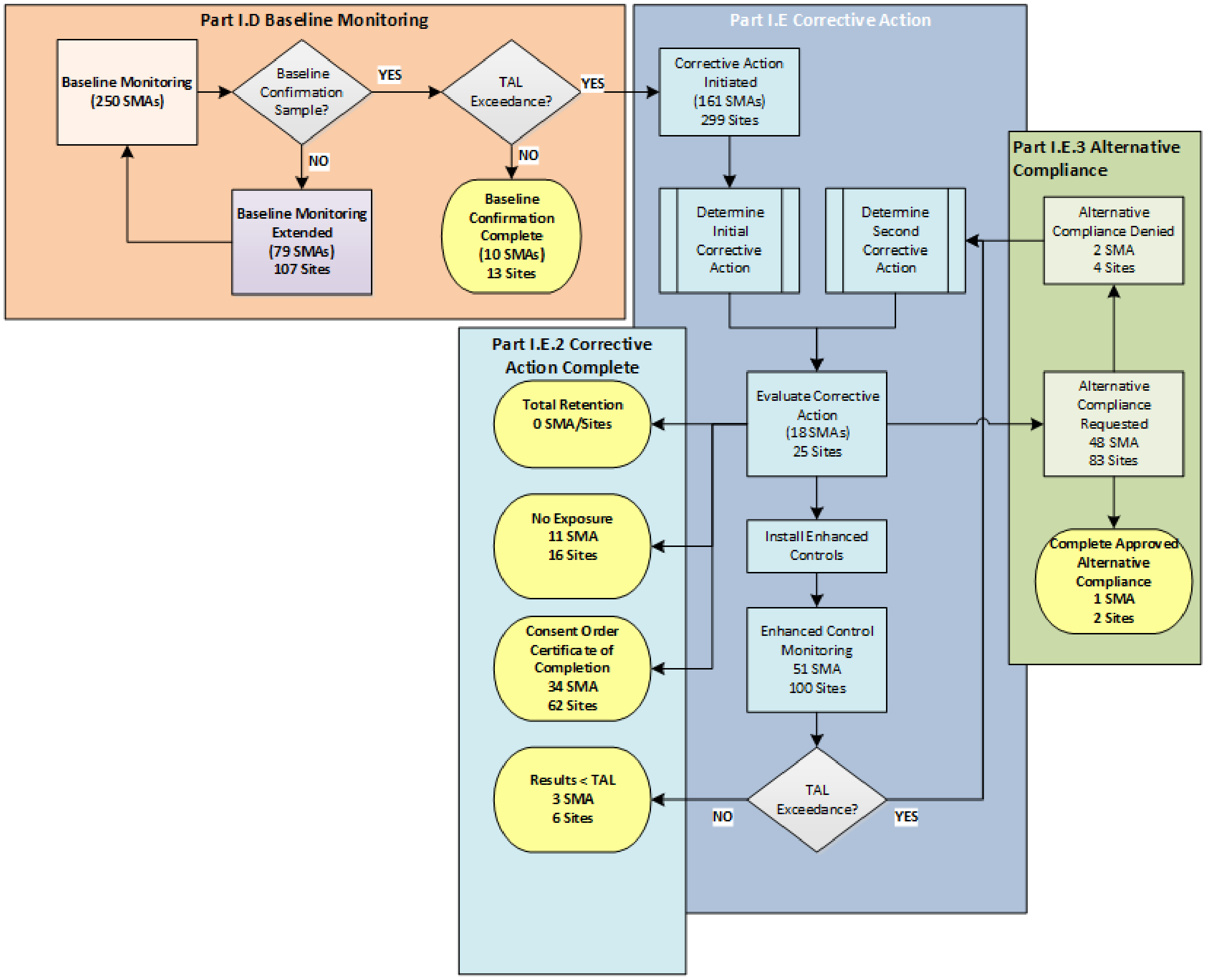


Figure 9 Permit compliance status as of December 31, 2018

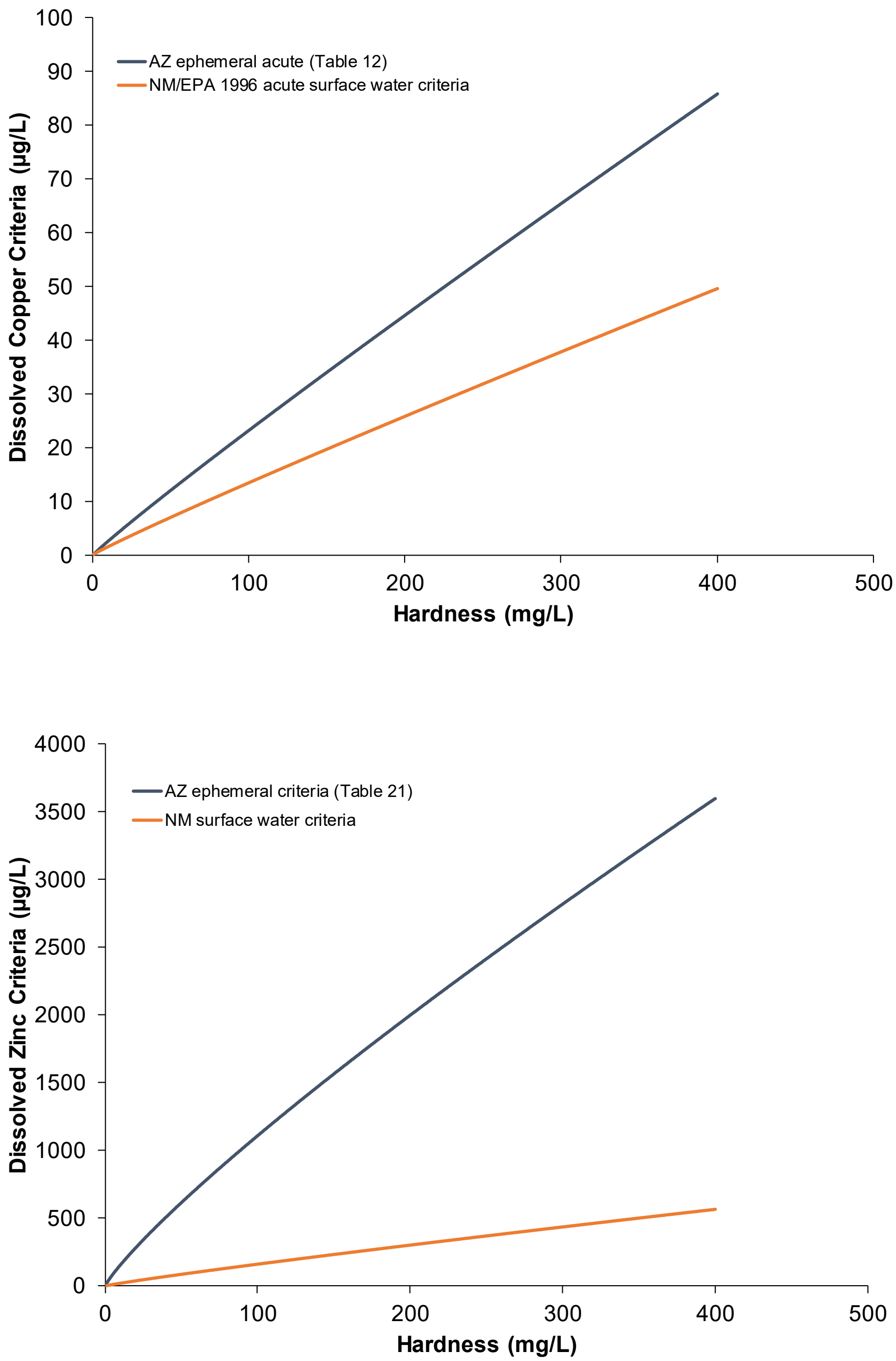
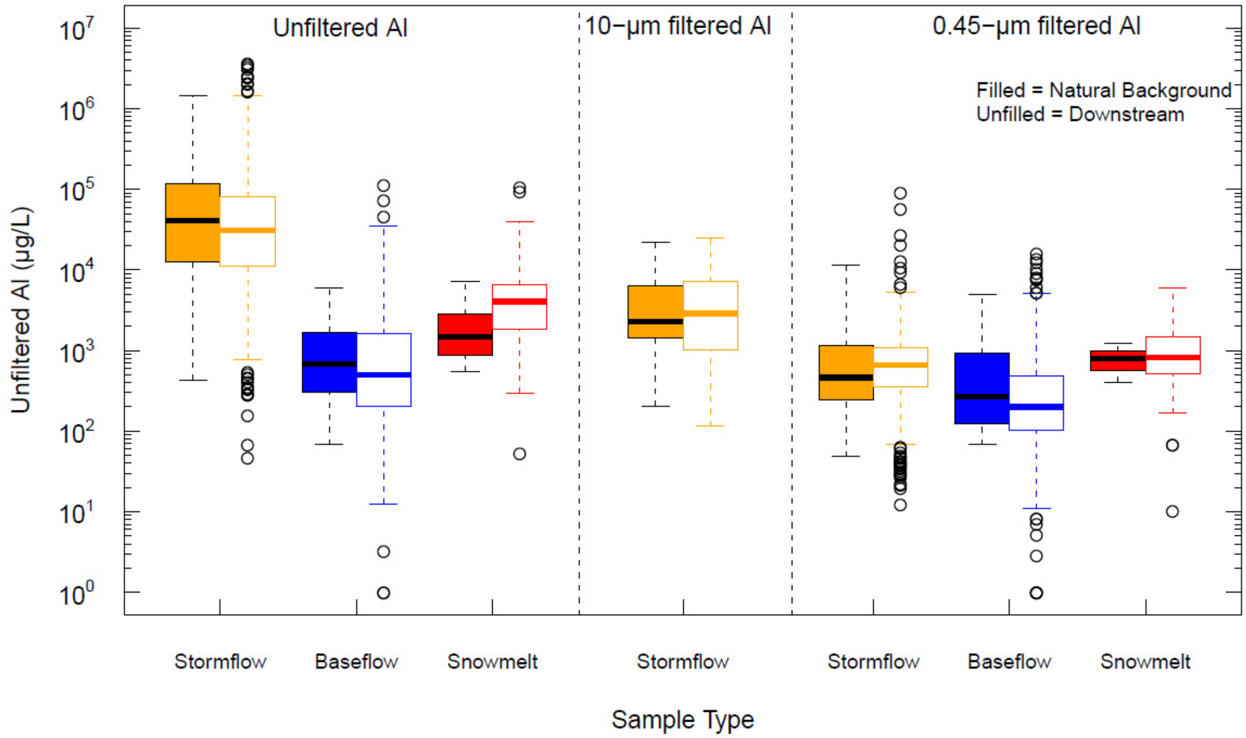
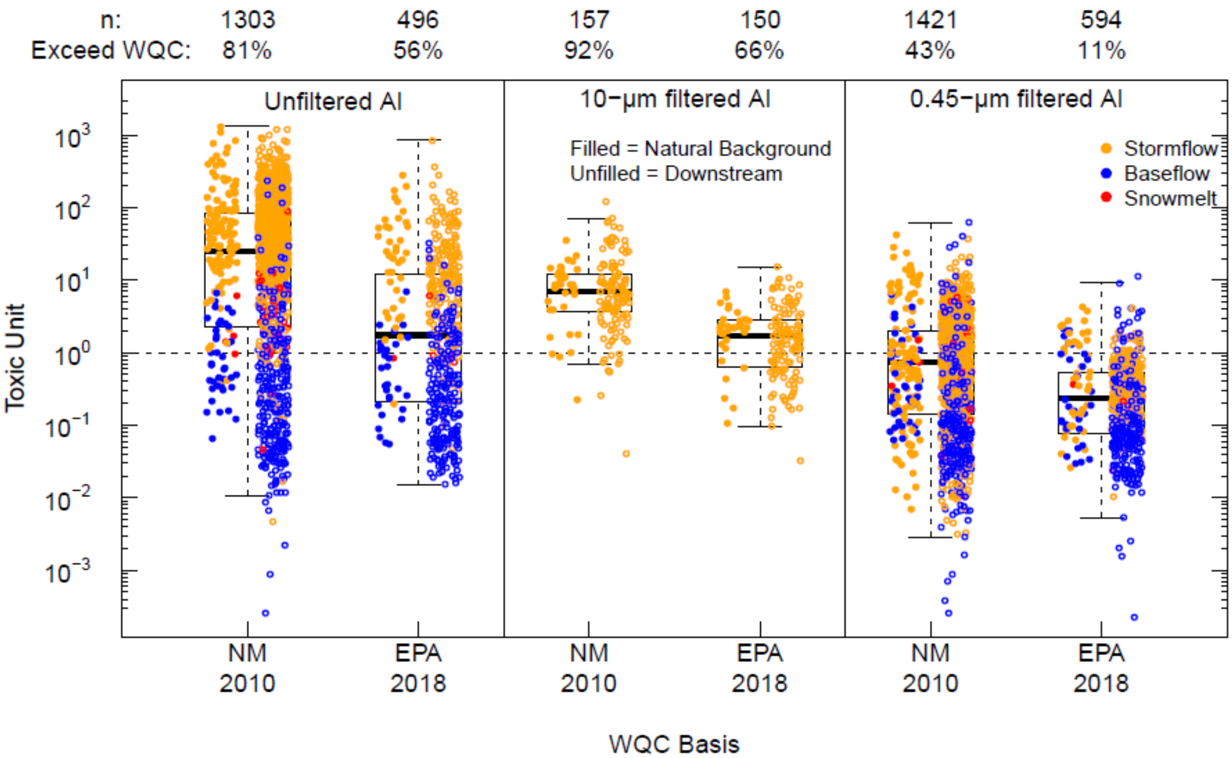


Figure 10 Comparison of New Mexico acute AWQC for copper (top) and zinc (bottom) with Arizona ephemeral AWQC



Note: Filled boxes are representative of data from natural background locations, and unfilled boxes are representative of data from downstream locations.

Figure 11 Comparison of aluminum concentrations for surface water samples from natural background and downstream locations on the Pajarito Plateau



Note: Results from natural background locations are shown with filled symbols (and left of center of each box) and results from downstream locations are shown with unfilled symbols (and right of center of each box).

Figure 12 Aluminum toxic units for various surface water sample types and preparations summarized for different AWQC calculation approaches

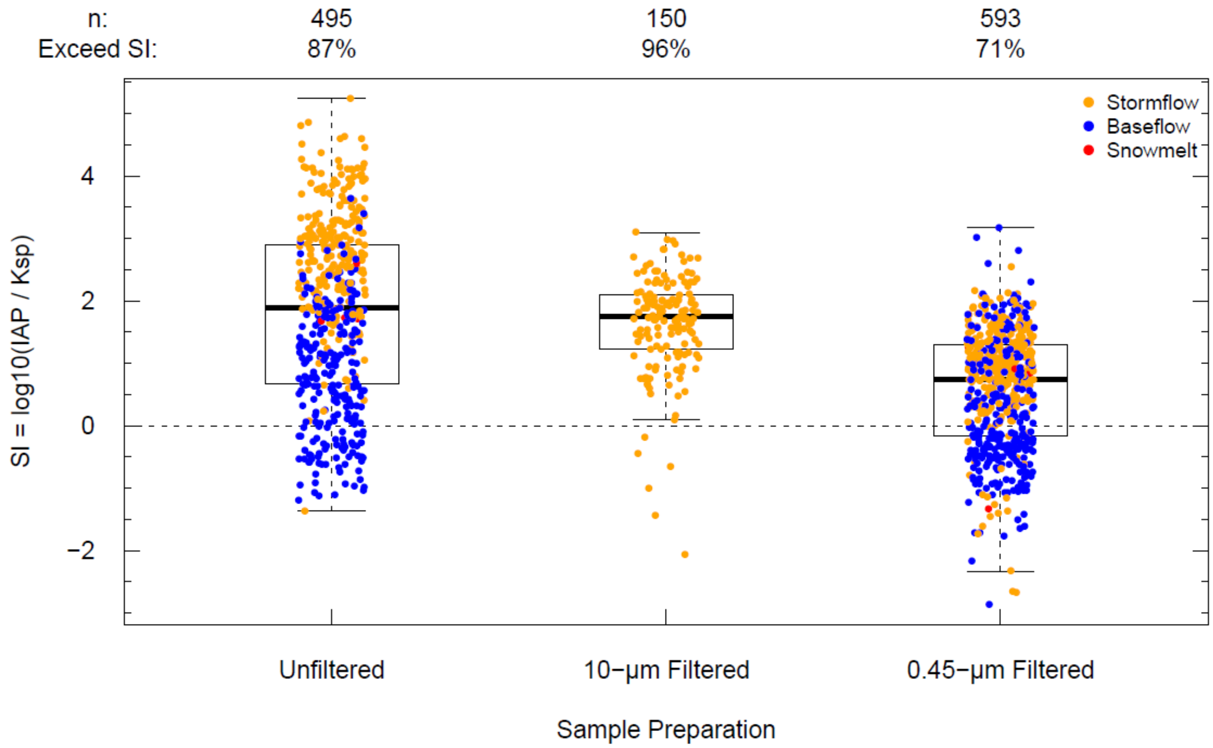


Figure 13 **Saturation index calculations for amorphous hydroxide under different sample preparation for natural background and downstream locations**

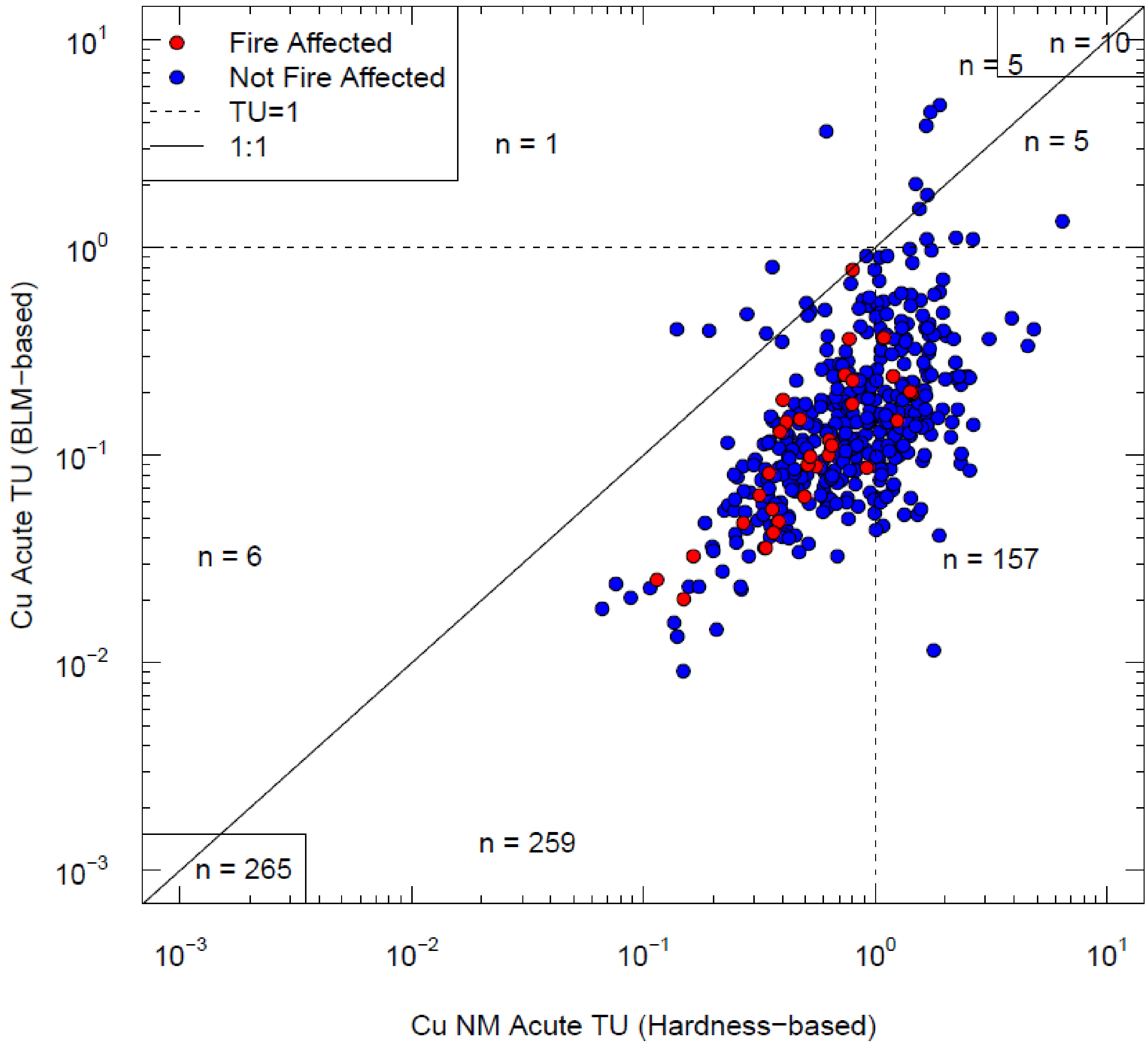


Figure 14 **Comparison of acute dissolved copper TUs using EPA 2007 BLM-based and New Mexico hardness-based AWQC**

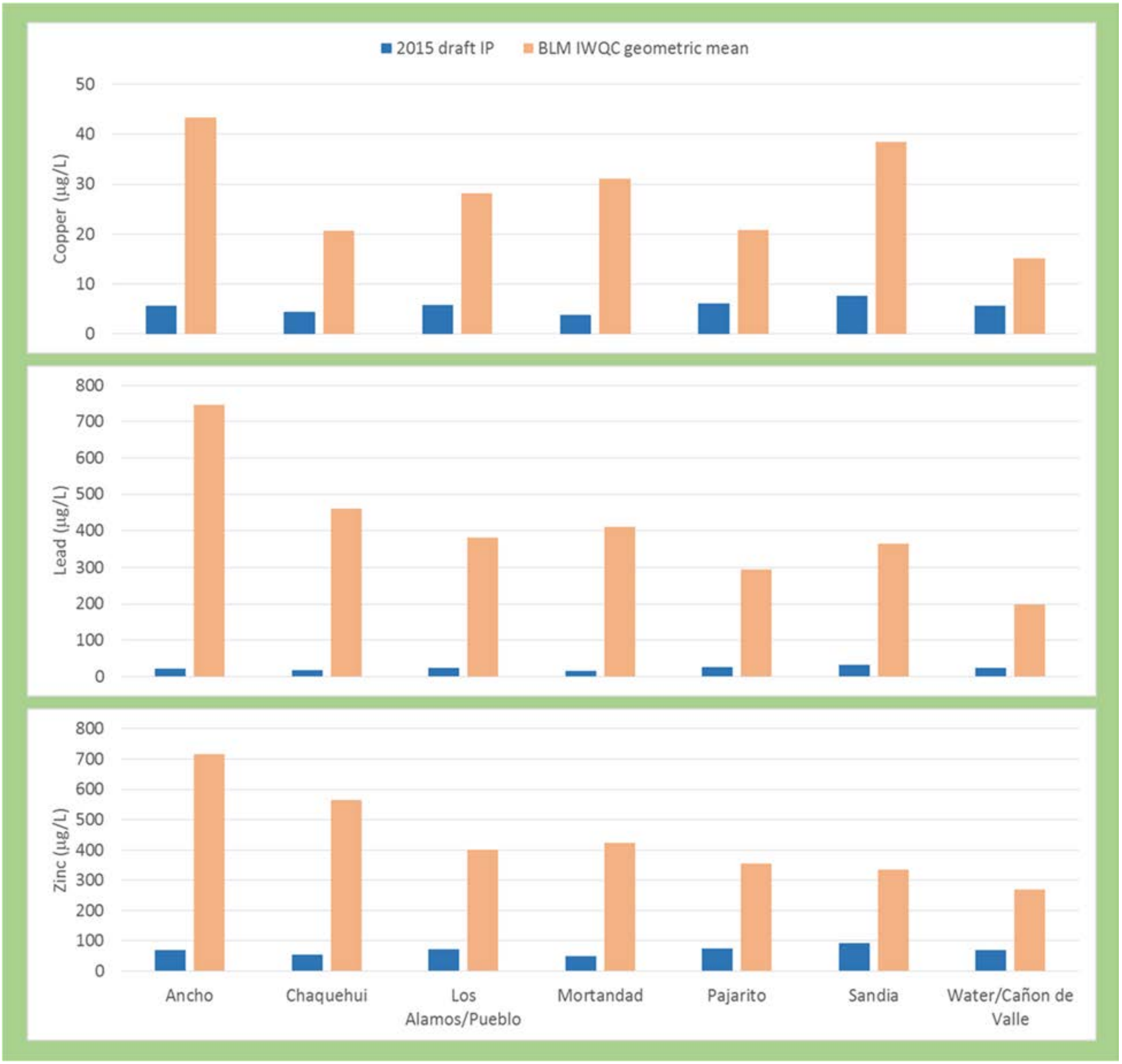


Figure 15 Comparison of 2015 draft IP MTALs with potential BLM-based MTALs for dissolved copper, lead, and zinc

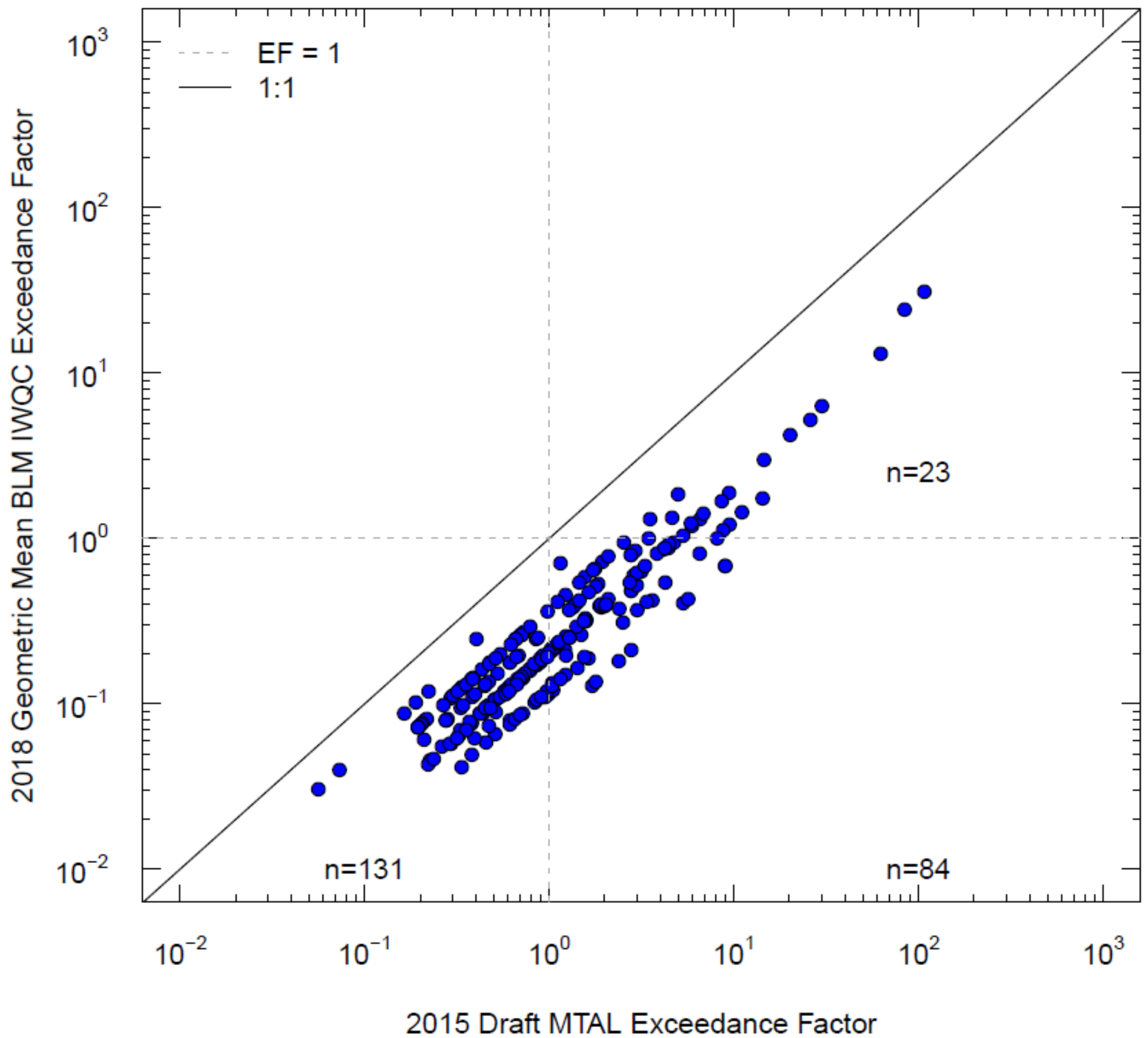


Figure 16 Comparison of SMA sample results for copper with 2015 draft IP MTALs and potential BLM-based MTALs

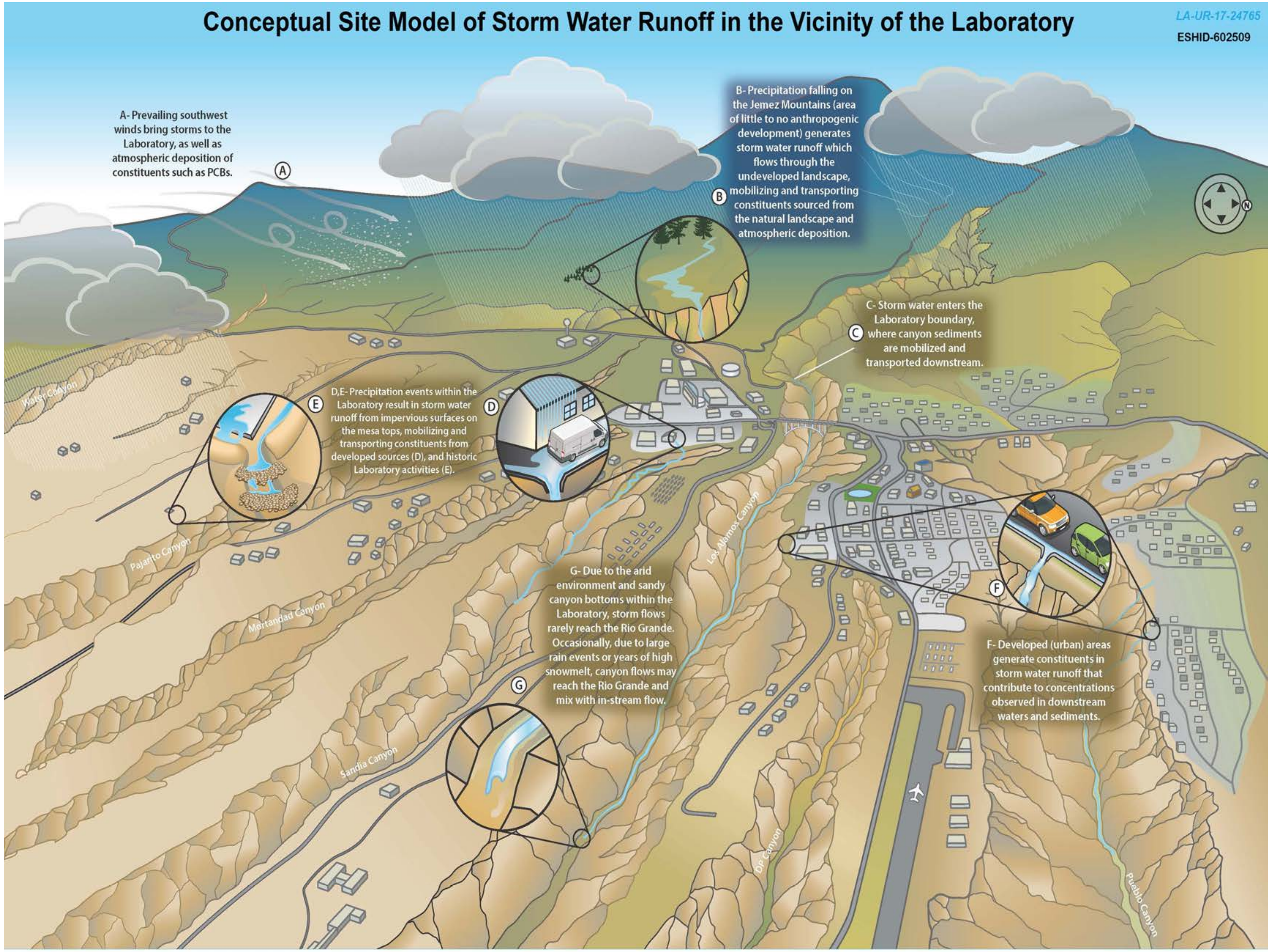


Figure 17 Conceptual site model of storm water runoff in the vicinity of the Laboratory

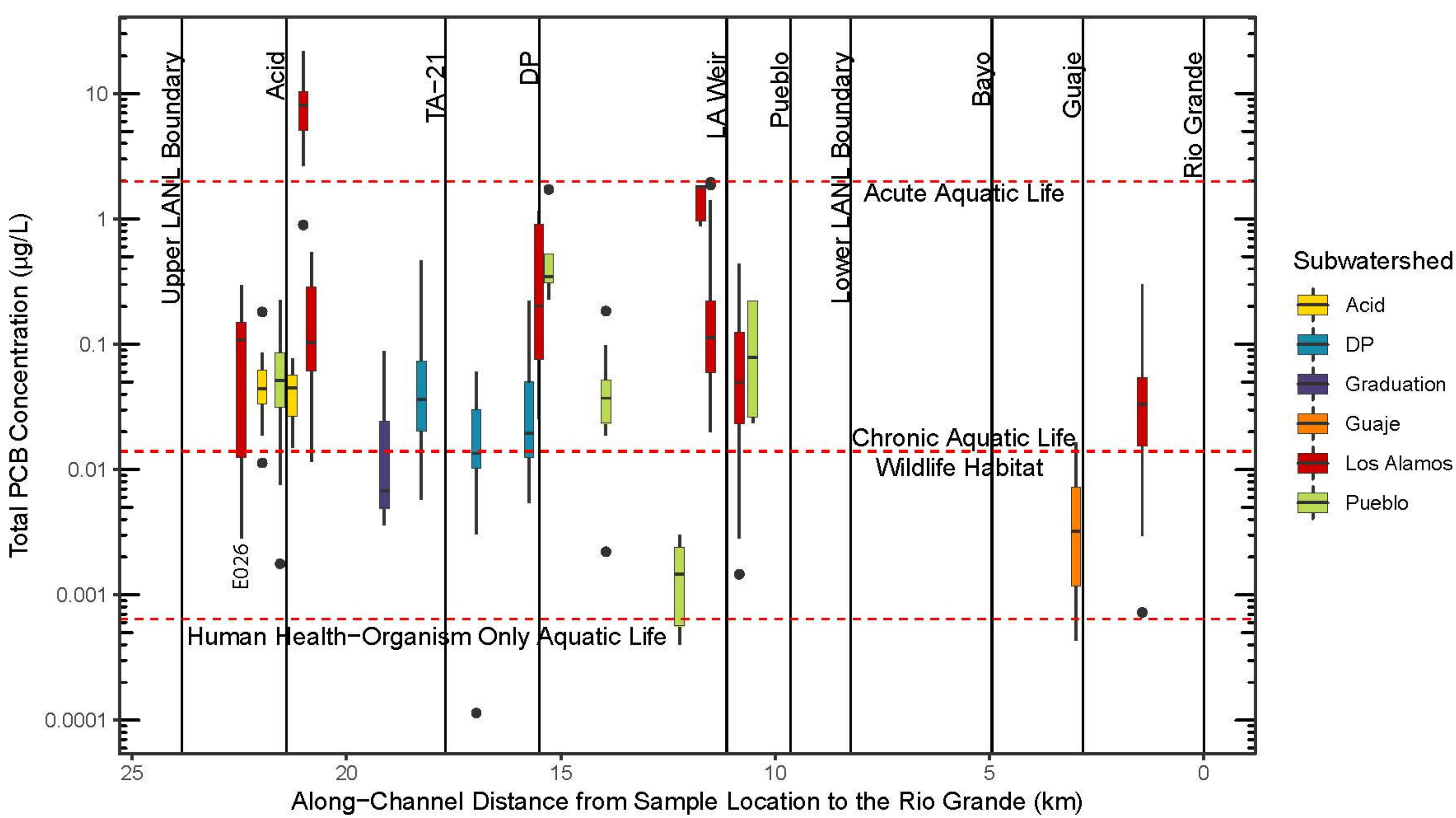


Figure 18 **Total PCBs at gaging stations in Los Alamos Canyon subwatersheds from upstream of the Laboratory to the Rio Grande**

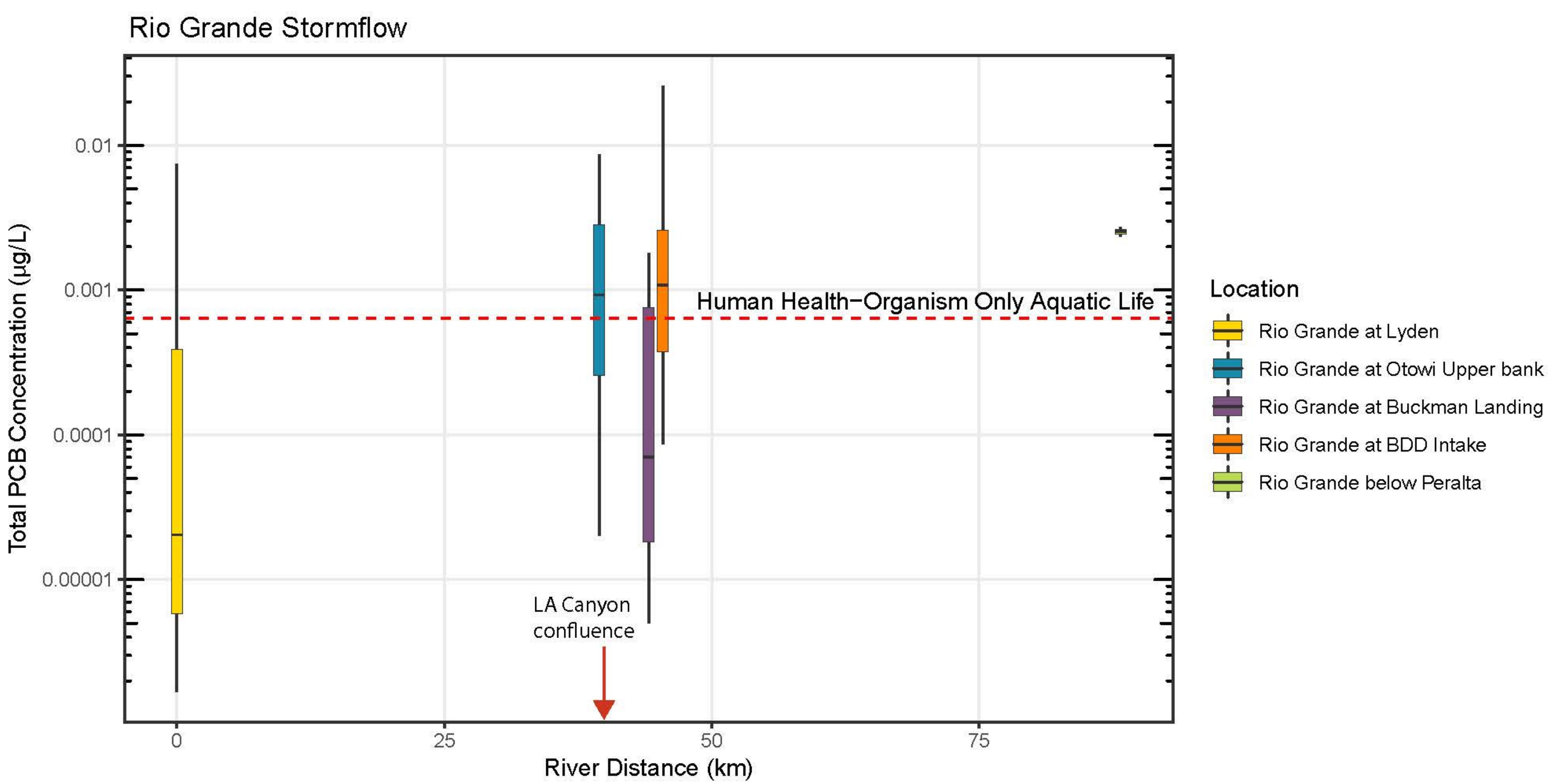


Figure 19 Total PCBs in storm water along the Rio Grande above and below the Los Alamos (LA) Canyon confluence

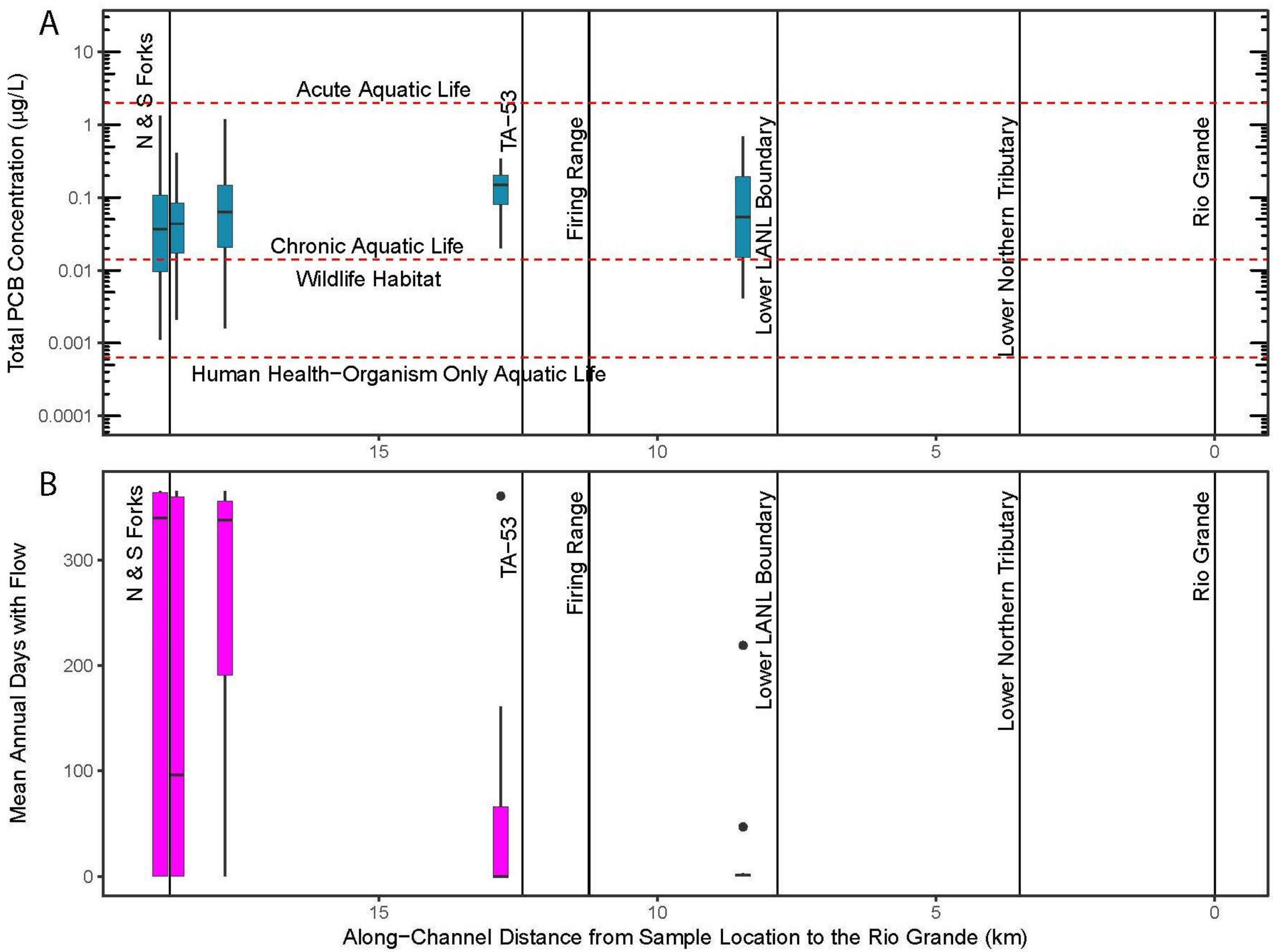


Figure 20 (A) Total PCBs in storm water in Sandia Canyon compared with (B) gaging station mean annual days with flow

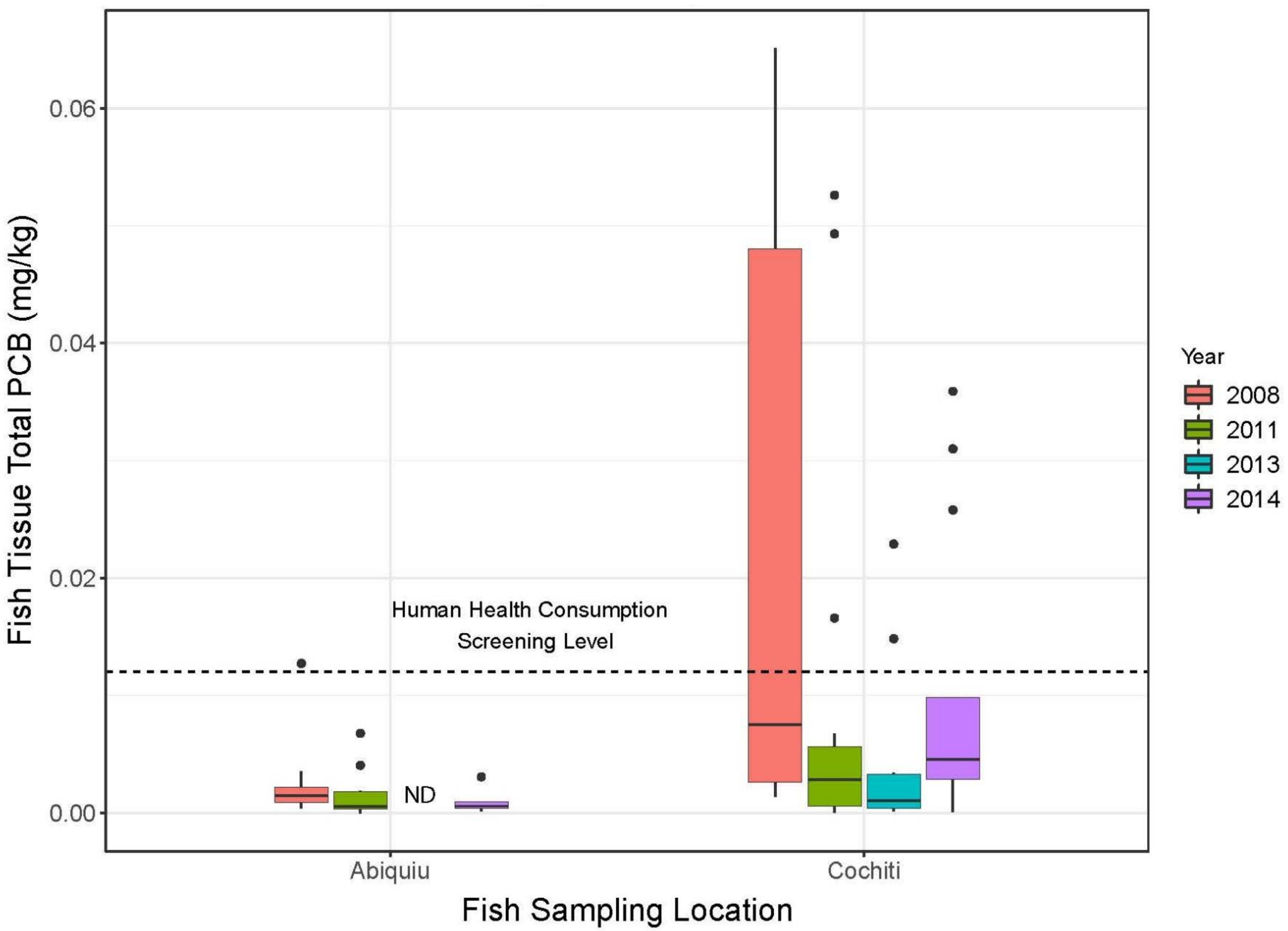


Figure 21 **Total PCBs in fish tissue over multiple survey years (ND = nondetect)**

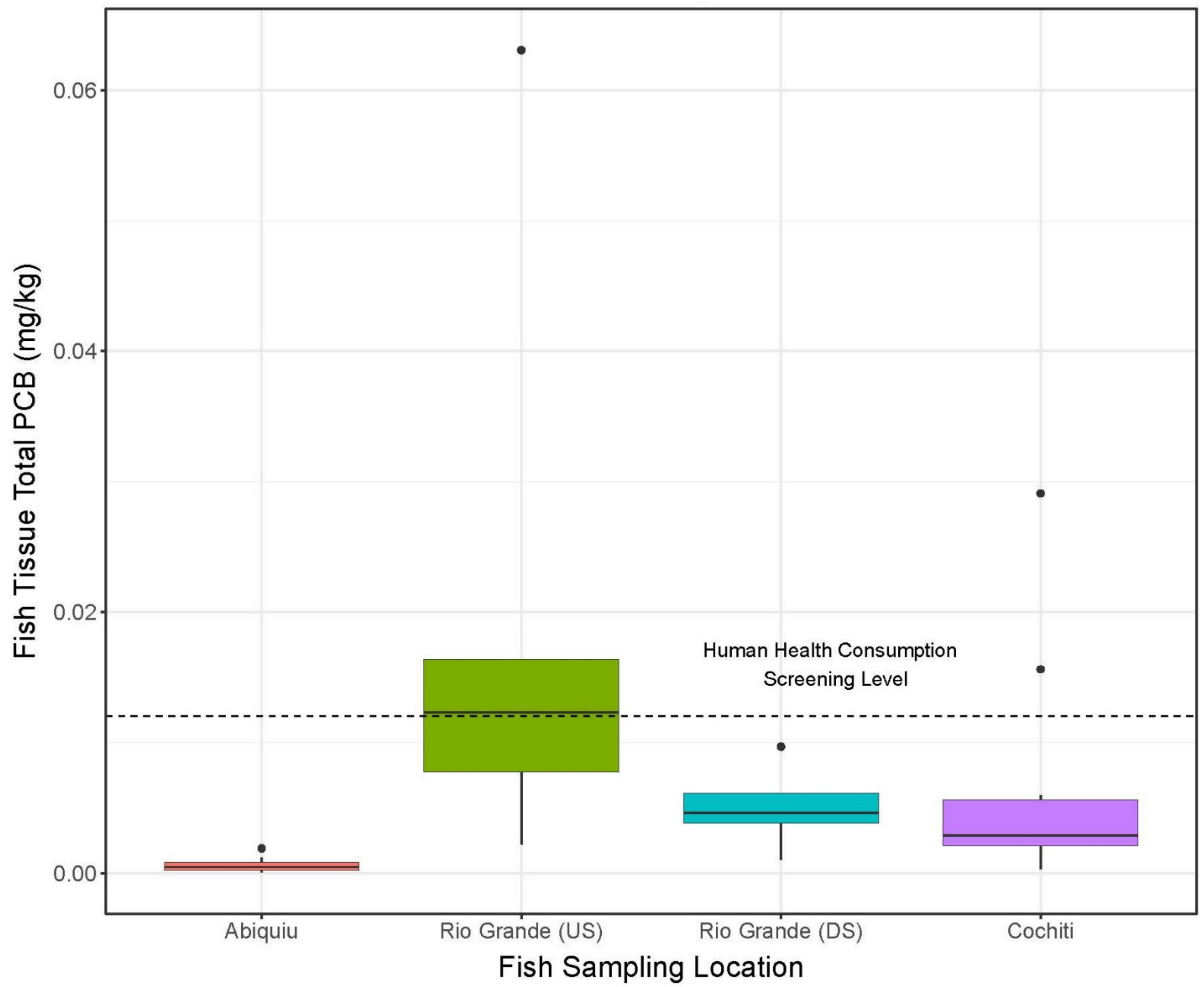


Figure 22 Total PCBs in fish tissue during the 2017 survey year (US = upstream, DS = downstream)

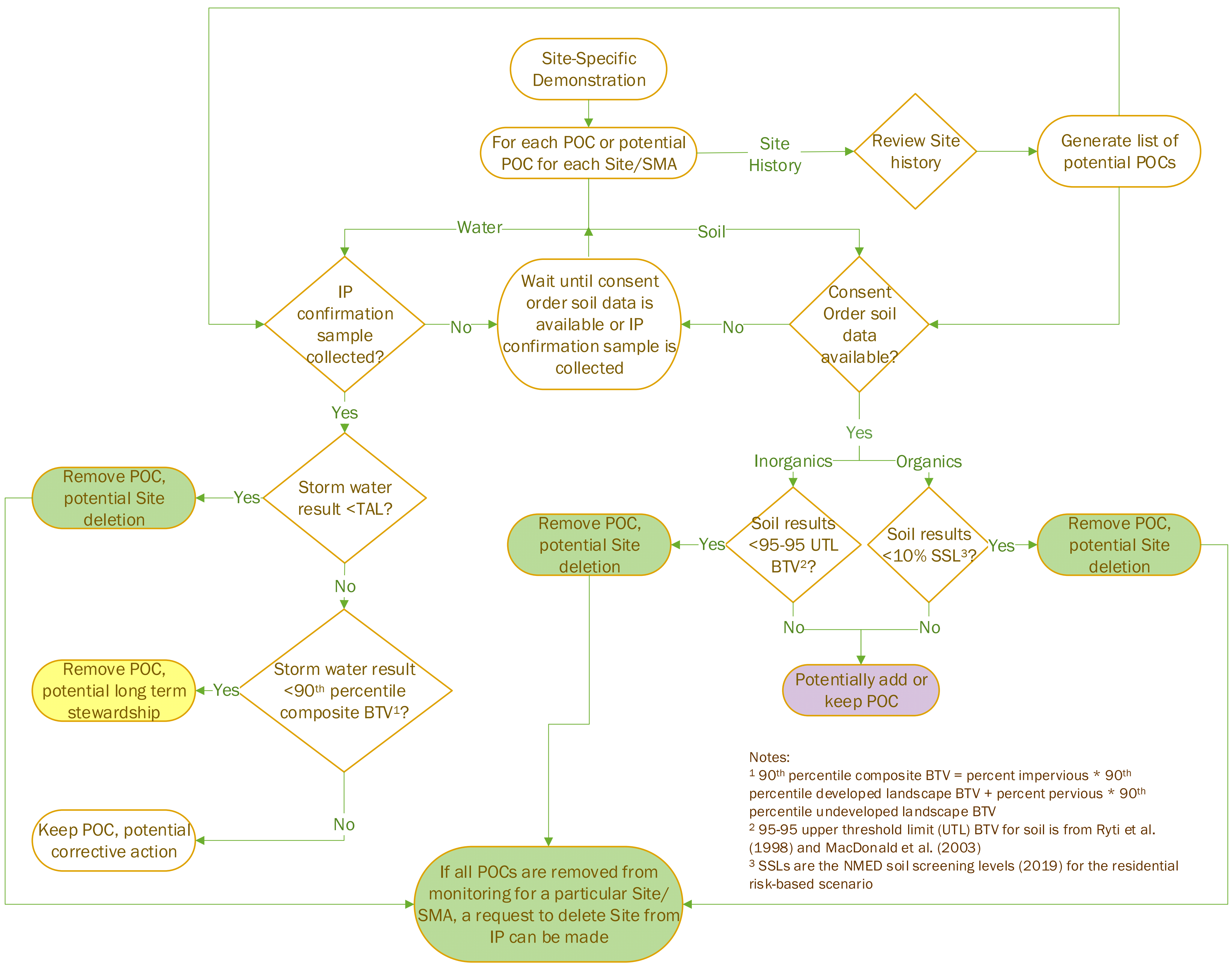


Figure 23 SSD flow chart

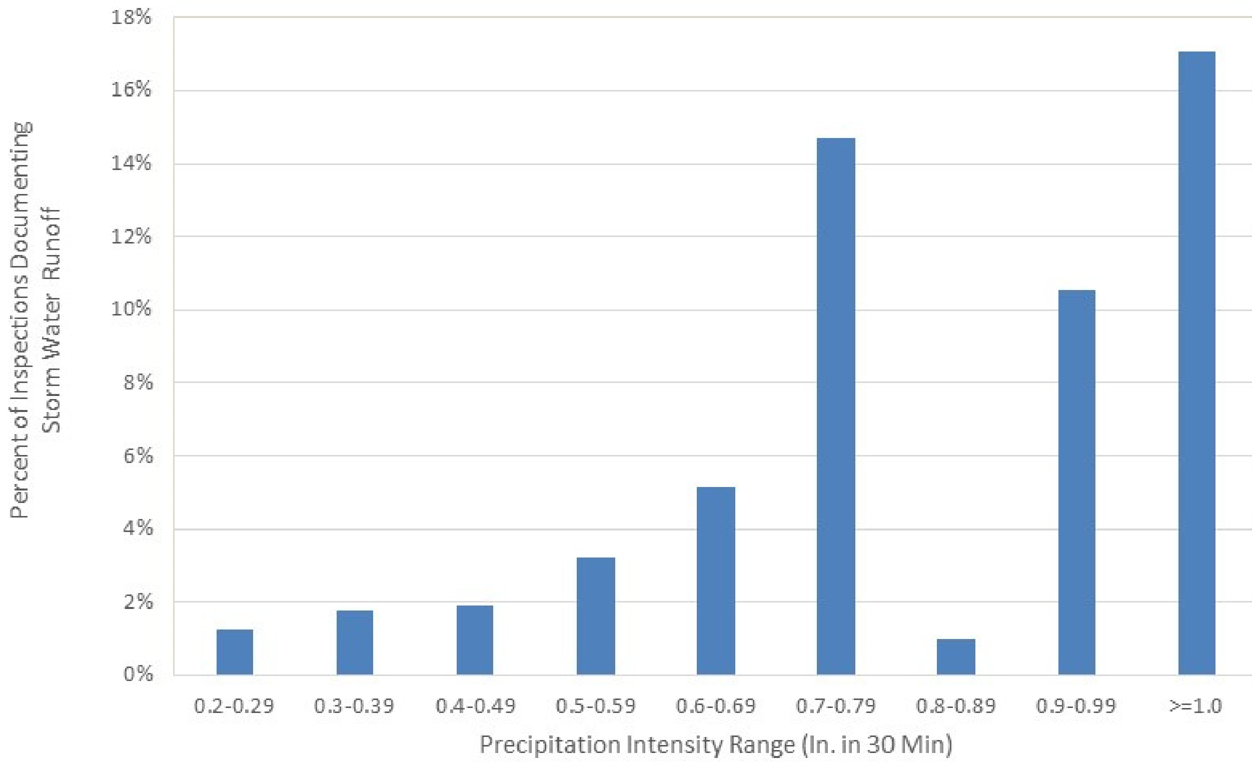


Figure 24 Rainfall intensity range (in. in 30 min) versus percent of inspections where storm water runoff was observed

Table 1
Site Organization by Watershed, Canyon, and SMA*

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Los Alamos/Pueblo	Rendija Canyon	~~R-SMA-0.5~~	~~C-00-020~~	Rendija Canyon	NM-9000.A_045	Rendija Canyon (Guaje Canyon to headwaters)
		~~R-SMA-1~~	~~C-00-041~~			
		R-SMA-1.95	00-015			
		~~R-SMA-2.05~~	~~00-011(c)~~	~~Rendija Canyon/ Cabra Canyon~~		
		~~R-SMA-2.3~~	~~00-011(e)~~	Rendija Canyon		
		R-SMA-2.5	00-011(a)			
	~~Bayo Canyon~~	~~B-SMA-0.5~~	~~10-001(a)~~	~~Bayo Canyon~~	~~NM-97.A_007~~	~~Bayo Canyon (San Ildefonso bnd to headwaters)~~
			~~10-001(b)~~			
			~~10-001(c)~~			
			~~10-001(d)~~			
			~~10-004(a)~~			
			~~10-004(b)~~			
			~~10-008~~			
			~~10-009~~			
		~~B-SMA-1~~	~~00-011(d)~~			
	Pueblo Canyon	~~ACID-SMA-1.05~~	~~00-030(g)~~	~~Pueblo Canyon/ Acid Canyon~~	~~NM-97.A_002~~	~~Acid Canyon (Pueblo Canyon to headwaters)~~
		~~ACID-SMA-2~~	~~01-002(b)-00~~			
			~~45-001~~			
			~~45-002~~			
			~~45-004~~			
		~~ACID-SMA-2.01~~	~~00-030(f)~~			
		~~ACID-SMA-2.1~~	~~01-002(b)-00~~			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Los Alamos/Pueblo	Pueblo Canyon	~~P-SMA-0.3~~	~~00-018(b)~~	~~Pueblo Canyon~~	~~NM-99.A_001~~	~~Pueblo Canyon (Los Alamos Canyon to Los Alamos WWTP)~~
		~~P-SMA-1~~	~~73-001(a)~~		NM-97.A_006	Pueblo Canyon (Los Alamos WWTP to Acid Canyon)
			~~73-004(d)~~			
		~~P-SMA-2~~	~~73-002~~			
			~~73-006~~			
		P-SMA-2.15	31-001			
		~~P-SMA-2.2~~	~~00-019~~	~~Pueblo Canyon/ Graduation Canyon~~	~~NM-97.A_005~~	~~Graduation Canyon (Pueblo Canyon to headwaters)~~
		~~P-SMA-3.05~~	~~00-018(a)~~	~~Pueblo Canyon~~	~~NM-9000.A_043~~	~~Pueblo Canyon (Acid Canyon to headwaters)~~
	Los Alamos Canyon	LA-SMA-0.85	03-055(c)	Los Alamos Canyon	NM-9000.A_063	Los Alamos Canyon (DP Canyon to upper LANL bnd)
		LA-SMA-0.9	00-017			
			C-00-044			
		LA-SMA-1	00-017			
			C-00-044			
		LA-SMA-1.1	43-001(b2)			
		LA-SMA-1.25	C-43-001			
		LA-SMA-2.1	01-001(f)			
		LA-SMA-2.3	01-001(b)			
		LA-SMA-3.1	~~01-001(e)~~			
			01-003(a)			
		LA-SMA-3.9	01-001(g)			
			~~01-006(a)~~			
		LA-SMA-4.1	~~01-003(b)~~			
			~~01-003(b1)~~			
			01-003(b2)			
			~~01-006(b)~~			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Los Alamos/Pueblo	Los Alamos Canyon	LA-SMA-4.2	01-001(c)	Los Alamos Canyon	NM-9000.A_063	Los Alamos Canyon (DP Canyon to upper LANL bnd)
			~~01-006(c)~~			
			~~01-006(d)~~			
		LA-SMA-5.01	~~01-001(d)~~			
			~~01-001(d1)~~			
			~~01-001(d2)~~			
			01-001(d3)			
			~~01-006(h)~~			
			~~01-006(h1)~~			
			~~01-006(h2)~~			
			~~01-006(h3)~~			
		LA-SMA-5.02	01-003(e)			
		LA-SMA-5.2	01-003(d)			
		LA-SMA-5.31	41-002(c)			
		LA-SMA-5.33	32-004			
		LA-SMA-5.35	C-41-004			
		LA-SMA-5.361	~~32-002(b)~~			
			32-002(b1)			
			32-002(b2)			
		LA-SMA-5.362	32-003			
		LA-SMA-5.51	02-003(a)			
			02-003(e)			
			02-004(a)			
			02-005			
			02-006(b)			
			02-006(c)			
			02-006(d)			
			02-006(e)			
			02-008(a)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Los Alamos/Pueblo	Los Alamos Canyon	LA-SMA-5.51 (continued)	02-009(b)			
			02-011(a)			
			02-011(b)			
			02-011(c)	Los Alamos Canyon	NM-9000.A_063	Los Alamos Canyon (DP Canyon to upper LANL bnd)
			02-011(d)			
			02-014			
		LA-SMA-5.52	02-003(b)			
			02-007			
			02-008(c)			
		LA-SMA-5.53	02-009(a)			
		LA-SMA-5.54	02-009(c)			
		LA-SMA-5.91	~~21-009~~			
			21-021			
			~~21-023(c)~~			
			~~21-027(d)~~			
		LA-SMA-5.92	~~21-013(b)~~			
			~~21-013(g)~~			
			~~21-018(a)~~			
			21-021			
		LA-SMA-6.25	21-021			
			21-024(d)			
			21-027(c)			
		~~LA-SMA-6.27~~	~~21-021~~			
		-	~~21-027(c)~~			
		LA-SMA-6.3	21-006(b)			
		LA-SMA-6.31	21-027(a)			
		LA-SMA-6.32	21-021			
		LA-SMA-6.34	21-021			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Los Alamos/Pueblo	Los Alamos Canyon		21-022(h)			
		~~LA-SMA-6.36~~	~~21-021~~			
		~~-~~	~~21-024(a)~~			
		LA-SMA-6.38	21-021	Los Alamos Canyon	NM-9000.A_063	Los Alamos Canyon (DP Canyon to upper LANL bnd)
			21-024(c)			
		LA-SMA-6.395	21-021			
			21-024(j)			
		LA-SMA-6.5	21-021			
			21-024(i)			
		LA-SMA-9	26-001		NM-9000.A_006	Los Alamos Canyon (NM 4 to DP Canyon)
			26-002(a)			
			26-002(b)			
			26-003			
		~~LA-SMA-10.11~~	~~53-002(a)~~			
		LA-SMA-10.12	53-008			
	DP Canyon	DP-SMA-0.3	21-029	DP Canyon	NM-128.A_14	DP Canyon (grade control to upper LANL Bnd)
		DP-SMA-0.4	21-021			
		DP-SMA-0.6	21-021			
			21-024(l)			
		DP-SMA-1	21-011(k)			
			21-021			
		DP-SMA-2	21-021			
			21-024(h)			
		DP-SMA-2.35	21-021			
			21-024(n)			
		DP-SMA-3	21-013(c)		NM-128.A_10	DP Canyon (Los Alamos Canyon to grade control)
			21-021			
		~~DP-SMA-4~~	~~21-021~~			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Sandia	Sandia Canyon	S-SMA-0.25	03-013(a)	Sandia Canyon	NM-9000.A_047	Sandia Canyon (Sigma Canyon to NPDES outfall 001)
			03-052(f)			
		S-SMA-1.1	03-029			
		S-SMA-2	03-012(b)			
			03-045(b)			
			03-045(c)			
			03-056(c)			
		S-SMA-2.01	03-052(b)			
		S-SMA-2.8	03-014(c2)			
		S-SMA-3.51	03-009(i)			
		S-SMA-3.52	03-021			
		S-SMA-3.53	03-014(b2)			
		S-SMA-3.6	60-007(b)			
		S-SMA-3.7	53-012(e)		NM-128.A_11	Sandia Canyon (within LANL below Sigma Canyon)
		S-SMA-3.71	53-001(a)			
		S-SMA-3.72	53-001(b)			
		S-SMA-3.95	20-002(a)			
		S-SMA-4.1	53-014			
		~~S-SMA-4.5~~	~~20-002(d)~~			
		S-SMA-5	20-002(c)			
		S-SMA-5.2	20-003(c)			
		S-SMA-5.5	20-005			
		S-SMA-6	72-001			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Mortandad	Cañada del Buey	CDB-SMA-0.15	04-003(a)	Cañada del Buey	NM-128.A_00	Cañada del Buey (within LANL)
			04-004			
		CDB-SMA-0.25	46-004(c2)			
			46-004(e2)			
		CDB-SMA-0.55	~~46-004(e2)~~			
			46-004(g)			
			46-004(m)			
			46-004(s)			
			46-006(f)			
		CDB-SMA-1	46-003(c)	Cañada del Buey /SWSC Canyon		
			46-004(d2)			
			46-004(f)			
			46-004(t)			
			46-004(w)			
			46-008(g)			
			46-009(a)			
			~~C-46-001~~			
		CDB-SMA-1.15	46-004(b)	Cañada del Buey		
			46-004(y)			
			46-004(z)			
			46-006(d)			
		~~CDB-SMA-1.35~~	~~46-004(a2)~~			
			~~46-004(u)~~			
			~~46-004(v)~~			
			~~46-004(x)~~			
			~~46-006(d)~~			
			~~46-008(f)~~			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Mortandad	Cañada del Buey	~~CDB-SMA-1.54~~	~~46-004(h)~~	Cañada del Buey	NM-128.A_00	Cañada del Buey (within LANL)
			~~46-004(q)~~			
			~~46-006(d)~~			
		~~CDB-SMA-1.55~~	~~46-003(e)~~			
		~~CDB-SMA-1.65~~	~~46-003(b)~~	Cañada del Buey /SWSC Canyon		
		CDB-SMA-4	54-017	Cañada del Buey		
			54-018			
			54-020			
	Mortandad Canyon	M-SMA-1	03-050(a)	Mortandad Canyon	NM-9000.A_042	Mortandad Canyon (within LANL)
			03-054(e)			
		M-SMA-1.2	03-049(a)			
		M-SMA-1.21	03-049(e)			
		M-SMA-1.22	03-045(h)			
		M-SMA-3	48-001			
			48-005			
			48-007(c)			
		M-SMA-3.1	48-001			
			48-007(b)			
		M-SMA-3.5	48-001			
			48-003			
		M-SMA-4	48-001	Mortandad Canyon/ Effluent Canyon		
			48-005			
			48-007(a)			
			48-007(d)			
			48-010			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Mortandad	Mortandad Canyon	M-SMA-5	42-001(a)	Mortandad Canyon/ Effluent Canyon	NM-9000.A_042	Mortandad Canyon (within LANL)
			42-001(b)			
			42-001(c)			
			42-002(a)			
			42-002(b)			
		M-SMA-6	35-016(h)			
		M-SMA-7	35-016(g)			
		M-SMA-7.9	50-006(d)			
		~~M-SMA-9.1~~	~~35-016(f)~~	Mortandad Canyon		
		M-SMA-10	35-008			
			35-014(e)			
		M-SMA-10.01	35-016(e)			
		M-SMA-10.3	35-014(e2)			
			35-016(i)			
		M-SMA-11.1	35-016(o)			
		M-SMA-12	35-016(p)			
		M-SMA-12.5	05-005(b)			
			05-006(c)			
		M-SMA-12.6	05-004			
		M-SMA-12.7	05-002			
			05-005(a)			
			05-006(b)			
			05-006(e)			
		M-SMA-12.8	05-001(a)			
			05-002			
		M-SMA-12.9	05-001(b)			
			05-002			
		M-SMA-12.92	00-001			
		M-SMA-13	05-001(c)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Mortandad	Ten Site Canyon	Pratt-SMA-1.05	35-003(h)	Ten Site Canyon/Pratt Canyon	NM-128.A_17	Ten Site Canyon (Mortandad Canyon to headwaters)
			35-003(p)			
			35-003(r)			
			~~35-004(h)~~			
			35-009(d)			
			35-016(k)			
			35-016(l)			
			~~35-016(m)~~			
		T-SMA-1	50-006(a)	Ten Site Canyon		
			50-009			
		T-SMA-2.5	35-014(g3)			
		T-SMA-2.85	35-014(g)			
			35-016(n)			
		T-SMA-3	35-016(b)			
		T-SMA-4	35-004(a)			
			35-009(a)			
			35-016(c)			
			35-016(d)			
		T-SMA-5	35-004(a)			
			35-009(a)			
			35-016(a)			
			35-016(q)			
		T-SMA-6.8	35-010(e)			
		T-SMA-7	04-003(b)			
		T-SMA-7.1	04-001			
			04-002			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Pajarito	Twomile Canyon	2M-SMA-1	03-010(a)	Twomile Canyon	NM-128.A_15	Two Mile Canyon (Pajarito to headwaters)
		2M-SMA-1.42	06-001(a)			
		2M-SMA-1.43	22-014(a)			
			22-015(a)			
		2M-SMA-1.44	06-001(b)			
		2M-SMA-1.45	06-006			
		2M-SMA-1.5	22-014(b)			
		2M-SMA-1.65	40-005			
		2M-SMA-1.67	06-003(h)			
		2M-SMA-1.7	03-055(a)			
		2M-SMA-1.8	03-001(k)			
		2M-SMA-1.9	03-003(a)			
		2M-SMA-2	03-050(d)			
			03-054(b)			
		2M-SMA-2.2	03-003(k)			
		2M-SMA-3	07-001(a)			
			07-001(b)			
			07-001(c)			
			07-001(d)			
		2M-SMA-2.5	40-001(c)			
	Threemile Canyon	3M-SMA-0.2	15-010(b)	Threemile Canyon	NM-9000.A_091	Three Mile Canyon (Pajarito Canyon to headwaters)
		3M-SMA-0.4	15-006(b)			
		3M-SMA-0.5	15-006(c)			
			15-009(c)			
		3M-SMA-0.6	15-008(b)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Pajarito	Threemile Canyon	3M-SMA-2.6	36-008	Threemile Canyon	NM-9000.A_091	Three Mile Canyon (Pajarito Canyon to headwaters)
			C-36-003			
		3M-SMA-4	18-002(b)			
			18-003(c)			
			18-010(f)			
	Pajarito Canyon	PJ-SMA-1.05	09-013	Pajarito Canyon	NM-128.A_07	Pajarito Canyon (within LANL above Starmers Gulch)
		PJ-SMA-2	09-009		NM-128.A_16	Arroyo de la Delfe (Pajarito Canyon to headwaters)
		PJ-SMA-3.05	09-004(o)			
		PJ-SMA-4.05	~~09-004(g)~~			Pajarito Canyon (Two Mile Canyon to Arroyo de La Delfe)
			09-005(g)			
		PJ-SMA-5	22-015(c)		NM-126.A_01	Pajarito Canyon (Arroyo de La Delfe to Starmers Spring)
		PJ-SMA-5.1	~~22-016~~			
			22-010(b)			
		PJ-SMA-6	40-010		NM-128.A_06	Pajarito Canyon (Two Mile Canyon to Arroyo de La Delfe)
		PJ-SMA-7	40-006(c)			
		PJ-SMA-8	40-006(b)			
		PJ-SMA-9	40-009			
		PJ-SMA-10	40-006(a)			
		PJ-SMA-11	40-003(a)			
		PJ-SMA-11.1	40-003(b)			
		~~PJ-SMA-13~~	~~18-002(a)~~		NM-128.A_08	Pajarito Canyon (Lower LANL bnd to Two Mile Canyon)
		PJ-SMA-13.7	18-010(b)			
		~~PJ-SMA-14~~	~~54-004~~			
		PJ-SMA-14.2	18-012(b)			
		PJ-SMA-14.3	18-003(e)			
		PJ-SMA-14.4	18-010(d)			
		PJ-SMA-14.6	18-010(e)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Pajarito	Pajarito Canyon	PJ-SMA-14.8	18-012(a)	Pajarito Canyon	NM-128.A_08	Pajarito Canyon (Lower LANL bnd to Two Mile Canyon)
		PJ-SMA-16	27-002			
		PJ-SMA-17	54-018			
		PJ-SMA-18	54-014(d)			
			54-017			
		PJ-SMA-19	54-013(b)			
			54-017			
			54-020			
		PJ-SMA-20	54-017			
		STRM-SMA-1.05	08-009(f)	Pajarito Canyon/ Starmer's Gulch	NM-126.A_01	Pajarito Canyon (Two Mile Canyon to Arroyo de La Delfe)
		STRM-SMA-1.5	08-009(d)			
		STRM-SMA-4.2	09-008(b)			
		STRM-SMA-5.05	09-013			
Water/ Cañon de Valle	Cañon de Valle	CDV-SMA-1.2	16-017(b)-99	Cañon de Valle	NM-128.A_02	Cañon de Valle (within LANL above Burning Ground Spur)
			16-029(k)			
		CDV-SMA-1.3	16-017(a)-99			
			16-026(m)			
		CDV-SMA-1.4	16-020			
			16-026(l)			
			16-028(c)			
			~~16-030(c)~~			
		CDV-SMA-1.45	16-026(i)			
		CDV-SMA-1.7	16-019			
		CDV-SMA-2	16-021(c)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Water/ Cañon de Valle	Cañon de Valle	CDV-SMA-2.3	13-001	Cañon de Valle	NM-128.A_01	Cañon de Valle (below LANL gage E256)
			13-002			
			16-003(n)			
			16-003(o)			
			16-029(h)			
			16-031(h)			
		~~CDV-SMA-2.41~~	~~16-018~~			
		~~CDV-SMA-2.42~~	~~16-010(b)~~			
		CDV-SMA-2.5	~~16-010(c)~~			
			~~16-010(d)~~			
			16-028(a)			
		CDV-SMA-2.51	16-010(i)			
		CDV-SMA-3	14-009			
		CDV-SMA-4	14-010			
		CDV-SMA-6.01	14-001(g)			
			14-006			
		CDV-SMA-6.02	~~14-002(d)~~			
			~~14-002(e)~~			
			14-002(c)			
		CDV-SMA-7	15-008(d)			
		CDV-SMA-8	15-011(c)			
		CDV-SMA-8.5	15-014(a)			
		CDV-SMA-9.05	15-007(b)			
	Fence Canyon	F-SMA-2	36-004(c)	Fence Canyon	NM-128.A_04	Fence Canyon (above Potrillo Canyon)

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Water/Cañon de Valle	Potrillo Canyon	PT-SMA-0.5	15-009(e)	Potrillo Canyon	NM-128.A_09	Potrillo Canyon (above Water Canyon)
			C-15-004			
		PT-SMA-1	15-004(f)			
			15-008(a)			
		PT-SMA-1.7	~~15-006(a)~~			
			15-003			
		PT-SMA-2	15-008(f)			
			36-003(b)			
			36-004(e)			
		PT-SMA-2.01	C-36-001			
			C-36-006(e)			
		PT-SMA-3	36-004(a)			
			36-006			
		PT-SMA-4.2	36-004(d)			
	Water Canyon	W-SMA-1	16-017(j)-99	Water Canyon	NM-128.A_13	Water Canyon (within LANL below Area-A Cyn)
			16-026(c2)			
			16-026(v)			
		W-SMA-1.5	16-026(b2)			
			16-028(d)			
		W-SMA-2.05	16-028(e)			
		W-SMA-3.5	16-026(y)			
		W-SMA-4.1	16-003(a)			
		W-SMA-5	16-001(e)	Water Canyon/ S-Site Canyon		
			16-003(f)			
			16-026(b)			
			16-026(c)			
			16-026(d)			
			16-026(e)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Water/ Cañon de Valle	Water Canyon	W-SMA-6	11-001(c)	Water Canyon	NM-128.A_13	Water Canyon (within LANL below Area-A Cyn)
		W-SMA-7	~~16-026(h2)~~			
			16-029(e)			
		W-SMA-7.8	16-031(a)			
		W-SMA-7.9	16-006(c)			
		W-SMA-8	16-016(g)			
			16-028(b)			
		W-SMA-8.7	13-001			
			13-002			
			16-004(a)			
			16-026(j2)			
			16-029(h)			
			16-035			
		W-SMA-8.71	16-004(c)			
		W-SMA-9.05	16-030(g)			
		W-SMA-9.5	11-012(c)	Water Canyon/S-Site Canyon		
		W-SMA-9.7	11-011(a)			
			11-011(b)			
		W-SMA-9.8	11-005(c)			
		W-SMA-9.9	11-006(b)			
		W-SMA-10	11-002			
			11-003(b)			
			11-005(a)			
			11-005(b)			
			11-006(c)			
			11-006(d)			
			11-011(d)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Water/ Cañon de Valle	Water Canyon	W-SMA-11.7	49-008(c)	Water Canyon	NM-128.A_13	Water Canyon (within LANL below Area-A Cyn)
		W-SMA-12.05	49-001(g)			
		W-SMA-14.1	15-004(h)			
			15-014(l)			
		W-SMA-15.1	49-005(a)			
Ancho	Ancho Canyon	A-SMA-1.1	39-004(a)	North Ancho Canyon	NM-9000.A_055	North Fork Ancho Canyon (Ancho Canyon to Headwaters)
			39-004(d)			
		A-SMA-2	39-004(b)			
			39-004(e)			
		A-SMA-2.5	39-010			
		A-SMA-2.7	39-002(c)			
			39-008			
		A-SMA-2.8	39-001(b)			
		A-SMA-3	39-002(b)			
			39-004(c)			
		A-SMA-3.5	39-006(a)	South Ancho Canyon	NM-9000.A_054	Ancho Canyon (Rio Grande to North Fork Ancho)
		A-SMA-4	33-010(d)			
		A-SMA-6	33-004(k)			
			33-007(a)			
			33-010(a)			
Chaquehui	Chaquehui Canyon	CHQ-SMA-0.5	33-004(g)	Chaquehui Canyon	NM-128.A_03	Chaquehui Canyon (within LANL)
			33-007(c)			
			33-009			
		CHQ-SMA-1.01	33-002(d)			

Table 1 (continued)

Watershed	Canyon	SMA ID	Site ID	Receiving Water	AU ID	AU Name
Chaquehui	Chaquehui Canyon	CHQ-SMA-1.02	33-004(h)	Chaquehui Canyon	NM-128.A_03	Chaquehui Canyon (within LANL)
			33-008(c)			
			33-011(d)			
			33-015			
		CHQ-SMA-1.03	33-008(c)			
			33-012(a)			
			33-017			
			C-33-001			
			C-33-003			
		CHQ-SMA-2	33-004(d)			
			33-007(c)			
			C-33-003			
		CHQ-SMA-3.05	33-010(f)			
		CHQ-SMA-4	33-011(e)			
		CHQ-SMA-4.1	33-016			
		CHQ-SMA-4.5	33-011(b)			
		CHQ-SMA-5.05	33-007(b)			
		CHQ-SMA-6	33-004(j)			
			33-006(a)			
			33-007(b)			
			33-010(c)			
			33-010(h)			
			33-014			
		CHQ-SMA-7.1	33-010(g)			

* Redline strikeout items are Sites requested for deletion per section 9.0.

Table 2
IP Program Rain Gage Network Precipitation Depth for Various Return Periods

Rain Gage	24-hr Design Storms (in.)							
	95th percentile	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
E038	0.81	1.06	1.25	1.46	1.73	2.06	2.31	2.56
E042.1	0.78	1.05	1.32	1.61	1.99	2.46	2.81	3.16
E121.9	1.03	1.22	1.45	1.71	2.03	2.43	2.73	3.03
E200.5	0.91	0.98	1.25	1.55	1.92	2.40	2.75	3.10
E203	0.85	0.84	1.09	1.36	1.71	2.15	2.48	2.80
E240	0.89	1.12	1.33	1.57	1.87	2.25	2.53	2.80
E245.5	0.75	0.87	1.09	1.33	1.64	2.03	2.32	2.60
E253	1.21	1.66	1.92	2.21	2.57	3.03	3.37	3.70
E257	0.97	1.50	1.79	2.10	2.49	2.99	3.36	3.72
E262.4	0.91	1.23	1.45	1.70	2.02	2.42	2.72	3.01
E265	0.81	1.02	1.35	1.72	2.18	2.76	3.19	3.62
E267.4	0.82	0.90	1.11	1.34	1.64	2.01	2.29	2.56
E340	0.84	1.12	1.31	1.57	1.87	2.25	2.53	2.8
R055.5	1.09	1.32	1.51	1.72	1.98	2.32	2.57	2.82
TA-06	0.89	1.25	1.40	1.57	1.78	2.04	2.24	2.43
TA-49	0.88	1.31	1.60	1.92	2.33	2.84	3.23	3.61
TA-53	0.85	1.07	1.19	1.31	1.48	1.68	1.84	1.99
TA-54	0.8	1.11	1.26	1.43	1.64	1.90	2.10	2.29
NCOM	0.95	1.33	1.49	1.66	1.89	2.17	2.38	2.58

Table 3
IP Sites by Aggregate Area*

SWMU Count	Site ID	SMA ID	Aggregate Area
Los Alamos/Pueblo			
1	00-011(a)	R-SMA-2.5	Gauje/Barrancas/Rendija
~~2~~	~~00-011(c)~~	~~R-SMA-2.05~~	~~Gauje/Barrancas/Rendija~~
~~2~~	~~00-011(d)~~	~~B-SMA-1~~	~~Gauje/Barrancas/Rendija~~
~~2~~	~~00-011(e)~~	~~R-SMA-2.3~~	~~Gauje/Barrancas/Rendija~~
2	00-015	R-SMA-1.95	Gauje/Barrancas/Rendija
3	00-017	LA-SMA-0.9	Upper Los Alamos
	00-017	LA-SMA-1	Upper Los Alamos
~~4~~	~~00-018(a)~~	~~P-SMA-3.05~~	~~Pueblo~~
~~4~~	~~00-018(b)~~	~~P-SMA-0.3~~	~~Pueblo~~
~~4~~	~~00-019~~	~~P-SMA-2.2~~	~~Pueblo~~
~~4~~	~~00-030(f)~~	~~ACID-SMA-2.01~~	~~Pueblo~~
~~4~~	~~00-030(g)~~	~~ACID-SMA-1.05~~	~~Pueblo~~
~~4~~	~~C-00-020~~	~~R-SMA-0.5~~	~~Gauje/Barrancas/Rendija~~
~~4~~	~~C-00-041~~	~~R-SMA-1~~	~~Gauje/Barrancas/Rendija~~
4	C-00-044	LA-SMA-0.9	Upper Los Alamos
	C-00-044	LA-SMA-1	Upper Los Alamos
5	01-001(b)	LA-SMA-2.3	Upper Los Alamos
6	01-001(c)	LA-SMA-4.2	Upper Los Alamos
~~7~~	~~01-001(d)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
~~7~~	~~01-001(d1)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
~~7~~	~~01-001(d2)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
7	01-001(d3)	LA-SMA-5.01	Upper Los Alamos
~~8~~	~~01-001(e)~~	~~LA-SMA-3.1~~	~~Upper Los Alamos~~
8	01-001(f)	LA-SMA-2.1	Upper Los Alamos
9	01-001(g)	LA-SMA-3.9	Upper Los Alamos
~~10~~	~~01-002(b)-00~~	~~ACID-SMA-2~~	~~Pueblo~~
	~~01-002(b)-00~~	~~ACID-SMA-2.1~~	~~Pueblo~~
10	01-003(a)	LA-SMA-3.1	Upper Los Alamos
~~11~~	~~01-003(b)~~	~~LA-SMA-4.1~~	~~Upper Los Alamos~~
~~11~~	~~01-003(b1)~~	~~LA-SMA-4.1~~	~~Upper Los Alamos~~
11	01-003(b2)	LA-SMA-4.1	Upper Los Alamos
12	01-003(d)	LA-SMA-5.2	Upper Los Alamos
13	01-003(e)	LA-SMA-5.02	Upper Los Alamos
~~14~~	~~01-006(a)~~	~~LA-SMA-3.9~~	~~Upper Los Alamos~~
~~14~~	~~01-006(b)~~	~~LA-SMA-4.1~~	~~Upper Los Alamos~~
~~14~~	~~01-006(c)~~	~~LA-SMA-4.2~~	~~Upper Los Alamos~~

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
~~14~~	~~01-006(d)~~	~~LA-SMA-4.2~~	~~Upper Los Alamos~~
~~14~~	~~01-006(h)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
~~14~~	~~01-006(h1)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
~~14~~	~~01-006(h2)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
~~14~~	~~01-006(h3)~~	~~LA-SMA-5.01~~	~~Upper Los Alamos~~
14	02-003(a)	LA-SMA-5.51	Middle Los Alamos
15	02-003(b)	LA-SMA-5.52	Middle Los Alamos
16	02-003(e)	LA-SMA-5.51	Middle Los Alamos
17	02-004(a)	LA-SMA-5.51	Middle Los Alamos
18	02-005	LA-SMA-5.51	Middle Los Alamos
19	02-006(b)	LA-SMA-5.51	Middle Los Alamos
20	02-006(c)	LA-SMA-5.51	Middle Los Alamos
21	02-006(d)	LA-SMA-5.51	Middle Los Alamos
22	02-006(e)	LA-SMA-5.51	Middle Los Alamos
23	02-007	LA-SMA-5.52	Middle Los Alamos
24	02-008(a)	LA-SMA-5.51	Middle Los Alamos
25	02-008(c)	LA-SMA-5.52	Middle Los Alamos
26	02-009(a)	LA-SMA-5.53	Middle Los Alamos
27	02-009(b)	LA-SMA-5.51	Middle Los Alamos
28	02-009(c)	LA-SMA-5.54	Middle Los Alamos
29	02-011(a)	LA-SMA-5.51	Middle Los Alamos
30	02-011(b)	LA-SMA-5.51	Middle Los Alamos
31	02-011(c)	LA-SMA-5.51	Middle Los Alamos
32	02-011(d)	LA-SMA-5.51	Middle Los Alamos
33	02-014	LA-SMA-5.51	Middle Los Alamos
34	03-055(c)	LA-SMA-0.85	Upper Los Alamos
~~35~~	~~10-001(a)~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-001(b)~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-001(c)~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-001(d)~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-004(a)~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-004(b)~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-008~~	~~B-SMA-0.5~~	~~Bayo~~
~~35~~	~~10-009~~	~~B-SMA-0.5~~	~~Bayo~~
35	21-006(b)	LA-SMA-6.3	DP
~~36~~	~~21-009~~	~~LA-SMA-5.91~~	~~DP~~
36	21-011(k)	DP-SMA-1	DP
~~37~~	~~21-013(b)~~	~~LA-SMA-5.92~~	~~DP~~
37	21-013(c)	DP-SMA-3	DP

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
~~38~~	~~21-013(g)~~	~~LA-SMA-5.92~~	~~DP~~
~~38~~	~~21-018(a)~~	~~LA-SMA-5.92~~	~~DP~~
38	21-021	DP-SMA-0.4	DP
	21-021	DP-SMA-0.6	DP
	21-021	DP-SMA-1	DP
	21-021	DP-SMA-2	DP
	21-021	DP-SMA-2.35	DP
	21-021	DP-SMA-3	DP
39	~~21-021~~	~~DP-SMA-4~~	~~DP~~
	21-021	LA-SMA-5.91	DP
	21-021	LA-SMA-5.92	DP
	21-021	LA-SMA-6.25	DP
	~~21-021~~	~~LA-SMA-6.27~~	~~DP~~
	21-021	LA-SMA-6.32	DP
	21-021	LA-SMA-6.34	DP
	~~21-021~~	~~LA-SMA-6.36~~	~~DP~~
	21-021	LA-SMA-6.38	DP
	21-021	LA-SMA-6.395	DP
	21-021	LA-SMA-6.5	DP
40	21-022(h)	LA-SMA-6.34	DP
~~41~~	~~21-023(c)~~	~~LA-SMA-5.91~~	~~DP~~
~~41~~	~~21-024(a)~~	~~LA-SMA-6.36~~	~~DP~~
42	21-024(c)	LA-SMA-6.38	DP
43	21-024(d)	LA-SMA-6.25	DP
44	21-024(h)	DP-SMA-2	DP
45	21-024(i)	LA-SMA-6.5	DP
46	21-024(j)	LA-SMA-6.395	DP
47	21-024(l)	DP-SMA-0.6	DP
48	21-024(n)	DP-SMA-2.35	DP
49	21-027(a)	LA-SMA-6.31	DP
50	21-027(c)	LA-SMA-6.25	DP
	~~21-027(c)~~	~~LA-SMA-6.27~~	~~DP~~
~~51~~	~~21-027(d)~~	~~LA-SMA-5.91~~	~~DP~~
52	21-029	DP-SMA-0.3	DP
53	26-001	LA-SMA-9	Middle Los Alamos
54	26-002(a)	LA-SMA-9	Middle Los Alamos
55	26-002(b)	LA-SMA-9	Middle Los Alamos
56	26-003	LA-SMA-9	Middle Los Alamos
57	31-001	P-SMA-2.15	Pueblo

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
~~58~~	~~32-002(b)~~	~~LA-SMA-5.361~~	~~Upper Los Alamos~~
58	32-002(b1)	LA-SMA-5.361	Upper Los Alamos
59	32-002(b2)	LA-SMA-5.361	Upper Los Alamos
60	32-003	LA-SMA-5.362	Upper Los Alamos
61	32-004	LA-SMA-5.33	Upper Los Alamos
62	41-002(c)	LA-SMA-5.31	Upper Los Alamos
63	C-41-004	LA-SMA-5.35	Upper Los Alamos
64	43-001(b2)	LA-SMA-1.1	Upper Los Alamos
65	C-43-001	LA-SMA-1.25	Upper Los Alamos
~~66~~	~~45-001~~	~~ACID-SMA-2~~	~~Pueblo~~
~~66~~	~~45-002~~	~~ACID-SMA-2~~	~~Pueblo~~
~~66~~	~~45-004~~	~~ACID-SMA-2~~	~~Pueblo~~
~~66~~	~~53-002(a)~~	~~LA-SMA-10.11~~	~~Lower Sandia~~
66	53-008	LA-SMA-10.12	Lower Sandia
~~67~~	~~73-001(a)~~	~~P-SMA-1~~	~~Pueblo~~
~~67~~	~~73-002~~	~~P-SMA-2~~	~~Pueblo~~
~~67~~	~~73-004(d)~~	~~P-SMA-1~~	~~Pueblo~~
~~67~~	~~73-006~~	~~P-SMA-2~~	~~Pueblo~~
Sandia			
1	03-009(i)	S-SMA-3.51	Upper Sandia
2	03-012(b)	S-SMA-2	Upper Sandia
3	03-013(a)	S-SMA-0.25	Upper Sandia
4	03-014(b2)	S-SMA-3.53	Upper Sandia
5	03-014(c2)	S-SMA-2.8	Upper Sandia
6	03-021	S-SMA-3.52	Upper Sandia
7	03-029	S-SMA-1.1	Upper Sandia
8	03-045(b)	S-SMA-2	Upper Sandia
9	03-045(c)	S-SMA-2	Upper Sandia
10	03-052(b)	S-SMA-2.01	Upper Sandia
11	03-052(f)	S-SMA-0.25	Upper Sandia
12	03-056(c)	S-SMA-2	Upper Sandia
13	20-002(a)	S-SMA-3.95	Lower Sandia
14	20-002(c)	S-SMA-5	Lower Sandia
~~15~~	~~20-002(d)~~	~~S-SMA-4.5~~	~~Lower Sandia~~
15	20-003(c)	S-SMA-5.2	Lower Sandia
16	20-005	S-SMA-5.5	Lower Sandia
17	53-001(a)	S-SMA-3.71	Lower Sandia
18	53-001(b)	S-SMA-3.72	Lower Sandia
19	53-012(e)	S-SMA-3.7	Lower Sandia

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
20	53-014	S-SMA-4.1	Lower Sandia
21	60-007(b)	S-SMA-3.6	Upper Sandia
22	72-001	S-SMA-6	Lower Sandia
Mortandad			
1	00-001	M-SMA-12.92	Middle Mortandad/Ten Site
2	03-045(h)	M-SMA-1.22	Upper Mortandad
3	03-049(a)	M-SMA-1.2	Upper Mortandad
4	03-049(e)	M-SMA-1.21	Upper Mortandad
5	03-050(a)	M-SMA-1	Twomile
6	03-054(e)	M-SMA-1	Upper Mortandad
7	04-001	T-SMA-7.1	Middle Mortandad/Ten Site
8	04-002	T-SMA-7.1	Middle Mortandad/Ten Site
9	04-003(a)	CDB-SMA-0.15	Upper Cañada del Buey
10	04-003(b)	T-SMA-7	Middle Mortandad/Ten Site
11	04-004	CDB-SMA-0.15	Upper Cañada del Buey
12	05-001(a)	M-SMA-12.8	Middle Mortandad/Ten Site
13	05-001(b)	M-SMA-12.9	Middle Mortandad/Ten Site
14	05-001(c)	M-SMA-13	Lower Mortandad/Cedro
15	05-002	M-SMA-12.7	Middle Mortandad/Ten Site
	05-002	M-SMA-12.8	Middle Mortandad/Ten Site
	05-002	M-SMA-12.9	Middle Mortandad/Ten Site
16	05-004	M-SMA-12.6	Lower Mortandad/Cedro
17	05-005(a)	M-SMA-12.7	Middle Mortandad/Ten Site
18	05-005(b)	M-SMA-12.5	Lower Mortandad/Cedro
19	05-006(b)	M-SMA-12.7	Middle Mortandad/Ten Site
20	05-006(c)	M-SMA-12.5	Lower Mortandad/Cedro
21	05-006(e)	M-SMA-12.7	Middle Mortandad/Ten Site
22	35-003(h)	Pratt-SMA-1.05	Middle Mortandad/Ten Site
23	35-003(p)	Pratt-SMA-1.05	Middle Mortandad/Ten Site
24	35-003(r)	Pratt-SMA-1.05	Middle Mortandad/Ten Site
25	35-004(a)	T-SMA-4	Middle Mortandad/Ten Site
	35-004(a)	T-SMA-5	Middle Mortandad/Ten Site
~~26~~	~~35-004(h)~~	~~Pratt-SMA-1.05~~	~~Middle Mortandad/Ten Site~~
26	35-008	M-SMA-10	Middle Mortandad/Ten Site
27	35-009(a)	T-SMA-4	Middle Mortandad/Ten Site
	35-009(a)	T-SMA-5	Middle Mortandad/Ten Site
28	35-009(d)	Pratt-SMA-1.05	Middle Mortandad/Ten Site
29	35-010(e)	T-SMA-6.8	Middle Mortandad/Ten Site
30	35-014(e)	M-SMA-10	Middle Mortandad/Ten Site

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
31	35-014(e2)	M-SMA-10.3	Middle Mortandad/Ten Site
32	35-014(g)	T-SMA-2.85	Middle Mortandad/Ten Site
33	35-014(g3)	T-SMA-2.5	Middle Mortandad/Ten Site
34	35-016(a)	T-SMA-5	Middle Mortandad/Ten Site
35	35-016(b)	T-SMA-3	Middle Mortandad/Ten Site
36	35-016(c)	T-SMA-4	Middle Mortandad/Ten Site
37	35-016(d)	T-SMA-4	Middle Mortandad/Ten Site
38	35-016(e)	M-SMA-10.01	Middle Mortandad/Ten Site
~~39~~	~~35-016(f)~~	~~M-SMA-9.1~~	~~Middle Mortandad/Ten Site~~
40	35-016(g)	M-SMA-7	Middle Mortandad/Ten Site
41	35-016(h)	M-SMA-6	Middle Mortandad/Ten Site
42	35-016(i)	M-SMA-10.3	Middle Mortandad/Ten Site
43	35-016(k)	Pratt-SMA-1.05	Middle Mortandad/Ten Site
44	35-016(l)	Pratt-SMA-1.05	Middle Mortandad/Ten Site
~~45~~	~~35-016(m)~~[e]	~~Pratt-SMA-1.05~~	~~Middle Mortandad/Ten Site~~
45	35-016(n)	T-SMA-2.85	Middle Mortandad/Ten Site
46	35-016(o)	M-SMA-11.1	Middle Mortandad/Ten Site
47	35-016(p)	M-SMA-12	Middle Mortandad/Ten Site
48	35-016(q)	T-SMA-5	Middle Mortandad/Ten Site
49	42-001(a)	M-SMA-5	Upper Mortandad
50	42-001(b)	M-SMA-5	Upper Mortandad
51	42-001(c)	M-SMA-5	Upper Mortandad
52	42-002(a)	M-SMA-5	Upper Mortandad
53	42-002(b)	M-SMA-5	Upper Mortandad
~~54~~	~~46-003(b)~~	~~CDB-SMA-1.65~~	~~Upper Cañada del Buey~~
54	46-003(c)	CDB-SMA-1	Upper Cañada del Buey
~~55~~	~~46-003(e)~~	~~CDB-SMA-1.55~~	~~Upper Cañada del Buey~~
~~55~~	~~46-004(a2)~~	~~CDB-SMA-1.35~~	~~Upper Cañada del Buey~~
55	46-004(b)	CDB-SMA-1.15	Upper Cañada del Buey
56	46-004(c2)	CDB-SMA-0.25	Upper Cañada del Buey
57	46-004(d2)	CDB-SMA-1	Upper Cañada del Buey
~~58~~	~~46-004(e2)~~	~~CDB-SMA-0.55~~	~~Upper Cañada del Buey~~
58	46-004(e2)	CDB-SMA-0.25	Upper Cañada del Buey
59	46-004(f)	CDB-SMA-1	Upper Cañada del Buey
60	46-004(g)	CDB-SMA-0.55	Upper Cañada del Buey
~~61~~	~~46-004(h)~~	~~CDB-SMA-1.54~~	~~Upper Cañada del Buey~~
61	46-004(m)	CDB-SMA-0.55	Upper Cañada del Buey
~~62~~	~~46-004(q)~~	~~CDB-SMA-1.54~~	~~Upper Cañada del Buey~~
62	46-004(s)	CDB-SMA-0.55	Upper Cañada del Buey

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
63	46-004(t)	CDB-SMA-1	Upper Cañada del Buey
~~64~~	~~46-004(u)~~	~~CDB-SMA-1.35~~	~~Upper Cañada del Buey~~
~~64~~	~~46-004(v)~~	~~CDB-SMA-1.35~~	~~Upper Cañada del Buey~~
64	46-004(w)	CDB-SMA-1	Upper Cañada del Buey
~~65~~	~~46-004(x)~~	~~CDB-SMA-1.35~~	~~Upper Cañada del Buey~~
65	46-004(y)	CDB-SMA-1.15	Upper Cañada del Buey
66	46-004(z)	CDB-SMA-1.15	Upper Cañada del Buey
67	46-006(d)	CDB-SMA-1.15	Upper Cañada del Buey
	~~46-006(d)~~	~~CDB-SMA-1.35~~	~~Upper Cañada del Buey~~
	~~46-006(d)~~	~~CDB-SMA-1.54~~	~~Upper Cañada del Buey~~
68	46-006(f)	CDB-SMA-0.55	Upper Cañada del Buey
~~69~~	~~46-008(f)~~	~~CDB-SMA-1.35~~	~~Upper Cañada del Buey~~
69	46-008(g)	CDB-SMA-1	Upper Cañada del Buey
70	46-009(a)	CDB-SMA-1	Upper Cañada del Buey
~~71~~	~~C-46-001~~	~~CDB-SMA-1~~	~~Upper Cañada del Buey~~
71	48-001	M-SMA-3	Upper Mortandad
	48-001	M-SMA-3.1	Upper Mortandad
	48-001	M-SMA-3.5	Upper Mortandad
	48-001	M-SMA-4	Upper Mortandad
72	48-003	M-SMA-3.5	Upper Mortandad
73	48-005	M-SMA-3	Upper Mortandad
	48-005	M-SMA-4	Upper Mortandad
74	48-007(a)	M-SMA-4	Upper Mortandad
75	48-007(b)	M-SMA-3.1	Upper Mortandad
76	48-007(c)	M-SMA-3	Upper Mortandad
77	48-007(d)	M-SMA-4	Upper Mortandad
78	48-010	M-SMA-4	Upper Mortandad
79	50-006(a)	T-SMA-1	Upper Mortandad
80	50-006(d)	M-SMA-7.9	Upper Mortandad
81	50-009	T-SMA-1	Upper Mortandad
82	54-017	CDB-SMA-4	Lower Pajarito
	54-017	PJ-SMA-18	Lower Pajarito
	54-017	PJ-SMA-19	Lower Pajarito
	54-017	PJ-SMA-20	Lower Pajarito
83	54-018	CDB-SMA-4	Lower Pajarito
	54-018	PJ-SMA-17	Lower Pajarito
84	54-020	CDB-SMA-4	Lower Pajarito
	54-020	PJ-SMA-19	Lower Pajarito

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
Pajarito			
1	03-001(k)	2M-SMA-1.8	Twomile
2	03-003(a)	2M-SMA-1.9	Twomile
3	03-003(k)	2M-SMA-2.2	Twomile
4	03-010(a)	2M-SMA-1	Twomile
5	03-050(d)	2M-SMA-2	Twomile
6	03-054(b)	2M-SMA-2	Twomile
7	03-055(a)	2M-SMA-1.7	Twomile
8	06-001(a)	2M-SMA-1.42	Twomile
9	06-001(b)	2M-SMA-1.44	Twomile
10	06-003(h)	2M-SMA-1.67	Twomile
11	06-006	2M-SMA-1.45	Twomile
12	07-001(a)	2M-SMA-3	Twomile
13	07-001(b)	2M-SMA-3	Twomile
14	07-001(c)	2M-SMA-3	Twomile
15	07-001(d)	2M-SMA-3	Twomile
16	08-009(d)	STRM-SMA-1.5	Starmer/Upper Pajarito
17	08-009(f)	STRM-SMA-1.05	Starmer/Upper Pajarito
~~18~~	~~09-004(g)~~	~~PJ-SMA-4.05~~	~~Starmer/Upper Pajarito~~
18	09-004(o)	PJ-SMA-3.05	Starmer/Upper Pajarito
19	09-005(g)	PJ-SMA-4.05	Starmer/Upper Pajarito
20	09-008(b)	STRM-SMA-4.2	Starmer/Upper Pajarito
21	09-009	PJ-SMA-2	Starmer/Upper Pajarito
22	09-013	PJ-SMA-1.05	Starmer/Upper Pajarito
	09-013	STRM-SMA-5.05	Starmer/Upper Pajarito
23	15-006(b)	3M-SMA-0.4	Threemile
24	15-006(c)	3M-SMA-0.5	Threemile
25	15-008(b)	3M-SMA-0.6	Threemile
26	15-009(c)	3M-SMA-0.5	Threemile
27	15-010(b)	3M-SMA-0.2	Threemile
~~28~~	~~18-002(a)~~	~~PJ-SMA-13~~	~~Lower Pajarito~~
28	18-002(b)	3M-SMA-4	Lower Pajarito
29	18-003(c)	3M-SMA-4	Lower Pajarito
30	18-003(e)	PJ-SMA-14.3	Lower Pajarito
31	18-010(b)	PJ-SMA-13.7	Lower Pajarito
32	18-010(d)	PJ-SMA-14.4	Lower Pajarito
33	18-010(e)	PJ-SMA-14.6	Lower Pajarito
34	18-010(f)	3M-SMA-4	Lower Pajarito
35	18-012(a)	PJ-SMA-14.8	Lower Pajarito

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
36	18-012(b)	PJ-SMA-14.2	Lower Pajarito
37	22-010(b)	PJ-SMA-5.1	Starmer/Upper Pajarito
38	22-014(a)	2M-SMA-1.43	Twomile
39	22-014(b)	2M-SMA-1.5	Twomile
40	22-015(a)	2M-SMA-1.43	Twomile
41	22-015(c)	PJ-SMA-5	Starmer/Upper Pajarito
~~42~~	~~22-016~~	~~PJ-SMA-5.1~~	~~Starmer/Upper Pajarito~~
42	27-002	PJ-SMA-16	Lower Pajarito
43	36-008	3M-SMA-2.6	Threemile
44	C-36-003	3M-SMA-2.6	Threemile
45	40-001(c)	2M-SMA-2.5	Starmer/Upper Pajarito
46	40-003(a)	PJ-SMA-11	Starmer/Upper Pajarito
47	40-003(b)	PJ-SMA-11.1	Starmer/Upper Pajarito
48	40-005	2M-SMA-1.65	Twomile
49	40-006(a)	PJ-SMA-10	Starmer/Upper Pajarito
50	40-006(b)	PJ-SMA-8	Starmer/Upper Pajarito
51	40-006(c)	PJ-SMA-7	Starmer/Upper Pajarito
52	40-009	PJ-SMA-9	Starmer/Upper Pajarito
53	40-010	PJ-SMA-6	Starmer/Upper Pajarito
~~54~~	~~54-004~~	~~PJ-SMA-14~~	~~Middle Cañada del Buey~~
54	54-013(b)	PJ-SMA-19	Lower Pajarito
55	54-014(d)	PJ-SMA-18	Lower Pajarito
56	54-017	CDB-SMA-4	Lower Pajarito
	54-017	PJ-SMA-18	Lower Pajarito
	54-017	PJ-SMA-19	Lower Pajarito
	54-017	PJ-SMA-20	Lower Pajarito
57	54-018	CDB-SMA-4	Lower Pajarito
	54-018	PJ-SMA-17	Lower Pajarito
58	54-020	CDB-SMA-4	Lower Pajarito
	54-020	PJ-SMA-19	Lower Pajarito
Water/Cañon de Valle			
1	11-001(c)	W-SMA-6	Upper Water
2	11-002	W-SMA-10	S-Site
3	11-003(b)	W-SMA-10	S-Site
4	11-005(a)	W-SMA-10	S-Site
5	11-005(b)	W-SMA-10	S-Site
6	11-005(c)	W-SMA-9.8	S-Site
7	11-006(b)	W-SMA-9.9	S-Site
8	11-006(c)	W-SMA-10	S-Site

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
9	11-006(d)	W-SMA-10	S-Site
10	11-011(a)	W-SMA-9.7	S-Site
11	11-011(b)	W-SMA-9.7	S-Site
12	11-011(d)	W-SMA-10	S-Site
13	11-012(c)	W-SMA-9.5	S-Site
14	13-001	CDV-SMA-2.3	S-Site
	13-001	W-SMA-8.7	S-Site
15	13-002	CDV-SMA-2.3	S-Site
	13-002	W-SMA-8.7	S-Site
16	14-001(g)	CDV-SMA-6.01	Cañon de Valle
~~17~~	~~14-002(d)~~	~~CDV-SMA-6.02~~	~~Cañon de Valle~~
~~17~~	~~14-002(e)~~	~~CDV-SMA-6.02~~	~~Cañon de Valle~~
17	14-002(c)	CDV-SMA-6.02	Cañon de Valle
18	14-006	CDV-SMA-6.01	Cañon de Valle
19	14-009	CDV-SMA-3	Cañon de Valle
20	14-010	CDV-SMA-4	Cañon de Valle
21	15-003[f]	PT-SMA-1.7	Potrillo/Fence
22	15-004(f)	PT-SMA-1	Potrillo/Fence
23	15-004(h)	W-SMA-14.1	Lower Water/Indio
~~24~~	~~15-006(a)~~	~~PT-SMA-1.7~~	~~Potrillo/Fence~~
24	15-007(b)	CDV-SMA-9.05	Cañon de Valle
25	15-008(a)	PT-SMA-1	Potrillo/Fence
26	15-008(d)	CDV-SMA-7	Cañon de Valle
27	15-008(f)	PT-SMA-2	Potrillo/Fence
28	15-009(e)	PT-SMA-0.5	Potrillo/Fence
29	15-011(c)	CDV-SMA-8	Cañon de Valle
30	15-014(a)	CDV-SMA-8.5	Cañon de Valle
31	15-014(l)	W-SMA-14.1	Lower Water/Indio
32	C-15-004	PT-SMA-0.5	Potrillo/Fence
33	16-001(e)	W-SMA-5	S-Site
34	16-003(a)	W-SMA-4.1	S-Site
35	16-003(f)	W-SMA-5	S-Site
36	16-003(n)	CDV-SMA-2.3	Cañon de Valle
37	16-003(o)	CDV-SMA-2.3	Cañon de Valle
38	16-004(a)	W-SMA-8.7	S-Site
39	16-004(c)	W-SMA-8.71	S-Site
40	16-006(c)	W-SMA-7.9	Upper Water
~~41~~	~~16-010(b)~~	~~CDV-SMA-2.42~~	~~Cañon de Valle~~
~~41~~	~~16-010(c)~~	~~CDV-SMA-2.5~~	~~Cañon de Valle~~

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
~~41~~	~~16-010(d)~~	~~CDV-SMA-2.5~~	~~Cañon de Valle~~
41	16-010(i)	CDV-SMA-2.51	Cañon de Valle
42	16-016(g)	W-SMA-8	Upper Water
43	16-017(a)-99	CDV-SMA-1.3	Cañon de Valle
44	16-017(b)-99	CDV-SMA-1.2	Cañon de Valle
45	16-017(j)-99	W-SMA-1	Upper Water
~~46~~	~~16-018~~	~~CDV-SMA-2.41~~	~~Cañon de Valle~~
46	16-019	CDV-SMA-1.7	Cañon de Valle
47	16-020	CDV-SMA-1.4	Cañon de Valle
48	16-021(c)	CDV-SMA-2	Cañon de Valle
49	16-026(b)	W-SMA-5	S-Site
50	16-026(b2)	W-SMA-1.5	Upper Water
51	16-026(c)	W-SMA-5	S-Site
52	16-026(c2)	W-SMA-1	Upper Water
53	16-026(d)	W-SMA-5	S-Site
54	16-026(e)	W-SMA-5	S-Site
~~55~~	~~16-026(h2)~~	~~W-SMA-7~~	~~Upper Water~~
55	16-026(i)	CDV-SMA-1.45	Cañon de Valle
56	16-026(j2)	W-SMA-8.7	Cañon de Valle
57	16-026(l)	CDV-SMA-1.4	Cañon de Valle
58	16-026(m)	CDV-SMA-1.3	Cañon de Valle
59	16-026(v)	W-SMA-1	Upper Water
60	16-026(y)	W-SMA-3.5	Upper Water
61	16-028(a)	CDV-SMA-2.5	Cañon de Valle
62	16-028(b)	W-SMA-8	Upper Water
63	16-028(c)	CDV-SMA-1.4	Cañon de Valle
64	16-028(d)	W-SMA-1.5	Upper Water
65	16-028(e)	W-SMA-2.05	Upper Water
66	16-029(e)	W-SMA-7	Upper Water
67	16-029(h)	CDV-SMA-2.3	S-Site
	16-029(h)	W-SMA-8.7	S-Site
68	16-029(k)	CDV-SMA-1.2	Cañon de Valle
~~69~~	~~16-030(c)~~	~~CDV-SMA-1.4~~	~~Cañon de Valle~~
69	16-030(g)	W-SMA-9.05	Upper Water
70	16-031(a)	W-SMA-7.8	Upper Water
71	16-031(h)	CDV-SMA-2.3	S-Site
72	16-035	W-SMA-8.7	S-Site
73	36-003(b)	PT-SMA-2	Potrillo/Fence
74	36-004(a)	PT-SMA-3	Potrillo/Fence

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
75	36-004(c)	F-SMA-2	Potrillo/Fence
76	36-004(d)	PT-SMA-4.2	Potrillo/Fence
77	36-004(e)	PT-SMA-2	Potrillo/Fence
78	36-006	PT-SMA-3	Potrillo/Fence
79	C-36-001	PT-SMA-2.01	Potrillo/Fence
80	C-36-006(e)	PT-SMA-2.01	Potrillo/Fence
81	49-001(g)	W-SMA-12.05	North Ancho
82	49-005(a)	W-SMA-15.1	North Ancho
83	49-008(c)	W-SMA-11.7	North Ancho
Ancho			
1	33-004(k)	A-SMA-6	South Ancho
2	33-007(a)	A-SMA-6	South Ancho
3	33-010(a)	A-SMA-6	South Ancho
4	33-010(d)	A-SMA-4	South Ancho
5	39-001(b)	A-SMA-2.8	North Ancho
6	39-002(b)	A-SMA-3	North Ancho
7	39-002(c)	A-SMA-2.7	North Ancho
8	39-004(a)	A-SMA-1.1	North Ancho
9	39-004(b)	A-SMA-2	North Ancho
10	39-004(c)	A-SMA-3	North Ancho
11	39-004(d)	A-SMA-1.1	North Ancho
12	39-004(e)	A-SMA-2	North Ancho
13	39-006(a)	A-SMA-3.5	North Ancho
14	39-008	A-SMA-2.7	North Ancho
15	39-010	A-SMA-2.5	North Ancho
Chaquehui			
1	33-002(d)	CHQ-SMA-1.01	Chaquehui
2	33-004(d)	CHQ-SMA-2	Chaquehui
3	33-004(g)	CHQ-SMA-0.5	Chaquehui
4	33-004(h)	CHQ-SMA-1.02	Chaquehui
5	33-004(j)	CHQ-SMA-6	Chaquehui
6	33-006(a)	CHQ-SMA-6	Chaquehui
7	33-007(b)	CHQ-SMA-5.05	Chaquehui
	33-007(b)	CHQ-SMA-6	Chaquehui
8	33-007(c)	CHQ-SMA-0.5	Chaquehui
	33-007(c)	CHQ-SMA-2	Chaquehui
9	33-008(c)	CHQ-SMA-1.02	Chaquehui
	33-008(c)	CHQ-SMA-1.03	Chaquehui
10	33-009	CHQ-SMA-0.5	Chaquehui

Table 3 (continued)

SWMU Count	Site ID	SMA ID	Aggregate Area
11	33-010(c)	CHQ-SMA-6	Chaquehui
12	33-010(f)	CHQ-SMA-3.05	Chaquehui
13	33-010(g)	CHQ-SMA-6	Chaquehui
	33-010(g)	CHQ-SMA-7.1	Chaquehui
14	33-010(h)	CHQ-SMA-6	Chaquehui
15	33-011(b)	CHQ-SMA-4.5	Chaquehui
16	33-011(d)	CHQ-SMA-1.02	Chaquehui
17	33-011(e)	CHQ-SMA-4	Chaquehui
18	33-012(a)	CHQ-SMA-1.03	Chaquehui
19	33-014	CHQ-SMA-6	Chaquehui
20	33-015	CHQ-SMA-1.02	Chaquehui
21	33-016	CHQ-SMA-4.1	Chaquehui
22	33-017	CHQ-SMA-1.03	Chaquehui
23	C-33-001	CHQ-SMA-1.03	Chaquehui
24	C-33-003	CHQ-SMA-1.03	Chaquehui
	C-33-003	CHQ-SMA-2	Chaquehui

* Redline strikeout items are Sites requested for deletion per section 9.0.

Table 4
Site-Specific Compliance Status

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
R001	R-SMA-0.5	12/16/2010	08/03/2012	09/12/2012	C-00-020	MPS[b]	CACompD	11/29/2012	—[c]	08/21/2013
					C-00-020	MPS	DelSiteR	10/14/2015	—	—
R002	R-SMA-1	05/16/2011	08/19/2011	10/13/2011	C-00-041	MPS	CACompD	03/06/2017	—	03/06/2017
R003	R-SMA-1.95	12/16/2010	08/19/2011	05/01/2012	00-015	MPS	CAM	09/25/2014	In Process	—
R004	R-SMA-2.05	12/01/2010	—	—	00-011(c)	MPS	DelSiteR	10/14/2015	—	—
			In Process	—	00-011(c)	MPS	MEx	10/31/2011	—	—
R005	R-SMA-2.3	12/01/2010	06/14/2013	—	00-011(e)	MPS	BCComp	07/23/2013	—	—
R006	R-SMA-2.5	12/16/2010	In Process	—	00-011(a)	MPS	MEx	04/30/2012	—	—
B001	B-SMA-0.5	12/16/2010	09/13/2013	10/30/2013	10-001(a)	MPS	CACompD	04/27/2017	—	04/27/2017
					10-001(b)	MPS	CACompD	04/27/2017	—	04/27/2017
					10-001(c)	MPS	CACompD	04/27/2017	—	04/27/2017
					10-001(d)	MPS	CACompD	04/27/2017	—	04/27/2017
					10-004(a)	MPS	CACompD	04/27/2017	—	04/27/2017
					10-004(b)	MPS	CACompD	04/27/2017	—	04/27/2017
					10-008	MPS	CACompD	04/27/2017	—	04/27/2017
					10-009	MPS	CACompD	04/27/2017	—	04/27/2017
B002	B-SMA-1	12/16/2010	09/13/2013	10/22/2013	00-011(d)	MPS	CACompD	11/22/2013	—	11/22/2013
P001	ACID-SMA-1.05	12/01/2010	08/21/2011	—	00-030(g)	MPS	BCComp	11/01/2011	—	—
P002	ACID-SMA-2	12/01/2010	08/19/2011	11/03/2011	01-002(b)-00	MPS	CAM	10/14/2016	01/10/2018	—
					45-001	MPS	CACompD	03/07/2013	—	03/07/2013
					45-002	MPS	CACompD	03/07/2013	—	03/07/2013
					45-004	MPS	CACompD	03/07/2013	—	03/07/2013
				01/10/2018	01-002(b)-00	MPS	S6B	01/10/2018	na[d]	In Process
P002A	ACID-SMA-2.01	12/16/2010	In Process	—	00-030(f)	MPS	MEx	04/30/2012	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
P003	ACID-SMA-2.1	12/01/2010	08/03/2012	09/07/2012	01-002(b)-00	MPS	CAM	10/14/2016	01/12/2018	—
				01/12/2018	01-002(b)-00	MPS	S6B	01/12/2018	—	—
P004	P-SMA-0.3	12/16/2010	07/25/2013	09/05/2013	00-018(b)	MPS	CACompD	09/16/2013	—	09/16/2013
P005	P-SMA-1	12/01/2010	In Process	—	73-001(a)	HPS[e]	MEx	10/31/2011	—	—
					73-004(d)	HPS	MEx	10/31/2011	—	—
P006	P-SMA-2	12/01/2010	09/05/2014	10/14/2014	73-002	MPS	CACompD	04/16/2015	—	04/16/2015
					73-006	MPS	CACompD	04/16/2015	—	04/16/2015
P007	P-SMA-2.15	12/16/2010	In Process	—	31-001	MPS	MEx	04/30/2012	—	—
P008	P-SMA-2.2	05/16/2011	In Process	—	00-019	HPS	MEx	04/30/2012	—	—
P009	P-SMA-3.05	12/16/2010	09/13/2013	10/22/2013	00-018(a)	HPS	CACompD	04/16/2015	—	04/16/2015
L001	LA-SMA-0.85	12/01/2010	—	10/07/2011	03-055(c)	MPS	CAM	10/23/2012	06/24/2013	—
				06/24/2013	03-055(c)	MPS	AltCompR	05/06/2015	—	—
L002	LA-SMA-0.9	12/16/2010	In Process	—	00-017	MPS	MEx	04/30/2012	—	—
					C-00-044	MPS	MEx	04/30/2012	—	—
L003	LA-SMA-1	12/16/2010	08/19/2011	04/30/2012	00-017	MPS	CAM	11/27/2012	10/08/2014	—
					C-00-044	MPS	CAM	11/27/2012	10/08/2014	—
				10/08/2014	00-017	MPS	CACompC	09/29/2015	—	09/29/2015
					C-00-044	MPS	AltCompR	05/06/2015	—	—
L004	LA-SMA-1.1	12/16/2010	08/19/2011	10/11/2011	43-001(b2)	MPS	CACompD	11/29/2012	—	08/21/2013
L005	LA-SMA-1.25	12/01/2010	08/28/2011	10/27/2011	C-43-001	MPS	CAM	08/30/2012	11/15/2012	—
				11/15/2012	C-43-001	MPS	AltCompR	05/06/2015	—	—
L006	LA-SMA-2.1	05/16/2011	09/13/2013	11/03/2013	01-001(f)	HPS	CAM	09/25/2014	In Process	—
L007	LA-SMA-2.3	12/16/2010	08/21/2011	05/01/2012	01-001(b)	MPS	CACompD	11/29/2012	—	08/21/2013
L008	LA-SMA-3.1	12/01/2010	10/24/2018	12/10/2018	01-001(e)	HPS	S7	—	—	—
					01-003(a)	HPS	S7	—	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
L009	LA-SMA-3.9	12/16/2010	In Process	—	01-001(g)	MPS	MEx	04/30/2012	—	—
					01-006(a)	MPS	MEx	04/30/2012	—	—
L010	LA-SMA-4.1	12/01/2010	09/04/2011	11/08/2011	01-003(b)	MPS	AltCompR	05/06/2015	—	—
					01-006(b)	MPS	AltCompR	05/06/2015	—	—
L011	LA-SMA-4.2	12/01/2010	In Process	—	01-001(c)	MPS	MEx	10/31/2011	—	—
					01-006(c)	MPS	MEx	10/31/2011	—	—
					01-006(d)	MPS	MEx	10/31/2011	—	—
L012	LA-SMA-5.01	12/16/2010	In Process	—	01-001(d)	HPS	MEx	04/30/2012	—	—
					01-006(h)	HPS	MEx	04/30/2012	—	—
L012A	LA-SMA-5.02	05/16/2011	08/19/2011	10/25/2011	01-003(e)	HPS	CACompD	11/29/2012	—	11/29/2012
L013	LA-SMA-5.2	05/16/2011	In Process	—	01-003(d)	MPS	MEx	04/30/2012	—	—
L014	LA-SMA-5.35	12/01/2010	09/07/2011	10/27/2011	C-41-004	MPS	CAM	11/27/2012	10/20/2014	—
				10/20/2014	C-41-004	MPS	AltCompR	05/06/2015	—	—
L015	LA-SMA-5.31	12/16/2010	08/19/2011	04/30/2012	41-002(c)	MPS	CAM	07/27/2012	In Process	—
L016	LA-SMA-5.33	12/16/2010	08/21/2011	04/30/2012	32-004	MPS	CACompD	07/30/2012	—	08/21/2013
L017	LA-SMA-5.361	04/28/2011	In Process	—	32-002(b1)	MPS	MEx	04/30/2012	—	—
					32-002(b2)	MPS	MEx	04/30/2012	—	—
L017A	LA-SMA-5.362	04/28/2011	In Process	—	32-003	MPS	MEx	04/30/2012	—	—
L018	LA-SMA-5.51	04/28/2011	07/12/2013	08/21/2013	02-003(a)	HPS	CAM	06/26/2014	In Process	—
					02-003(e)	HPS	CAM	06/26/2014	In Process	—
					02-004(a)	HPS	CAM	06/26/2014	In Process	—
					02-005	HPS	CAM	06/26/2014	In Process	—
					02-006(b)	HPS	CAM	06/26/2014	In Process	—
					02-006(c)	HPS	CAM	06/26/2014	In Process	—
					02-006(d)	HPS	CAM	06/26/2014	In Process	—
					02-006(e)	HPS	CAM	06/26/2014	In Process	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
L018 (continued)	LA-SMA-5.51 (continued)	04/28/2011	07/12/2013	08/21/2013	02-008(a)	HPS	CAM	06/26/2014	In Process	—
					02-009(b)	HPS	CAM	06/26/2014	In Process	—
					02-011(a)	HPS	CAM	06/26/2014	In Process	—
					02-011(b)	HPS	CAM	06/26/2014	In Process	—
					02-011(c)	HPS	CAM	06/26/2014	In Process	—
					02-011(d)	HPS	CAM	06/26/2014	In Process	—
					02-014	HPS	CAM	06/26/2014	In Process	—
L018A	LA-SMA-5.52	04/28/2011	07/29/2014	10/20/2014	02-003(b)	HPS	CAM	10/28/2015	In Process	—
					02-007	HPS	CAM	10/28/2015	In Process	—
					02-008(c)	HPS	CAM	10/28/2015	In Process	—
L018B	LA-SMA-5.53	04/28/2011	In Process	—	02-009(a)	HPS	MEx	04/30/2012	—	—
L018C	LA-SMA-5.54	04/28/2011	09/13/2013	11/03/2013	02-009(c)	HPS	CAM	09/25/2014	In Process	—
L019	LA-SMA-5.91	12/01/2010	09/07/2011	10/31/2011	21-009	MPS	CAM	07/08/2013	08/25/2014	—
					21-021	MPS	CAM	07/08/2013	08/25/2014	—
					21-023(c)	MPS	CACompD	08/21/2013	—	08/21/2013
					21-027(d)	MPS	CAM	07/08/2013	08/25/2014	—
				08/21/2014	21-009	MPS	CACompD	03/06/2017	—	03/06/2017
					21-021	MPS	AltCompR	05/06/2015	—	—
					21-027(d)	MPS	FMCOC	01/19/2016	na	—
L019A	LA-SMA-5.92	12/01/2010	07/12/2013	08/27/2013	21-013(b)	MPS	CACompD	11/22/2013	—	11/22/2013
					21-013(b)	MPS	CAM	10/28/2015	In Process	—
					21-013(g)	MPS	CACompD	11/22/2013	—	11/22/2013
					21-018(a)	MPS	CACompD	11/22/2013	—	11/22/2013
					21-021	MPS	CAM	10/28/2015	In Process	—
L020	LA-SMA-6.25	12/01/2010	In Process	—	21-021	MPS	MEx	10/31/2011	—	—
					21-024(d)	MPS	MEx	10/31/2011	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
					21-027(c)	MPS	MEx	10/31/2011	—	—
L021	LA-SMA-6.27	12/01/2010	In Process	—	21-021	MPS	MEx	10/31/2011	—	—
					21-027(c)	MPS	MEx	10/31/2011	—	—
L022	LA-SMA-6.3	12/16/2010	In Process	—	21-006(b)	MPS	MEx	04/30/2012	—	—
L022A	LA-SMA-6.31	12/16/2010	In Process	—	21-027(a)	MPS	MEx	04/30/2012	—	—
L023	LA-SMA-6.32	12/16/2010	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
L024	LA-SMA-6.34	12/16/2010	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
					21-022(h)	MPS	MEx	04/30/2012	—	—
L025	LA-SMA-6.36	12/16/2010	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
					21-024(a)	MPS	MEx	04/30/2012	—	—
L026	LA-SMA-6.38	12/16/2010	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
					21-024(c)	MPS	MEx	04/30/2012	—	—
L027	LA-SMA-6.395	12/16/2010	09/13/2013	10/25/2013	21-021	MPS	AltCompR	05/06/2015	—	—
					21-024(j)	MPS	CACompD	03/06/2017	—	03/06/2017
L028	LA-SMA-6.5	12/16/2010	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
					21-024(i)	HPS	MEx	04/30/2012	—	—
L029	LA-SMA-9	04/28/2011	08/10/2014	09/17/2014	26-001	MPS	AltCompR	05/06/2015	—	—
					26-002(a)	MPS	AltCompR	05/06/2015	—	—
					26-002(b)	MPS	AltCompR	05/06/2015	—	—
					26-003	MPS	AltCompR	05/06/2015	—	—
L030	LA-SMA-10.11	12/16/2010	In Process	—	53-002(a)	MPS	MEx	04/30/2012	—	—
L030A	LA-SMA-10.12	05/16/2011	09/01/2011	05/01/2012	53-008	MPS	CAM	11/30/2012	10/27/2015	—
				10/27/2015	53-008	MPS	CACompA	03/04/2016	—	03/04/2016
D001	DP-SMA-0.3	04/28/2011	08/19/2011	05/01/2012	21-029	MPS	CAM	07/08/2013	10/30/2013	—
				10/30/2013	21-029	MPS	CACompD	03/06/2017	—	03/06/2017
D002	DP-SMA-0.4	12/16/2010	09/13/2013	10/26/2013	21-021	MPS	AltCompR	05/06/2015	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
D003	DP-SMA-0.6	04/28/2011	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
					21-024(l)	MPS	MEx	04/30/2012	—	—
D004	DP-SMA-1	12/16/2010	In Process	—	21-011(k)	MPS	MEx	04/30/2012	—	—
					21-021	MPS	MEx	04/30/2012	—	—
D005	DP-SMA-2	12/01/2010	In Process	—	21-021	MPS	MEx	10/31/2011	—	—
					21-024(h)	MPS	MEx	10/31/2011	—	—
D006	DP-SMA-2.35	12/16/2010	09/13/2013	10/30/2013	21-021	MPS	AltCompR	05/06/2015	—	—
					21-024(n)	MPS	AltCompR	05/06/2015	—	—
D007	DP-SMA-3	02/11/2011	07/29/2011	05/01/2012	21-013(c)	MPS	CACompD	03/06/2017	—	03/06/2017
					21-021	MPS	CAM	08/30/2012	In Process	—
D008	DP-SMA-4	12/16/2010	In Process	—	21-021	MPS	MEx	04/30/2012	—	—
S001	S-SMA-0.25	12/01/2010	08/15/2011	10/20/2011	03-013(a)	HPS	CAM	06/26/2014	11/03/2014	—
					03-052(f)	HPS	CAM	06/26/2014	11/03/2014	—
				11/03/2014	03-013(a)	HPS	CACompC	09/29/2015	—	09/29/2015
					03-052(f)	HPS	FMCOC	09/10/2015	—	—
S002	S-SMA-1.1	05/16/2011	08/04/2011	11/02/2011	03-029	HPS	CAM	11/27/2012	10/07/2014	—
				10/07/2014	03-029	HPS	FMCOC	09/23/2013	—	—
S003	S-SMA-2	12/01/2010	08/13/2011	10/20/2011	03-012(b)	HPS	CAM	07/08/2013	09/10/2013	—
					03-045(b)	HPS	CAM	07/08/2013	09/10/2013	—
					03-045(c)	HPS	CAM	07/08/2013	09/10/2013	—
					03-056(c)	HPS	CACompD	08/21/2013	—	08/21/2013
				09/10/2013	03-012(b)	HPS	FMCOC	09/23/2013	—	—
					03-045(b)	HPS	AltCompA	09/10/2013	—	—
					03-045(b)	HPS	DelSiteR	10/21/2015	—	—
					03-045(c)	HPS	AltCompA	09/10/2013	—	—
					03-045(c)	HPS	DelSiteR	10/21/2015	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
S003A	S-SMA-2.01	12/16/2010	09/07/2011	11/02/2011	03-052(b)	HPS	FMCOC	09/23/2013	—	—
S004	S-SMA-2.8	12/16/2010	In Process	—	03-014(c2)	MPS	MEx	04/30/2012	—	—
S005	S-SMA-3.51	12/16/2010	In Process	—	03-009(i)	HPS	MEx	04/30/2012	—	—
S005A	S-SMA-3.52	12/16/2010	In Process	—	03-021	HPS	MEx	04/30/2012	—	—
S005B	S-SMA-3.53	12/16/2010	08/04/2011	04/30/2012	03-014(b2)	HPS	CAM	05/02/2013	08/18/2014	—
				08/18/2014	03-014(b2)	HPS	FMCOC	09/23/2013	—	—
S006	S-SMA-3.6	12/01/2010	08/13/2011	10/20/2011	60-007(b)	HPS	CAM	11/27/2012	08/13/2013	—
				08/13/2013	60-007(b)	HPS	FMCOC	09/23/2013	—	—
S007	S-SMA-3.7	12/16/2010	In Process	—	53-012(e)	MPS	MEx	04/30/2012	—	—
S008	S-SMA-3.71	12/16/2010	In Process	—	53-001(a)	MPS	MEx	04/30/2012	—	—
S009	S-SMA-3.72	12/16/2010	07/20/2015	08/28/2015	53-001(b)	MPS	CACompD	10/29/2015	—	10/30/2015
S010	S-SMA-3.95	05/16/2011	09/13/2013	10/25/2013	20-002(a)	MPS	AltCompR	05/06/2015	—	—
S011	S-SMA-4.1	12/16/2010	09/01/2011	11/02/2011	53-014	HPS	CACompD	10/29/2015	—	08/21/2013
S012	S-SMA-4.5	05/16/2011	In Process	—	20-002(d)	MPS	MEx	04/30/2012	—	—
S013	S-SMA-5	05/16/2011	In Process	—	20-002(c)	HPS	MEx	04/30/2012	—	—
S014	S-SMA-5.2	12/16/2010	In Process	—	20-003(c)	MPS	MEx	04/30/2012	—	—
S015	S-SMA-5.5	05/16/2011	07/31/2014	09/11/2014	20-005	MPS	AltCompR	05/06/2015	—	—
S016	S-SMA-6	05/16/2011	08/19/2011	11/02/2011	72-001	HPS	CAM	10/15/2015	07/27/2016	—
				07/27/2016	72-001	HPS	CAM2	07/27/2016	01/16/2018	—
				01/16/2018	72-001	HPS	S7	—	—	—
C001	CDB-SMA-0.15	12/01/2010	07/20/2015	08/25/2015	04-003(a)	MPS	AltCompR	02/26/2016	—	—
					04-004	MPS	AltCompR	02/26/2016	—	—
C002	CDB-SMA-0.25	12/01/2010	09/01/2011	11/02/2011	46-004(c2)	MPS	CAM	07/20/2012	10/22/2013	—
					46-004(e2)	MPS	CAM	07/20/2012	10/22/2013	—
				10/22/2013	46-004(c2)	MPS	AltCompR	05/06/2015	—	—
					46-004(e2)	MPS	AltCompR	05/06/2015	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
C003	CDB-SMA-0.55	01/12/2011	09/13/2013	10/25/2013	46-004(g)	MPS	AltCompR	05/06/2015	—	—
					46-004(m)	MPS	CACompD	11/22/2013	—	11/22/2013
					46-004(s)	MPS	AltCompR	05/06/2015	—	—
					46-006(f)	MPS	AltCompR	05/06/2015	—	—
C004	CDB-SMA-1	1/12/11	09/07/2011	04/30/2012	46-003(c)	MPS	CAM	07/30/2012	11/05/2013	—
					46-004(d2)	MPS	CAM	07/30/2012	11/05/2013	—
					46-004(f)	MPS	CAM	07/30/2012	11/05/2013	—
					46-004(t)	MPS	CAM	07/30/2012	11/05/2013	—
					46-004(w)	MPS	CAM	07/30/2012	11/05/2013	—
					46-008(g)	MPS	CAM	07/30/2012	11/05/2013	—
					46-009(a)	MPS	CAM	07/30/2012	11/05/2013	—
					C-46-001	MPS	CACompD	11/29/2012	—	11/29/2012
				11/05/2013	46-003(c)	MPS	CAM2	09/04/2015	In Process	—
					46-004(d2)	MPS	CAM2	09/04/2015	In Process	—
					46-004(f)	MPS	CAM2	09/04/2015	In Process	—
					46-004(t)	MPS	CAM2	09/04/2015	In Process	—
					46-004(w)	MPS	CAM2	09/04/2015	In Process	—
					46-008(g)	MPS	CAM2	09/04/2015	In Process	—
					46-009(a)	MPS	CAM2	09/04/2015	In Process	—
					C-46-001	MPS	DelSiteR	10/14/2015	—	—
C005	CDB-SMA-1.15	12/01/2010	In Process	—	46-004(b)	MPS	MEx	10/31/2011	—	—
					46-004(y)	MPS	MEx	10/31/2011	—	—
					46-004(z)	MPS	MEx	10/31/2011	—	—
					46-006(d)	MPS	MEx	10/31/2011	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
C006	CDB-SMA-1.35	12/01/2010	In Process	—	46-004(a2)	MPS	MEx	10/31/2011	—	—
					46-004(u)	MPS	MEx	10/31/2011	—	—
					46-004(v)	MPS	MEx	10/31/2011	—	—
					46-004(x)	MPS	MEx	10/31/2011	—	—
					46-006(d)	MPS	MEx	10/31/2011	—	—
					46-008(f)	MPS	MEx	10/31/2011	—	—
C007	CDB-SMA-1.54	12/01/2010	In Process	—	46-004(h)	MPS	MEx	10/31/2011	—	—
					46-004(q)	MPS	MEx	10/31/2011	—	—
					46-006(d)	MPS	MEx	10/31/2011	—	—
C008	CDB-SMA-1.55	12/01/2010	In Process	—	46-003(e)	MPS	MEx	10/31/2011	—	—
C009	CDB-SMA-1.65	12/01/2010	In Process	—	46-003(b)	MPS	MEx	10/31/2011	—	—
C010	CDB-SMA-4	12/16/2010	07/25/2013	08/27/2013	54-017	HPS	CACompC	08/27/2014	—	08/27/2014
					54-018	HPS	CACompC	08/27/2014	—	08/27/2014
					54-020	HPS	CACompC	08/27/2014	—	08/27/2014
M001	M-SMA-1	12/01/2010		11/02/2011	03-050(a)	MPS	CAM	11/27/2012	08/13/2013	—
					03-054(e)	MPS	CAM	11/27/2012	08/13/2013	—
				08/13/2013	03-050(a)	MPS	AltCompR	05/06/2015	—	—
					03-054(e)	MPS	AltCompR	05/06/2015	—	—
M002	M-SMA-1.2	12/16/2010	09/13/2013	10/30/2013	03-049(a)	MPS	CAM	09/25/2014	01/16/2018	—
				01/16/2018	03-049(a)	MPS	S6B	01/16/2018	—	—
M002A	M-SMA-1.21	12/16/2010	10/24/2018	12/10/2018	03-049(e)	MPS	S7	—	—	—
M002B	M-SMA-1.22	02/11/2011	09/15/2011	05/01/2012	03-045(h)	MPS	CAM	05/02/2013	10/20/2014	—
				10/20/2014	03-045(h)	MPS	AltCompR	05/06/2015	—	—
M003	M-SMA-3	05/16/2011	07/12/2013	08/13/2013	48-001	MPS	AltCompR	05/06/2015	—	—
					48-005	MPS	CAM	10/15/2015	In Process	—
					48-007(c)	MPS	AltCompR	05/06/2015	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
M004	M-SMA-3.1	12/16/2010	In Process	—	48-001	MPS	MEx	04/30/2012	—	—
					48-007(b)	MPS	MEx	04/30/2012	—	—
M005	M-SMA-3.5	05/16/2011	In Process	—	48-001	MPS	MEx	04/30/2012	—	—
					48-003	HPS	MEx	04/30/2012	—	—
M006	M-SMA-4	12/01/2010	08/19/2011	10/31/2011	48-001	MPS	AltCompR	05/06/2015	—	—
					48-005	MPS	CACompC	09/29/2015	—	09/29/2015
					48-007(a)	MPS	CACompD	08/21/2013	—	08/21/2013
					48-007(d)	MPS	CACompD	08/21/2013	—	08/21/2013
					48-010	MPS	CACompD	08/21/2013	—	08/21/2013
M007	M-SMA-5	05/16/2011	In Process	—	42-001(a)	MPS	MEx	04/30/2012	—	—
					42-001(b)	MPS	MEx	04/30/2012	—	—
					42-001(c)	MPS	MEx	04/30/2012	—	—
					42-002(a)	MPS	MEx	04/30/2012	—	—
					42-002(b)	MPS	MEx	04/30/2012	—	—
M008	M-SMA-6	12/16/2010	10/12/2012	11/15/2012	35-016(h)	MPS	AltCompR	05/06/2015	—	—
M009	M-SMA-7	12/16/2010	07/07/2012	08/22/2012	35-016(g)	MPS	AltCompR	05/06/2015	—	—
M010	M-SMA-7.9	12/16/2010	09/13/2013	10/25/2013	50-006(d)	HPS	AltCompR	04/21/2014	—	—
M011	M-SMA-9.1	02/11/2011	In Process	—	35-016(f)	MPS	MEx	04/30/2012	—	—
M012	M-SMA-10	12/16/2010	06/30/2013	08/13/2013	35-008	MPS	CACompD	10/30/2015	—	10/30/2015
					35-014(e)	MPS	CACompD	10/30/2015	—	10/30/2015
M012A	M-SMA-10.01	12/16/2010	09/15/2011	11/15/2011	35-016(e)	MPS	CAM	09/25/2012	—	—
				09/25/2012	35-016(e)	MPS	CACompD	10/30/2015	—	10/30/2015
M013	M-SMA-10.3	05/16/2011	08/19/2011	10/24/2011	35-014(e2)	HPS	CACompD	10/30/2013	—	10/30/2013
					35-016(i)	HPS	CACompD	10/30/2013	—	10/30/2013
M014	M-SMA-11.1	12/16/2010	In Process	—	35-016(o)	MPS	MEx	04/30/2012	—	—
M015	M-SMA-12	04/28/2011	07/07/2015	08/11/2015	35-016(p)	MPS	CACompD	10/30/2015	—	10/30/2015

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
M016	M-SMA-12.5	12/01/2010	In Process	—	05-005(b)	MPS	MEx	10/31/2011	—	—
					05-006(c)	MPS	MEx	10/31/2011	—	—
M017	M-SMA-12.6	05/16/2011	09/13/2013	10/22/2013	05-004	MPS	FMCOC	10/30/2015	—	—
M018	M-SMA-12.7	12/16/2010	In Process	—	05-002	MPS	MEx	04/30/2012	—	—
					05-005(a)	MPS	MEx	04/30/2012	—	—
					05-006(b)	MPS	MEx	04/30/2012	—	—
					05-006(e)	MPS	MEx	04/30/2012	—	—
M019	M-SMA-12.8	12/16/2010	In Process	—	05-001(a)	MPS	MEx	04/30/2012	—	—
					05-002	MPS	MEx	04/30/2012	—	—
M020	M-SMA-12.9	12/16/2010	07/20/2015	08/25/2015	05-001(b)	MPS	CACompD	10/30/2015	—	10/30/2015
					05-002	MPS	CACompD	10/30/2015	—	10/30/2015
M021	M-SMA-12.92	12/01/2010	In Process	—	00-001	MPS	MEx	10/31/2011	—	—
M022	M-SMA-13	12/16/2010	09/13/2013	—	05-001(c)	MPS	BCComp	10/21/2013	—	—
T001	Pratt-SMA-1.05	12/16/2010	09/13/2013	10/30/2013	35-003(h)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-003(p)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-003(r)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-004(h)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-004(h)	HPS	DelSiteR	10/14/2015	—	—
					35-009(d)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-016(k)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-016(l)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-016(m)	HPS	CACompD	10/30/2015	—	10/30/2015
					35-016(m)	HPS	DelSiteR	10/14/2015	—	—
T002	T-SMA-1	12/16/2010	08/15/2011	10/21/2011	50-006(a)	HPS	FMCOC	09/23/2013	—	—
					50-009	HPS	CACompC	10/31/2013	—	10/31/2013
T003	T-SMA-2.5	12/16/2010	In Process	—	35-014(g3)	MPS	MEx	04/30/2012	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
T004	T-SMA-2.85	12/16/2010	07/12/2013	08/21/2013	35-014(g)	MPS	CACompD	10/30/2015	—	10/30/2015
					35-016(n)	MPS	CACompD	10/30/2015	—	10/30/2015
T005	T-SMA-3	12/16/2010	09/12/2012	10/19/2012	35-016(b)	MPS	CACompD	10/30/2015	—	10/30/2015
T006	T-SMA-4	12/16/2010	09/13/2013	10/25/2013	35-004(a)	MPS	CAM	10/15/2015	10/30/2015	—
					35-009(a)	MPS	CAM	10/15/2015	10/30/2015	—
					35-016(c)	MPS	CAM	10/15/2015	10/30/2015	—
					35-016(d)	MPS	CAM	10/15/2015	10/30/2015	—
T007	T-SMA-5	12/16/2010	In Process	—	35-004(a)	MPS	MEx	04/30/2012	—	—
					35-009(a)	MPS	MEx	04/30/2012	—	—
					35-016(a)	MPS	MEx	04/30/2012	—	—
					35-016(q)	MPS	MEx	04/30/2012	—	—
T008	T-SMA-6.8	12/16/2010	07/31/2014	09/17/2014	35-010(e)	MPS	CACompD	10/30/2015	—	10/30/2015
T009	T-SMA-7	12/16/2010	09/12/2017	01/16/2018	04-003(b)	MPS	S6B	01/16/2018	—	—
T010	T-SMA-7.1	12/16/2010	In Process	—	04-001	MPS	MEx	04/30/2012	—	—
					04-002	MPS	MEx	04/30/2012	—	—
E001	2M-SMA-1	12/01/2010	08/20/2011	10/18/2011	03-010(a)	MPS	CAM	07/20/2012	10/19/2012	—
				10/19/2012	03-010(a)	MPS	AltCompR	05/06/2015	—	—
E002	2M-SMA-1.42	01/12/2011	09/15/2011	11/10/2011	06-001(a)	MPS	CAM	06/27/2012	02/26/2016	—
E003	2M-SMA-1.43	12/01/2010	07/12/2013	08/21/2013	22-014(a)	MPS	AltCompR	05/06/2015	—	—
					22-015(a)	MPS	AltCompR	05/06/2015	—	—
E004	2M-SMA-1.44	01/12/2011	08/21/2011	04/30/2012	06-001(b)	MPS	CAM	06/27/2012	10/20/2014	—
				10/20/2014	06-001(b)	MPS	CAM2	09/04/2015	In Process	—
E005	2M-SMA-1.45	01/12/2011	09/07/2011	05/01/2012	06-006	MPS	CAM	08/20/2012	09/08/2015	—
				09/08/2015	06-006	MPS	CACompA	09/08/2015	—	09/08/2015
E006	2M-SMA-1.5	12/01/2010	In Process	—	22-014(b)	MPS	MEx	10/31/2011	—	—
E007	2M-SMA-1.65	01/12/2011	08/21/2011	05/01/2012	40-005	MPS	CAM	07/19/2012	In Process	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
E008	2M-SMA-1.67	04/28/2011	In Process	—	06-003(h)	MPS	MEx	04/30/2012	—	—
E009	2M-SMA-1.7	01/12/2011	09/09/2011	11/03/2011	03-055(a)	MPS	CAM	07/27/2012	09/29/2014	—
				09/29/2014	03-055(a)	MPS	AltCompR	05/06/2015	—	—
E010	2M-SMA-1.8	01/12/2011	09/09/2011	11/03/2011	03-001(k)	MPS	AltCompR	05/06/2015	—	—
E011	2M-SMA-1.9	01/12/2011	07/11/2012	08/23/2012	03-003(a)	MPS	AltCompR	05/06/2015	—	—
E012	2M-SMA-2	01/12/2011		11/03/2011	03-050(d)	MPS	CAM	05/02/2013	09/24/2013	—
					03-054(b)	MPS	CAM	05/02/2013	09/24/2013	—
				09/24/2013	03-050(d)	MPS	AltCompR	05/06/2015	—	—
					03-054(b)	MPS	AltCompR	05/06/2015	—	—
E013	2M-SMA-2.2	12/01/2010	09/04/2011	11/03/2011	03-003(k)	MPS	CACompC	09/29/2015	--	09/29/2015
E014	2M-SMA-3	01/12/2011	07/12/2013	08/16/2013	07-001(a)	MPS	CACompA	01/12/2018	01/12/2018	01/12/2018
					07-001(b)	MPS	CACompA	01/12/2018	01/12/2018	01/12/2018
					07-001(c)	MPS	CACompA	01/12/2018	01/12/2018	01/12/2018
					07-001(d)	MPS	CACompA	01/12/2018	01/12/2018	01/12/2018
E015	2M-SMA-2.5	01/12/2011	09/09/2012	—	40-001(c)	MPS	BCComp	10/19/2012	—	—
H001	3M-SMA-0.2	12/01/2010	07/15/2018	08/20/2018	15-010(b)	MPS	S7	—	—	—
H002	3M-SMA-0.4	01/12/2011	07/12/2013	08/27/2013	15-006(b)	MPS	AltCompR	05/06/2015	—	—
H003	3M-SMA-0.5	01/12/2011	07/09/2014	08/18/2014	15-006(c)	MPS	CAM	10/28/2015	In Process	—
					15-009(c)	MPS	AltCompR	05/06/2015	—	—
H004	3M-SMA-0.6	01/12/2011	In Process	—	15-008(b)	MPS	MEx	04/30/2012	—	—
H005	3M-SMA-2.6	04/28/2011	In Process	—	36-008	MPS	MEx	04/30/2012	—	—
					C-36-003	MPS	MEx	04/30/2012	—	—
H006	3M-SMA-4	01/12/2011	07/29/2014	10/20/2014	18-002(b)	MPS	CAM	10/28/2015	01/12/2018	—
					18-003(c)	MPS	CAM	10/28/2015	01/12/2018	—
					18-010(f)	MPS	CAM	10/28/2015	01/12/2018	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
H006 (continued)	3M-SMA-4 (continued)	01/12/2011	07/29/2014	01/12/2018	18-002(b)	MPS	S6B	01/12/2018	—	—
					18-003(c)	MPS	S6B	01/12/2018	—	—
					18-010(f)	MPS	S6B	01/12/2018	—	—
J001	PJ-SMA-1.05	12/01/2010	09/13/2013	11/03/2013	09-013	MPS	CAM	09/04/2015	In Process	—
J002	PJ-SMA-2	12/01/2010	In Process	—	09-009	MPS	MEx	10/31/2011	—	—
J003	PJ-SMA-3.05	02/11/2011	08/19/2011	04/30/2012	09-004(o)	MPS	CAM	07/18/2012	In Process	—
J004	PJ-SMA-4.05	12/01/2010	09/13/2013	10/30/2013	09-004(g)	MPS	AltCompR	05/06/2015	—	—
					09-005(g)	MPS	AltCompR	05/06/2015	—	—
J005	PJ-SMA-5	12/01/2010	10/12/2012	11/15/2012	22-015(c)	MPS	CAM	08/10/2015	In Process	—
J006	PJ-SMA-5.1	01/12/2011	09/07/2011	10/31/2011	22-010(b)	MPS	CAM	07/18/2012	In Process	—
				10/31/2011	22-016	MPS	CAM	07/18/2012	In Process	—
J007	PJ-SMA-6	12/01/2010	07/08/2014	08/18/2014	40-010	MPS	AltCompR	05/06/2015	—	—
J008	PJ-SMA-7	12/01/2010	In Process	—	40-006(c)	MPS	MEx	10/31/2011	—	—
J009	PJ-SMA-8	12/01/2010	In Process	—	40-006(b)	MPS	MEx	10/31/2011	—	—
J010	PJ-SMA-9	12/01/2010	06/21/2014	08/04/2014	40-009	MPS	CAM	10/28/2015	In Process	—
J012	PJ-SMA-10	01/12/2011	07/04/2014	08/11/2014	40-006(a)	MPS	CAM	10/28/2015	10/05/2016	—
				10/06/2016	40-006(a)	MPS	CAM2	04/07/2017	—	—
J013	PJ-SMA-11	01/12/2011	09/13/2013	10/30/2013	40-003(a)	MPS	CAM	08/10/2015	In Process	—
J014	PJ-SMA-11.1	01/12/2011	09/13/2013	10/30/2013	40-003(b)	MPS	CAM	08/10/2015	In Process	—
J015	PJ-SMA-13	04/28/2011	In Process	—	18-002(a)	MPS	MEx	04/30/2012	—	—
J016	PJ-SMA-13.7	01/12/2011	09/01/2011	05/01/2012	18-010(b)	MPS	CAM	07/08/2013	In Process	—
J017	PJ-SMA-14	04/28/2011	In Process	—	54-004	MPS	MEx	04/30/2012	—	—
J018	PJ-SMA-14.2	12/01/2010	In Process	—	18-012(b)	MPS	MEx	10/31/2011	—	—
J019	PJ-SMA-14.3	12/01/2010	In Process	—	18-003(e)	MPS	MEx	10/31/2011	—	—
J020	PJ-SMA-14.4	04/28/2011	In Process	—	18-010(d)	MPS	MEx	04/30/2012	—	—
J021	PJ-SMA-14.6	12/01/2010	In Process	—	18-010(e)	MPS	MEx	10/31/2011	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
J022	PJ-SMA-14.8	01/12/2011	08/18/2011	—	18-012(a)	MPS	BCComp	05/01/2012	—	—
J023	PJ-SMA-16	12/01/2010	08/08/2013	—	27-002	MPS	BCComp	09/11/2013	—	—
J024	PJ-SMA-17	12/01/2010	07/25/2013	09/05/2013	54-018	HPS	CACompC	08/27/2014	—	08/27/2014
J026	PJ-SMA-18	12/01/2010	07/25/2013	09/03/2013	54-014(d)	MPS	CACompC	08/28/2014	—	08/28/2014
					54-017	HPS	CACompC	08/28/2014	—	08/28/2014
J025	PJ-SMA-19	12/01/2010	08/08/2013	09/12/2013	54-013(b)	HPS	CACompC	08/28/2014	—	08/28/2014
					54-017	HPS	CACompC	08/28/2014	—	08/28/2014
					54-020	HPS	CACompC	08/28/2014	—	08/28/2014
J027	PJ-SMA-20	12/16/2010	08/22/2011	05/01/2012	54-017	HPS	CACompC	10/25/2013	—	10/25/2013
J028	STRM-SMA-1.05	12/01/2010	08/26/2011	10/17/2011	08-009(f)	MPS	CAM	05/02/2013	09/10/2013	—
				09/10/2013	08-009(f)	MPS	AltCompR	05/06/2015	—	—
J029	STRM-SMA-1.5	12/01/2010	07/11/2012	08/27/2012	08-009(d)	MPS	CAM	07/08/2013	10/21/2013	—
				10/21/2013	08-009(d)	MPS	CAM2	09/04/2015	In Process	—
J030	STRM-SMA-4.2	12/01/2010	09/09/2011	11/10/2011	09-008(b)	MPS	CAM	08/21/2012	09/27/2017	—
				01/16/2018	09-008(b)	MPS	BEC2	01/16/2018	—	—
J031	STRM-SMA-5.05	12/01/2010	08/21/2011	10/31/2011	09-013	MPS	CAM	06/27/2012	02/26/2016	—
V001	CDV-SMA-1.2	01/12/2011	08/02/2015	—	16-017(b)-99	MPS	BCComp	09/14/2015	—	—
					16-029(k)	MPS	BCComp	09/14/2015	—	—
V002	CDV-SMA-1.3	01/12/2011	09/13/2013	10/25/2013	16-017(a)-99	MPS	CACompD	09/26/2016	—	09/26/2016
					16-026(m)	MPS	CACompD	09/26/2016	—	09/26/2016
V003	CDV-SMA-1.4	01/12/2011	09/10/2012	10/18/2012	16-020	MPS	CAM	05/12/2014	In Process	—
					16-026(l)	MPS	CAM	05/12/2014	In Process	—
					16-028(c)	MPS	CAM	05/12/2014	In Process	—
					16-030(c)	MPS	CACompD	08/21/2013	—	08/21/2013
					16-030(c)	MPS	DelSiteR	10/14/2015	—	—
V004	CDV-SMA-1.45	01/12/2011	08/21/2011	04/30/2012	16-026(i)	MPS	CAM	07/18/2012	In Process	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
V005	CDV-SMA-1.7	01/12/2011	09/13/2013	10/25/2013	16-019	MPS	CAM	09/04/2015	In Process	—
V006	CDV-SMA-2	05/16/2011	07/12/2013	08/20/2013	16-021(c)	MPS	AltCompR	05/06/2015	—	—
V007	CDV-SMA-2.3	01/12/2011	07/20/2015	08/26/2015	13-001	MPS	AltCompR	02/26/2016	—	—
					13-002	MPS	AltCompR	02/26/2016	—	—
					16-003(n)	MPS	AltCompR	02/26/2016	—	—
					16-003(o)	MPS	AltCompR	02/26/2016	—	—
					16-029(h)	MPS	AltCompR	02/26/2016	—	—
					16-031(h)	MPS	AltCompR	02/26/2016	—	—
V008	CDV-SMA-2.41	01/12/2011	08/21/2011	05/01/2012	16-018	MPS	CAM	06/26/2014	In Process	—
					16-018	MPS	DelSiteR	10/21/2015	—	—
V008A	CDV-SMA-2.42	01/12/2011	07/12/2013	08/26/2013	16-010(b)	MPS	CAM	09/28/2015	01/16/2018	—
				01/16/2018	16-010(b)	MPS	DelSiteR	10/21/2015	—	—
					16-010(b)	MPS	BEC2	01/16/2018	—	—
V009	CDV-SMA-2.5	01/12/2011	07/26/2013	—	16-010(c)	MPS	BCComp	08/29/2013	—	—
					16-010(c)	MPS	DelSiteR	10/21/2015	—	—
					16-010(d)	MPS	BCComp	08/29/2013	—	—
					16-010(d)	MPS	DelSiteR	10/21/2015	—	—
					16-028(a)	MPS	BCComp	08/29/2013	—	—
V009A	CDV-SMA-2.51	01/12/2011	09/13/2013	10/25/2013	16-010(i)	MPS	AltCompR	05/06/2015	—	—
V010	CDV-SMA-3	02/11/2011	08/21/2011	04/30/2012	14-009	MPS	CAM	07/18/2012	In Process	—
V011	CDV-SMA-4	02/11/2011	In Process	—	14-010	MPS	MEx	04/30/2012	—	—
V012	CDV-SMA-6.01	02/11/2011	07/31/2014	10/20/2014	14-001(g)	MPS	CAM	10/15/2015	In Process	—
					14-006	MPS	CAM	10/15/2015	In Process	—
V012A	CDV-SMA-6.02	02/11/2011	09/01/2011	10/31/2011	14-002(c)	MPS	CAM	07/18/2012	In Process	—
					14-002(d)	MPS	CAM	07/18/2012	In Process	—
					14-002(e)	MPS	CAM	07/18/2012	In Process	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
V013	CDV-SMA-7	01/12/2011	09/13/2013	10/30/2013	15-008(d)	MPS	CAM	09/04/2015	10/24/2018	—
				10/24/2018	15-008(d)	MPS	S7	—	—	—
V014	CDV-SMA-8	01/12/2011	07/31/2014	10/07/2014	15-011(c)	MPS	AltCompR	05/06/2015	—	—
V015	CDV-SMA-8.5	01/12/2011	In Process	—	15-014(a)	MPS	MEx	04/30/2012	—	—
V016	CDV-SMA-9.05	01/12/2011	08/10/2018	10/24/2018	15-007(b)	MPS	S7	—	—	—
F001	F-SMA-2	01/12/2011	08/15/2011	05/01/2012	36-004(c)	MPS	CAM	06/26/2014	09/08/2014	—
				09/08/2014	36-004(c)	MPS	CAM2	09/28/2015	In Process	—
I001	PT-SMA-0.5	04/28/2011	09/01/2011	05/01/2012	15-009(e)	MPS	CAM	11/27/2012	In Process	—
					C-15-004	MPS	CAM	11/27/2012	In Process	—
I002	PT-SMA-1	04/28/2011	09/01/2011	04/30/2012	15-004(f)	MPS	CAM	08/03/2012	10/07/2014	—
					15-008(a)	MPS	CAM	08/03/2012	10/07/2014	—
				10/07/2014	15-004(f)	MPS	CAM2	10/15/2015	09/26/2017	—
					15-008(a)	MPS	CAM2	10/15/2015	09/26/2017	—
				10/07/2014	15-004(f)	MPS	S6B	—	—	—
					15-008(a)	MPS	S6B	—	—	—
I003	PT-SMA-1.7	04/28/2011	04/28/2011	10/18/2012	15-003	MPS	CAM	06/26/2014	In Process	—
					15-006(a)	MPS	CAM	06/26/2014	In Process	—
I004	PT-SMA-2	04/28/2011	07/07/2014	08/11/2014	15-008(f)	MPS	CAM	09/28/2015	In Process	—
					36-003(b)	MPS	CAM	09/28/2015	In Process	—
					36-004(e)	MPS	CAM	09/28/2015	In Process	—
I004A	PT-SMA-2.01	04/28/2011	08/18/2011	04/30/2012	C-36-001	MPS	CACompC-Inv	08/28/2017	—	08/28/2017
					C-36-006(e)	MPS	CAM	08/03/2012	In Process	—
I005	PT-SMA-3	12/01/2010	07/15/2014	08/25/2014	36-004(a)	MPS	CAM	08/10/2015	In Process	—
					36-006	MPS	CAM	08/10/2015	In Process	—
I007	PT-SMA-4.2	12/01/2010	07/02/2014	08/11/2014	36-004(d)	MPS	CAM	10/28/2015	In Process	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
W001	W-SMA-1	12/01/2010	09/09/2011	11/08/2011	16-017(j)-99	MPS	CAM	05/02/2013	08/29/2014	—
					16-026(c2)	MPS	CAM	05/02/2013	08/29/2014	—
					16-026(v)	MPS	CAM	05/02/2013	08/29/2014	—
				08/29/2014	16-017(j)-99	MPS	CACompC	09/29/2015	—	09/29/2015
					16-026(c2)	MPS	AltCompR	05/06/2015	—	—
					16-026(v)	MPS	AltCompR	05/06/2016	—	—
W002	W-SMA-1.5	01/12/2011	09/01/2011	11/08/2011	16-026(b2)	MPS	CAM	09/25/2012	08/28/2014	—
					16-028(d)	MPS	CAM	09/25/2012	08/28/2014	—
				08/28/2014	16-026(b2)	MPS	CAM2	09/04/2015	In Process	—
					16-028(d)	MPS	CAM2	09/04/2015	In Process	—
W003	W-SMA-2.05	01/12/2011	08/21/2011	05/01/2012	16-028(e)	MPS	CAM	09/25/2012	In Process	—
W004	W-SMA-3.5	01/12/2011	In Process	—	16-026(y)	MPS	MEx	04/30/2012	—	—
W005	W-SMA-4.1	01/12/2011	In Process	—	16-003(a)	MPS	MEx	04/30/2012	—	—
W006	W-SMA-5	01/12/2011	07/03/2012	09/18/2012	16-001(e)	MPS	AltCompR	05/06/2015	—	—
					16-003(f)	MPS	AltCompR	05/06/2015	—	—
					16-026(b)	MPS	AltCompR	05/06/2015	—	—
					16-026(c)	MPS	AltCompR	05/06/2015	—	—
					16-026(d)	MPS	AltCompR	05/06/2015	—	—
					16-026(e)	MPS	AltCompR	05/06/2015	—	—
W007	W-SMA-6	01/12/2011	In Process	—	11-001(c)	MPS	MEx	04/30/2012	—	—
W008	W-SMA-7	01/12/2011	07/08/2014	08/11/2014	16-026(h2)	MPS	CAM	09/28/2015	In Process	—
					16-029(e)	MPS	CAM	09/28/2015	In Process	—
W009	W-SMA-7.8	01/12/2011	In Process	—	16-031(a)	MPS	MEx	04/30/2012	—	—
W010	W-SMA-7.9	01/12/2011	In Process	—	16-006(c)	MPS	MEx	04/30/2012	—	—
W011	W-SMA-8	01/12/2011	09/12/2013	10/25/2013	16-016(g)	MPS	CAM	08/10/2015	In Process	—
					16-028(b)	MPS	CAM	08/10/2015	In Process	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
W012	W-SMA-8.7	01/12/2011	09/12/2013	10/25/2013	13-001	MPS	AltCompR	05/06/2015	—	—
					13-002	MPS	AltCompR	05/06/2015	—	—
					16-004(a)	MPS	AltCompR	05/06/2015	—	—
					16-026(j2)	MPS	AltCompR	05/06/2015	—	—
					16-029(h)	MPS	AltCompR	05/06/2015	—	—
					16-035	MPS	AltCompR	05/06/2015	—	—
W012A	W-SMA-8.71	01/12/2011	08/21/2011	05/01/2012	16-004(c)	MPS	CAM	11/27/2012	10/30/2013	—
				10/30/2013	16-004(c)	MPS	CAM2	09/04/2015	In Process	—
W013	W-SMA-9.05	01/12/2011	09/13/2013	—	16-030(g)	MPS	BCComp	10/21/2013	—	—
W014	W-SMA-9.5	12/01/2010	09/27/2017	01/16/2018	11-012(c)	MPS	BEC	01/16/2018	—	—
W015	W-SMA-9.7	01/12/2011	09/13/2013	10/30/2013	11-011(a)	MPS	AltCompR	05/06/2015	—	—
					11-011(b)	MPS	AltCompR	05/06/2015	—	—
W016	W-SMA-9.8	01/12/2011	In Process	—	11-005(c)	MPS	MEx	04/30/2012	—	—
W017	W-SMA-9.9	01/12/2011	08/21/2011	04/30/2012	11-006(b)	MPS	CAM	06/27/2012	In Process	—
W018	W-SMA-10	01/12/2011	08/21/2011	05/01/2012	11-002	MPS	AltCompR	02/26/2016	—	—
					11-003(b)	MPS	AltCompR	02/26/2016	—	—
					11-005(a)	MPS	AltCompR	02/26/2016	—	—
					11-005(b)	MPS	AltCompR	02/26/2016	—	—
					11-006(c)	MPS	AltCompR	02/26/2016	—	—
					11-006(d)	MPS	AltCompR	02/26/2016	—	—
					11-011(d)	MPS	AltCompR	02/26/2016	—	—
W019	W-SMA-11.7	01/12/2011	09/01/2011	05/01/2012	49-008(c)	MPS	CAM	10/23/2012	In Process	—
W020	W-SMA-12.05	01/12/2011	In Process	—	49-001(g)	MPS	MEx	04/30/2012	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
W021	W-SMA-14.1	04/28/2011	08/18/2011	10/17/2011	15-004(h)	MPS	CAM	09/25/2012	08/25/2014	—
					15-014(l)	MPS	CAM	09/25/2012	08/25/2014	—
				08/25/2014	15-004(h)	MPS	AltCompR	05/06/2015	--	—
					15-014(l)	MPS	AltCompR	05/06/2015	--	—
W022	W-SMA-15.1	01/12/2011	09/01/2011	05/01/2012	49-005(a)	MPS	CAM	10/23/2012	In Process	—
A001	A-SMA-1.1	12/01/2010	08/10/2018	09/26/2018	39-004(a)	MPS	S7	—	—	—
					39-004(d)	MPS	S7	—	—	—
A002	A-SMA-2	02/11/2011	09/12/2013	10/22/2013	39-004(b)	MPS	CAM	08/10/2015	In Process	—
					39-004(e)	MPS	CAM	08/10/2015	In Process	—
A003	A-SMA-2.5	02/11/2011	In Process		39-010	MPS	MEx	04/30/2012	—	—
A004	A-SMA-2.7	02/11/2011	09/04/2011	10/27/2011	39-002(c)	MPS	CACompD	08/21/2013	—	08/21/2013
					39-008	MPS	CAM	08/23/2012	In Process	—
A005	A-SMA-2.8	02/11/2011	In Process		39-001(b)	MPS	MEx	04/30/2012	—	—
A006	A-SMA-3	12/01/2010	07/25/2013	08/29/2013	39-002(b)	MPS	CAM	09/04/2015	In Process	—
					39-004(c)	MPS	CAM	09/04/2015	In Process	—
A007	A-SMA-3.5	02/11/2011	07/25/2013	—	39-006(a)	MPS	BCComp	09/06/2013	—	—
A008	A-SMA-4	02/11/2011	07/23/2018	09/26/2018	33-010(d)	MPS	S7	—	—	—
A009	A-SMA-6	02/11/2011	08/04/2013	09/04/2013	33-004(k)	MPS	AltCompR	05/06/2015	—	—
					33-007(a)	MPS	AltCompR	05/06/2015	—	—
					33-010(a)	MPS	AltCompR	05/06/2015	—	—
Q001	CHQ-SMA-0.5	02/11/2011	07/23/2014	09/22/2014	33-004(g)	MPS	CAM	10/28/2015	In Process	—
					33-007(c)	MPS	CAM	10/28/2015	In Process	—
					33-009	MPS	CAM	10/28/2015	In Process	—
Q002	CHQ-SMA-1.01	02/11/2011	In Process	—	33-002(d)	MPS	MEx	04/30/2012	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
Q002A	CHQ-SMA-1.02	02/11/2011	08/21/2011	05/01/2012	33-004(h)	MPS	CAM	10/24/2012	11/03/2013	—
					33-008(c)	MPS	CAM	10/24/2012	11/03/2013	—
					33-011(d)	MPS	CAM	10/24/2012	11/03/2013	—
					33-015	MPS	CAM	10/24/2012	11/03/2013	—
				11/03/2013	33-004(h)	MPS	CAM2	09/04/2015	08/10/2018	—
					33-008(c)	MPS	CAM2	09/04/2015	08/10/2018	—
					33-011(d)	MPS	CAM2	09/04/2015	08/10/2018	—
					33-015	MPS	CAM2	09/04/2015	08/10/2018	—
				08/10/2018	33-004(h)	MPS	S7	—	—	—
					33-008(c)	MPS	S7	—	—	—
					33-011(d)	MPS	S7	—	—	—
					33-015	MPS	S7	—	—	—
Q002B	CHQ-SMA-1.03	02/11/2011	07/04/2012	08/27/2012	33-008(c)	MPS	CAM	05/13/2014	In Process	—
					33-012(a)	MPS	CAM	05/13/2014	In Process	—
					33-017	MPS	CAM	05/13/2014	In Process	—
					C-33-001	MPS	CAM	05/13/2014	In Process	—
					C-33-003	MPS	CAM	05/13/2014	In Process	—
Q003	CHQ-SMA-2	02/11/2011	07/04/2012	08/27/2012	33-004(d)	MPS	AltCompR	05/06/2015	—	—
					33-007(c)	MPS	CAM	10/28/2015	10/24/2018	—
					C-33-003	MPS	AltCompR	05/06/2015	—	—
				10/24/2018	33-007(c)	MPS	S7	—	—	—
Q004	CHQ-SMA-3.05	02/11/2011	09/10/2013	10/23/2013	33-010(f)	MPS	CAM	08/10/2015	In Process	—
Q005	CHQ-SMA-4	02/11/2011	07/23/2018	09/26/2018	33-011(e)	MPS	S7	—	—	—
Q006	CHQ-SMA-4.1	02/11/2011	09/13/2013	10/22/2013	33-016	MPS	AltCompR	05/06/2015	--	—
Q007	CHQ-SMA-4.5	02/11/2011	07/25/2013	09/05/2013	33-011(b)	MPS	AltCompR	05/06/2015	—	—
Q008	CHQ-SMA-5.05	12/01/2010	In Process	—	33-007(b)	MPS	MEx	10/31/2011	—	—

Table 4 (continued)

Permitted Feature	SMA	Certify Baseline Controls	Completion of Baseline Monitoring	Initiation of Corrective Action	Site Number	Priority	Compliance Status[a]	Compliance Status Initiation	Completion of Enhanced Control Monitoring	Completion of Corrective Action
Q009	CHQ-SMA-6	02/11/2011	07/25/2013	08/29/2013	33-004(j)	MPS	CAM	08/10/2015	In Process	—
					33-006(a)	MPS	CAM	08/10/2015	In Process	—
					33-007(b)	MPS	CAM	08/10/2015	In Process	—
					33-010(c)	MPS	CAM	08/10/2015	In Process	—
					33-010(g)	MPS	CAM	08/10/2015	In Process	—
					33-010(h)	MPS	CAM	08/10/2015	In Process	—
					33-014	MPS	CAM	08/10/2015	In Process	—
Q010	CHQ-SMA-7.1	02/11/2011	07/23/2018	09/26/2018	33-010(g)	MPS	S7	—	—	—

[a] Compliance Status codes:
AltCompA = Alternative compliance approved.
AltCompR = Alternative compliance requested.
BCComp = Baseline control measures complete (all results for all POCs are below TALs and no further sampling is required).
BEC = Build enhanced controls (enhanced controls are being built to initiate corrective action monitoring during spring of 2019).
BEC2 = Second round of build enhanced controls.
CACompA = Corrective action complete (all confirmation monitoring results are below TAL).
CACompC = Corrective action complete (control measures installed to totally eliminate exposure of pollutants to storm water, collect one informational sample).
CACompC-Inv = Corrective action complete (control measures installed to totally eliminate exposure of pollutants to storm water, collect one informational, investigative sample).
CACompD = Corrective action complete (RCRA Certificate of Completion under Consent Order, collect no sample).
CAM = Corrective action monitoring (collect two confirmation samples after installation of enhanced control measures).
CAM2 = Second round of corrective action monitoring (collect two confirmation samples after installation of enhanced control measures).
DelSiteR = Permittees submitted a request to delete Site.
FMCOC = Permittees submitted a request for an extension because of a force majeure event.
MEx = Extended baseline monitoring (confirmation monitoring will continue until a sample is collected).
S6B = Alternative compliance is suggested for the Site if other alternatives do not show that corrective action can be completed through Permit mechanisms.
S7 = An alternative analysis is planned to design controls to reduce or eliminate TAL exceedances.

[b] MPS = Medium Priority Site.

[c] — = Corrective action has not been initiated.

[d] na = Not applicable.

[e] HPS = High Priority Site.

Table 5
Summary of IP Compliance Status

Compliance Phase	Number of SMAs	Number of Sites*	Milestone	Status as of December 31, 2018
Baseline Control Measures Installation	250	405	April 30, 2011	Baseline control measure installation and implementation were completed on schedule.
Baseline Control Measures Certification	250	405	May 30, 2011	Baseline control measure certification was completed on schedule.
Baseline Monitoring	250	405	October 31, 2011 April 30, 2012	Baseline monitoring ended on the milestone date.
Baseline Monitoring Extended	79	107	As applicable	Baseline monitoring is extended until one confirmation sample can be collected.
Baseline Confirmation Complete	10	13	October 31, 2013 October 31, 2015	No TAL exceedances were observed at 11 Medium Priority Sites during baseline monitoring.
Corrective Action Initiated	161	299	As applicable	See Section 4 of the Annual Report for details on the criteria used to determine which SMAs require corrective action.
Evaluating Corrective Action	12	17	As applicable	Corrective action is being evaluated at 12 SMAs where monitoring was completed in 2018.
Corrective Action Complete	13	20	October 13, 2013	Corrective action has been completed at 15 High Priority Sites.
	37	61	October 13, 2015	Corrective action has been completed at 21 Medium Priority Sites.
Alternative Compliance Approved	1	4	As applicable	Alternative compliance for Sites 03-012(b), 03-045(b), 03-045(c) and 03-056(c) in S-SMA-2.
Deletion of Site	9	12	As applicable	Deletion of Site from the Permit has not been requested.

* The number of Sites may add up to more than 405 (the number of permitted Sites) because some Sites are assigned to more than one SMA in different compliance phases.

Table 6
Summary of Confirmation Monitoring Sampling Events by Year

Monitoring Year	SMA with Baseline Monitoring Completed	SMAs with Enhanced Control Measures Installed	SMA with all Monitoring Complete	Baseline Monitoring Samples Collected	Corrective Action Monitoring Samples Collected
2011	71	0	0	106	0
2012	13	42	4	15	7
2013	54	10	10	56	34
2014	17	12	3	17	21
2015	6	37	48	6	6
2016	0	2	10	0	2
2017	2	2	6	2	16
2018	8	0	2	8	13

Table 7
ATAL Exceedances

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
2M-SMA-1.42	CAM5	Gross Alpha*	pCi/L	15	16	1.067
2M-SMA-1.42	M18	Gross Alpha	pCi/L	15	19.92	1.328
2M-SMA-1.43	MEx	Gross Alpha	pCi/L	15	52	3.467
2M-SMA-1.44	M18	Gross Alpha	pCi/L	15	21.1	1.407
2M-SMA-1.45	M18	Gross Alpha	pCi/L	15	398	26.53
2M-SMA-1.65	CAM5	Gross Alpha	pCi/L	15	22.6	1.507
2M-SMA-1.65	M18	Gross Alpha	pCi/L	15	220	14.67
2M-SMA-2	CAM5	Total PCBs	µg/L	0.00064	0.02712	42.38
2M-SMA-2	M18	Total PCBs	µg/L	0.00064	0.0652	101.9
2M-SMA-2.2	CACompCInv	Total PCBs	µg/L	0.00064	0.0411	64.22
2M-SMA-2.2	M12	Total PCBs	µg/L	0.00064	0.008492	13.27
2M-SMA-2.2	CACompCInv	Gross Alpha	pCi/L	15	37.9	2.527
3M-SMA-0.2	MEx	Gross Alpha	pCi/L	15	127	8.467
3M-SMA-0.2	MEx	Mercury	µg/L	0.77	2.02	2.623
3M-SMA-0.4	MEx	Gross Alpha	pCi/L	15	120	8
3M-SMA-0.5	MEx	Gross Alpha	pCi/L	15	29.5	1.967
3M-SMA-4	MEx	Gross Alpha	pCi/L	15	259	17.27
A-SMA-1.1	MEx	Gross Alpha	pCi/L	15	333	22.2
A-SMA-1.1	MEx	Mercury	µg/L	0.77	1.08	1.403
A-SMA-1.1	MEx	Selenium	µg/L	5	7.88	1.576
A-SMA-2	MEx	Gross Alpha	pCi/L	15	23.7	1.58

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
A-SMA-2.7	M18	Gross Alpha	pCi/L	15	28.42	1.895
A-SMA-2.7	CAM5	Gross Alpha	pCi/L	15	175	11.67
A-SMA-3	CAM5	Total PCBs	µg/L	0.00064	3.4	5313
A-SMA-3	MEx	Total PCBs	µg/L	0.00064	3.06	4781
A-SMA-3	CAM5	Gross Alpha	pCi/L	15	90.8	6.053
A-SMA-3	MEx	Gross Alpha	pCi/L	15	136	9.067
A-SMA-3	MEx	Mercury	µg/L	0.77	9.04	11.74
A-SMA-3	MEx	Selenium	µg/L	5	12.1	2.42
A-SMA-4	MEx	Gross Alpha	pCi/L	15	122	8.133
A-SMA-6	MEx	Gross Alpha	pCi/L	15	29.6	1.973
ACID-SMA-2	CAM5	Total PCBs	µg/L	0.00064	0.07757	121.2
ACID-SMA-2	CAM5	Total PCBs	µg/L	0.00064	0.0341	53.28
ACID-SMA-2	M12	Total PCBs	µg/L	0.00064	0.0822	128.4
ACID-SMA-2	CAM5	Gross Alpha	pCi/L	15	106.3	7.088
ACID-SMA-2	CAM5	Gross Alpha	pCi/L	15	65.3	4.353
ACID-SMA-2	M12	Gross Alpha	pCi/L	15	40.5	2.7
ACID-SMA-2.1	CAM5	Total PCBs	µg/L	0.00064	0.02754	43.03
ACID-SMA-2.1	MEx	Total PCBs	µg/L	0.00064	0.0249	38.91
ACID-SMA-2.1	CAM5	Gross Alpha	pCi/L	15	41.21	2.747
ACID-SMA-2.1	MEx	Gross Alpha	pCi/L	15	24.8	1.653
B-SMA-0.5	MEx	Gross Alpha	pCi/L	15	486	32.4
B-SMA-1	MEx	Gross Alpha	pCi/L	15	126	8.4
CDB-SMA-0.25	CAM5	Total PCBs	µg/L	0.00064	0.003656	5.713
CDB-SMA-0.25	M12	Total PCBs	µg/L	0.00064	0.00635	9.922
CDB-SMA-0.55	MEx	Total PCBs	µg/L	0.00064	0.000711	1.111
CDB-SMA-1	CAM5	Total PCBs	µg/L	0.00064	0.0721	112.7
CDB-SMA-1	M18	Total PCBs	µg/L	0.00064	0.0233	36.41
CDB-SMA-1	CAM5	Gross Alpha	pCi/L	15	71.5	4.767
CDB-SMA-1	M18	Gross Alpha	pCi/L	15	15.2	1.013
CDB-SMA-4	MEx	Total PCBs	µg/L	0.00064	0.00437	6.828
CDB-SMA-4	MEx	Gross Alpha	pCi/L	15	54.8	3.653
CDV-SMA-0.05	MEx	Gross Alpha	pCi/L	15	16.4	1.093
CDV-SMA-1.3	MEx	Gross Alpha	pCi/L	15	34.7	2.313
CDV-SMA-1.45	M18	Gross Alpha	pCi/L	15	17.8	1.187
CDV-SMA-1.7	MEx	RDX	µg/L	200	908	4.54
CDV-SMA-1.7	MEx	Cyanide (WAD)	µg/L	10	17.5	1.75

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
CDV-SMA-1.7	MEx	Gross Alpha	pCi/L	15	36.9	2.46
CDV-SMA-2	MEx	Gross Alpha	pCi/L	15	18.2	1.213
CDV-SMA-2.3	MEx	Gross Alpha	pCi/L	15	54.4	3.627
CDV-SMA-2.41	CAM5	Total PCBs	µg/L	0.00064	0.0253	39.53
CDV-SMA-2.41	M18	Total PCBs	µg/L	0.00064	0.0241	37.66
CDV-SMA-2.41	CAM5	Gross Alpha	pCi/L	15	94.2	6.28
CDV-SMA-2.41	M18	Gross Alpha	pCi/L	15	231	15.4
CDV-SMA-2.42	CAM5	Total PCBs	µg/L	0.00064	0.0296	46.25
CDV-SMA-2.42	MEx	Total PCBs	µg/L	0.00064	0.0332	51.88
CDV-SMA-2.42	CAM5	Gross Alpha	pCi/L	15	63.02	4.201
CDV-SMA-2.42	MEx	Gross Alpha	pCi/L	15	89.3	5.953
CDV-SMA-2.51	MEx	Gross Alpha	pCi/L	15	16.4	1.093
CDV-SMA-3	M18	Gross Alpha	pCi/L	15	33.4	2.227
CDV-SMA-6.01	MEx	Gross Alpha	pCi/L	15	140	9.333
CDV-SMA-6.01	MEx	Ra-226+228	pCi/L	30	46.3	1.543
CDV-SMA-6.02	M18	Gross Alpha	pCi/L	15	171	11.4
CDV-SMA-6.02	M18	Mercury	µg/L	0.77	1.233	1.601
CDV-SMA-7	CAM5	Gross Alpha	pCi/L	15	203.2	13.55
CDV-SMA-7	MEx	Gross Alpha	pCi/L	15	191	12.73
CDV-SMA-7	MEx	Selenium	µg/L	5	5.33	1.066
CDV-SMA-8	MEx	Gross Alpha	pCi/L	15	53.4	3.56
CHQ-SMA-0.5	MEx	Total PCBs	ug/L	0.00064	0.0119	18.59
CHQ-SMA-0.5	MEx	Gross Alpha	pCi/L	15	88.3	5.887
CHQ-SMA-1.02	CAM5	Total PCBs	µg/L	0.00064	0.01028	16.06
CHQ-SMA-1.02	M18	Total PCBs	µg/L	0.00064	0.00922	14.41
CHQ-SMA-1.03	CAM5	Total PCBs	µg/L	0.00064	0.000863	1.348
CHQ-SMA-1.03	MEx	Total PCBs	µg/L	0.00064	0.0155	24.22
CHQ-SMA-1.03	CAM5	Gross Alpha	pCi/L	15	16.2	1.08
CHQ-SMA-1.03	MEx	Gross Alpha	pCi/L	15	63.5	4.233
CHQ-SMA-2	CAM5	Gross Alpha	pCi/L	15	60.57	4.038
CHQ-SMA-2	MEx	Gross Alpha	pCi/L	15	91.1	6.073
CHQ-SMA-3.05	MEx	Total PCBs	µg/L	0.00064	0.000851	1.33
CHQ-SMA-3.05	MEx	Gross Alpha	pCi/L	15	60.3	4.02
CHQ-SMA-4	MEx	Total PCBs	µg/L	0.00064	0.635	992.2
CHQ-SMA-4	MEx	Gross Alpha	pCi/L	15	978	65.2
CHQ-SMA-4	MEx	Selenium	µg/L	5	16	3.2

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
CHQ-SMA-4.1	MEx	Gross Alpha	pCi/L	15	34.5	2.3
CHQ-SMA-4.5	MEx	Gross Alpha	pCi/L	15	103	6.867
CHQ-SMA-6	MEx	Gross Alpha	pCi/L	15	157	10.47
CHQ-SMA-7.1	MEx	Gross Alpha	pCi/L	15	75.1	5.007
DP-SMA-0.3	CAM5	Gross Alpha	pCi/L	15	77.67	5.178
DP-SMA-0.3	M18	Gross Alpha	pCi/L	15	65.5	4.367
DP-SMA-0.3	M18	Ra-226+228	pCi/L	30	68.3	2.277
DP-SMA-2.35	MEx	Gross Alpha	pCi/L	15	25	1.667
DP-SMA-3	M18	Gross Alpha	pCi/L	15	174	11.6
F-SMA-2	CAM5	Gross Alpha	pCi/L	15	81.22	5.415
F-SMA-2	M18	Gross Alpha	pCi/L	15	140	9.333
LA-SMA-1	CACompClnv	Total PCBs	µg/L	0.00064	0.0232	36.25
LA-SMA-1	CAM5	Total PCBs	µg/L	0.00064	0.02314	36.16
LA-SMA-1	CACompClnv	Gross Alpha	pCi/L	15	31.1	2.073
LA-SMA-1	CAM5	Gross Alpha	pCi/L	15	178.4	11.89
LA-SMA-1	M18	Gross Alpha	pCi/L	15	1800	120
LA-SMA-1.1	M18	Gross Alpha	pCi/L	15	26.16	1.744
LA-SMA-10.12	M18	Gross Alpha	pCi/L	15	23	1.533
LA-SMA-2.1	MEx	Total PCBs	µg/L	0.00064	21.1	32970
LA-SMA-2.1	MEx	Gross Alpha	pCi/L	15	125	8.333
LA-SMA-2.3	M18	Gross Alpha	pCi/L	15	74.7	4.98
LA-SMA-4.1	M12	Total PCBs	µg/L	0.00064	0.0225	35.16
LA-SMA-4.1	M12	Gross Alpha	pCi/L	15	32.69	2.18
LA-SMA-5.02	M18	Total PCBs	µg/L	0.00064	0.06033	94.26
LA-SMA-5.31	M18	Gross Alpha	pCi/L	15	86	5.733
LA-SMA-5.33	M18	Gross Alpha	pCi/L	15	100	6.667
LA-SMA-5.35	CAM5	Gross Alpha	pCi/L	15	22.45	1.496
LA-SMA-5.35	M12	Gross Alpha	pCi/L	15	100.3	6.684
LA-SMA-5.51	MEx	Total PCBs	µg/L	0.00064	0.0591	92.34
LA-SMA-5.51	MEx	Gross Alpha	pCi/L	15	92.3	6.153
LA-SMA-5.51	MEx	Mercury	µg/L	0.77	2.39	3.104
LA-SMA-5.52	MEx	Total PCBs	µg/L	0.00064	0.307	479.7
LA-SMA-5.52	MEx	Gross Alpha	pCi/L	15	171	11.4
LA-SMA-5.52	MEx	Mercury	µg/L	0.77	0.994	1.291
LA-SMA-5.54	MEx	Total PCBs	µg/L	0.00064	0.0598	93.44
LA-SMA-5.54	MEx	Gross Alpha	pCi/L	15	356	23.73

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
LA-SMA-5.91	CAM5	Gross Alpha	pCi/L	15	51.51	3.434
LA-SMA-5.91	M12	Gross Alpha	pCi/L	15	92.6	6.173
LA-SMA-5.92	MEx	Gross Alpha	pCi/L	15	264	17.6
LA-SMA-5.92	MEx	Mercury	µg/L	0.77	2.89	3.753
LA-SMA-6.395	MEx	Gross Alpha	pCi/L	15	300	20
LA-SMA-9	MEx	Gross Alpha	pCi/L	15	208	13.87
M-SMA-1	M12	Total PCBs	µg/L	0.00064	0.04597	71.83
M-SMA-1	CAM5	Total PCBs	µg/L	0.00064	0.01035	16.17
M-SMA-1	M12	Gross Alpha	pCi/L	15	25.17	1.678
M-SMA-1	CAM5	Gross Alpha	pCi/L	15	19.16	1.278
M-SMA-1.2	MEx	Arsenic	µg/L	9	10.6	1.178
M-SMA-10	MEx	Gross Alpha	pCi/L	15	32.2	2.147
M-SMA-10.01	CAM5	Gross Alpha	pCi/L	15	19.6	1.307
M-SMA-10.3	M18	Total PCBs	µg/L	0.00064	0.00431	6.734
M-SMA-12	MEx	Total PCBs	µg/L	0.00064	0.00427	6.672
M-SMA-12.6	MEx	Gross Alpha	pCi/L	15	19.2	1.28
M-SMA-12.9	MEx	Gross Alpha	pCi/L	15	276	18.4
M-SMA-3	MEx	Total PCBs	µg/L	0.00064	0.0181	28.28
M-SMA-3	MEx	Gross Alpha	pCi/L	15	25.4	1.693
M-SMA-4	CACompCInv	Total PCBs	µg/L	0.00064	0.00897	14.02
M-SMA-4	M12	Total PCBs	µg/L	0.00064	0.0578	90.31
M-SMA-4	M12	Ra-226+228	pCi/L	30	70.3	2.343
M-SMA-6	MEx	Total PCBs	µg/L	0.00064	0.0349	54.53
M-SMA-6	MEx	Gross Alpha	pCi/L	15	168	11.2
M-SMA-7	MEx	Gross Alpha	pCi/L	15	46.3	3.087
M-SMA-7.9	MEx	Total PCBs	µg/L	0.00064	0.00215	3.359
M-SMA-7.9	MEx	Gross Alpha	pCi/L	15	51.4	3.427
P-SMA-0.3	MEx	Gross Alpha	pCi/L	15	28.6	1.907
P-SMA-0.3	MEx	Mercury	µg/L	0.77	39.3	51.04
P-SMA-0.3	MEx	Ra-226+228	pCi/L	30	55.6	1.853
P-SMA-0.3	MEx	Selenium	µg/L	5	10.7	2.14
P-SMA-2	MEx	Gross Alpha	pCi/L	15	130	8.667
P-SMA-3.05	MEx	Total PCBs	µg/L	0.00064	0.0868	135.6
PJ-SMA-1.05	MEx	Total PCBs	µg/L	0.00064	0.00872	13.63
PJ-SMA-10	MEx	Gross Alpha	pCi/L	15	280	18.67
PJ-SMA-11	CAM5	Gross Alpha	pCi/L	15	164	10.93

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
PJ-SMA-11	MEx	Gross Alpha	pCi/L	15	65.4	4.36
PJ-SMA-11	CAM5	Selenium	µg/L	5	5.48	1.096
PJ-SMA-11.1	MEx	Gross Alpha	pCi/L	15	89.4	5.96
PJ-SMA-13.7	M18	Gross Alpha	pCi/L	15	52.6	3.507
PJ-SMA-17	MEx	Gross Alpha	pCi/L	15	61.6	4.107
PJ-SMA-18	CACompCInv	Gross Alpha	pCi/L	15	33.6	2.24
PJ-SMA-18	MEx	Gross Alpha	pCi/L	15	23.6	1.573
PJ-SMA-19	MEx	Total PCBs	µg/L	0.00064	0.0204	31.88
PJ-SMA-19	MEx	Gross Alpha	pCi/L	15	51.2	3.413
PJ-SMA-19	MEx	Mercury	µg/L	0.77	1.67	2.169
PJ-SMA-19	MEx	Ra-226+228	pCi/L	30	43.7	1.457
PJ-SMA-3.05	M18	Cyanide (WAD)	µg/L	10	27.4	2.74
PJ-SMA-3.05	CAM5	Gross Alpha	pCi/L	15	40.8	2.72
PJ-SMA-3.05	M18	Gross Alpha	pCi/L	15	65.9	4.393
PJ-SMA-4.05	MEx	Gross Alpha	pCi/L	15	47.2	3.147
PJ-SMA-5.1	M18	Gross Alpha	pCi/L	15	40.87	2.725
PJ-SMA-6	MEx	Gross Alpha	pCi/L	15	81.6	5.44
PJ-SMA-9	MEx	Gross Alpha	pCi/L	15	41.6	2.773
Pratt-SMA-1.05	MEx	Total PCBs	µg/L	0.00064	0.447	698.4
Pratt-SMA-1.05	MEx	Gross Alpha	pCi/L	15	96.5	6.433
Pratt-SMA-1.05	MEx	Mercury	µg/L	0.77	0.91	1.182
PT-SMA-0.5	M18	Gross Alpha	pCi/L	15	79.5	5.3
PT-SMA-1	M18	Gross Alpha	pCi/L	15	104	6.933
PT-SMA-1	CAM52	Gross Alpha	pCi/L	15	17.6	1.173
PT-SMA-1	CAM5	Gross Alpha	pCi/L	15	1699	113.3
PT-SMA-1.7	MEx	Gross Alpha	pCi/L	15	92.6	6.173
PT-SMA-2	MEx	Gross Alpha	pCi/L	15	290	19.33
PT-SMA-2.01	M18	Gross Alpha	pCi/L	15	295	19.67
PT-SMA-3	MEx	Gross Alpha	pCi/L	15	548	36.53
PT-SMA-4.2	CAM5	Gross Alpha	pCi/L	15	84.5	5.633
PT-SMA-4.2	MEx	Gross Alpha	pCi/L	15	393	26.2
PT-SMA-4.2	MEx	Ra-226+228	pCi/L	30	95.9	3.197
R-SMA-0.5	MEx	Gross Alpha	pCi/L	15	36.5	2.433
R-SMA-1	M18	Gross Alpha	pCi/L	15	32.84	2.189
R-SMA-1.95	M18	Gross Alpha	pCi/L	15	27.4	1.827
S-SMA-0.25	CACompCInv	Total PCBs	µg/L	0.00064	0.00173	2.703

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
S-SMA-0.25	CAM3	Total PCBs	µg/L	0.00064	0.01293	20.2
S-SMA-0.25	M12	Total PCBs	µg/L	0.00064	0.0502	78.44
S-SMA-0.25	CACompCInv	Gross Alpha	pCi/L	15	28.5	1.9
S-SMA-0.25	M12	Gross Alpha	pCi/L	15	15.2	1.013
S-SMA-1.1	CAM3	Total PCBs	µg/L	0.00064	0.01845	28.83
S-SMA-1.1	M18	Total PCBs	µg/L	0.00064	0.1061	165.7
S-SMA-1.1	CAM3	Gross Alpha	pCi/L	15	20.07	1.338
S-SMA-2	CAM3	Total PCBs	µg/L	0.00064	0.1038	162.2
S-SMA-2	M12	Total PCBs	µg/L	0.00064	0.165	257.8
S-SMA-2.01	CAM3	Total PCBs	µg/L	0.00064	0.164	256.3
S-SMA-2.01	M18	Total PCBs	µg/L	0.00064	0.8553	1336
S-SMA-3.53	CAM3	Total PCBs	µg/L	0.00064	0.0997	155.8
S-SMA-3.53	M18	Total PCBs	µg/L	0.00064	0.702	1097
S-SMA-3.53	CAM3	Gross Alpha	pCi/L	15	34.4	2.293
S-SMA-3.53	M18	Gross Alpha	pCi/L	15	62.5	4.167
S-SMA-3.6	CAM3	Total PCBs	µg/L	0.00064	0.003453	5.395
S-SMA-3.6	M12	Total PCBs	µg/L	0.00064	0.007572	11.83
S-SMA-3.95	MEx	Gross Alpha	pCi/L	15	15.4	1.027
S-SMA-4.1	CACompD	Total PCBs	µg/L	0.00064	0.00155	2.422
S-SMA-4.1	M18	Total PCBs	µg/L	0.00064	0.001891	2.954
S-SMA-5.5	MEx	Gross Alpha	pCi/L	15	91	6.067
S-SMA-6	M18	Total PCBs	µg/L	0.00064	2.195	3430
S-SMA-6	CAM32	Total PCBs	µg/L	0.00064	0.00326	5.094
S-SMA-6	M18	Cyanide (WAD)	µg/L	10	10.16	1.016
S-SMA-6	M18	Gross Alpha	pCi/L	15	2307	153.8
S-SMA-6	CAM32	Gross Alpha	pCi/L	15	27.67	1.845
S-SMA-6	M18	Ra-226+228	pCi/L	30	31.5	1.05
STRM-SMA-1.5	MEx	Cyanide (WAD)	µg/L	10	27.6	2.76
STRM-SMA-1.5	MEx	Gross Alpha	pCi/L	15	1270	84.67
STRM-SMA-1.5	CAM5	Gross Alpha	pCi/L	15	16.1	1.073
STRM-SMA-1.5	CAM52	Gross Alpha	pCi/L	15	81.3	5.42
STRM-SMA-1.5	MEx	Mercury	µg/L	0.77	1.17	1.519
STRM-SMA-1.5	MEx	Ra-226+228	pCi/L	30	38.5	1.283
STRM-SMA-5.05	CAM5	Total PCBs	µg/L	0.00064	0.00226	3.531
STRM-SMA-5.05	M12	Total PCBs	µg/L	0.00064	0.00669	10.45
STRM-SMA-5.05	M12	Gross Alpha	pCi/L	15	24.5	1.633

Table 7 (continued)

SMA Number	Stage Number	Analyte	Geomean Unit	ATAL	Geomean	Geomean/ ATAL Ratio
T-SMA-1	M18	Total PCBs	µg/L	0.00064	0.02838	44.34
T-SMA-2.85	MEx	Gross Alpha	pCi/L	15	36.6	2.44
T-SMA-3	MEx	Gross Alpha	pCi/L	15	34.4	2.293
T-SMA-4	MEx	Gross Alpha	pCi/L	15	94.8	6.32
T-SMA-4	MEx	Mercury	µg/L	0.77	2.14	2.779
T-SMA-6.8	MEx	Gross Alpha	pCi/L	15	163	10.87
T-SMA-7	MEx	Gross Alpha	pCi/L	15	18.1	1.207
W-SMA-1	M12	Gross Alpha	pCi/L	15	18.54	1.236
W-SMA-1	CAM5	Gross Alpha	pCi/L	15	50.53	3.368
W-SMA-10	CAM5	Gross Alpha	pCi/L	15	77.8	5.187
W-SMA-10	M18	Gross Alpha	pCi/L	15	106	7.067
W-SMA-11.7	CAM5	Gross Alpha	pCi/L	15	39.6	2.64
W-SMA-11.7	M18	Gross Alpha	pCi/L	15	38.1	2.54
W-SMA-14.1	CAM5	Gross Alpha	pCi/L	15	61.02	4.068
W-SMA-15.1	M18	Gross Alpha	pCi/L	15	33.2	2.213
W-SMA-7	MEx	Gross Alpha	pCi/L	15	427	28.47
W-SMA-7	MEx	Ra-226+228	pCi/L	30	42	1.4
W-SMA-8.71	M18	Gross Alpha	pCi/L	15	15.8	1.053
W-SMA-8.71	CAM5	Mercury	µg/L	0.77	1.51	1.961
W-SMA-9.5	MEx	Gross Alpha	pCi/L	15	81	5.4
W-SMA-9.5	MEx	Mercury	µg/L	0.77	1.1	1.429
W-SMA-9.9	CAM5	Gross Alpha	pCi/L	15	74.4	4.96
W-SMA-9.9	M18	Gross Alpha	pCi/L	15	95.9	6.393

* Gross alpha is total gross alpha, compared to the adjusted gross alpha ATAL of 15 pCi/L

Table 8
MTAL Exceedances

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
CDV-SMA-1.4	MEx	Silver	9/10/12	7.86	µg/L	0.5	0.4	15.72
STRM-SMA-1.5	MEx	Silver	7/11/12	0.589	µg/L	0.5	0.4	1.178
STRM-SMA-1.5	CAM5	Silver	9/13/13	4.02	µg/L	0.5	0.4	8.04
STRM-SMA-1.5	CAM52	Silver	9/3/18	1.21	µg/L	0.5	0.4	2.42
STRM-SMA-4.2	CAM5	Silver	7/29/17	0.519	µg/L	0.5	0.4	1.038
2M-SMA-1	M12	Aluminum	8/20/11	1200	µg/L	2.5	750	1.6
2M-SMA-1	CAM5	Aluminum	9/12/12	1430	µg/L	2.5	750	1.907
2M-SMA-3	MEx	Aluminum	7/12/13	3750	µg/L	2.5	750	5
A-SMA-2	MEx	Aluminum	9/12/13	1310	µg/L	2.5	750	1.747
ACID-SMA-2	CAM5	Aluminum	7/26/17	798	µg/L	2.5	750	1.064
CDB-SMA-1	M18	Aluminum	9/7/11	1120	µg/L	2.5	750	1.493
CDV-SMA-2.42	CAM5	Aluminum	6/25/17	3470	µg/L	2.5	750	4.627
CDV-SMA-7	MEx	Aluminum	9/13/13	956	µg/L	2.5	750	1.275
CDV-SMA-8	MEx	Aluminum	7/31/14	1360	µg/L	2.5	750	1.813
CHQ-SMA-2	MEx	Aluminum	7/4/12	967	µg/L	2.5	750	1.289
LA-SMA-1	CAM5	Aluminum	9/13/13	800	µg/L	2.5	750	1.067
M-SMA-10.3	M18	Aluminum	7/30/11	2500	µg/L	2.5	750	3.333
M-SMA-10.3	M18	Aluminum	8/19/11	873	µg/L	2.5	750	1.164
M-SMA-12	MEx	Aluminum	7/7/15	1510	µg/L	2.5	750	2.013
PT-SMA-0.5	M18	Aluminum	9/1/11	1380	µg/L	2.5	750	1.84
PT-SMA-1	M18	Aluminum	9/1/11	6550	µg/L	2.5	750	8.733
R-SMA-1	M18	Aluminum	8/19/11	2010	µg/L	2.5	750	2.68
S-SMA-6	M18	Aluminum	7/30/11	1470	µg/L	2.5	750	1.96
S-SMA-6	CAM32	Aluminum	7/27/17	1070	µg/L	2.5	750	1.427
LA-SMA-1	M18	Aluminum	8/19/11	6510	µg/L	2.5	750	8.68
DP-SMA-0.4	MEx	Aluminum	9/13/13	3540	µg/L	2.5	750	4.72
LA-SMA-0.85	M12	Aluminum	7/30/11	1310	µg/L	2.5	750	1.747
LA-SMA-0.85	M12	Aluminum	8/14/11	4170	µg/L	2.5	750	5.56
LA-SMA-5.52	MEx	Aluminum	7/29/14	1070	µg/L	2.5	750	1.427
M-SMA-1.22	M18	Aluminum	9/15/11	904	µg/L	2.5	750	1.205
CDB-SMA-0.15	MEx	Aluminum	7/20/15	1250	µg/L	2.5	750	1.667
CDB-SMA-0.25	M12	Aluminum	9/1/11	2310	µg/L	2.5	750	3.08
S-SMA-3.53	M18	Aluminum	8/4/11	1490	µg/L	2.5	750	1.987
PJ-SMA-19	MEx	Aluminum	8/8/13	761	µg/L	2.5	750	1.015
F-SMA-2	M18	Aluminum	8/15/11	866	µg/L	2.5	750	1.155

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
STRM-SMA-5.05	M12	Aluminum	8/21/11	1170	µg/L	2.5	750	1.56
STRM-SMA-4.2	M12	Aluminum	9/9/11	2330	µg/L	2.5	750	3.107
2M-SMA-1.42	M18	Aluminum	8/21/11	794	µg/L	2.5	750	1.059
2M-SMA-1.42	CAM5	Aluminum	7/20/15	1900	µg/L	2.5	750	2.533
2M-SMA-1.43	MEx	Aluminum	7/12/13	1500	µg/L	2.5	750	2
Pratt-SMA-1.05	MEx	Aluminum	9/13/13	943	µg/L	2.5	750	1.257
W-SMA-2.05	M18	Aluminum	8/21/11	1240	µg/L	2.5	750	1.653
ACID-SMA-2.1	CAM5	Aluminum	11/5/16	818	µg/L	2.5	750	1.091
ACID-SMA-2.1	CAM5	Aluminum	8/7/17	906	µg/L	2.5	750	1.208
ACID-SMA-2	M12	Aluminum	8/19/11	789	µg/L	2.5	750	1.052
A-SMA-1.1	MEx	Aluminum	8/10/18	807	µg/L	2.5	750	1.076
A-SMA-3	MEx	Aluminum	7/25/13	997	µg/L	2.5	750	1.329
CHQ-SMA-7.1	MEx	Aluminum	7/23/18	944	µg/L	2.5	750	1.259
PJ-SMA-11.1	MEx	Aluminum	9/13/13	1040	µg/L	2.5	750	1.387
W-SMA-8.7	MEx	Aluminum	9/12/13	1920	µg/L	2.5	750	2.56
W-SMA-9.9	M18	Aluminum	8/21/11	962	µg/L	2.5	750	1.283
W-SMA-11.7	M18	Aluminum	9/1/11	1020	µg/L	2.5	750	1.36
DP-SMA-3	M18	Aluminum	7/29/11	1870	µg/L	2.5	750	2.493
STRM-SMA-4.2	CAM5	Aluminum	7/29/17	2190	µg/L	2.5	750	2.92
STRM-SMA-4.2	CAM5	Aluminum	9/27/17	1980	µg/L	2.5	750	2.64
W-SMA-1	M12	Aluminum	8/3/11	918	µg/L	2.5	750	1.224
W-SMA-1	M12	Aluminum	9/9/11	1410	µg/L	2.5	750	1.88
W-SMA-1	CAM5	Aluminum	9/12/13	1010	µg/L	2.5	750	1.347
W-SMA-1	CAM5	Aluminum	7/19/14	858	µg/L	2.5	750	1.144
W-SMA-8	MEx	Aluminum	9/12/13	823	µg/L	2.5	750	1.097
STRM-SMA-1.5	MEx	Cadmium	7/11/12	1.26	µg/L	1	0.6	1.26
PJ-SMA-3.05	M18	Cyanide (WAD)	8/19/11	27.4	µg/L	10	22	1.245
STRM-SMA-1.5	MEx	Cyanide (WAD)	7/11/12	27.6	µg/L	10	22	1.255
2M-SMA-1.7	M18	Copper	8/3/11	11.4	µg/L	0.5	4.3	2.651
2M-SMA-1.7	CAM5	Copper	7/8/14	4.6	µg/L	0.5	4.3	1.07
2M-SMA-2	CAM5	Copper	6/14/13	18.5	µg/L	0.5	4.3	4.302
2M-SMA-2	CAM5	Copper	8/18/13	19.9	µg/L	0.5	4.3	4.628
2M-SMA-3	MEx	Copper	7/12/13	6.05	µg/L	0.5	4.3	1.407
3M-SMA-0.2	MEx	Copper	7/15/18	6.72	µg/L	0.5	4.3	1.563
3M-SMA-0.5	MEx	Copper	7/9/14	4.35	µg/L	0.5	4.3	1.012

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
A-SMA-2	MEx	Copper	9/12/13	23.9	µg/L	0.5	4.3	5.558
A-SMA-6	MEx	Copper	8/4/13	5.86	µg/L	0.5	4.3	1.363
CDB-SMA-1	M18	Copper	9/7/11	8	µg/L	0.5	4.3	1.86
CDV-SMA-1.7	MEx	Copper	9/13/13	11	µg/L	0.5	4.3	2.558
CDV-SMA-2.42	CAM5	Copper	6/25/17	5.54	µg/L	0.5	4.3	1.288
CHQ-SMA-1.03	CAM5	Copper	8/10/18	4.6	µg/L	0.5	4.3	1.07
CHQ-SMA-2	MEx	Copper	7/4/12	6.75	µg/L	0.5	4.3	1.57
CHQ-SMA-2	CAM5	Copper	8/15/18	4.82	µg/L	0.5	4.3	1.121
CHQ-SMA-6	MEx	Copper	7/25/13	87.6	µg/L	0.5	4.3	20.37
LA-SMA-0.85	CAM5	Copper	11/9/12	26.4	µg/L	0.5	4.3	6.14
LA-SMA-0.85	CAM5	Copper	5/15/13	22.8	µg/L	0.5	4.3	5.302
M-SMA-1	CAM5	Copper	6/14/13	31.2	µg/L	0.5	4.3	7.256
M-SMA-1	CAM5	Copper	7/2/13	9.66	µg/L	0.5	4.3	2.247
M-SMA-10.3	M18	Copper	7/30/11	4.7	µg/L	0.5	4.3	1.093
M-SMA-12	MEx	Copper	7/7/15	4.41	µg/L	0.5	4.3	1.026
M-SMA-12.9	MEx	Copper	7/20/15	25.1	µg/L	0.5	4.3	5.837
M-SMA-4	M12	Copper	8/19/11	6	µg/L	0.5	4.3	1.395
M-SMA-4	CACompCInv	Copper	8/3/16	11.5	µg/L	0.5	4.3	2.674
PJ-SMA-10	MEx	Copper	7/7/14	16.8	µg/L	0.5	4.3	3.907
PJ-SMA-11	CAM5	Copper	8/10/18	28	µg/L	0.5	4.3	6.512
PJ-SMA-5	MEx	Copper	10/12/12	75.5	µg/L	0.5	4.3	17.56
PJ-SMA-5	CAM5	Copper	9/3/18	651	µg/L	0.5	4.3	151.4
PJ-SMA-9	MEx	Copper	6/21/14	7.76	µg/L	0.5	4.3	1.805
PT-SMA-0.5	M18	Copper	9/1/11	6.5	µg/L	0.5	4.3	1.512
PT-SMA-1	M18	Copper	9/1/11	174	µg/L	0.5	4.3	40.47
PT-SMA-1	CAM52	Copper	9/26/17	4.8	µg/L	0.5	4.3	1.116
PT-SMA-2	MEx	Copper	7/7/14	10.3	µg/L	0.5	4.3	2.395
S-SMA-3.6	M12	Copper	7/28/11	40.5	µg/L	0.5	4.3	9.419
S-SMA-3.6	M12	Copper	8/13/11	10.9	µg/L	0.5	4.3	2.535
S-SMA-3.6	CAM3	Copper	6/14/13	20.8	µg/L	0.5	4.3	4.837
S-SMA-3.6	CAM3	Copper	7/2/13	15.4	µg/L	0.5	4.3	3.581
S-SMA-6	M18	Copper	7/30/11	8.6	µg/L	0.5	4.3	2
S-SMA-6	M18	Copper	8/19/11	6.1	µg/L	0.5	4.3	1.419
S-SMA-6	CAM32	Copper	7/27/17	65.3	µg/L	0.5	4.3	15.19
S-SMA-6	CAM32	Copper	9/29/17	9.73	µg/L	0.5	4.3	2.263

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
P-SMA-0.3	MEx	Copper	7/25/13	9.01	µg/L	0.5	4.3	2.095
LA-SMA-1	M18	Copper	8/19/11	7.8	µg/L	0.5	4.3	1.814
LA-SMA-1.1	M18	Copper	7/28/11	26.6	µg/L	0.5	4.3	6.186
LA-SMA-1.1	M18	Copper	8/19/11	6.3	µg/L	0.5	4.3	1.465
LA-SMA-1.1	CACompD	Copper	9/28/12	17.7	µg/L	0.5	4.3	4.116
LA-SMA-2.1	MEx	Copper	9/13/13	11.1	µg/L	0.5	4.3	2.581
LA-SMA-5.31	M18	Copper	8/19/11	5.5	µg/L	0.5	4.3	1.279
DP-SMA-0.4	MEx	Copper	9/13/13	10.7	µg/L	0.5	4.3	2.488
A-SMA-2.7	M18	Copper	7/24/11	6.2	µg/L	0.5	4.3	1.442
A-SMA-2.7	M18	Copper	9/4/11	5.4	µg/L	0.5	4.3	1.256
CDV-SMA-2.42	MEx	Copper	7/12/13	4.37	µg/L	0.5	4.3	1.016
CDV-SMA-6.01	MEx	Copper	7/31/14	10	µg/L	0.5	4.3	2.326
CDV-SMA-6.02	M18	Copper	8/13/11	29.3	µg/L	0.5	4.3	6.814
CDV-SMA-6.02	M18	Copper	9/1/11	28.1	µg/L	0.5	4.3	6.535
CHQ-SMA-1.02	M18	Copper	8/21/11	8	µg/L	0.5	4.3	1.86
CHQ-SMA-1.02	CAM5	Copper	7/25/13	4.46	µg/L	0.5	4.3	1.037
CHQ-SMA-1.02	CAM52	Copper	8/10/18	6.79	µg/L	0.5	4.3	1.579
CHQ-SMA-1.03	MEx	Copper	7/4/12	14.4	µg/L	0.5	4.3	3.349
P-SMA-3.05	MEx	Copper	9/13/13	5.2	µg/L	0.5	4.3	1.209
LA-SMA-0.85	M12	Copper	7/30/11	18.9	µg/L	0.5	4.3	4.395
LA-SMA-0.85	M12	Copper	8/14/11	47.1	µg/L	0.5	4.3	10.95
LA-SMA-1.25	M12	Copper	7/30/11	13.8	µg/L	0.5	4.3	3.209
LA-SMA-1.25	M12	Copper	8/28/11	33.3	µg/L	0.5	4.3	7.744
LA-SMA-1.25	CAM5	Copper	9/10/12	25	µg/L	0.5	4.3	5.814
LA-SMA-1.25	CAM5	Copper	10/12/12	7.31	µg/L	0.5	4.3	1.7
LA-SMA-5.02	M18	Copper	8/19/11	4.9	µg/L	0.5	4.3	1.14
LA-SMA-5.35	M12	Copper	8/4/11	5.9	µg/L	0.5	4.3	1.372
LA-SMA-5.35	CAM5	Copper	6/21/14	11.3	µg/L	0.5	4.3	2.628
LA-SMA-5.92	MEx	Copper	7/12/13	8.32	µg/L	0.5	4.3	1.935
M-SMA-1.2	MEx	Copper	9/13/13	38.4	µg/L	0.5	4.3	8.93
M-SMA-1.2	CAM5	Copper	9/29/17	55	µg/L	0.5	4.3	12.79
M-SMA-1.22	M18	Copper	9/15/11	6	µg/L	0.5	4.3	1.395
M-SMA-1.22	CAM5	Copper	9/12/13	5.96	µg/L	0.5	4.3	1.386
M-SMA-10.01	M18	Copper	8/27/11	16	µg/L	0.5	4.3	3.721
M-SMA-10.01	M18	Copper	9/15/11	6.5	µg/L	0.5	4.3	1.512

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
CDB-SMA-0.15	MEx	Copper	7/20/15	6.66	µg/L	0.5	4.3	1.549
CDB-SMA-0.25	M12	Copper	9/1/11	11.2	µg/L	0.5	4.3	2.605
CDB-SMA-0.25	CAM5	Copper	7/26/13	15.2	µg/L	0.5	4.3	3.535
CDB-SMA-0.25	CAM5	Copper	9/10/13	15.2	µg/L	0.5	4.3	3.535
CDB-SMA-0.55	MEx	Copper	9/13/13	16.3	µg/L	0.5	4.3	3.791
S-SMA-0.25	M12	Copper	7/28/11	9.7	µg/L	0.5	4.3	2.256
S-SMA-0.25	M12	Copper	8/15/11	10.9	µg/L	0.5	4.3	2.535
S-SMA-0.25	CAM3	Copper	7/15/14	15.2	µg/L	0.5	4.3	3.535
S-SMA-0.25	CAM3	Copper	8/22/14	9.79	µg/L	0.5	4.3	2.277
S-SMA-0.25	CACompCInv	Copper	6/4/16	40.4	µg/L	0.5	4.3	9.395
S-SMA-2.01	M18	Copper	8/5/11	10.9	µg/L	0.5	4.3	2.535
S-SMA-2.01	M18	Copper	9/7/11	10.7	µg/L	0.5	4.3	2.488
S-SMA-3.53	M18	Copper	8/4/11	9.6	µg/L	0.5	4.3	2.233
S-SMA-3.53	CAM3	Copper	7/7/14	7.41	µg/L	0.5	4.3	1.723
S-SMA-3.72	MEx	Copper	7/20/15	4.59	µg/L	0.5	4.3	1.067
PJ-SMA-5.1	M18	Copper	8/21/11	8.2	µg/L	0.5	4.3	1.907
PJ-SMA-5.1	M18	Copper	9/7/11	11.1	µg/L	0.5	4.3	2.581
PJ-SMA-17	MEx	Copper	7/25/13	5.13	µg/L	0.5	4.3	1.193
PJ-SMA-20	M18	Copper	7/29/11	8.1	µg/L	0.5	4.3	1.884
F-SMA-2	M18	Copper	8/15/11	72.5	µg/L	0.5	4.3	16.86
F-SMA-2	CAM5	Copper	7/15/14	10.8	µg/L	0.5	4.3	2.512
STRM-SMA-1.05	M12	Copper	8/5/11	5.7	µg/L	0.5	4.3	1.326
STRM-SMA-1.05	M12	Copper	8/26/11	6.9	µg/L	0.5	4.3	1.605
STRM-SMA-1.05	CAM5	Copper	7/12/13	10.8	µg/L	0.5	4.3	2.512
STRM-SMA-1.05	CAM5	Copper	8/1/13	9.92	µg/L	0.5	4.3	2.307
2M-SMA-1.44	M18	Copper	8/21/11	31.5	µg/L	0.5	4.3	7.326
2M-SMA-1.44	CAM5	Copper	9/12/13	39.5	µg/L	0.5	4.3	9.186
2M-SMA-1.44	CAM5	Copper	7/31/14	27.6	µg/L	0.5	4.3	6.419
2M-SMA-2.2	M12	Copper	8/13/11	16.4	µg/L	0.5	4.3	3.814
2M-SMA-2.2	M12	Copper	9/4/11	10.1	µg/L	0.5	4.3	2.349
2M-SMA-2.2	CACompCInv	Copper	7/1/16	4.8	µg/L	0.5	4.3	1.116
T-SMA-1	M18	Copper	7/30/11	21.2	µg/L	0.5	4.3	4.93
T-SMA-1	M18	Copper	8/15/11	12.6	µg/L	0.5	4.3	2.93
T-SMA-2.85	MEx	Copper	7/12/13	5.64	µg/L	0.5	4.3	1.312
W-SMA-9.7	MEx	Copper	9/13/13	9.74	µg/L	0.5	4.3	2.265

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
ACID-SMA-2.1	CAM5	Copper	11/5/16	5.36	µg/L	0.5	4.3	1.247
ACID-SMA-2.1	CAM5	Copper	8/7/17	4.69	µg/L	0.5	4.3	1.091
ACID-SMA-2	CAM5	Copper	11/4/16	11.9	µg/L	0.5	4.3	2.767
A-SMA-3	MEx	Copper	7/25/13	245	µg/L	0.5	4.3	56.98
A-SMA-3	CAM5	Copper	8/10/18	50.2	µg/L	0.5	4.3	11.67
A-SMA-3	CAM5	Copper	8/10/18	48.3	µg/L	0.5	4.3	11.23
CHQ-SMA-7.1	MEx	Copper	7/23/18	8.25	µg/L	0.5	4.3	1.919
LA-SMA-4.1	M12	Copper	8/19/11	6.7	µg/L	0.5	4.3	1.558
LA-SMA-4.1	M12	Copper	9/4/11	5.3	µg/L	0.5	4.3	1.233
CDB-SMA-4	MEx	Copper	7/25/13	8.14	µg/L	0.5	4.3	1.893
3M-SMA-4	MEx	Copper	7/29/14	4.72	µg/L	0.5	4.3	1.098
3M-SMA-4	CAM5	Copper	7/26/17	8.11	µg/L	0.5	4.3	1.886
S-SMA-1.1	M18	Copper	8/4/11	5.2	µg/L	0.5	4.3	1.209
S-SMA-1.1	M18	Copper	9/4/11	5.8	µg/L	0.5	4.3	1.349
S-SMA-2	M12	Copper	7/28/11	8.3	µg/L	0.5	4.3	1.93
S-SMA-2	M12	Copper	8/13/11	5.8	µg/L	0.5	4.3	1.349
S-SMA-2	CAM3	Copper	7/11/13	4.43	µg/L	0.5	4.3	1.03
S-SMA-2	CAM3	Copper	8/1/13	5.08	µg/L	0.5	4.3	1.181
PJ-SMA-11	MEx	Copper	9/13/13	42.9	µg/L	0.5	4.3	9.977
PJ-SMA-11.1	MEx	Copper	9/13/13	20.9	µg/L	0.5	4.3	4.86
2M-SMA-1.8	M18	Copper	8/4/11	13.2	µg/L	0.5	4.3	3.07
2M-SMA-1.8	M18	Copper	9/9/11	6.6	µg/L	0.5	4.3	1.535
2M-SMA-1.9	MEx	Copper	7/11/12	24.9	µg/L	0.5	4.3	5.791
2M-SMA-2	M18	Copper	7/28/11	14.9	µg/L	0.5	4.3	3.465
2M-SMA-2	M18	Copper	9/4/11	5.5	µg/L	0.5	4.3	1.279
W-SMA-1.5	M18	Copper	9/1/11	9.7	µg/L	0.5	4.3	2.256
W-SMA-1.5	CAM5	Copper	7/19/14	6.9	µg/L	0.5	4.3	1.605
W-SMA-14.1	M18	Copper	7/25/11	42.6	µg/L	0.5	4.3	9.907
W-SMA-14.1	M18	Copper	8/18/11	20	µg/L	0.5	4.3	4.651
M-SMA-6	MEx	Copper	10/12/12	13	µg/L	0.5	4.3	3.023
DP-SMA-3	M18	Copper	7/29/11	5.5	µg/L	0.5	4.3	1.279
PT-SMA-1	CAM5	Copper	7/9/14	45.5	µg/L	0.5	4.3	10.58
PT-SMA-1	CAM5	Copper	7/31/14	21.4	µg/L	0.5	4.3	4.977
STRM-SMA-4.2	CAM5	Copper	7/29/17	8.81	µg/L	0.5	4.3	2.049
STRM-SMA-4.2	CAM5	Copper	9/27/17	5.26	µg/L	0.5	4.3	1.223

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
T-SMA-3	MEx	Copper	9/10/12	13.4	µg/L	0.5	4.3	3.116
T-SMA-4	MEx	Copper	9/13/13	6.61	µg/L	0.5	4.3	1.537
W-SMA-1	CAM5	Copper	7/19/14	4.45	µg/L	0.5	4.3	1.035
W-SMA-5	MEx	Copper	7/3/12	6.28	µg/L	0.5	4.3	1.46
W-SMA-8	MEx	Copper	9/12/13	28.1	µg/L	0.5	4.3	6.535
W-SMA-8.71	CAM5	Copper	9/13/13	19.8	µg/L	0.5	4.3	4.605
3M-SMA-0.2	MEx	Mercury	7/15/18	2.02	µg/L	0.005	1.4	1.443
P-SMA-0.3	MEx	Mercury	7/25/13	39.3	µg/L	0.005	1.4	28.07
CDV-SMA-6.02	M18	Mercury	9/1/11	1.6	µg/L	0.005	1.4	1.143
LA-SMA-5.51	MEx	Mercury	7/12/13	2.39	µg/L	0.005	1.4	1.707
LA-SMA-5.92	MEx	Mercury	7/12/13	2.89	µg/L	0.005	1.4	2.064
PJ-SMA-19	MEx	Mercury	8/8/13	1.67	µg/L	0.005	1.4	1.193
A-SMA-3	MEx	Mercury	7/25/13	9.04	µg/L	0.005	1.4	6.457
T-SMA-4	MEx	Mercury	9/13/13	2.14	µg/L	0.005	1.4	1.529
W-SMA-8.71	CAM5	Mercury	9/13/13	1.51	µg/L	0.005	1.4	1.079
S-SMA-6	CAM32	Lead	7/27/17	129	µg/L	0.5	17	7.588
S-SMA-6	CAM32	Lead	9/29/17	36.5	µg/L	0.5	17	2.147
LA-SMA-1	M18	Lead	8/19/11	42.1	µg/L	0.5	17	2.476
LA-SMA-0.85	M12	Lead	8/14/11	17.7	µg/L	0.5	17	1.041
2M-SMA-2	CAM5	Zinc	6/14/13	102	µg/L	20	42	2.429
2M-SMA-2	CAM5	Zinc	8/18/13	123	µg/L	20	42	2.929
LA-SMA-0.85	CAM5	Zinc	11/9/12	56.1	µg/L	20	42	1.336
LA-SMA-0.85	CAM5	Zinc	5/15/13	78.2	µg/L	20	42	1.862
M-SMA-1	CAM5	Zinc	6/14/13	264	µg/L	20	42	6.286
M-SMA-1	CAM5	Zinc	7/2/13	53.4	µg/L	20	42	1.271
M-SMA-10.3	M18	Zinc	7/30/11	55	µg/L	20	42	1.31
M-SMA-7	MEx	Zinc	7/7/12	60.6	µg/L	20	42	1.443
PT-SMA-1	M18	Zinc	9/1/11	75.9	µg/L	20	42	1.807
R-SMA-1	M18	Zinc	7/2/11	45.3	µg/L	20	42	1.079
S-SMA-3.6	M12	Zinc	7/28/11	147	µg/L	20	42	3.5
S-SMA-3.6	M12	Zinc	8/13/11	70.7	µg/L	20	42	1.683
S-SMA-3.6	CAM3	Zinc	6/14/13	135	µg/L	20	42	3.214
S-SMA-3.6	CAM3	Zinc	7/2/13	108	µg/L	20	42	2.571
LA-SMA-1.1	M18	Zinc	7/28/11	162	µg/L	20	42	3.857
LA-SMA-1.1	CACompD	Zinc	9/28/12	131	µg/L	20	42	3.119

Table 8 (continued)

SMA Number	Stage Number	Analyte	Sample Date	Std. Result	Std Units	Target Level MQL	Target Level MTAL	Result Target Ratio
LA-SMA-0.85	M12	Zinc	7/30/11	55.7	µg/L	20	42	1.326
LA-SMA-0.85	M12	Zinc	8/14/11	186	µg/L	20	42	4.429
LA-SMA-1.25	M12	Zinc	7/30/11	109	µg/L	20	42	2.595
LA-SMA-1.25	M12	Zinc	8/28/11	112	µg/L	20	42	2.667
LA-SMA-1.25	CAM5	Zinc	9/10/12	111	µg/L	20	42	2.643
LA-SMA-1.25	CAM5	Zinc	10/12/12	53.2	µg/L	20	42	1.267
S-SMA-0.25	M12	Zinc	7/28/11	74.4	µg/L	20	42	1.771
S-SMA-0.25	M12	Zinc	8/15/11	52.9	µg/L	20	42	1.26
S-SMA-0.25	CAM3	Zinc	7/15/14	103	µg/L	20	42	2.452
S-SMA-0.25	CACompCInv	Zinc	6/4/16	290	µg/L	20	42	6.905
PJ-SMA-5.1	M18	Zinc	8/21/11	50.6	µg/L	20	42	1.205
PJ-SMA-5.1	M18	Zinc	9/7/11	59.4	µg/L	20	42	1.414
2M-SMA-2.2	M12	Zinc	8/13/11	97.2	µg/L	20	42	2.314
2M-SMA-2.2	M12	Zinc	9/4/11	90.1	µg/L	20	42	2.145
T-SMA-1	M18	Zinc	7/30/11	324	µg/L	20	42	7.714
T-SMA-1	M18	Zinc	8/15/11	103	µg/L	20	42	2.452
S-SMA-2	M12	Zinc	7/28/11	62.6	µg/L	20	42	1.49
S-SMA-2	CAM3	Zinc	7/11/13	54	µg/L	20	42	1.286
S-SMA-2	CAM3	Zinc	8/1/13	44.2	µg/L	20	42	1.052
2M-SMA-1.8	M18	Zinc	8/4/11	71.8	µg/L	20	42	1.71
2M-SMA-1.9	MEx	Zinc	7/11/12	314	µg/L	20	42	7.476
2M-SMA-2	M18	Zinc	7/28/11	140	µg/L	20	42	3.333
2M-SMA-2	M18	Zinc	9/4/11	72.3	µg/L	20	42	1.721
W-SMA-1.5	M18	Zinc	8/3/11	49.3	µg/L	20	42	1.174
W-SMA-14.1	M18	Zinc	7/25/11	55.9	µg/L	20	42	1.331
W-SMA-8.71	CAM5	Zinc	9/13/13	55.4	µg/L	20	42	1.319

Table 9
Arizona MSGP Metals Benchmarks for
Storm Water Discharges to Ephemeral Waters

Hardness Range (mg/L)	Benchmark Values (mg/L, total)					
	Cadmium	Copper	Lead	Nickel	Silver	Zinc
0–25	0.0059	0.0063	0.0293	1.287	0.0003	0.344
25–50	0.0116	0.0121	0.0636	2.313	0.0010	0.618
50–75	0.0172	0.0177	0.0995	3.260	0.0020	0.871
75–100	0.0228	0.0233	0.1363	4.158	0.0032	1.112
100–125	0.0286	0.0283	0.1736	5.022	0.0047	1.343
125–150	0.0338	0.0341	0.2113	5.860	0.0065	1.568
150–175	0.0393	0.0394	0.2492	6.676	0.0084	1.787
175–200	0.0447	0.0447	0.2873	7.475	0.0106	2.001
200–225	0.0501	0.0500	0.3255	8.258	0.0130	2.211
225–250	0.0555	0.0552	0.3637	9.028	0.0156	2.417
250–275	0.0609	0.0601	0.4020	9.786	0.0183	2.620
275–300	0.0663	0.0655	0.4402	10.53	0.0213	2.821
300–325	0.0714	0.0706	0.4784	11.27	0.0244	3.019
325–350	0.0770	0.0757	0.5166	12.00	0.0278	3.214
350–375	0.0823	0.0800	0.5547	12.72	0.0312	3.408
375–400	0.0876	0.0859	0.5927	13.44	0.0349	3.599

Table 10
Proposed Metals MTALs[a] (Proposed Revised Appendix F to 2015 draft IP)

Major Canyon	Hardness[b] (mg/L)	Aluminum	Cadmium (dissolved)	Chromium (dissolved)	Copper (dissolved)	Lead (dissolved)	Manganese (dissolved)	Nickel (dissolved)	Silver (dissolved)	Zinc (dissolved)
Ancho	35.7	830	0.69	250	5.1	20.7	2100	200	0.55	63
Chaquehui	30.0	660	0.59	210	4.3	17.0	2000	170	0.41	54
Los Alamos/Pueblo	34.5	800	0.67	240	4.9	19.9	2100	190	0.52	61
Mortandad	29.4	640	0.58	210	4.2	16.7	2000	170	0.39	43
Pajarito	30.2	660	0.59	210	4.3	17.2	2000	170	0.41	54
Sandia	44.8	1140	0.83	300	6.3	26.7	2300	240	0.81	77
Water/Cañon de Valle	47.7	1240	0.88	310	6.7	28.6	2300	250	0.90	82

[a] MTALs are based on acute aquatic life criteria contained in New Mexico WQS in NMAC 20.6.4.900, computed at the hardness values listed.

[b] Geometric mean receiving water hardness for each major canyon, based on calculated hardness using dissolved (0.45-µm filtered) calcium and magnesium results (SM 2340B).

Table 11
SMA Dissolved Manganese Concentrations Compared with New Mexico AWQC

SMA	Watershed	Maximum Dissolved Manganese Concentration (µg/L)	Hardness-Adjusted New Mexico AWQC (µg/L)[a]
2M-SMA-3	Twomile	51.7	1977
3M-SMA-0.2	Threemile	376	1985
ACID-SMA-2	Acid	259	1815
ACID-SMA-2.1	Acid	4.25	1815
A-SMA-1.1	Ancho	998	2195
A-SMA-4	Ancho	11.2	2195
CDV-SMA-2.42	Cañon de Valle	3.44	2200
CDV-SMA-7	Cañon de Valle	41	2200
CDV-SMA-9.05	Cañon de Valle	3.85	2200
CHQ-SMA-1.03	Chaquehui	57.6	2001
CHQ-SMA-2	Chaquehui	75.8	2001
CHQ-SMA-4	Chaquehui	8.5	2001
CHQ-SMA-7.1	Chaquehui	30	2001
LA-SMA-1	Los Alamos	5.97	2236
PJ-SMA-11	Pajarito	19.6	2250
PJ-SMA-18	Pajarito	47.8	2250
PJ-SMA-3.05	Pajarito	2.97	2250
PT-SMA-1	Potrillo	134	1787
S-SMA-6	Sandia	76.9	2439
STRM-SMA-1.5	Starmer's Gulch[b]	15	2250[b]
STRM-SMA-4.2	Starmer's Gulch	44.8	2250[b]
T-SMA-7	Ten Site	99.9	1616
W-SMA-1.5	Water	4.9	2195

[a] Values in this table are the same as proposed by EPA in its 2015 draft IP Appendix F.

[b] Starmer's Gulch is a subwatershed of the Pajarito Canyon watershed, thus has the same AWQC as Pajarito.

Table 12
BLM-Based AWQC

Major Canyon	Copper (dissolved)	Lead (dissolved)	Zinc (dissolved)
Ancho	43.4	745	716
Chaquehui	20.6	460	565
Los Alamos/Pueblo	28.1	381	400
Mortandad	31.0	410	423
Pajarito	20.8	295	356
Sandia	38.4	364	335
Water/Cañon de Valle	15.1	198	268

Note: BLM-based AWQC for copper, lead, and zinc are the geometric mean of BLM-based instantaneous WQC calculated and provided in Windward 2018 (700230).

Table 13
2019 Storm Water Background Threshold Values

Constituent	Sample Preparation	Landscape	Data Subset Description[a]	Unit	N	DF	No. of Detects	Distribution Assumption[b]: Based on ProUCL Test (BCF Step 4.1)	Distribution Assumption[b]: Confirmed with Q-Q Plots (BCF Step 4.2)	Geomean	95-95 UTL[c]: Parametric Range[d]	95-95 UTL[c]: Non-parametric	Upper Percentiles[c]: 75th	Upper Percentiles[c]: 80th	Upper Percentiles[c]: 90th	Upper Percentiles[c]: 95th	Max.	Notes on BTVs
Aluminum	F	developed	all locations	mg/kg SSC	76	96%	73	lognormal	lognormal	280	5300	11,000	600	780	2100	5100	13,000	none
Aluminum	F	undeveloped	SEP Reference	µg/L	16	100%	16	all	any	1400	4300–9100	3600	2400	2800	3200	3400	3600	limited spatial scope
Aluminum	F	undeveloped	Locations other than SEP Reference (major group) and E240 (d/s of SR-501)	µg/L	51	100%	51	lognormal	lognormal	370	2400	2600	570	730	1200	1400	6700	none
Aluminum	F	undeveloped	E240 gage location (d/s of SR-501)	µg/L	14	100%	14	lognormal	lognormal	1300	15,000	12,000	1700	1800	2200	5500	12,000	limited spatial scope
Aluminum	UF	developed	all locations	mg/kg SSC	44	100%	44	gamma	gamma	9100	61,000	100,000	19,000	22,000	34,000	39,000	100,000	none
Aluminum	UF	undeveloped	SEP and Western Reference	mg/kg SSC	39	100%	39	lognormal or gamma	lognormal or gamma	13,000	76,000–110,000	130,000	26,000	28,000	36,000	47,000	130,000	none
Aluminum	UF	undeveloped	Northern and Bandelier Reference	mg/kg SSC	30	100%	30	all	any	4100	17,000–46,000	20,000	9500	9900	12,000	15,000	20,000	none
Arsenic	F	developed	all locations	µg/L	113	8%	9	all	any	nr	nr	nr	nr	nr	nr	nr	nr	DF insufficient to reasonably estimate nondetect concentrations; percentiles, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Arsenic	F	undeveloped	all locations	µg/L	78	13%	10	all	any	2.3	nr	nr	2.6	5.0	6.0	6.0	6.2	DF insufficient to reasonably estimate nondetect concentrations, therefore UTLs, UPLs, and USLs are not recommended.
Boron	F	developed	Lab Developed	µg/L	35	40%	14	lognormal or gamma	none	nr	nr	nr	nr	nr	nr	nr	nr	Dataset has a relatively high degree of instability, the source of which could not be identified (Appendix B, Section 9). Because of instability, no BTVs are recommended.
Boron	F	developed	Town Developed	µg/L	77	23%	18	all	any	21	24–34	50	24	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Boron	F	undeveloped	Western and Northern Reference	µg/L	40	38%	15	all	any	17	25–38	50	20	20	23	28	50	none

Table 13 (continued)

Constituent	Sample Preparation	Landscape	Data Subset Description[a]	Unit	N	DF	No. of Detects	Distribution Assumption[b]		Geomean	95-95 UTL[c]		Upper Percentiles[c]				Max.	Notes on BTVs
								Based on ProUCL Test (BCF Step 4.1)	Confirmed with Q-Q Plots (BCF Step 4.2)		Parametric Range[d]	Non-parametric	75th	80th	90th	95th		
Boron	F	undeveloped	SEP and Bandelier Reference	µg/L	25	40%	10	all	any	17	20–23	50	17	17	21	45	50	none
Benzo(a)pyrene	UF	developed	all locations	µg/L	30	37%	11	all	any	0.051	0.10–0.12	0.13	0.062	0.062	0.067	0.10	0.13	none
Cadmium	F	developed	all locations	µg/L	113	3%	3	normal or lognormal	none	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cadmium	F	undeveloped	all locations	µg/L	77	4%	3	normal or lognormal	none	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cobalt	F	developed	all locations	µg/L	112	33%	37	lognormal	lognormal	1.6	3.2	5.2	2.3	2.8	5.0	5.0	7.2	none
Cobalt	F	undeveloped	Western and Northern Reference	µg/L	57	67%	38	all	lognormal	1.9	6.5	6.5	3.2	3.4	4.3	4.8	7.0	Review of Q-Q plot indicates lognormal as most accurate of distribution assumptions.
Cobalt	F	undeveloped	SEP and Bandelier Reference	µg/L	21	38%	8	none	none	1.2	nc	5.0	1.2	1.2	1.9	2.4	5.0	None of the distributions fit to the cobalt data due to the presence of a single extreme concentration. There does not appear to be a clear reason to exclude the single high value (Appendix B, Section 14). There is a high degree of uncertainty associated with all BTVs.
Chromium	F	developed	all locations	µg/L	114	13%	15	lognormal	none	3.6	nr	nr	nr	nr	nr	nr	33	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit. This BTV is highly uncertain because the error rate associated with the maximum is unknown.
Chromium	F	undeveloped	all locations	µg/L	78	8%	6	all	none	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Copper	F	developed	Lab Developed	µg/L	33	100%	33	all	lognormal or gamma	5.0	14-17	13	6.8	8.1	11	12	13	Review of Q-Q plot indicates lognormal and gamma distribution assumptions as more accurate than normality.

Table 13 (continued)

Constituent	Sample Preparation	Landscape	Data Subset Description[a]	Unit	N	DF	No. of Detects	Distribution Assumption[b]		Geomean	95-95 UTL[c]		Upper Percentiles[c]				Max.	Notes on BTVs
								Based on ProUCL Test (BCF Step 4.1)	Confirmed with Q-Q Plots (BCF Step 4.2)		Parametric Range[d]	Non-parametric	75th	80th	90th	95th		
Copper	F	developed	Town Developed	µg/L	77	99%	76	none	none	4.0	nc	20	5.2	5.9	8.0	15	26	None of the distribution types attempted explain the copper distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Copper	F	undeveloped	minor groups other than Bandelier	µg/L	71	82%	58	lognormal or gamma	lognormal or gamma	1.9	4.5-5.2	5.1	2.9	3.0	3.3	4.0	5.6	none
Gross alpha	UF	developed	all locations	pCi/g SSC	46	93%	43	normal or gamma	normal or gamma	22	59-76	63	36	40	47	53	66	none
Gross alpha	UF	undeveloped	all locations	pCi/g SSC	45	96%	43	lognormal or gamma	lognormal	22	190	100	38	53	66	98	220	Review of Q-Q plot indicates lognormal distribution assumption as more accurate than gamma.
Mercury	UF	developed	all locations	µg/L	83	8%	7	all	any (unclear)	0.073	nr	nr	nr	nr	nr	nr	0.48	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit.
Mercury	UF	undeveloped	Western and Northern Reference, excluding E240 gage location	µg/L	40	38%	15	all	any	0.094	0.23–0.31	0.60	0.14	0.17	0.21	0.29	0.60	none
Mercury	UF	undeveloped	SEP and Bandelier Reference	µg/L	21	43%	9	none	none	0.079	nc	0.42	0.079	0.079	0.10	0.11	0.42	None of the distributions fit the mercury data due to the presence of a single extreme concentration. There does not appear to be a clear reason to exclude the single high value (Appendix B, Section 20).
Nickel	F	developed	all locations	µg/L	112	94%	105	lognormal or gamma	lognormal or gamma	1.5	4.4–4.8	4.4	2.2	2.4	3.1	3.8	11	none
Nickel	F	undeveloped	Chupaderos, Garcia, and Mortandad	µg/L	18	100%	18	all	lognormal or gamma	1.9	4.8–5.4	4.5	2.5	2.6	3.1	3.6	4.5	Review of Q-Q plot indicates lognormal and gamma distribution assumptions as more accurate than normality.

Table 13 (continued)

Constituent	Sample Preparation	Landscape	Data Subset Description[a]	Unit	N	DF	No. of Detects	Distribution Assumption[b] Based on ProUCL Test (BCF Step 4.1)	Distribution Assumption[b] Confirmed with Q-Q Plots (BCF Step 4.2)	Geomean	95-95 UTL[c] Parametric Range[d]	95-95 UTL[c] Non-parametric	Upper Percentiles[c] 75th	80th	90th	95th	Max.	Notes on BTVs
Nickel	F	undeveloped	Watersheds other than Chupaderos, Garcia, and Mortandad	µg/L	60	88%	53	gamma	gamma	0.99	2.4	2.1	1.4	1.5	1.7	1.8	4.6	none
Lead	F	developed	all locations	µg/L	114	29%	33	none	none	0.87	nc	7.1	2.0	2.0	2.0	2.9	50	None of the distribution types attempted explain the lead distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Lead	F	undeveloped	minor groups other than Bandelier	µg/L	73	51%	37	none	none	0.72	nc	4.6	0.91	0.99	1.5	2.2	10	None of the distribution types attempted explain the lead distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Total PCBs	UF	developed	minor watersheds other than South Fork Acid	µg/L	87	100%	87	lognormal	lognormal	0.0046	0.064	0.13	0.012	0.014	0.028	0.048	0.19	none
Total PCBs	UF	developed	South Fork Acid	µg/L	9	100%	9	lognormal or gamma	none	nr	nr	nr	nr	nr	nr	nr	nr	Although BTVs were estimated for this dataset, the sample size (n = 9) is very small; all BTVs are highly uncertain for this spatially limited dataset.
Total PCBs	UF	undeveloped	Northern and Western Reference	µg/L	41	100%	41	lognormal	lognormal	0.0010	0.058	0.13	0.0043	0.0055	0.012	0.017	0.13	none
Total PCBs	UF	undeveloped	SEP Reference	µg/L	9	100%	9	none	none	nr	nc	nr	nr	nr	nr	nr	nr	Although BTVs were estimated for this dataset, the sample size (n = 9) is very small; all BTVs are highly uncertain for this spatially limited dataset. Also, none of the distributions appear to fit the datasets, due in part to 2 extreme values that were retained (Appendix B, Section 37).

Table 13 (continued)

Constituent	Sample Preparation	Landscape	Data Subset Description[a]	Unit	N	DF	No. of Detects	Distribution Assumption[b] Based on ProUCL Test (BCF Step 4.1)	Distribution Assumption[b] Confirmed with Q-Q Plots (BCF Step 4.2)	Geomean	95-95 UTL[c] Parametric Range[d]	95-95 UTL[c] Non-parametric	Upper Percentiles[c] 75th	Upper Percentiles[c] 80th	Upper Percentiles[c] 90th	Upper Percentiles[c] 95th	Max.	Notes on BTVs
Radium-226 and radium-228	UF	developed	all locations	pCi/g SSC	39	62%	24	lognormal or gamma	lognormal	3.0	17	27	5.4	6.1	10	11	27	Review of Q-Q plot indicated that lognormal distribution assumption was more accurate than gamma (based on upper tail of distribution).
Radium-226 and radium-228	UF	undeveloped	all locations	pCi/g SSC	13	85%	11	lognormal or gamma	lognormal or gamma	2.5	15–23	15	3.5	4.1	7.5	11	15	none
Antimony	F	developed	all locations	µg/L	111	15%	17	gamma	none	nr	nr	nr	nr	nr	nr	nr	nr	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended. Also, there appears to be instability in this dataset (Appendix B, Section 5), but the source of the instability cannot be determined. Because of instability, no BTVs are recommended.
Selenium	UF	developed	all locations	µg/L	88	5%	4	all	none	2.4	nr	nr	5.0	5.0	5.6	5.6	15	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended.
Selenium	UF	undeveloped	Watersheds other than Mortandad	µg/L	71	32%	23	lognormal or gamma	lognormal or gamma	2.0	7.0–7.2	15	2.5	3.5	4.8	7.5	17	none
Thallium	F	developed	all locations	µg/L	113	3%	3	normal or lognormal	none	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Vanadium	F	developed	all locations	µg/L	113	96%	108	none	none	2.6	nc	9.7	3.9	4.4	5.5	8.2	24	None of the distribution types attempted explain the vanadium distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.

Table 13 (continued)

Constituent	Sample Preparation	Landscape	Data Subset Description[a]	Unit	N	DF	No. of Detects	Distribution Assumption[b]		Geomean	95-95 UTL[c]		Upper Percentiles[c]				Max.	Notes on BTVs
								Based on ProUCL Test (BCF Step 4.1)	Confirmed with Q-Q Plots (BCF Step 4.2)		Parametric Range[d]	Non-parametric	75th	80th	90th	95th		
Vanadium	F	undeveloped	Watersheds other than Mortandad	µg/L	74	93%	69	none	none	2.3	nc	8.8	3.2	3.4	4.3	4.9	49	None of the distributions fit the vanadium data because of the presence of 1 or 2 extreme concentrations. There does not appear to be a clear reason to exclude the high values (Appendix B, Section 29).
Zinc	F	developed	all locations	µg/L	114	91%	104	gamma	gamma	25	120	120	55	58	77	100	140	none
Zinc	F	undeveloped	Watersheds other than Garcia	µg/L	72	62%	45	none	none	5.4	nc	31	7.2	7.6	10	16	43	None of the distribution types attempted explain the zinc distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.

Note: This table is similar to Table 4-2 from the 2019 BTV report (Windward 2019, 700289). A supplemental analysis is forthcoming based on the addition of 2018 SEP data; BTVs presented in Table 12 are therefore preliminary and subject to change.

[a] Subsets were generated using the BCF. Subsets are reasonably stable over space and time and sufficiently large for ProUCL software to calculate BTVs.

[b] The selected distribution (confirmed with Q-Q plots) is based on results of goodness-of-fit tests conducted in ProUCL and visual confirmation with Q-Q plots. “Any” indicates that all three of the distributions (i.e., normal, lognormal, and gamma) appear valid. “None” indicates that none of the distributions appear valid (e.g., because of low number of detections resulting in high uncertainty in distribution selection).

[c] No potential BTV values are reported in cases where parametric statistics are not warranted (i.e., no distribution assumption is valid, or all assumptions are unclear due to low DF or number of detected samples). In this case, the value “nc” is reported instead of a BTV. The value “nr” is reported for BTVs that are not recommended; see the “Note on BTVs” column for rationale.

[d] A range of values is provided for parametric statistics when multiple distribution types appeared to be reasonable (based on both statistical tests and visualizing Q-Q plots). Though both the WH and HW methods are valid for calculating gamma BTVs, results based on the WH method are provided in Table 12. The WH method results in more conservative (lower) gamma BTVs when the distribution is highly skewed (EPA 2013, 600837).

BCF = background characterization framework
BTV = background threshold value
d/s = downstream
DF = detection frequency
F = filtered
HW = Hawkins-Wixley
n = sample size
nc = not calculated
nr = not recommended/not reported
PCB = polychlorinated biphenyl
pCi = picocurie
Q-Q = quantile-quantile
SEP = Supplemental Environmental Project
SR = state route
SSC = suspended sediment concentration
UPL = upper prediction limit
USL = upper simultaneous limit
UF = unfiltered
UTL = upper tolerance limit
WH = Wilson-Hilferty

Table 14
SIP Review Results

Watershed	Number of Permitted Features (SMAs)	Number of Sites in SIP review	Number of Current SMA Monitoring Locations not Moved	Number of SMA Monitoring Locations Moved	Number of Investigative Monitoring Locations Added	Total Number of Monitoring Locations Proposed on Permit Reapplication
Los Alamos and Pueblo	64	107	46	18	5	69
Sandia	19	23	15	4	4	23
Mortandad	45	96	36	9	5	50
Pajarito	51	57	38	13	6	57
Water and Cañon de Valle	50	88	38	8	8	54
Ancho	9	15	8	1	0	9
Chaquehui	12	24	11	1	1	13
Total Number	**250**	**410**	**192**	**54**	**29**	**275**

Table 15
Sites that Qualify for No Discharge

Canyon	SMA	Site
Rendija Canyon	R-SMA-2.05	00-011(c)
Los Alamos Canyon	LA-SMA-6.27	21-021
		21-027(c)
	LA-SMA-6.36	21-021
		21-024(a)
	LA-SMA-10.11	53-002(a)
DP Canyon	DP-SMA-4	21-021
Sandia Canyon	S-SMA-4.5	20-002(d)
Canada del Buey	CDB-SMA-1.35	46-004(a2)
		46-004(u)
		46-004(v)

Table 15 (continued)

Canyon	SMA	Site
Canada del Buey	CDB-SMA-1.35	46-004(x)
		46-006(d)
		46-008(f)
	CDB-SMA-1.54	46-004(h)
		46-004(q)
		46-006(d)
	CDB-SMA-1.55	46-003(e)
	CDB-SMA-1.65	46-003(b)
Mortandad Canyon	M-SMA-9.1	35-016(f)
Pajarito Canyon	PJ-SMA-13	18-002(a)
	PJ-SMA-14	54-004

Table 16
Sites on Non-DOE Property

SWMU/AOC (Site)	SMA	Current Land Ownership of Site	2010 IP Compliance Status*	Brief Summary of Condition
00-011(d)	B-SMA-1	Los Alamos County/Private	CACompD	Site, sampling location, and majority of SMA are on Los Alamos County property, a small portion of SMA is on private property.
00-011(e)	R-SMA-2.3	USFS	BCComp	Site, sampling location, and SMA are located on USFS property
00-018(a)	P-SMA-3.05	Los Alamos County	CACompD	Site, sampling location, and SMA are located on Los Alamos County property
00-018(b)	P-SMA-0.3	Los Alamos County	CACompD	Site, sampling location, and SMA are located on Los Alamos County property
00-019	P-SMA-2.2	Los Alamos County	MEx	Site, sampling location, and SMA are located on Los Alamos County property
00-030(f)	ACID-SMA-2.01	Los Alamos County/Private	MEx	Discharge point, sampling location, and SMA are located on Los Alamos County property, footprint of Site is located on private property

Table 16 (continued)

SWMU/AOC (Site)	SMA	Current Land Ownership of Site	2010 IP Compliance Status*	Brief Summary of Condition
00-030(g)	ACID-SMA-1.05	Los Alamos County/Private	BCComp	Discharge point, sampling location, and SMA are located on Los Alamos County property, footprint of Site is located on private property
~~01-001(d)~~ 01-001(d1)	LA-SMA-5.01	Private	MEx	Permitted Site 01-001(d) administratively split into 01-001(d1), 01-001(d2), and 01-001(d3) in 2016. Site 01-001(d1) and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
~~01-001(d)~~ 01-001(d2)	LA-SMA-5.01	Private	MEx	Permitted Site 01-001(d) administratively split into 01-001(d1), 01-001(d2), and 01-001(d3) in 2016. Site 01-001(d2) and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
01-001(e)	LA-SMA-3.1	Los Alamos County/Private	MEx	Site and majority of SMA are located on LAC and/or private property. Sampling location and portion of SMA are located on DOE property
01-002(b)-00	ACID-SMA-2.1 and ACID-SMA-2	Los Alamos County/Private	CACompD	Site, sampling location and portion of SMA are located on Los Alamos County property. Majority of SMA are located on LAC and private property.
~~01-003(b)~~ 01-003(b1)	LA-SMA-4.1	Los Alamos County	AltCompR	Permitted Site 01-003(b) administratively split into 01-003(b1) and 01-003(b2) in 2016. Site 01-003(b1) and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
01-006(a)	LA-SMA-3.9	Private	MEx	Site is located on private property. SMA and sampling location are located on DOE property.
01-006(b)	LA-SMA-4.1	Los Alamos County	AltCompR	Site and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
01-006(c)	LA-SMA-4.2	Private	MEx	Site and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
01-006(d)	LA-SMA-4.2	Private	MEx	Site and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
~~01-006(h)~~ 01-006(h1)	LA-SMA-5.01	Private	MEx	Permitted Site 01-006(h) administratively split into 01-006(h1), 01-006(h2), and 01-006(h3) in 2016. Site 01-006(h1) and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
~~01-006(h)~~ 01-006(h2)	LA-SMA-5.01	Private	MEx	Permitted Site 01-006(h) administratively split into 01-006(h1), 01-006(h2), and 01-006(h3) in 2016. Site 01-006(h2) and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.

Table 16 (continued)

SWMU/AOC (Site)	SMA	Current Land Ownership of Site	2010 IP Compliance Status*	Brief Summary of Condition
~~01-006(h)~~ 01-006(h3)	LA-SMA-5.01	Private	MEx	Permitted Site 01-006(h) administratively split into 01-006(h1), 01-006(h2), and 01-006(h3) in 2016. Site 01-006(h3) and portion of SMA are located on private property. Portion of SMA and sampling location are located on DOE property.
10-001(a)	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-001(b)	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-001(c)	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-001(d)	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-004(a)	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-004(b)	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-008	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
10-009	B-SMA-0.5	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
21-009	LA-SMA-5.91	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
21-013(b)	LA-SMA-5.92	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property
21-013(g)	LA-SMA-5.92	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
21-018(a)	LA-SMA-5.92	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property
21-023(c)	LA-SMA-5.91	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.
21-027(d)	LA-SMA-5.91	Los Alamos County	CAM/FMCOC	Site, SMA and sampling location are located on Los Alamos County property.
45-001	ACID-SMA-2	Los Alamos County/Private	CACompD	Site, portion of SMA and sampling location are located on Los Alamos County property. Portion of SMA is located on private property.
45-002	ACID-SMA-2	Los Alamos County/Private	CACompD	Site, portion of SMA and sampling location are located on Los Alamos County property. Portion of SMA is located on private property.
45-004	ACID-SMA-2	Los Alamos County/Private	CACompD	Site, portion of SMA and sampling location are located on Los Alamos County property. Portion of SMA is located on private property.
73-001(a)	P-SMA-1	Los Alamos County	MEx	Site, SMA and sampling location are located on Los Alamos County property
73-002	P-SMA-2	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property
73-004(d)	P-SMA-1	Los Alamos County	MEx	Site, SMA and sampling location are located on Los Alamos County property
73-006	P-SMA-2	Los Alamos County	CACompD	Site, SMA and sampling location are located on Los Alamos County property.

Table 16 (continued)

SWMU/AOC (Site)	SMA	Current Land Ownership of Site	2010 IP Compliance Status*	Brief Summary of Condition
C-00-020	R-SMA-0.5	USFS	CACompD	Site, SMA and sampling location are located on USFS property.
C-00-041	R-SMA-1	Los Alamos County/USFS	CACompD	Portions of Site and SMA are located on LAC property. Portions of Site and SMA and sampling location are located on USFS property.

* Complaince Status codes:

AltCompR = Alternative compliance requested.

BCComp = Baseline control measures complete (all results for all POCs are below TALs and no further sampling is required).

CACompD = Corrective action complete (RCRA Certificate of Completion under Consent Order, collect no sample).

CAM/FMCOC = Corrective action monitoring (collect two confirmation samples after installation of enhanced control measures)/Permittees submitted a request for an extension because of a force majeure event.

MEx = Extended baseline monitoring (confirmation monitoring will continue until a sample is collected).

Table 17
Deferred Sites

SMA	Site	Site History
R-1.95	00-015	Active Firing Site
W-SMA-10	11-002	Burn Site
W-SMA-10	11-003(b)	Air gun
W-SMA-9.5	11-012(c)	Potential soil contamination
CDV-SMA-6.01	14-001(g)	Firing Site
CDV-SMA-6.02	14-002(d)	Firing Site
CDV-SMA-6.02	14-002(e)	Firing Site
PT-SMA-1.7	15-006(a)	PHERMEX firing site
3M-SMA-0.4	15-006(b)	Active firing Site
PT-SMA-2	15-008(f)	IJ Firing Site
PT-SMA-3	36-004(a)	Active Firing Site - Eenie
F-SMA-2	36-004(c)	Active Firing Site - Minie
PT-SMA-4.2	36-004(d)	Active Firing Site -Lower Slobbovia
PT-SMA-2	36-004(e)	Active Firing Site - IJ
A-SMA-1.1	39-004(a)	Firing Site
A-SMA-2	39-004(b)	Firing Site
A-SMA-3	39-004(c)	Firing Site
A-SMA-1.1	39-004(d)	Firing Site 39-57 (open detonation) RCRA Unit (active)
A-SMA-2	39-004(e)	Firing Site
A-SMA-2.7	39-008	Area of potential soil contamination
PJ-SMA-8	40-006(b)	Firing Site
PJ-SMA-7	40-006(c)	Firing Site
LA-SMA5.31	41-002(c)	Sludge drying bed
M-SMA-3	48-005	Inactive RLW lines
M-SMA-4	48-005	Inactive RLW lines
S-SMA-6	72-001	Firing Site
PT-SMA-2.01	C-36-001	Containment Vessel
PT-SMA-2.01	C-36-006(e)	Projectile Test Area
LA-SMA-5.35	C-41-004	Storm drains
S-SMA-0.25	03-013(a)	Storm drain
3M-SMA-0.5	15-006(c)	Active Firing Site
A-SMA-3.5	39-006(a)	Septic System
PJ-SMA-10	40-006(a)	Active Firing Site

Attachment 1

Proposed Changes to the 2015 Draft Individual Permit, Redline Strikeout Version and Changes Accepted Version

Redline-Strikeout Version of the Proposed Changes to the 2015 Draft Individual Permit

Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733 **NPDES Permit No. NM0030759**

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATIONSYSTEM

In compliance with the provisions of the Clean Water Act, as amended,
(33 U.S.C. 1251 et. seq; the "Act"),

Los Alamos National Laboratory (LANL), managed and owned by Permittees

~~Los Alamos National Security, LLC and U.S. Department of Energy~~
~~Management Contractor for Operations Los Alamos Area Office~~
~~Los Alamos, New Mexico 87545 Los Alamos, New Mexico 87544~~

Newport News Nuclear BWXT-Los Alamos, LLC and	U.S. Department of Energy
600 Sixth Street	Office of Environmental Management
Los Alamos, New Mexico 87544	Los Alamos Field Office
	P.O. Box 1663
	Los Alamos, New Mexico
	87545-1663

is authorized to discharge storm water associated with industrial activities from specified solid waste management units (SWMUs) and areas of concern (AOCs) (as identified in Appendix A and referred to herein as "Sites") from the facility located at Los Alamos, New Mexico, to receiving waters named:

Tributaries or main channels of Mortandad Canyon, Canada del Buey, Los Alamos Canyon, DP Canyon, Sandia Canyon, Ten Site Canyon, Canyon de Valle, Water Canyon, Ancho Canyon, Bayo Canyon, Chaquehui Canyon, Fence Canyon, Pajarito Canyon, Two-mile Canyon, Threemile Canyon, Potrillo Canyon, Pueblo Canyon, and Rendija Canyon, in Water Body Segment No. 20.6.4.98, 20.6.4.126 or 20.6.4.128 of the Rio Grande Basin,

in accordance with this cover page and monitoring requirements, and other conditions set forth in the ~~Parts I [~~Requirements for NPDES Permits and Appendices A through C,~~], II [Other Conditions], and III [Standard Conditions for NPDES Permits]~~ hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Issued on Prepared by

~~William K. Honker~~ Charles Maguire Isaac Chen

Permittees' Recommendations for NPDES Storm Water Individual Permit (NM0030759):

Director
Water Quality Protection Division (6WQ)

Environmental Engineer
NPDES Permits Branch (6WQ-P)

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~~PART I –~~REQUIREMENTS FOR NPDES PERMITS

This Permit authorizes only those storm water discharges associated with inactive solid waste management units (SWMUs) and areas of concerns~~s~~ (AOCs) listed in the Hazardous Waste Permit (Permit No. NM0890010515) for Los Alamos National Laboratory (LANL). The SWMUs and AOCs applicable to this permit are listed in Appendix A.~~. of the this Permit.~~ The SWMUs and AOCs identified in Appendix A are collectively referred to throughout this Permit as "Sites." This Permit does not authorize storm water discharges associated with current conventional industrial activities at ~~the Permittees'~~ LANL~~facility~~. Storm water discharges associated with current conventional industrial activities are ~~currently~~ covered under U.S. Environmental Protection Agency's (EPA's) National Pollutant Discharge Elimination System (NPDES) general permit for storm water discharges from industrial activity, also known as the Multi-Sector General Permit (MSGP). Unless otherwise specified, references to "industrial activity" or "industrial storm water" under this Permit refer to the definition of "storm water discharge associated with industrial activity" at 40 C.F.R. § 122.26(b)(14).

~~The~~ This Permit contains non-numeric technology-based effluent limitations, coupled with a comprehensive, coordinated monitoring program and corrective action where necessary, to minimize pollutants of concern (POC), or site-related constituents, in Permittees' storm water discharges. As used in this Permit, "minimize" means to reduce and/or eliminate discharges of ~~pollutant~~POCs in storm water to the extent achievable using site-specific control measures (including best management practices) that reflect best industry practice considering their technological availability, economic achievability and practicability.

The Permittees are required to implement site-specific control measures (including best management practices) to address the non-numeric technology-based effluent limits contained in ~~the~~ this Permit, followed by confirmation monitoring screened against New Mexico water-quality criteria-equivalent target action levels (TALs) to determine the effectiveness of the site-specific measures. Any TAL exceedances will be evaluated and informed by background threshold values (BTVs) for those ~~constituent~~POCs that are released by natural or urban environments and are not Site-related. The Permittees must also develop, maintain, and update a Site Discharge Pollution Prevention Plan (SDPPP) and Sampling Implementation Plan (SIP) consistent with ~~Sections~~ Parts D.1 and F.1~~.~~ of ~~the~~ this Permit. Collectively, these plans describe the ~~describing the~~ control measures used to meet the requirements of ~~the~~ this Permit.

A. MAINTENANCE OF CONTROL MEASURES

For all Sites identified in Appendix A of this Permit, the Permittees shall install and maintain structural and nonstructural control measures to meet the non-numeric technology-based effluent limits, as necessary, to minimize Site-related ~~pollutant~~POCs in storm water discharges. Nothing in this Permit relieves the Permittees of the obligation to implement additional control measures required by other Federal authorities or by a State or local authority. Structural control measures, the installation of which involve the discharge of dredge or placement of fill material into any receiving waters (e.g., wetlands), may require a separate permit under section 404 of the Clean Water Act (CWA) before installation.

1. **Structural Control Measures**

(a) Basic structural control measures include:

(i)~~–~~ **Erosion and Sedimentation Controls.** The Permittees must minimize discharges of ~~pollutant~~POCs caused by onsite erosion and sedimentation. The Permittees must implement structural, vegetative, and/or stabilization control measures as necessary to achieve this requirement.

(ii) **Management of Run-on and Runoff.** The Permittees must, to the extent practicable, divert, infiltrate, reuse, contain, detain, or otherwise reduce storm water run-on/runoff to minimize Site-related ~~pollutant~~POCs from discharging to receiving waters.

(iii) **Unauthorized Discharges.** The Permittees must eliminate non-storm water discharges (e.g., process wastewater, spills or leaks of toxic or hazardous materials, contaminated groundwater, or any contaminated non–storm water) not authorized by an NPDES permit.

(iv) **Other Controls.** The Permittees must do the following where applicable:

(a) Implement controls to ~~ensure~~ prevent the discharge of ~~no~~ waste, garbage, or floatable debris ~~is discharged~~ to receiving waters, except as authorized by a permit issued under section 404 of the CWA;

(b) Minimize the generation of dust, along with ~~off-site~~ vehicles tracking ~~of~~ raw, final, or waste materials or sediments off-site;

(c) Minimize the introduction of raw, final, or waste materials to exposed areas;

(d) Minimize the effects of any increase in downstream erosion resulting from the construction and operation of structural controls; and

(e) Place flow velocity dissipation devices at discharge locations and along the length of any discharge channel if the flows would otherwise create erosive conditions.

(b) The Permittees must maintain control measures in effective operating condition. Failure to do so is a violation of this Permit. These maintenance requirements under this Permit do not apply to:

(i) Controls installed for a Site that has been removed from the Permit so that discharges from that Site are no longer authorized under this permit, or

(ii) A control measure that has been replaced by another control measure, or

(iii) A control measure that has been retired because it is no longer necessary to perform the functions of a control as defined by Part ~~I.~~A.1(a)(i) or (ii).

~~The Permittees must maintain all control measures in effective operating condition.~~ The Permittees must keep documentation onsite that describes procedures and a plan for inspection and preventative maintenance of all control measures and specifies ~~discussions of~~ backup practices ~~in place~~to be used should a runoff event occur while a control measure is off-line. Nonstructural control measures must also be diligently maintained (e.g., employee training described in Part A.2~~.~~). Nothing in this Permit shall be construed to prevent the Permittees from taking action(s) to modify control measures as appropriate to address deficiencies.

If, during an inspection or other event, a control measure is identified as not operating effectively, ~~inspections, or any other event or observation, control measures that are not operating effectively are identified,~~ the Permittees must repair or replace ~~them~~ the control before the next anticipated storm event if possible, or as soon as practicable, following that storm event. In the interim, the Permittees must have backup measures in place.

Requirements of inspection and maintenance of existing control measures described in this part, Part ~~I.~~A, also ~~applies~~ apply to additional, enhanced, or advanced control measures.

2. Nonstructural Control Measures

The Permittees must provide training at least once per year to ~~all~~ employees who are responsible for implementing activities identified in the Permit and the SDPPP (e.g., inspectors, maintenance personnel), including ~~all~~ members of the Site Discharge Pollution Prevention Team (referred to as Pollution Prevention Team in this Permit). Training must cover ~~both~~ the specific components of the Permit, the ~~and~~ scope of the SDPPP, and the control measures required under this Part. The Permittees shall maintain ~~the~~ records of ~~Permit~~ employee training ~~program~~.

~~**B. APPLICABLE TARGET ACTION LEVELS**~~

~~The target action levels established below are based on and equivalent to New Mexico State water quality criteria for the subject pollutants. The applicable target action levels are not themselves effluent limitations, but are benchmarks to determine the effectiveness of control measures implemented to meet the non-numeric technology-based effluent limitations. Monitoring results based on analytical data showing pollutant concentrations above applicable target action levels at any Site indicate that further corrective action may be required.~~

~~Total, unless indicated~~	~~CAS No.~~	~~MQL (µg/l)(*1)~~	~~ATAL (µg/l)(*2)~~	~~MTAL (µg/l)(*3)~~
	~~**RADIOACTIVITIES**~~			
~~Ra-226 and Ra-228 (pCi/l)~~			~~30~~	~~---~~
~~Adjusted Gross Alpha (pCi/l)~~			~~15~~	~~---~~
	~~**METALS**~~			
~~Aluminum, total recoverable~~	~~7429-90-5~~	~~2.5~~	~~---~~	~~3421~~
~~Antimony, dissolved (P)~~	~~7440-36-0~~	~~60~~	~~640~~	~~---~~
~~Arsenic, dissolved (P)~~	~~7440-38-2~~	~~0.5~~	~~9~~	~~340~~
~~Boron, dissolved~~	~~7440-42-8~~	~~100~~	~~5000~~	~~---~~
~~Cadmium, dissolved~~	~~7440-43-9~~	~~1~~	~~---~~	~~(*5)~~
~~Chromium VI, dissolved~~	~~18540-29-9~~	~~10~~	~~---~~	~~16~~
~~Cobalt, dissolved~~	~~7440-48-4~~	~~50~~	~~1000~~	~~---~~
~~Copper, dissolved~~	~~7440-50-8~~	~~0.5~~	~~---~~	~~(*5)~~
~~Lead, dissolved~~	~~7439-92-1~~	~~0.5~~	~~---~~	~~(*5)~~
~~Mercury, dissolved~~	~~7439-97-6~~	~~0.005~~	~~0.77~~	~~1.4~~
~~Mercury, total~~	~~7439-97-6~~	~~0.005~~	~~0.77~~	~~---~~

~~Total, unless indicated~~	~~CAS No.~~	~~MQL (µg/l)(*1)~~	~~ATAL (µg/l)(*2)~~	~~MTAL (µg/l)(*3)~~
~~Nickel, dissolved (P)~~	~~7440-02-0~~	~~0.5~~	~~---~~	~~(*5)~~
~~Selenium, total recoverable~~	~~7782-49-2~~	~~5~~	~~5~~	~~20~~
~~Silver, dissolved~~	~~7440-22-4~~	~~0.5~~	~~---~~	~~(*5)~~
~~Thallium, dissolved (P)~~	~~7440-28-0~~	~~0.5~~	~~0.47~~	~~---~~
~~Vanadium, dissolved~~	~~7440-62-2~~	~~50~~	~~100~~	~~---~~
~~Zinc, dissolved~~	~~7440-66-6~~	~~20~~	~~---~~	~~(*5)~~
	~~**CYANIDE**~~			
~~Cyanide, total recoverable~~	~~57-12-5~~	~~10~~	~~5.2~~	~~22~~
	~~**DIOXIN**~~			
~~2,3,7,8-TCDD (P)~~	~~1746-01-6~~	~~0.00001~~	~~5.1E-08~~	~~---~~
	~~**SEMIVOLATILE COMPOUNDS**~~			
~~Pentachlorophenol~~	~~87-86-5~~	~~5~~	~~---~~	~~19~~
~~Benzo(a)pyrene (P)~~	~~50-32-8~~	~~5~~	~~0.18~~	~~---~~
~~Hexachlorobenzene (P)~~	~~118-74-1~~	~~5~~	~~0.0029~~	~~---~~
	~~**PESTICIDES**~~			
~~Aldrin (P)~~	~~309-00-2~~	~~0.01~~	~~0.0005~~	~~3~~
~~Gamma-BHC~~	~~58-89-9~~	~~0.05~~	~~---~~	~~0.95~~
~~Chlordane (P)~~	~~57-74-9~~	~~0.2~~	~~0.0081~~	~~2.4~~
~~4,4'-DDT and derivatives (P)~~	~~50-29-3~~	~~0.02~~	~~0.001~~	~~1.1~~
~~Dieldrin (P)~~	~~60-57-1~~	~~0.02~~	~~0.00054~~	~~0.24~~
~~Alpha-Endosulfan~~	~~959-98-8~~	~~0.01~~	~~---~~	~~0.22~~
~~Beta-Endosulfan~~	~~33213-65-9~~	~~0.02~~	~~---~~	~~0.22~~
~~Endrin~~	~~72-20-8~~	~~0.02~~	~~---~~	~~0.086~~
~~Heptachlor~~	~~76-44-8~~	~~0.01~~	~~---~~	~~0.52~~
~~Heptachlor Epoxide~~	~~1024-57-3~~	~~0.01~~	~~---~~	~~0.52~~
~~Toxaphene~~	~~8001-35-2~~	~~0.3~~	~~---~~	~~0.73~~
	~~**PCBS**~~			
~~PCBs (P)~~	~~1336-36-3~~	~~(*4)~~	~~0.00064~~	~~---~~
	~~**HIGH EXPLOSIVES**~~			
~~RDX~~	~~121-82-4~~		~~200~~	~~---~~
~~2,4,6-Trinitrotoluene (TNT)~~	~~118-96-7~~		~~20~~	~~---~~

~~Footnote:~~

~~(*1) MQL is the minimum quantification level. EPA approved analytical methods with the same or more sensitive detectable level (DL) than MQL shall be used. If an individual analytical test result is smaller than the MQL or the more sensitive DL, a value of zero (0) or "ND" may be used for reporting and action purpose.~~

~~(*2) ATAL stands for Average Target Action Level~~

~~(*3) MTAL stands for Maximum Target Action Level~~

~~(*4) Method 1668 Revision C or the most current revision of the Congener Method shall be used for PCB analysis. See Appendix C for MQL.~~

~~(*5) Hardness-dependent metals target action levels. (See Appendix F)~~

B. CONFIRMATION MONITORING REQUIREMENTS

The Permittees shall monitor POCs in storm water discharges from Sites at specified sampling points known as site monitoring areas (SMAs) ~~against applicable target action levels~~. The Permittees shall perform confirmation monitoring as detailed below following installation ~~in accordance with Permittees' SDPPP~~ of each site-specific control measure~~, including any enhanced or additional control measure installed as corrective action. Pollutants of concern to be monitored are specified in Appendix B.~~.

1. Confirmation Sampling

~~After new, modified, or enhanced control measures are installed, the Permittees shall collect two or more confirmation samples. The Permittees shall immediately restart the samplers after collection of a sample.~~

If, during the previous permit, all analytical results(s) for a particular POC at a particular SMA listed in Appendix A were at or below the maximum target action level (MTAL) and/or the geomean of all analytical sampling result(s) was at or below the average target action level (ATAL), monitoring of that POC at the same SMA is not required.

If corrective action was initiated during the previous Permit, the Permittees shall determine confirmation monitoring requirements based on the Annual Sampling Implementation Plan (SIP; Part D.1). Annual confirmation monitoring requirements shall be maintained in the SIP. If confirmation monitoring is required, the Permittees shall collect two confirmation samples.

Confirmation sampling is used to determine the effectiveness of baseline and enhanced control measure installations, and to inform the Permittees if additional corrective actions are necessary. There are several categories of confirmation monitoring required by this Permit;

(a) After baseline or enhanced control measures are installed, the Permittees shall collect two confirmation samples. The Permittees shall continue to sample ~~restart the samplers~~ after collection of ~~a~~ the first sample, unless the end of monitoring season weather makes this impractical.

(b) After construction of a cap or other engineered cover, one confirmation sample is required if the capped area is smaller than the SMA drainage area. Otherwise, no further confirmation sampling is required, unless required by Part B.5.

(c) Following certification of completion of soil removal, the Permittees shall perform storm water confirmation sampling. The Permittees shall collect two confirmation samples. If a TAL is not exceeded for two samples, then further monitoring is not required for the remainder of Permit and the Permittees may seek to delete the Site or Sites from the Permit pursuant to Part I.2(d).

~~(a)~~(d) After installation of control measures that retain a volume of storm water runoff from a Site or SMA that is equivalent to a 3-year, 24-hour storm event or greater, the Permittees will be in compliance with this Permit at that Site or SMA once they have certified through the submission of certified as-built drawings, that such measures have been properly installed to perform their function to totally retain the appropriate design volume of storm water. No further confirmation monitoring is required post-certification, unless required by Part B.5.

2. Sampling Locations

All samples collected for purposes of confirmation monitoring shall be collected in accordance with the monitoring requirements specified below at the SMAs identified in Appendix A of~~to~~ ~~the~~ this Permit. ~~Instead of monitoring at each individual Site, the Permittees may, when appropriate based on drainage patterns for the affected Sites, monitor two or more Sites in conjunction at an associated SMA, as long as the SMA and all associated Sites are identified in Appendix A to the Permit.~~ SMA locations are based on reasonable site accessibility for sampling purposes and the Permittees' best judgment ~~to ensure~~ that samples taken ~~at a particular point~~ will be representative of discharges of storm water from Site-affected media (soil, sediment, or bedrock)~~ and to minimize potential impacts from confounding factors (e.g., urban runoff and construction activity).~~ as determined by the SIP. The ~~size of~~ drainage area of each SMA shall be representative of ~~and as close as practical to the size~~ of the Site or Sites within the SMA.

~~**(a) Sampling locations**. All sampling locations should be representative of storm water discharges collected from affected Sites. Factors for selection of sampling locations may include, but are not limited to, concentrations of Site-related constituents in shallow soils (i.e., less than 3 feet below ground surface), Site surface water drainage patterns, Site history identifying areas of known or potential releases, Site accessibility, and run-on from non-Site affected areas.~~

(a) ~~(b)~~**Sampler location adjustments.** The Permittees may move a sampler to make adjustments that arise from changes in natural conditions, installation of structural controls, unexpected events, or as otherwise necessary to ensure the sampling location is representative of storm water discharges from the Site-affected media as delineated by soil sampling data. Such changes may include minor updates in Site boundaries, changes in storm water drainage patterns, or adjustments due ~~, logistical~~to logistical or security issues.~~, or security adjustment.~~ Any such movement of a sampler ~~will~~ shall be ~~be published on the LANL Individual Permit public website within 30 days after the change occurs and~~ documented in the annual SIP and SDPPP.

(b) **Sampler additions**: In the event that the annual SIP identifies potential discharges from a Site within an SMA that may not flow through the current monitoring location, the Permittees shall add additional sampling locations during the Permit term in order to collect additional investigation samples. Each additional sampling location and the corresponding sampling results are subject to the sampling, reporting, inspection, and corrective action requirements of this Permit. ~~new information indicates the current sampling location is not representative of discharges from the Site-affected media, the Permittees may add additional sampling locations during the permit term in order to collect more~~

~~representative samples. Proportional sample volumes shall be composited for analysis if samples collected from more than one location are collected. The Permittees shall provide relevant documentation to support the determination for additional sampling locations to EPA and the New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB), and make such documentation available on the LANL Individual Permit public website within 30 days after submittal of supporting documents to EPA and included in the next update to the SDPPP.~~

3. Sampling Procedures

Any sampling performed for purposes of confirmation monitoring at a particular SMA must be performed after installation of applicable control measures and following a storm event~~,~~ ~~after installation of applicable control measures~~ that results in an actual discharge from the Site or Sites and that produces sufficient volume to perform the required analyses (referred to herein as a "measurable storm event"). For each sampling event, the Permittees must identify the date and duration (in hours) of the storm event(s) sampled, rainfall measurements or estimates (in inches) of the storm event that generated the sampled runoff, and the duration between the storm event sample~~s~~ collection and the end of the previous measurable storm event. The Permittees may take meteorological information from the nearest meteorological tower or ~~automated~~ rain gage. Snowmelt samples shall not be used for purposes of confirmation monitoring.

Grab samples shall be taken ~~when discharge occurs. Samples must be collected beginning~~ within the first thirty (30) minutes of (or as soon after as practical, but beginning no later than one (1) hour after) a measurable storm event.

4. Collection of Partial Samples

In the event the collected volume is insufficient to perform all required analyses listed in ~~Appendix B~~the SIP, the partial sample shall be analyzed in accordance with a priority list of Site-specific ~~analyte~~POCs determined by the Permittees based upon a review of site history, soil data, and other acceptable knowledge ~~as defined under Part I. D.1(b)~~. The priority list for each Site is documented in ~~Appendix B~~the SIP ~~Appendix B. The results of the analyses of the partial sample shall be reported by e-mail to EPA, with a copy to NMED, documented in the next update to the SDPPP and published on the LANL Individual Permit public website within 30 days of receipt of the sample analytical results. The results of a partial sample shall be evaluated under Parts I.C.5 and I.D.~~.

In the event that a partial sample is collected, the Permittees shall immediately reactivate the sampler to attempt to complete the full Site-specific ~~analyte~~POC suite listed in ~~Appendix B~~ the SIP.

~~**5. Confirmation Results below TALs**~~

~~**(a) Removal of Appendix B Monitoring Requirements for a Site or SMA**~~

~~A minimum of two confirmation samples must be collected and analyzed before one or more pollutants of concern may be removed from monitoring requirements for an individual SMA, except as provided in Part I.H.1. The two samples required for initial sampling under Part I.C.1 are sufficient to meet this requirement, provided analytical results for the pollutant(s) of concern at the same SMA if all analytical results for a pollutant of concern at a particular SMA are at or below the maximum target action level (MTAL) and the average of all applicable sampling results is at or below the average target action level (ATAL).~~

5. Additional Sampling Requirements

(a) If soil disturbance within the Site-affected media occurs, storm water samples collected by the Permittees following these activities shall be analyzed for all ~~pollutant~~POCs listed in ~~Appendix B~~the SIP for that SMA. Installation of controls and routine maintenance of monitoring devices are not subject to the requirements of this Part.

(b) Notwithstanding the provisions of Parts ~~I.C.5~~ B.1 and C.1, and except as provided in Part ~~I.H~~ I.1, if a Site for which monitoring has ceased later exhibits evidence of a discharge of contaminated runoff or conditions that could lead to a discharge of contaminated runoff, such as control measure failure, erosion problems, re-exposure of "no exposure" Sites, or if monitoring data (from the facility, state or local agency) show an exceedance of applicable TALs, the Permittees shall initiate appropriate actions to correct the problems within thirty (30) days of being made aware of such information and shall report the problem and the corrective actions taken to EPA, with a copy to the New Mexico Environment Department (NMED).

C. CORRECTIVE ACTION SCREENING

A corrective action evaluation will be conducted i~~I~~f any validated analytical result for a particular ~~pollutantof concern~~POC from a confirmation sample at an individual SMA is greater than the MTAL (Appendix C) or the geomean of all applicable sampling results is greater than the ATAL (Appendix C) or BTV (Appendix B). ~~the Permittees shall conduct visual inspections for all Sites within the SMA. If the Permittees are not able to document that the Site is not reasonably expected to be the source of the pollutant under Parts I.D.1, the Permittees shall initiate corrective action measures as soon as practicable, as required in Part I.D.2 below.~~

If a Site(s) is ~~currently~~ in corrective action as a result of activity completed under ~~from~~ the 2010 Permit, the Permittees shall follow the requirements pursuant to Part C.2 to continue towards a certification of completion.

1. Site~~- Contributing~~ Specific ~~Evaluation~~Demonstration

~~If analytical results are greater than the TAL the Permittees will take action to determine if the pollutants of concern are, or are not, reasonably expected to be Site-related.~~

~~(a) If analytical results for one or more pollutants of concern at an SMA are greater than the applicable TAL the Permittees may choose to submit a site-specific demonstration (SSD) to EPA, with a copy to NMED, or its designee, that the Site or Sites are not reasonably expected to be the source for one or more of the remaining pollutant(s) of concern.~~

~~This demonstration may include the collection of storm water run-on data for all constituents that exceeded the TALs, from a sampler located above the Site. In addition, the Permittees may choose to collect additional runoff data below a Site or Sites. The runoff sampler may or may not be the SMA sampler location, but the runoff sampler location should be representative of runoff from Site-affected media for the Site(s) being evaluated by the SSD. An example where a runoff sampler is not the SMA sampler is where two or more Sites exist within an SMA and the Permittees choose to monitor runoff from a single Site in the SMA~~

The Permittees may choose to demonstrate that a TAL exceedance is beyond the Permittees' control. Sources that are outside the Permittees' control include natural background and aerial deposition of contaminants not associated with the current or historic activities conducted by the Permittees. The demonstration must include data previously collected by the Permittees or others (including literature studies) that describe the levels of natural background and baseline concentrations of pollutants in storm water in the local area.

The Permittees may choose one or more of the following methods ~~in the SSD to demonstrate~~ to perform a site-specific demonstration (SSD) showing that the Site or Sites are not reasonably expected to be the source for one or more of the remaining ~~pollutants of concern~~ POCs that have exceeded applicable TALs. For Sites where data has been collected under the 2010 Permit, this demonstration must be conducted within 1 year of the effective date of this Permit. The results shall be provided in the initial SIP pursuant to Part D.1 and annually thereafter.

(a) **Run-on ~~(including precipitation)~~ /runoff evaluation.** ~~Collect a minimum of three storm water samples from each of the run-on (including precipitation) and runoff locations, and compare the geomean of run-on and runoff data.~~ This demonstration may include the collection of storm water run-on data for all POCs that exceeded the TALs, from a sampler located above the Site. In addition, the Permittees may choose to collect additional runoff data below a Site or Sites. The runoff sampler may or may not be the SMA sampler location, but the runoff sampler location should be representative of runoff from Site-affected media for the Site(s) being evaluated by the SSD. An example where a runoff sampler is not the SMA sampler is where two or more Sites exist within an SMA and the Permittees choose to monitor runoff from a single Site in the SMA.

If the following condition is met, the Permittees will have demonstrated that the Site or Sites are not reasonably expected to be the sole source for one or more of the remaining POCs and the Permittees will have also demonstrated that discharges from the Site or Sites do not contribute to the exceedance of TALs. Further confirmation sampling for those POCs are not required.

Geomean (runoff) – Geomean (run-on/precipitation) <= TAL

(b) **~~Run-on (including precipitation) and s~~Site-specific information.** If the Permittees collect a minimum of one~~sample from the run-on sampler, but are unable to collect the minimum number of run-on samples required for the run-on/run-off evaluation,~~ confirmation sample that exceeds a TAL, the Permittees ~~shall~~ may use this data, ~~combined with an evaluation of~~along with other ~~to evaluate other~~ Site-specific information, to determine if the Site or Sites are reasonably expected to be the source of the ~~pollutant~~POC that exceeds the applicable TAL(s). Sources of site-specific information include, but are not limited to, site history, validated surface soil data (i.e., ~~top 3 ft~~ collected in top 3 feet), BTVs, ~~applicable natural background or baseline concentrations of storm water pollutants,~~ information on land use ~~above~~ upstream of and within the SMA, ~~urban background storm water values~~ and scientific literature.

~~(b) If the following condition is met, the Permittees has demonstrated that the Site or Sites are not reasonably expected to be the sole source for one or more of the remaining pollutant(s) of concern and the Permittees have also demonstrated that discharges from the Site or Sites do not contribute exceedance of TALs. Further confirmation sampling for those pollutants of concern are not required.~~

~~Geomean (run-off) – Geomean (run-on/precipitation) <= TAL~~

(i) **Storm Water (SW):** If Permittees choose to use Site-specific information in the SSD, confirmation storm water monitoring results shall be compared to the TALs (Appendix C) and to the BTVs (Appendix B) using the composite BTV formula below. Permittees shall compare the confirmation sample results to the composite BTV.

90th percentile composite BTV = (% impervious SMA area * 90th percentile developed landscape BTV) + (% pervious SMA area * 90th percentile undeveloped landscape BTV)

where the % impervious SMA area is the % impervious, or developed, area of the SMA, and the % pervious SMA area is the % pervious, or undeveloped, area of the SMA. The % impervious and pervious SMA areas and the resulting composite BTV for each Site shall be listed in an appendix of the annual SIP. The Permittees shall provide the results of the screening process in the annual SIP based on the comparison of confirmation sample results with composite BTVs and TALs. The results of the comparison shall be sorted into the following tiers:

SW Tier 1: When the confirmation sample result is less than the TAL, the Permittees can cease monitoring for that POC for the remainder of the permit and it is not considered as a Site-related POC.

SW Tier 2: When the confirmation sample result of one or more POCs exceeds the TAL but is less than the 90th percentile composite BTV, the SMA shall enter into long-term stewardship (LTS) and meet the requirements of Part G.3. However, if the BTV and the confirmation sample result are less than the TAL, SW Tier 1 applies.

SW Tier 3: When the confirmation sample result of one or more POCs exceeds the 90th percentile composite BTV, the SMA shall enter into corrective action per Part E. However, if the BTV and the confirmation sample result are less than the TAL, SW Tier 1 applies.

(ii) **Soil Data (SD):** Using validated surface soil data results (i.e., within 3 feet below ground surface) from Consent Order soil characterization efforts, the following comparison can be made: 95-95 upper tolerance limit (UTL) BTVs for inorganic POCs (LANL 1998, "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory"), and 2019 NMED soil screening levels (SSLs) for organic POCs and inorganic POCs with no BTV. The results of the comparison shall be sorted into the following tiers:

SD Tier 1: When the soil sample result is less than the 95-95 UTL BTV for inorganic POCs or less than 10% of the SSL for organic POCs and inorganic POCs with no BTV, the Permittees can cease monitoring for that POC and it is not considered as a Site-related POC. If SW Tier 1 conditions are also met, Permittees may request the Site be deleted from the Permit.

SD Tier 2: When the soil sample result of one or more POCs exceed the 95-95 UTL BTV for inorganic POCs or 10% of the SSL for organic POCs and inorganic POCs with no BTV, the POC shall remain or be added to storm water monitoring requirements for that SMA if it is considered as a Site-related POC.

The tier results of the confirmation and/or soil data comparisons shall be used to determine annual sampling requirements and whether POCs are reasonably expected to be the source for one or more of the POCs (see Part D).

(iii) **Site History**: In order for a POC to be determined as Site-related and added to the SIP for monitoring, documentation should provide evidence that the POC was managed or released at the Site during historic industrial activities; as well as evidence that supports that the Site is exposed to storm water and that the Site generated storm water runoff while exposed. Relevant documentation of Site-related knowledge shall be reported in the SIP.

When confirmation monitoring or soil data is unavailable, and no relevant Site history exists, Consent Order sample collection may be accelerated and results can be used to assess appropriate SMA monitoring.

2. Monitoring at Sites in Corrective Action

For each SMA with Sites in corrective action, the following requirements apply:

(a) If the Permittees have collected a confirmation sample and are currently in corrective action, they shall complete the corrective action and proceed to confirmation monitoring pursuant to Part B.

(b) If the Permittees have previously installed and certified enhanced controls, they shall collect two confirmation samples if no sample has been collected, or one confirmation sample if a sample has already been collected.

(c) If the Permittees have submitted requests (e.g., Alternative Compliance, or force majeure) to EPA that are pending, the Permittees shall complete an SSD pursuant to Part C.1 to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TALs or BTVs.

(d) If the Permittees have achieved Resource Conservation and Recovery Act (RCRA) corrective action complete status under the NMED Consent Order and have, by definition, collected at least one confirmation sample, the Permittees shall complete an SSD pursuant to Part C.1 to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TALs or BTVs.

For Sites with a completed SSD, the tier results of the confirmation monitoring and/or soil data comparisons shall be used to determine annual sampling requirements. ~~If EPA approves an SSD demonstrating that no applicable TAL exceedances are reasonably expected to be Site-related, for all SMAs identified as containing the Site in Appendix A, the Permittees shall inspect and maintain all existing controls in accordance with Part I.A. (The Site is placed under the Inspection and Maintenance mode.)~~

~~(c) If EPA approves an SSD demonstrating that one or more pollutants of concern exceeding the applicable TALs are not reasonably expected to be Site-related no further confirmation sampling is required for that pollutant or pollutants for the Site or group of Sites within the associated SMA for the remaining period of the Permit.~~

~~(d) If EPA does not approve an SSD, approves an SSD with modifications, or approves an SSD in which one or more pollutants of concern exceeding the applicable TALs are not included, the Permittees shall perform a corrective action evaluation to determine the appropriate method for completion of corrective action measures for these pollutants of concern for the Site or Sites within the SMA pursuant to Part I.D.2.~~

D. ANNUAL SAMPLING IMPLEMENTATION PLAN

Within 1 year of the effective date of the Permit, the Permittees, in consultation with NMED Surface Water Quality Bureau (SWQB), shall evaluate the appropriate monitoring requirements and representative sampling locations for all Sites covered under this permit per Part C. Before May 1 of subsequent years, the Permittees shall review all new available information to determine if the current SMA storm water sampling location is representative of storm water discharges from Site-affected media and determine the appropriate monitoring requirements list for the upcoming field season.

1. Annual Sampling Implementation Plan

Any changes shall be documented in the annual SIP update. EPA may require the Permittees to submit additional information to justify proposed changes or document site knowledge regarding a Site in the SIP. If sampler moves are required by the SIP, samplers shall be moved to more representative locations at the initiation of the storm water sampling season or as soon as practicable to facilitate sample collection.

The SIP shall include the following:

(a) **Monitoring location list** - For each SMA, if the sampler location changed or a new location was added as an investigative sample location from the previous year, report any updated latitude and longitude and indicate the reason for the change in the appropriate SIP section. The representative sampling location review conducted in 2016–2018 resulted in new sample locations for several SMAs, and constitutes an initial review that shall be provided in the first SIP update following the issuance of this Permit. Monitoring locations shall be reviewed annually to ensure representative samples will continue to be collected.

When a Site and the associated controls are designated as a LTS location, monitoring is no longer required. The Permittees shall update the list of these Sites annually in the SIP. The Permittees shall meet the inspection requirements per Part G.3 and must track the status of inspections and maintenance completed.

(b) **Monitoring requirements list** – For each SMA, the Permittees must annually complete an SSD screening of new confirmation samples or soil data received during the previous year as required by Part C.1.

If the SIP requires the addition of one or more POCs for monitoring and the Site has previously entered corrective action, the Permittees are required to complete all applicable requirements of Part B.1 and initiate confirmation monitoring for all added POCs.

In the event that a POC that has been added for monitoring does not have a TAL or BTV listed in this Permit, the Permittees shall collect two samples. If there is an associated water quality standard for that water POC that is Site-related, the monitoring result shall be compared to that standard. Permittees will evaluate current and necessary best management practices to address any exceedances. The Permittees shall document analytical results and any voluntary actions taken in the SIP.

The results of the SIP updates must be presented in the annual update to the SDPPP as required by Part F.1. Additionally, the SIP updates must be published on the IP Public website per Part I.7(a).

E. CORRECTIVE ACTION

Once corrective action has been initiated, the Permittees are required to implement Site-specific control measures to address the non-numeric technology-based effluent limits contained in the Permit. The options for completion of corrective action include installation of enhanced control measures, elimination of exposure to POCs, or retention of a 3-year, 24-hour storm event as described below.

1. Evaluation of Corrective Action Measures

~~If no demonstration has been made that a Site or Sites are not reasonably expected to be the source of the TAL exceedance for one or more pollutants of concern pursuant to Part I.D.1, the Permittees shall perform a corrective action evaluation to determine the appropriate method for completion of corrective action.~~ Once a TAL or BTV has been exceeded for a Site-related POC, the Permittees shall perform a corrective action evaluation to determine the appropriate method for completion of corrective action. At a minimum, this corrective action evaluation shall consider the following: ~~comparison of the TAL exceedance with natural background and baseline values listed in Appendix F, run-on pollutant concentrations not impacted by Site-affected media;~~ volume of storm water currently retained and the potential for additional retention of storm water; potential and physical limitation for installation of Site-appropriate storm water controls (with consideration of technological availability); evaluation of the efficacy, limitations, and predicted water quality improvement performance of any proposed storm water controls based on published literature; or distribution of contaminants in soil and the predicted efficacy of any proposed soil removal on removal of ~~pollutants~~ POCs from storm water.

(a) Installation of Enhanced Control Measures

Enhanced (i.e., additional, expanded or better-tailored) control measures may be used to complete corrective action. Where feasible, these enhanced controls shall incorporate low-impact design and green infrastructure design features.

The enhanced control process may include more than one iteration of control measure installation followed by confirmation monitoring, pursuant to Parts B and C.1, after each control measure installation. ~~If this type of corrective action is selected, two or more post-enhanced control installation confirmation samples are needed to demonstrate completion of corrective action for an analyte list that reflects the pollutants with TAL exceedances. Enhanced control monitoring is not required for any non-Site-related pollutants pursuant to Part I.D.1.~~

~~(i) If no applicable TAL is exceeded for one or more pollutants in the first confirmation sample collected after the installation of the enhanced control, the Permittees shall collect a second confirmation sample. If no applicable TAL is exceeded for one or more pollutants in this second confirmation sample, no further monitoring of that pollutant is required for the remaining period of the Permit. The Permittees shall inspect and maintain all existing controls in accordance with Part I.A.~~

~~(ii) If the applicable TAL(s) is exceeded for one or more pollutants in any confirmation sample(s) that is collected after the installation of the enhanced control, the Permittees shall update the corrective action evaluation performed under Part I.D.2, considering the storm water sampling results. The updated corrective action evaluation shall recommend one or more of the following:~~

~~(A) Install an additional structural control and/or modify the design of the existing structural control in accordance with Part I.A,~~

~~(B) Initiate further measures to complete corrective action under Parts I.D.2(b) or (c), or~~

~~(C) Submit a request for alternative compliance under Part I.D.4 as soon as practicable.~~

~~(iii) If the Permittees choose to install additional enhanced controls and/or modify an existing enhanced control one or more post- installation confirmation sample shall be collected.~~

~~(A) If no Applicable TAL is exceeded for one or more pollutants in the first confirmation sample, the Permittees shall collect a second confirmation sample. If no Applicable TAL is exceeded for one or more pollutants in this second confirmation sample, no further monitoring of that pollutant is required for the remaining period of the Permit. The Permittees shall inspect and maintain all existing controls in accordance with Part I.A.~~

~~(B) If the applicable TALs is exceeded for one or more pollutants in any confirmation sample, the Permittees shall initiate further measures to complete corrective action under Parts I.D.2(b) or (c) or Alternative Compliance under Part I.D.4 as soon as practicable.~~

~~(iv) In the event that corrective action was triggered by a partial sample and enhanced controls were completed before collection of the entire Appendix B analytical suite, monitoring shall be reinitiated by the priority list per Part I.C.4, if confirmation sample volume is insufficient for the entire analytical suite.~~

~~(v)~~ Permittees shall certify completion of installation of control measures under this subpart to EPA, with a copy to NMED, within 30 days of completion of all such measures at the Site. Such certification shall be signed in accordance with 40 CFR 122.22(b) and shall include a description and photographs of all completed measures and the results of the corrective action measures evaluation performed in Part ~~I.D.2~~E.1. Except as provided in Part ~~I.H~~I.2, the Permittees are required to continue to inspect the Site in accordance with Part ~~I.F~~G ~~of the Permit~~ and to maintain all control measures in effective operating condition as required by Part ~~I.~~A.

(b) **Total Elimination of Exposure of Site-Related POCs to Storm Water**

To complete corrective action at a Site or Sites within an individual SMA, the Permittees may decide to ~~achieve corrective action through the~~pursue total elimination of exposure of Site-related ~~pollutants~~ POCs to storm water. Total elimination of exposure of Site-related ~~pollutants~~POCs to storm water may be achieved in one of two ways:

(i) **Constructing a cap or other engineered cover.** If the Permittees choose this method to achieve total elimination of exposure of Site-related ~~pollutants~~ POCs to storm water, the Permittees shall ~~construct~~ demonstrate that a cap or other engineered cover has been constructed. The Permittees shall ~~will~~ be in compliance with this Permit once they have certified and demonstrated to EPA, through the submission of certified as-built drawings, that such measures have been properly installed to perform their function to totally eliminate exposure of Site-related POCs ~~pollutants~~ to storm water. One confirmation ~~sampling~~ sample is required if capped area is smaller than the SMA drainage area. Otherwise, no further confirmation sampling is required, unless required by Part ~~I.C.6(b)~~ B.5.

(ii) **Soil removal.** If the Permittees chose this method to achieve total elimination of exposure of Site-related ~~pollutant(s)~~ POCs to storm water, the Permittees shall demonstrate and certify to EPA, with a copy to NMED, that soil removal meets the requirements of this Part through collection and evaluation of confirmation soil sampling results. Following certification of completion of soil removal, the Permittees shall perform storm water confirmation sampling.

~~**1.** If no Applicable TAL is exceeded for all pollutants in the first confirmation sample, the Permittees shall collect a second confirmation sample. If no Applicable TAL is exceeded for all pollutants in this second confirmation sample, no further monitoring of that pollutant is required for the remaining period of the Permit and the Permittees may seek to delete the Site or Sites from the Permit pursuant to Part I.H.2(e).~~

~~**2.** If the applicable TALs for one or more Site-related pollutants is exceeded in any post soil removal confirmation sample, the Permittees shall initiate further measures to complete corrective action under Parts I.D.2(a) or (c) or Alternative Compliance under Part I.D.3 as soon as practicable.~~

If the Permittees certify to EPA, with a copy to NMED, that ~~three (~~3~~)~~ feet or more depth of soils are removed and replaced with clean soils and EPA determines new soil data has demonstrated that no significant amount of industrial materials remain on the Site, the Permittees will have demonstrated completion of corrective action. The Permittees may submit soil data ~~from~~for new fill soil, ~~soil data from replaced soil,~~ or soil data from upstream background soil to demonstrate no significant materials from past industrial activities would remain exposed to storm water. EPA may require soil testing for some radius outside the remediated area to ensure "no significant industrial materials remain" in the soil on the water pathway (Note: If evidence~~s~~ shows that surface runoff~~s~~ from that Site will penetrate deeper than ~~three~~ 3 feet, the Permittees may not use this approach.)

The Permittees shall certify elimination of exposure under this Part to EPA, with a copy to NMED, within 30-days of completion of all such measures at the Site. Such certification shall be signed in accordance with 40 CFR 122.22(b) and shall include a description and photographs of all completed measures and the results of the corrective action measures evaluation performed in Part ~~I.D.2~~E.1. Except as provided in Part.~~I.H.2~~ I.2, the Permittees are required to continue to inspect the Site in accordance with Part ~~I.F~~G ~~of the Permit~~ and to maintain all control measures in effective operating condition as required by Part ~~I.~~A.

(c) **Retention of a 3-Year, 24-Hour Storm**

The Permittees may decide to achieve completion of corrective action under this Part through installation of control measures that retain a volume of storm water runoff from a Site or SMA that is equivalent to a 3-year, 24-hour storm event based on the most representative rain gage historic records from the nearest meteorological tower ~~to any particular Site and statistic data~~ or rain gage. The Permittees ~~will~~ shall be in compliance with this Permit at that Site or SMA once they have certified and demonstrated to EPA, with a copy to NMED, through the submission of certified as-built drawings, that such measures have been properly installed to perform their function to totally retain the appropriate design volume of storm water. No further confirmation sampling is required post-certification, unless required by Part ~~I.C.6(b).~~ B.5.

Identification of the rain gage applicable to each Site shall be maintained within the SDPPP. The Permittees shall provide information (e.g., sediment removal, sediment depth, water level, estimated capacity remaining, evidence of discharges, or others) to demonstrate the retention facility maintains capacity to store a 3-year, 24-hour storm.

The Permittees may choose to install ~~a~~ run-on control measures to ~~coping with~~reduce ~~runoff~~ run-on and sediment ~~control measures~~ (i.e., low impact development, green infrastructure, sediment ~~catch~~ detention basin or ~~barrier~~berm, etc.), and such installations shall minimize discharges ~~from~~ to the equivalent of ~~any storm less than the~~ a 3-year, 24-hour storm event.

In an event of discharge, the Permittees shall report such a discharge in the annual SDPPP and demonstrate that such a discharge is caused by a storm event that is equivalent to a 3-year, 24-hour or greater storm. The Permittees are required to continue to inspect the Site in accordance with Part ~~I.~~ ~~F~~G (as applicable) ~~of the Permit~~ and to maintain all control measures in effective operating condition as required by Part ~~I.~~A.

2. **Completion of Corrective Action**

The Permittees must certify to EPA, pursuant to 40 CFR 122.22(b), completion of corrective action wherever applicable. ~~, Except as provided in Part I.D.4, "Completion of Corrective Action," under~~ Under this Permit, completion of corrective action shall mean:

(a) No applicable TAL or BTV exceedances are reasonably expected to be Site-related as demonstrated ~~by the EPA approved SSD~~ under Part ~~I.D.1~~ C.1; or

(b) The installation of enhanced control measures under Part E.1(a) with confirmation monitoring analytical results less than the applicable TALs or BTVs as demonstrated under Part ~~I.D.2(a)~~C.1; or

(c) The installation of control measures that totally eliminate exposure of Site-related ~~pollutants~~POCs to storm water under Part ~~I.~~E.1(b)~~D.2~~, with confirmation monitoring analytical results less than the applicable TALs or BTVs as demonstrated under Part C.1, if confirmation monitoring is required; or

(d) The installation of control measures that retains a volume of storm water runoff or minimize discharges from a Site or SMA that is equivalent to a 3-year, 24-hour storm event under Part ~~I.D.2~~E.1(c).

3. **Alternative Compliance**

(a) Where the Permittees believe, based upon a technical evaluation of existing control measures, that they will be unable to certify ~~Completion of C~~corrective actions under Part ~~I.D.3(a) through (d)~~E.1(a) through (c) above (individually or collectively) due, for instance, to site conditions that make it impracticable to install further control measures, or ~~pollutants of concern~~ POCs that exceed ~~approved background or baseline values~~BTVs and are contributed by sources beyond the Permittees control, the Permittees may seek to place a site into Alternative Compliance, whereby ~~C~~completion of c~~C~~orrective a~~A~~ction shall be accomplished on a case-by-case basis, and as necessary, pursuant to an individually tailored control measure by EPA.

(b) To seek to place a Site or Sites into Alternative Compliance, the Permittees must file a written request with EPA and provide written notice to the public and opportunity for public comment, within 90-days of validated confirmation of TAL or BTV exceedance but not later than 180-days prior to the expiration date of the permit. However, the EPA Director may grant an extension, not to exceed the expiration date of the permit. Such a request must include the following:

(i) A comprehensive description of the control measures installed at the Site or Sites;

(ii) A list of additional on-the-ground actions or a watershed protection approach (see Part ~~I. H.3~~ I.4) which have resulted in a reduction ~~of~~ in the potential for Site-related POC discharges to reach downstream canyons; and

(iii) A detailed demonstration, including any underlying studies and technical information, of how the Permittees reached the conclusion that they are unable to certify ~~C~~completion of ~~C~~corrective action under Parts ~~I. D.3(a) through (d)~~ E.1(a) through (c) ~~above~~ (individually or collectively).

Upon submitting such a request to EPA, the Permittees shall make the request and all supporting information available to NMED and the public for review and comment for a period of forty-five (45) days and shall develop and provide to the commenters a written response document addressing all relevant and significant concerns raised during the comment period. The Permittees' request under this ~~subp~~Part, along with the complete record of public comment and the Permittees' response to comments, shall be submitted to EPA Region 6 for a final determination on the request. The Permittees' response to comments may include a revision to the Alternative Compliance request and/or the proposed individually tailored work plan.

(c) The Permittees shall not be out of compliance with the applicable requirements for achieving completion of corrective action with respect to the Site or Sites covered by a request. The Permittees shall continue to conduct inspections and maintenance of existing control measures on those Sites.

(d) If EPA, after considering all the information submitted by the Permittees, including all comments received on the request and the Permittees response to those comments, denies the request, EPA may require the Permittees to install Site-specific control measures to complete the corrective action, in writing.

(e) If EPA approves the request, EPA may set site-specific requirements for inspection, maintenance, and/or monitoring.

(f) Unless EPA acts to disapprove within 90-days of the completion of the public comment period, the request shall be considered approved.

~~5.~~4. Schedules for Corrective Actions

If one or more ~~pollutants of concern~~ POCs exceeding the applicable TALs or BTVs cannot be excluded as the source of the exceedance pursuant to Part ~~I.~~ ~~D~~C.1, the Permittees shall take proper corrective actions and complete installation of additional control measures no later than 24 months from the date when the Permittees have knowledge of TAL or BTV exceedance. The Permittees shall make reasonable efforts, in good faith, to achieve completion of corrective actions within the 24-month compliance schedule.

(a) **"Force Majeure."** The Permittees may seek EPA approval for an extension to a deadline if the Permittees can demonstrate that "force majeure" has resulted, or will result, in a delay in meeting the obligation to confirm completion of corrective action by the specified deadline. An event that constitutes "force majeure," includes, but is not limited to (a) Acts of God, natural disasters such as fire or flood, war, terrorism, insurrection, civil disturbance, or explosion; (b) a federal government shut down, such as the ones that occurred in 1996 and 2018; (c) unanticipated breakage or accident to machinery, equipment or lines of pipe; (d) restraint by court order; (e) inability to obtain the necessary authorizations, approvals, permits or licenses due to an action or inaction caused by another governmental authority; (f) unanticipated delays caused by compliance with applicable statutes or regulations governing contracting, procurement or acquisition procedures; and (g) inability to secure the reasonable cooperation of any other property owner in addressing storm water run-on to a Site or Sites from such property.

To obtain an extension from EPA, the Permittees shall describe in detail (a) the cause or causes of the delay; (b) the expected duration of the delay, including any obligations that would be affected; (c) the actions taken or to be taken by the Permittees to minimize the delay; and (d) the timetable by which those actions are expected to be implemented. EPA will notify the Permittees whether an extension is reasonably justified and provide a new reasonable deadline that takes into account the actual delay resulting from the event, anticipated seasonal construction conditions, and any other relevant factors. If EPA does not agree to the extension, it will notify the Permittees in writing and provide the basis for its conclusion.

~~pursuant to the schedules listed below:~~

~~a) Initiate a corrective action evaluation to determine the appropriate method for completion of corrective action no later than 30 days from the date when the Permittees have knowledge of TAL exceedance.~~
~~b) Complete the corrective action evaluation to determine the appropriate method for completion of corrective action no later than 180 days from the date when the Permittees have knowledge of TAL exceedance.~~
~~c) Commence engineering design, purchase order, or installation of BMPs processes no later than 270 days from the date when the Permittees have knowledge of TAL exceedance.~~
~~Complete installation of additional control measures no later than 36 months from the date when the Permittees have knowledge of TAL exceedance.~~

F. SITE DISCHARGE POLLUTION PREVENTION PLAN (SDPPP)

The Permittees shall update the facility's SDPPP annually, submit it to EPA and copy NMED by May 1 of each calendar year of the Permit and post the SDPPP on the ~~LANL~~Permittees' Individual Permit public website within 30-days after the submittal. The annual update shall fully incorporate all changes made during the previous year and reflect any changes projected for the following year. The facility's SDPPP must remain compliant with relevant State, Tribal, and local regulations, if applicable.

1. Contents of SDPPP

The facility's SDPPP must describe all control measures installed to meet the requirements of this Permit. In addition, the facility's SDPPP must contain all of the elements described below. The SDPPP must also address the inspection requirements set forth in Part ~~I. F~~G below.

(a) **Site Discharge Pollution Prevention Team.** The Permittees must identify the staff members (by name or title) that comprise the facility's Site Discharge Pollution Prevention Team (Pollution Prevention Team). The Permittees' Pollution Prevention Team is responsible for assisting the facility manager in developing and revising the facility's SDPPP as well as maintaining control measures and taking corrective actions for deficiencies. Specific responsibilities of each staff individual on the Team must be identified and listed in the SDPPP. Each member of the Pollution Prevention Team must have ready access to either an electronic or paper copy of applicable portions of this Permit and the facility's SDPPP.

(b) **Site Description.** The facility's SDPPP must include a description of historical activities at each Site, precipitation information, general location map, and Site maps.

(c) **Receiving Waters and Wetlands.** The SDPPP must include the name(s) of all receiving waters that receive discharges from Sites covered by this permit. The

SDPPP must also include the size and description of wetlands or other special aquatic sites.

(d) **Summary of Potential ~~Pollutant~~ POC Sources.** The SDPPP must identify each Site at the facility where industrial materials or activities were previously exposed to storm water and from which allowable non–storm water discharges were released. The SDPPP must also identify the POCs associated with those activities.

(e) **Description of Control Measures.** The Permittees must update the SDPPP as needed to document all structural control measures installed at a Site as well as the dates installation was completed. The SDPPP must include sufficient detail to identify and describe the Site-specific control measures.

(f) **Schedules for Control Measure Installation.** The Permittees shall update the SDPPP as necessary to include schedules for additional control measure installation and implementation resulting from c~~C~~orrective ~~A~~action under Part ~~I.~~ ~~D~~E of th~~e~~ise Permit.

(g) **Monitoring and Inspection Procedures.** The Permittees must document in the SDPPP schedules and planned procedures for sample collection and site inspection. For each sample to be collected, the SDPPP must identify:

(i) Locations where samples are to be collected, including coordinates for sampling locations, and any determination that two or more Sites are substantially identical;

(ii) Person(s) or positions of person(s) responsible for sample collection;

(iii) Parameters to be sampled and frequency of sampling for each parameter;

(iv) Procedures for gathering storm event data.

The Permittees must document in the SDPPP all tentative schedules and procedures for erosion and post-storm inspections as described in Parts ~~I.F.1~~ G.1 and ~~F~~G.2 of th~~e~~ise Permit ~~below~~.

(h) **SMA Maps.** The Permittees must include a map with the following information in their SDPPP regarding each SMA:

(i) Location of each Site within the SMA drainage area;

(ii) Coordinates and locations of the SMA samplers (with updates as adjustments occur). ~~If more than one Site is monitored by a SMA, information to demonstrate representative runoff from the individual Sites within the SMA cannot be achieved because site conditions result in mixing of storm water runoff before representative sampling can occur, or the spitting of the SMA into individual Sites would result in substantially small SMA areas as to prevent the collection of storm water, or those Sites are expected to discharge substantially identical effluents; and~~

(iii) Estimates of the size (in acres) of the SMA and of Site(s) within the SMA.

(iv) Any adjustments/changes to sampler locations under Parts ~~I.C~~B.2 and the associated documentation for the sampler move.

(v) Coordinates and identification of any run-on ~~and/or runoff~~ sampler locations.

(i) **Annual Compliance Status Reports.** Annual Compliance Status Reports as specified in Part H shall be integrated into the SDPPP.

(j) **Annual SIP.** The annual SIP, as specified in Part ~~I.~~D shall be integrated into the SDPPP.

(k) **Signature Requirements.** The SDPPP shall be signed, certified and dated in accordance with 40 CFR 122.22(b) ~~no later than one hundred-eighty (180) days from the effective date of this Permit.~~ prior to submittal of annual updates.

2. Documentation

The Permittees are required to maintain inspection, monitoring, and certification documentation with the SDPPP that together keep the records complete and ~~help to explain~~support ongoing SDPPP implementation activities. These records are maintained alongside the SDPPP document, thereby providing a consolidated record of documented storm water requirements and implementation procedures.

The Permittees must, at a minimum, keep the following records and documentation alongside the SDPPP:

(a) Dates of training sessions, names of employees trained, and subject matter of training under Part ~~I.~~A.2.;

(b) Sampling reports including sampling dates, analytical results, outfall locations, name and qualifications of technician;

(c) Annual SIP: monitoring location lists, monitoring requirements lists including ~~confirmation~~storm water and sediment sample screening results, adjustments to annual monitoring plan, and re-initiating monitoring requirements where applicable;

(d) Inspection reports~~, including visual inspections required by Part I.D above,~~ and any other information required to be included in an Inspection Report under Part ~~I. F.3~~G.4 ~~below~~;

(e) An accounting and an explanation of the length of time it takes to modify control measures or implement additional control measures following the discovery of a deficiency or the need for modification;

(f) Documentation of maintenance and repairs of control measures, including the date(s) of regular maintenance, date(s) of discovery of areas in need of repair/replacement, and for repairs, the date(s) that control measure(s) were returned to full function~~,~~ and the justification for any extended maintenance/repair schedules.

3. Required Modifications

The Permittees must keep documents and records with the SDPPP as necessary to reflect:

(a) Construction or a change in design, operation, or maintenance at the facility having a significant impact on the discharge, or potential for discharge, of ~~pollutants~~ POCs from the facility;

(b) Findings of deficiencies in control measures during inspection or based on analytical monitoring results;

(c) Any change of monitoring requirement or compliance status;

(d) Any change of SMA location in accordance with Part~~s I.C.2(a)-(e)~~ B.2; and

(e) Summary of changes from the last year's SDPPP.

If any of the circumstances described above occur at any Site, the Permittees must address these changes or deficiencies to ensure compliance with this Permit's conditions and applicable monitoring requirements. All changes must be incorporated into the SDPPP and a summary of these changes must be included in the Annual Report.

4. SDPPP Availability

The Permittees must retain a paper copy of the current SDPPP required by this Permit at the facility, and it must be immediately available to EPA, a State, Tribal or local agency approving storm water management plans, the Pollution Prevention Team members, and representatives of the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) at the time of an on-site inspection or upon request. A copy of the SDPPP shall also be made available on the Permittees' Individual Permit public website.

G. INSPECTIONS

The Permittees must conduct the following inspections for every Site. The facility's Pollution Prevention Team may conduct a combined inspection for a Site, if appropriate.

1. ~~Erosion Inspection and Reevaluation~~ Significant Event Inspections

~~The facility's Pollution Prevention Team shall inspect and evaluate each Site annually for changes of conditions affecting erosion.~~ The facility's Pollution Prevention Team must ~~also re~~inspect and re-evaluate all Sites after notice of a significant event, such as a fire or flood, which could significantly impact the control measures and environmental conditions in the affected area. Such inspection and reevaluation should be conducted before the next anticipated storm event or as early as practicable.

2. Post-Storm Inspection

The facility's Pollution Prevention Team must inspect control measures and storm water management devices at any Site affected by a "storm rain event" defined below, within fifteen (15) ~~calendar~~ days after such storm rain event. The occurrence of a "storm rain event" as defined below shall be determined based on data from the nearest meteorological tower to any particular Site. A "storm rain event" under this paragraph means a ~~0.25 in~~0.50 inches or more intensive rain event within 30 ~~min~~ minutes.

If several storms exceeding the above intensity threshold occur over a period not to exceed fifteen (15) days from the first event, a single inspection following these storms is sufficient for compliance with this requirement, provided that the inspection occurs no more than fifteen (15) days from the date of the first storm. If adverse weather conditions prevent a site inspection within the required time period, the Permittees shall inspect the Site as soon as practicable. Adverse weather events shall be documented and this information shall be maintained with the SDPPP. Adverse weather conditions include dangerous weather-related events (e.g., flooding, wildfires, hail, or lightning) that make site inspection dangerous for worker safety.

3. Long-Term Stewardship Inspections

When a Site and its associated controls are designated as a LTS location under Part C.1(b), Permittees shall inspect and evaluate each Site and its associated controls annually (a) for a 5-year period (a Permit cycle) and (b) after a 3-year, 24-hour return period storm. The reporting of inspection results shall meet all requirements set forth in ~~Section~~Part G.4. An assessment shall be conducted at the end of each Permit cycle to determine if the storm water runoff or erosion potential at each Site is in a stable condition and if adjustments should be made to the control measure inspection frequency set forth in this Part~~section~~. A determination of future inspection frequency or termination of LTS shall be included with subsequent re-application submittals. Sites in LTS will be tracked by Site, not to the individual control, and the inspection dates, maintenance dates, maintenance activities, and LTS listing date will be tracked for each Site.

4. Inspection Report

All inspection reports shall include, at a minimum, the following items:

(a) The personnel who conduct the inspections;

(b) Date(s) on which inspection was performed;

(c) A written summary of major observations, including observation of deficiency;

(d) A summary of evidence of potential contaminants, failure of a best management practice, or alteration of management structure or runoff pathway, etc;

(e) Actions that should be taken to correct noted deficiencies;

(f) Photo documentation of findings at the Site, if necessary; and

(g) The signature of the delegated official of the Permittees and certification of findings, including observation of no deficiency.

H. REPORTING

1. Annual Compliance Status Reports

The Permittees shall submit Annual Compliance Status Reporting (CSR) information. The reporting period is from January 1 to December 31. ~~This report, due on March 1 of the following year,~~ The reporting requirements shall be integrated into the SDPPP, due by May 1 of the following year, and shall include the following:

(a) For each SMA (or Site), a summary of the Site-specific compliance status during the report period;

(b) ~~Discharge Monitoring Report (DMR) using the same sample form provided in Appendix D,~~ Monitoring information which shows the results available during the reporting period and that include the following information required in (i) through ~~(v)~~ (iii) below;

(i) SMA and associated o~~O~~utfall and Site(s) numbers/identifications;

(ii) Monitoring results available during the reporting period;

(iii) Identification of POCs that exceed the applicable ~~MTAL or ATAL~~TAL or BTV;

~~(iv) Description of control measures installed, including the completion date;~~

~~(v) Description of corrective actions required under Part I.D of this Permit to be taken, or having been taken, including completion date or targeted completion date, and Progress update;~~

~~(c) Identification of Sites which meet No Exposure status;~~

(c) Description of control measures installed during the reporting period, including the certification of completion date;

(d) Description of corrective actions required under Part E of this Permit to be taken, or having been taken, including completion date or targeted completion date, and progress update;

(e) Description of sampler maintenance and identification of all missed sample opportunities during storm rain events and the cause of missed opportunity (i.e., sampling equipment malfunctioning, repairs, construction activities) with an explanation of circumstances;

(f) ~~(d)~~Highlights of any change of compliance status from the previous Annual Compliance Status Report;

(g) ~~(e)~~Lists of requests, including any requests for change of monitoring location or Site deletion and any requests to place a Site or Sites into Part ~~I. D.4~~ E.3, Alternative Compliance; and

(h) ~~(f)~~A summary of inspections performed in accordance with Part~~s I. F.1 and~~ G~~, as well as for any visual inspections performed under Part I.D~~.

EPA may require the Permittees to submit additional information. This ~~report~~ CSR information shall be signed, certified, and dated in accordance with 40 CFR 122.22(b). One signature is sufficient for all CSR forms. ~~In addition to electronic and hard copy reports to the EPA Region 6 Enforcement Division, copies of this report in electronic format (e.g., compact discs or other acceptable media) shall be submitted to EPA 6WQ-PP and the NMED-SWQB no later than March 1 of each year. A copy of each report shall be kept with the facility's SDPPP and a copy of the most current Annual Compliance Status Report shall be maintained on the LANL Individual Permit public website.~~

I. OTHER CONDITIONS

1. Soil Disturbance Associated with the Installation of Control Measures

If the installation of control measures ~~or other work~~ at a Site involves soil disturbance of Site-affected soils, the Permittees shall temporarily suspend sampling activities and take all necessary steps to minimize migration of sediments and runoff from disturbed sites. Steps taken to minimize discharges of contaminated runoff during remediation activity shall be included in the SDPPP update. The Permittees shall conduct site inspections once a week while installing control measures to ensure sediment and runoff control measures are maintained in good order. Corrective actions shall be taken immediately if deficiencies of sediment and runoff control measures are noticed either by inspectors or contractors. After completion of such mitigation measures, the Permittees shall reactivate the sampler and analyze the storm water sample in accordance with Part ~~I.~~C.~~1~~1~~6~~.

Storm water discharges associated with construction activity disturbing 1 acre or more are not covered under this permit. Storm water discharges associated with construction activity disturbing one acre or more must be covered under EPA's Construction General Permit (CGP) or through a separate individual NPDES permit.

2. Deletion of Site

The Permittees may submit a written request to remove a Site from coverage under the Permit if the Permittees can demonstrate that the Site no longer has "storm water discharges associated with industrial activity" under 40 CFR 122.26(b)(14) as follows:

(a) No industrial activities as specified under 40 CRF 122.26(b)(14) ever took place at the Site;

(b) Site-related ~~pollutants~~POCs have never been exposed, or will no longer be exposed, to storm water. A request to EPA to remove a Site meeting the conditions of this Part shall include documentation that demonstrates historic activities that led the Site to be a SWMU or AOC did not result in significant materials exposed to storm water (e.g. Site-related ~~pollutants~~ POCs are a minimum of 3 ~~-~~feet below the ground surface, below existing building);~~,~~ ~~or that any later installed control measures will prevent pollutants of concern from being exposed to storm water; or;~~

(c) Sites have no significant industrial materials remaining that are exposed to storm water after installation of permanent control measures. For all SMAs that contain the Site, a minimum of two confirmation storm water samples were collected, no ~~pollutants~~POCs exceeded the applicable TALs, and therefore, the Permittees demonstrated that the Site is no longer considered an industrial activity for areas where industrial activity has taken place in the past and pursuant to 40 CFR 122.26(b)(14); ~~or~~

(d) The Permittees certified corrective action complete under Part ~~I.D.2(b)(ii)~~E.1(b) by removing soil that contained a release of Site-related ~~pollutants~~POCs that were exposed to storm water and demonstrating that no significant materials from previous industrial activity remain in the Site. A request to EPA to remove a Site meeting the conditions of this Part shall include the certification of correction action complete under Part ~~I.D.2(b)(ii)~~ E.1(b) and storm water confirmation sampling results, if applicable; ~~or~~

(e) Storm water discharges associated with industrial activity no longer occur at the Site when the SSD shows that the data screening for all POCs resulted in a SW Tier 1 and SD Tier 1 result per Part C.1(b); or

~~(e)The EPA has approved an SSD that demonstrates that no applicable TAL exceedances are reasonably expected to be Site-related, for all SMAs identified to contain the Site in Appendix A. A request to EPA to remove a Site meeting the conditions of this Part shall include the EPA approved SSD(s) pursuant to Part I.D.1(b). The Permittees are required to certify that all on-site control measures will be properly maintained.~~

(f) Insufficient storm water runoff results in confirmation samples not being collected at the associated SMA during the previous permit cycle. If the following criteria are met, the Sites are not discharging into a receiving stream or canyon:

(i) Activ~~ate~~e samplers are in representative locations;

~~(i)~~ No confirmation sample has been collected after a 25-year, 24-hour return period storm~~,~~; and

(ii)

(iii) Inspection records validate full operability of sampler.

EPA may approve such a request in writing by issuing a minor permit modification pursuant to 40 CFR 122.63(e)(2). Documents to support such requests and decisions must be kept with facility's SDPPP and published on the ~~LANL~~ Permittees' Individual Permit public website. If EPA decides to disapprove the request, it shall provide the Permittees a detailed written response stating the technical and regulatory reasons for the decision. Once a Site is removed from the Permit, a discharge of contaminated point-source runoff is no longer authorized by this Permit.

3. Compliance Schedule Requests

A period of 24 months from the effective date of this Permit is provided for the Permittees to complete their ongoing study of aluminum and its potential toxicity in Pajarito Plateau waters, and for the State of New Mexico to review the findings and conclusions from that study and potentially update its guidance for sampling to minimize non-toxic forms of aluminum consistent with the State of New Mexico Water Quality Standards. This compliance schedule requires the Permittees to complete the aluminum characterizations, toxicity testing, and associated evaluations ~~described in the Aluminum Toxicity Sampling Plan~~ and submit ~~the~~a report discussing results to NMED for review and comment. During the compliance schedule, compliance requirements in this Permit triggered by exceedances of the aluminum MTALs in Appendix C are deferred until the Permit has been modified to reflect updated sampling and analysis methods for aluminum, unless other information arises that determines that the aluminum at a particular SMA/Site is attributable to historic Site activities or significant industrial material.

4. ~~3.~~ Watershed Protection Approach

EPA encourages the Permittees to voluntarily install watershed-based control measures, such as sediment barriers, to mitigate sediment or storm water runoff reaching the main channels of the canyons and/or the Rio Grande. The Permittees should include information and monitoring data regarding the installation of any such watershed-based control measures in ~~the Annual Report or~~ the SDPPP. If the Permittees submit to EPA a Watershed Protection Plan which can demonstrate significant reduction of ~~pollutants~~nonpoint-source and point-source water POCs from being discharged into major canyons and therefore will result in improvement of receiving water quality, EPA may consider such a Watershed Protection Plan as Alternative Compliance for associated Sites within the scope of the Plan.

~~4. No Confirmation Sample Collected during the Permit Period~~

~~This Part applies to the following three circumstances in which: (1) no confirmation sample has been collected for a Site or Sites within an SMA, or (2) no confirmation sample has been collected following installation of an enhanced control under Part I.D.2(a), or (3) no confirmation sample has been collected following soil removal actions completed under Part I.D.2(b). For any of these three circumstances the Permittees shall inspect and maintain all existing controls in accordance with Part I.A. The Permittees may make a determination that existing control measures and topography are capable of retaining a volume of storm water runoff from a Site or SMA that is equivalent to a 3-yr, 24-hr storm or greater. This determination may be made based upon a site survey and/or field evidence that the SMA did not discharge storm water during a 3-yr, 24-hr storm or greater event and all sampling equipment was fully functional during the storm event.~~

5. Record Keeping

The Permittees shall retain records of all monitoring information and reports, Site inspections and reports, decision-making procedures and supporting documents and records, and annual SDPPP updates with supplemental information for at least three (3) years after the issuance of the next permit renewal.

~~6. Permit Modification~~

~~Any changes to monitoring and/or control measure requirements made to the Permit shall be addressed in the Annual Report and in the annual SDPPP update.~~

6. ~~7.~~ Permit Compliance

Any noncompliance with any of the requirements of this Permit, except for exce~~r~~ptions provided in the permit, constitutes a violation of the CWA. Failure to take any required corrective actions constitute an independent violation of this Permit and the CWA. Where corrective action is triggered by an event that does not itself constitute Permit noncompliance, such as an exceedance of applicable TALs or BTVs, there is no violation of the Permit, provided the Permittees take the required corrective action within the relevant deadlines.

7. ~~8.~~**Public Involvement**

(a) **Individual Permit Public Website**: The Permittees shall maintain a public website where information on the Permit, including the SDPPP, SIP, Annual Reports, ~~Inspection Reports, DMRs,~~ CSRs, transmittal correspondence including Alternative Compliance requests between Permittees and EPA, and other relevant data and documents, shall be made available. A copy (either paper or electronic) of these documents ~~will~~ shall also be made available by the Permittees as soon as practicable to any member of the public who makes such a request in writing. Confidential Business Information (CBI) may not be withheld from regulatory agencies but may be withheld from the public. All portions of the SDPPP not identified as CBI, pursuant to 40 CFR Part 2, must be provided to the public upon request.

(b) **E-mail notification**: The Permittees ~~will~~ shall provide the opportunity for members of the public to register for and receive e-mail notifications on compliance with the Permit on the public web~~-~~site. E-mail notifications ~~will~~ shall provide notice of completion of installation of ~~baseline~~ control measures, updates on Permit compliance, any requests for time extensions, spill information, and notification of any modification to the Permit, SIP, or SDPPP including changing SMA locations, removing, deleting, or adding Sites, and completion of corrective actions. Such notifications ~~will~~ shall have a direct link to the specific document to which it relates. Notice shall also be provided for any request to complete correction action under Alternative Compliance, Part ~~I.D.4~~ E.3 of th~~e~~is Permit.

(c) **Public Meetings**: The Permittees shall publish a public notice and send an e-mail notification to members of the public who have registered as provided in Part ~~I.H.8(b)~~ I.7(b) about public meetings that ~~will~~ shall be held approximately every six (6) months. The Permittees shall update the public on implementation of and compliance with the Permit and provide an opportunity for both written and oral public comment. The meetings may be combined with other public meetings, but the Permittees shall provide a discrete, separate time for comment and discussion of this Permit. The Permittees shall e-mail a draft agenda at least one (1) week before the meeting, publish the draft agenda on the ~~LANL~~ Permittees' Individual Permit public website, and consider suggestions from the public for changes or additions to the agenda. The Permittees shall publish the final agenda on the ~~LANL~~ Permittees' Individual Permit public website no later than three (3) days before the meeting.

~~**J. WATER QUALITY-BASED EFFLUENT LIMITS**~~

~~The Permittees must control discharges from all Sites (individually or collectively) as necessary to ensure such discharges shall not cause or contribute to a violation of applicable water quality standards. EPA believes that compliance with the non-numeric technology-based effluent limitations and other terms and conditions of this Permit shall control discharges as~~

~~necessary to meet applicable water quality standards.~~

~~PART II - OTHER CONDITIONS~~

~~A. MINIMUM QUANTIFICATION LEVEL (MQL)~~

~~The Permittees shall use sufficiently sensitive EPA-approved analytical methods (under 40 CFR part 136 and 40 CFR chapter I, subchapters N and O) when quantifying the presence of pollutants in a discharge for analyses of pollutants or pollutant parameters under the permit. In case the minimum quantifi=cation levels (MQLs) are not sufficiently sensitive to the limits, the actual detected values, instead of zeros, need to be reported. if there is a sensitive method with MDL (method detection limit) below the TAL, but the MQL is above the TAL, they cannot report zero based on MQL but must report actual value.~~

~~If any individual analytical test result is less than the MQL listed in Appendix C or C-1, or the more sensitive MDL, a value of zero (0) may be used for that individual result for reporting purpose.~~

~~The Permittees may develop an eff=luent specific method detection limit (MDL) in accordance with Appendix B to 40 CFR 136. For any pollutant for which the Permittees determine an eff=luent specific MDL, the Permittees shall send to the EPA Region 6 NPDES Permits Branch (6WQ-P) a report containing QA/QC documenta=tion, analytical results, and calcu=lations necessary to demonstrate that the effluent specific MDL was cor-rectly calculated. An effluent specific minimum quantification level (MQL) shall be de-termined in accordance with the following calculation:~~

~~MQL = 3.3 x MDL~~

~~Upon written approval by the EPA Region 6 NPDES Permits Branch (6WQ-P), the effluent specific MQL may be utilized by the Permittees for all future Discharge Monitoring Report (DMR) reporting requirements.~~

~~The PCB congener-specific MQLs are listed in Appendix C-1.~~

~~B. 24 HOUR ORAL REPORTING~~

~~Exceedances of MTAL (Maximum Target Action Level) for any applicable pollutants shall be reported to to NMED, Surface Water Quality Bureau (SWQB) at (505) 827-0187 within 24 hours from the time the Permittees become aware of the exceedance.~~

~~C. COMPOSITE SAMPLING~~

~~Unless otherwise specified in this permit, the term "composite sample" means samples collected either by an automatic sampler or by manual, during the whole or part of a rainfall period, are composited prior to an analysis. The Permittees may use either grab samples or composite samples for monitoring purpose as long as it keeps practice consistency.~~

~~D. DATA AVERAGE~~

~~The average is the geometric mean of applicable monitoring results at the SMA. If all analytical results are below analytical method detect level, a value of "zero" may be reported. If one or more data are above detect level, a value of ½ detect level shall be assigned to those below detect level data for calculation purpose. If the average value of a specific pollutant is below its MQL, a value of "zero" may be reported for the average.~~

~~If a new or an enhanced BMP is installed, the average is calculated based on analytical results from samples taken after installation of the BMP.~~

~~E~~J. PERMIT REOPENER

The Permit may be reopened and modified during the life of the Permit if relevant portions of New Mexico's Water Quality Standards for Interstate and Intrastate Streams are revised, or new ~~State~~ state water quality standards are established and/or remanded by the New Mexico Water Quality Control Commission. The Permit also may be reopened and modified if new information, e.g., EPA approved TMDLs, ~~and~~ etc., is received that was not available at the time of permit issuance that would have justified the application of different permit conditions at the time of permit issuance.

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos/Pueblo	Rendija Canyon	~~R001~~	~~R-SMA-0.5~~	~~C-00-020~~	~~Rendija Canyon~~
		~~R002~~	~~R-SMA-1~~	~~C-00-041~~	~~Rendija Canyon~~
		R003	R-SMA-1.95	00-015	Rendija Canyon
		~~R004~~	~~R-SMA-2.05~~	~~00-011(c)~~	~~Cabra Canyon - Tributary to Rendija Canyon~~
		~~R005~~	~~R-SMA-2.3~~	~~00-011(e)~~	~~Rendija Canyon~~
		R006	R-SMA-2.5	00-011(a)	Rendija Canyon
	~~Bayo Canyon~~	~~B001~~	~~B-SMA-0.5~~	~~10-001(a)~~	~~Bayo Canyon~~
				~~10-001(b)~~	
				~~10-001(c)~~	
				~~10-001(d)~~	
				~~10-004(a)~~	
				~~10-004(b)~~	
				~~10-008~~	
				~~10-009~~	
		~~B002~~	~~B-SMA-1~~	~~00-011(d)~~	~~Bayo Canyon~~
	Pueblo Canyon	~~P001~~	~~ACID-SMA-1.05~~	~~00-030(g)~~	~~Acid Canyon - Tributary to Pueblo Canyon~~
		~~P002~~	~~ACID-SMA-2~~	~~01-002(b)-00~~	~~Acid Canyon - Tributary to Pueblo Canyon~~
				~~45-001~~	
				~~45-002~~	
				~~45-004~~	
		~~P002A~~	~~ACID-SMA-2.01~~	~~00-030(f)~~	~~Acid Canyon - Tributary to Pueblo Canyon~~
		~~P003~~	~~ACID-SMA-2.1~~	~~01-002(b)-00~~	~~Acid Canyon - Tributary to Pueblo Canyon~~
		~~P004~~	~~P-SMA-0.3~~	~~00-018(b)~~	~~Pueblo Canyon~~
		~~P005~~	~~P-SMA-1~~	~~73-001(a)~~	~~Pueblo Canyon~~
				~~73-004(d)~~	
		~~P006~~	~~P-SMA-2~~	~~73-002~~	~~Pueblo Canyon~~
				~~73-006~~	
		P007	P-SMA-2.15	31-001	Pueblo Canyon
		~~P008~~	~~P-SMA-2.2~~	~~00-019~~	~~Graduation Canyon - Tributary to Pueblo~~
		~~P009~~	~~P-SMA-3.05~~	~~00-018(a)~~	~~Pueblo Canyon~~
	Los Alamos Canyon	L001	LA-SMA-0.85	03-055(c)	Los Alamos Canyon
		L002	LA-SMA-0.9	00-017	Los Alamos Canyon
				C-00-044	
		L003	LA-SMA-1	00-017	Los Alamos Canyon
				C-00-044	
		L004	LA-SMA-1.1	43-001(b2)	Los Alamos Canyon
		L005	LA-SMA-1.25	C-43-001	Los Alamos Canyon
		L006	LA-SMA-2.1	01-001(f)	Los Alamos Canyon
		L007	LA-SMA-2.3	01-001(b)	Los Alamos Canyon

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Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos/Pueblo	Los Alamos Canyon	L008	LA-SMA-3.1	~~01-001(e)~~	Los Alamos Canyon
				01-003(a)	
		L009	LA-SMA-3.9	01-001(g)	Los Alamos Canyon
				~~01-006(a)~~	
		L010	LA-SMA-4.1	~~01-003(b)~~	Los Alamos Canyon
				~~01-003(b1)~~	
				01-003(b2)	
				~~01-006(b)~~	
		L011	LA-SMA-4.2	01-001(c)	Los Alamos Canyon
				~~01-006(c)~~	
				~~01-006(d)~~	
		L012	LA-SMA-5.01	~~01-001(d)~~	Los Alamos Canyon
				~~01-001(d1)~~	
				~~01-001(d2)~~	
				01-001(d3)	
				~~01-006(h)~~	
				~~01-006(h1)~~	
				~~01-006(h2)~~	
				~~01-006(h3)~~	
		L012A	LA-SMA-5.02	01-003(e)	Los Alamos Canyon
		L013	LA-SMA-5.2	01-003(d)	Los Alamos Canyon
		L015	LA-SMA-5.31	41-002(c)	Los Alamos Canyon
		L016	LA-SMA-5.33	32-004	Los Alamos Canyon
		L014	LA-SMA-5.35	C-41-004	Los Alamos Canyon
		L017	LA-SMA-5.361	~~32-002~~	Los Alamos Canyon
				32-002(b1)	
				32-002(b2)	
		L017A	LA-SMA-5.362	32-003	Los Alamos Canyon
		L018	LA-SMA-5.51	02-003(a)	Los Alamos Canyon
				02-003(e)	
				02-004(a)	
				02-005	
				02-006(b)	
				02-006(c)	
				02-006(d)	
				02-006(e)	
				02-008(a)	
				02-009(b)	
				02-011(a)	

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Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos/Pueblo	Los Alamos Canyon	L018	LA-SMA-5.51	02-011(b)	Los Alamos Canyon
				02-011(c)	
				02-011(d)	
				02-014	
		L018A	LA-SMA-5.52	02-003(b)	Los Alamos Canyon
				02-007	
				02-008(c)	
		L018B	LA-SMA-5.53	02-009(a)	Los Alamos Canyon
		L018C	LA-SMA-5.54	02-009(c)	Los Alamos Canyon
		L019	LA-SMA-5.91	~~21-009~~	BV Canyon - Tributary to Los Alamos Canyon
				21-021	
				~~21-023(c)~~	
				~~21-027(d)~~	
		L019A	LA-SMA-5.92	~~21-013(b)~~	BV Canyon - Tributary to Los Alamos Canyon
				~~21-013(g)~~	
				~~21-018(a)~~	
				21-021	
		L020	LA-SMA-6.25	21-021	Los Alamos Canyon
				21-024(d)	
				21-027(c)	
		~~L021~~	~~LA-SMA-6.27~~	~~21-021~~	~~Los Alamos Canyon~~
				~~21-027(c)~~	
		L022	LA-SMA-6.3	21-006(b)	Los Alamos Canyon
		L022A	LA-SMA-6.31	21-027(a)	Los Alamos Canyon
		L023	LA-SMA-6.32	21-021	Los Alamos Canyon
		L024	LA-SMA-6.34	21-021	Los Alamos Canyon
				21-022(h)	
		~~L025~~	~~LA-SMA-6.36~~	~~21-021~~	~~Los Alamos Canyon~~
				~~21-024(a)~~	
		L026	LA-SMA-6.38	21-021	Los Alamos Canyon
				21-024(c)	
		L027	LA-SMA-6.395	21-021	Los Alamos Canyon
				21-024(j)	
		L028	LA-SMA-6.5	21-021	Los Alamos Canyon
				21-024(i)	
		L029	LA-SMA-9	26-001	Los Alamos Canyon
				26-002(a)	
				26-002(b)	
				26-003	
		~~L030~~	~~LA-SMA-10.11~~	~~53-002(a)~~	~~Los Alamos Canyon~~
		L030A	LA-SMA-10.12	53-008	Los Alamos Canyon

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Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos Pueblo	DP Canyon	D001	DP-SMA-0.3	21-029	DP Canyon
		D002	DP-SMA-0.4	21-021	DP Canyon
		D003	DP-SMA-0.6	21-021	DP Canyon
				21-024(l)	
		D004	DP-SMA-1	21-011(k)	DP Canyon
				21-021	
		D005	DP-SMA-2	21-021	DP Canyon
				21-024(h)	
		D006	DP-SMA-2.35	21-021	DP Canyon
				21-024(n)	
		D007	DP-SMA-3	21-013(c)	DP Canyon
				21-021	
		~~D008~~	~~DP-SMA-4~~	~~21-021~~	~~DP Canyon~~
Sandia	Sandia Canyon	S001	S-SMA-0.25	03-013(a)	Sandia Canyon
				03-052(f)	
		S002	S-SMA-1.1	03-029	Sandia Canyon
		S003	S-SMA-2	03-012(b)	Sandia Canyon
				03-045(b)	
				03-045(c)	
				03-056(c)	
		S003A	S-SMA-2.01	03-052(b)	Sandia Canyon
		S004	S-SMA-2.8	03-014(c2)	Sandia Canyon
		S005	S-SMA-3.51	03-009(i)	Sandia Canyon
		S005A	S-SMA-3.52	03-021	Sandia Canyon
		S005B	S-SMA-3.53	03-014(b2)	Sandia Canyon
		S006	S-SMA-3.6	60-007(b)	Sandia Canyon
		S007	S-SMA-3.7	53-012(e)	Sandia Canyon
		S008	S-SMA-3.71	53-001(a)	Sandia Canyon
		S009	S-SMA-3.72	53-001(b)	Sandia Canyon
		S010	S-SMA-3.95	20-002(a)	Sandia Canyon
		S011	S-SMA-4.1	53-014	Sandia Canyon
		~~S012~~	~~S-SMA-4.5~~	~~20-002(d)~~	~~Sandia Canyon~~
		S013	S-SMA-5	20-002(c)	Sandia Canyon
		S014	S-SMA-5.2	20-003(c)	Sandia Canyon
		S015	S-SMA-5.5	20-005	Sandia Canyon
		S016	S-SMA-6	72-001	Sandia Canyon
Mortandad	Cañada del Buey	C001	CDB-SMA-0.15	04-003(a)	Canada del Buey
				04-004	
		C002	CDB-SMA-0.25	46-004(c2)	Canada del Buey
				46-004(e2)	

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Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Mortandad	Cañada del Buey	C003	CDB-SMA-0.55	~~46-004(e2)~~	Canada del Buey
				46-004(g)	
				46-004(m)	
				46-004(s)	
				46-006(f)	
		C004	CDB-SMA-1	46-003(c)	SWSC Canyon - Tributary to Canada del Buey
				46-004(d2)	
				46-004(f)	
				46-004(t)	
				46-004(w)	
				46-008(g)	
				46-009(a)	
				~~C-46-001~~	
		C005	CDB-SMA-1.15	46-004(b)	Canada del Buey
				46-004(y)	
				46-004(z)	
				46-006(d)	
		~~C006~~	~~CDB-SMA-1.35~~	~~46-004(a2)~~	~~Canada del Buey~~
				~~46-004(u)~~	
				~~46-004(v)~~	
				~~46-004(x)~~	
				~~46-006(d)~~	
				~~46-008(f)~~	
		~~C007~~	~~CDB-SMA-1.54~~	~~46-004(h)~~	~~Canada del Buey~~
				~~46-004(q)~~	
				~~46-006(d)~~	
		~~C008~~	~~CDB-SMA-1.55~~	~~46-003(e)~~	~~Canada del Buey~~
		~~C009~~	~~CDB-SMA-1.65~~	~~46-003(b)~~	~~SWSC Canyon - Tributary to Canada~~
		C010	CDB-SMA-4	54-017	Canada del Buey
				54-018	
				54-020	
	Mortandad Canyon	M001	M-SMA-1	03-050(a)	Mortandad Canyon
				03-054(e)	
		M002	M-SMA-1.2	03-049(a)	Mortandad Canyon
		M002A	M-SMA-1.21	03-049(e)	Mortandad Canyon
		M002B	M-SMA-1.22	03-045(h)	Mortandad Canyon
		M003	M-SMA-3	48-001	Mortandad Canyon
				48-005	
				48-007(c)	
		M004	M-SMA-3.1	48-001	Mortandad Canyon
				48-007(b)	

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Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Mortandad	Mortandad Canyon	M005	M-SMA-3.5	48-001	Mortandad Canyon
				48-003	
		M006	M-SMA-4	48-001	Effluent Canyon - Tributary to Mortandad Canyon
				48-005	
				48-007(a)	
				48-007(d)	
				48-010	
		M007	M-SMA-5	42-001(a)	Effluent Canyon - Tributary to Mortandad Canyon
				42-001(b)	
				42-001(c)	
				42-002(a)	
				42-002(b)	
		M008	M-SMA-6	35-016(h)	Effluent Canyon - Tributary to Mortandad Canyon
		M009	M-SMA-7	35-016(g)	Effluent Canyon - Tributary to Mortandad Canyon
		M010	M-SMA-7.9	50-006(d)	Effluent Canyon - Tributary to Mortandad Canyon
		~~M011~~	~~M-SMA-9.1~~	~~35-016(f)~~	~~Mortandad Canyon~~
		M012	M-SMA-10	35-008	Mortandad Canyon
				35-014(e)	
		M012A	M-SMA-10.01	35-016(e)	Mortandad Canyon
		M013	M-SMA-10.3	35-014(e2)	Mortandad Canyon
				35-016(i)	
		M014	M-SMA-11.1	35-016(o)	Mortandad Canyon
		M015	M-SMA-12	35-016(p)	Mortandad Canyon
		M016	M-SMA-12.5	05-005(b)	Mortandad Canyon
				05-006(c)	
		M017	M-SMA-12.6	05-004	Mortandad Canyon
		M018	M-SMA-12.7	05-002	Mortandad Canyon
				05-005(a)	
				05-006(b)	
				05-006(e)	
		M019	M-SMA-12.8	05-001(a)	Mortandad Canyon
				05-002	
		M020	M-SMA-12.9	05-001(b)	Mortandad Canyon
				05-002	
		M021	M-SMA-12.92	00-001	Mortandad Canyon
		M022	M-SMA-13	05-001(c)	Mortandad Canyon
	Ten-Site Canyon	T001	Pratt-SMA-1.05	35-003(h)	Pratt Canyon - Tributary to Ten-Site Canyon
				35-003(p)	
				35-003(r)	
				~~35-004(h)~~	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Mortandad	Ten-Site Canyon	T001	Pratt-SMA-1.05	35-009(d)	Pratt Canyon - Tributary to Ten-Site Canyon
				35-016(k)	
				35-016(l)	
				~~35-016(m)~~	
		T002	T-SMA-1	50-006(a)	Ten-Site Canyon
				50-009	
		T003	T-SMA-2.5	35-014(g3)	Ten-Site Canyon
		T004	T-SMA-2.85	35-014(g)	Ten-Site Canyon
				35-016(n)	
		T005	T-SMA-3	35-016(b)	Ten-Site Canyon
		T006	T-SMA-4	35-004(a)	Ten-Site Canyon
				35-009(a)	
				35-016(c)	
				35-016(d)	
		T007	T-SMA-5	35-004(a)	Ten-Site Canyon
				35-009(a)	
				35-016(a)	
				35-016(q)	
		T008	T-SMA-6.8	35-010(e)	Ten-Site Canyon
		T009	T-SMA-7	04-003(b)	Ten-Site Canyon
		T010	T-SMA-7.1	04-001	Ten-Site Canyon
				04-002	
Pajarito	Twomile Canyon	E001	2M-SMA-1	03-010(a)	Twomile Canyon
		E002	2M-SMA-1.42	06-001(a)	Twomile Canyon
		E003	2M-SMA-1.43	22-014(a)	Twomile Canyon
				22-015(a)	
		E004	2M-SMA-1.44	06-001(b)	Twomile Canyon
		E005	2M-SMA-1.45	06-006	Twomile Canyon
		E006	2M-SMA-1.5	22-014(b)	Twomile Canyon
		E007	2M-SMA-1.65	40-005	Twomile Canyon
		E008	2M-SMA-1.67	06-003(h)	Twomile Canyon
		E009	2M-SMA-1.7	03-055(a)	Twomile Canyon
		E010	2M-SMA-1.8	03-001(k)	Twomile Canyon
		E011	2M-SMA-1.9	03-003(a)	Twomile Canyon
		E012	2M-SMA-2	03-050(d)	Twomile Canyon
				03-054(b)	
		E013	2M-SMA-2.2	03-003(k)	Twomile Canyon
		E014	2M-SMA-3	07-001(a)	Twomile Canyon
				07-001(b)	
				07-001(c)	
				07-001(d)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Pajarito	Twomile Canyon	E015	2M-SMA-2.5	40-001(c)	Twomile Canyon
	Threemile Canyon	H001	3M-SMA-0.2	15-010(b)	Threemile Canyon
		H002	3M-SMA-0.4	15-006(b)	Threemile Canyon
		H003	3M-SMA-0.5	15-006(c)	Threemile Canyon
				15-009(c)	
		H004	3M-SMA-0.6	15-008(b)	Threemile Canyon
		H005	3M-SMA-2.6	36-008	Threemile Canyon
				C-36-003	
		H006	3M-SMA-4	18-002(b)	Threemile Canyon
				18-003(c)	
				18-010(f)	
	Pajarito Canyon	J001	PJ-SMA-1.05	09-013	Pajarito Canyon
		J002	PJ-SMA-2	09-009	Pajarito Canyon
		J003	PJ-SMA-3.05	09-004(o)	Pajarito Canyon
		J004	PJ-SMA-4.05	~~09-004(g)~~	Pajarito Canyon
				09-005(g)	
		J005	PJ-SMA-5	22-015(c)	Pajarito Canyon
		J006	PJ-SMA-5.1	22-010(b)	Pajarito Canyon
				~~22-016~~	
		J007	PJ-SMA-6	40-010	Pajarito Canyon
		J008	PJ-SMA-7	40-006(c)	Pajarito Canyon
		J009	PJ-SMA-8	40-006(b)	Pajarito Canyon
		J010	PJ-SMA-9	40-009	Pajarito Canyon
		J012	PJ-SMA-10	40-006(a)	Pajarito Canyon
		J013	PJ-SMA-11	40-003(a)	Pajarito Canyon
		J014	PJ-SMA-11.1	40-003(b)	Pajarito Canyon
		~~J015~~	~~PJ-SMA-13~~	~~18-002(a)~~	~~Pajarito Canyon~~
		J016	PJ-SMA-13.7	18-010(b)	Pajarito Canyon
		~~J017~~	~~PJ-SMA-14~~	~~54-004~~	~~Pajarito Canyon~~
		J018	PJ-SMA-14.2	18-012(b)	Pajarito Canyon
		J019	PJ-SMA-14.3	18-003(e)	Pajarito Canyon
		J020	PJ-SMA-14.4	18-010(d)	Pajarito Canyon
		J021	PJ-SMA-14.6	18-010(e)	Pajarito Canyon
		J022	PJ-SMA-14.8	18-012(a)	Pajarito Canyon
		J023	PJ-SMA-16	27-002	Pajarito Canyon
		J024	PJ-SMA-17	54-018	Pajarito Canyon
		J026	PJ-SMA-18	54-014(d)	Pajarito Canyon
				54-017	
		J025	PJ-SMA-19	54-013(b)	Pajarito Canyon
				54-017	
				54-020	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Pajarito	Pajarito Canyon	J027	PJ-SMA-20	54-017	Pajarito Canyon
		J028	STRM-SMA-1.05	08-009(f)	Pajarito Canyon/Starmers Gulch
		J029	STRM-SMA-1.5	08-009(d)	Pajarito Canyon/Starmers Gulch
		J030	STRM-SMA-4.2	09-008(b)	Pajarito Canyon/Starmers Gulch
		J031	STRM-SMA-5.05	09-013	Pajarito Canyon/Starmers Gulch
Water/Cañon de Valle	Cañon de Valle	V001	CDV-SMA-1.2	16-017(b)-99	Canon de Valle
				16-029(k)	
		V002	CDV-SMA-1.3	16-017(a)-99	Canon de Valle
				16-026(m)	
		V003	CDV-SMA-1.4	16-020	Canon de Valle
				16-026(l)	
				16-028(c)	
				~~16-030(c)~~	
		V004	CDV-SMA-1.45	16-026(i)	Canon de Valle
		V005	CDV-SMA-1.7	16-019	Canon de Valle
		V006	CDV-SMA-2	16-021(c)	Canon de Valle
		V007	CDV-SMA-2.3	13-001	Canon de Valle
				13-002	
				16-003(n)	
				16-003(o)	
				16-029(h)	
				16-031(h)	
		~~V008~~	~~CDV-SMA-2.41~~	~~16-018~~	~~Canon de Valle~~
		~~V008A~~	~~CDV-SMA-2.42~~	~~16-010(b)~~	~~Canon de Valle~~
		V009	CDV-SMA-2.5	~~16-010(c)~~	Canon de Valle
				~~16-010(d)~~	
				16-028(a)	
		V009A	CDV-SMA-2.51	16-010(i)	Canon de Valle
		V010	CDV-SMA-3	14-009	Canon de Valle
		V011	CDV-SMA-4	14-010	Canon de Valle
		V012	CDV-SMA-6.01	14-001(g)	Canon de Valle
				14-006	
		V012A	CDV-SMA-6.02	14-002(c)	Canon de Valle
				~~14-002(d)~~	
				~~14-002(e)~~	
		V013	CDV-SMA-7	15-008(d)	Canon de Valle
		V014	CDV-SMA-8	15-011(c)	Canon de Valle
		V015	CDV-SMA-8.5	15-014(a)	Canon de Valle
		V016	CDV-SMA-9.05	15-007(b)	Canon de Valle
	Fence Canyon	F001	F-SMA-2	36-004(c)	Fence Canyon
	Potrillo Canyon	I001	PT-SMA-0.5	15-009(e)	Potrillo Canyon

APPENDIX A

SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
				C-15-004	
		I002	PT-SMA-1	15-004(f)	Potrillo Canyon
				15-008(a)	
Water/Cañon de Valle	Potrillo Canyon	I003	PT-SMA-1.7	15-003	Potrillo Canyon
				~~15-006(a)~~	
		I004	PT-SMA-2	15-008(f)	Potrillo Canyon
				36-003(b)	
				36-004(e)	
		I004A	PT-SMA-2.01	C-36-001	Potrillo Canyon
				C-36-006(e)	
		I005	PT-SMA-3	36-004(a)	Potrillo Canyon
				36-006	
		I007	PT-SMA-4.2	36-004(d)	Potrillo Canyon
	Water Canyon	W001	W-SMA-1	16-017(j)-99	Water Canyon
				16-026(c2)	
				16-026(v)	
		W002	W-SMA-1.5	16-026(b2)	Water Canyon
				16-028(d)	
		W003	W-SMA-2.05	16-028(e)	Water Canyon
		W004	W-SMA-3.5	16-026(y)	Water Canyon
		W005	W-SMA-4.1	16-003(a)	Water Canyon
		W006	W-SMA-5	16-001(e)	S-Site Canyon - Tributary to Water Canyon
				16-003(f)	
				16-026(b)	
				16-026(c)	
				16-026(d)	
				16-026(e)	
		W007	W-SMA-6	11-001(c)	Water Canyon
		W008	W-SMA-7	~~16-026(h2)~~	Water Canyon
				16-029(e)	
		W009	W-SMA-7.8	16-031(a)	Water Canyon
		W010	W-SMA-7.9	16-006(c)	Water Canyon
		W011	W-SMA-8	16-016(g)	Water Canyon
				16-028(b)	Water Canyon
		W012	W-SMA-8.7	13-001	Water Canyon
				13-002	
				16-004(a)	
				16-026(j2)	

				16-029(h)	
				16-035	
		W012A	W-SMA-8.71	16-004(c)	Water Canyon
		W013	W-SMA-9.05	16-030(g)	Water Canyon

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Water/Cañon de Valle	Water Canyon	W014	W-SMA-9.5	11-012(c)	S-Site Canyon - Tributary to Water Canyon
		W015	W-SMA-9.7	11-011(a)	S-Site Canyon - Tributary to Water Canyon
				11-011(b)	
		W016	W-SMA-9.8	11-005(c)	S-Site Canyon - Tributary to Water Canyon
		W017	W-SMA-9.9	11-006(b)	S-Site Canyon - Tributary to Water Canyon
		W018	W-SMA-10	11-002	S-Site Canyon - Tributary to Water Canyon
				11-003(b)	
				11-005(a)	
				11-005(b)	
				11-006(c)	
				11-006(d)	
				11-011(d)	
		W019	W-SMA-11.7	49-008(c)	Water Canyon
		W020	W-SMA-12.05	49-001(g)	Water Canyon
		W021	W-SMA-14.1	15-004(h)	Water Canyon
				15-014(l)	
		W022	W-SMA-15.1	49-005(a)	Water Canyon
Ancho	Ancho Canyon	A001	A-SMA-1.1	39-004(a)	North Ancho Canyon
				39-004(d)	
		A002	A-SMA-2	39-004(b)	North Ancho Canyon
				39-004(e)	
		A003	A-SMA-2.5	39-010	North Ancho Canyon
		A004	A-SMA-2.7	39-002(c)	North Ancho Canyon
				39-008	
		A005	A-SMA-2.8	39-001(b)	North Ancho Canyon
		A006	A-SMA-3	39-002(b)	North Ancho Canyon
				39-004(c)	
		A007	A-SMA-3.5	39-006(a)	South Ancho Canyon
		A008	A-SMA-4	33-010(d)	South Ancho Canyon
		A009	A-SMA-6	33-004(k)	South Ancho Canyon
				33-007(a)	
				33-010(a)	
Chaquehui	Chaquehui Canyon	Q001	CHQ-SMA-0.5	33-004(g)	Chaquehui Canyon
				33-007(c)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

				33-009	
		Q002	CHQ-SMA-1.01	33-002(d)	Chaquehui Canyon
		Q002A	CHQ-SMA-1.02	33-004(h)	Chaquehui Canyon
				33-008(c)	

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Chaquehui	Chaquehui Canyon	Q002A	CHQ-SMA-1.02	33-011(d)	Chaquehui Canyon
				33-015	
		Q002B	CHQ-SMA-1.03	33-008(c)	Chaquehui Canyon
				33-012(a)	
				33-017	
				C-33-001	
				C-33-003	
		Q003	CHQ-SMA-2	33-004(d)	Chaquehui Canyon
				33-007(c)	
				C-33-003	
		Q004	CHQ-SMA-3.05	33-010(f)	Chaquehui Canyon
		Q005	CHQ-SMA-4	33-011(e)	Chaquehui Canyon
		Q006	CHQ-SMA-4.1	33-016	Chaquehui Canyon
		Q007	CHQ-SMA-4.5	33-011(b)	Chaquehui Canyon
		Q008	CHQ-SMA-5.05	33-007(b)	Chaquehui Canyon
		Q009	CHQ-SMA-6	33-004(j)	Chaquehui Canyon
				33-006(a)	
				33-007(b)	
				33-010(c)	
				33-010(g)	
				33-010(h)	
				33-014	
		Q010	CHQ-SMA-7.1	33-010(g)	Chaquehui Canyon

APPENDIX B
STORM WATER BACKGROUND THRESHOLD VALUES (BTVS)

Pollutant of Concern	Sample Preparation[1]	Landscape	Data Subset Description	SSC-Normalized?	Units	90th Percentile BTV
Aluminum	F	Developed	All locations	Yes	mg/kg SSC	2100
Aluminum	F	Undeveloped	SEP Reference[2]	No	µg/L	3200
Aluminum	F	Undeveloped	Locations other than SEP Reference and E240 gage	No	µg/L	1200
Aluminum	F	Undeveloped	E240 gage	No	µg/L	2200
Aluminum	UF	Developed	All locations	Yes	mg/kg SSC	34,000
Aluminum	UF	Undeveloped	SEP and Western Reference	Yes	mg/kg SSC	36,000
Aluminum	UF	Undeveloped	Northern and Bandelier Reference	Yes	mg/kg SSC	12,000
Arsenic	F	Developed	All locations	No	µg/L	NR[3]
Arsenic	F	Undeveloped	All locations	No	µg/L	6.0
Boron	F	Developed	Lab Developed	No	µg/L	NR
Boron	F	Developed	Town Developed	No	µg/L	NR
Boron	F	Undeveloped	Western and Northern Reference	No	µg/L	23
Boron	F	Undeveloped	SEP and Bandelier Reference	No	µg/L	21
Benzo(a)pyrene	UF	Developed	All locations	No	µg/L	0.067
Cadmium	F	Developed	All locations	No	µg/L	NR
Cadmium	F	Undeveloped	All locations	No	µg/L	NR
Cobalt	F	Developed	All locations	No	µg/L	5.0
Cobalt	F	Undeveloped	Western and Northern Reference	No	µg/L	4.3
Cobalt	F	Undeveloped	SEP and Bandelier Reference	No	µg/L	1.9
Chromium	F	Developed	All locations	No	µg/L	NR
Chromium	F	Undeveloped	All locations	No	µg/L	NR
Copper	F	Developed	Lab Developed	No	µg/L	11
Copper	F	Developed	Town Developed	No	µg/L	8.0
Copper	F	Undeveloped	All Reference except Bandelier	No	µg/L	3.3
Gross alpha	UF	Developed	All locations	Yes	pCi/g SSC	47
Gross alpha	UF	Undeveloped	All locations	Yes	pCi/g SSC	66
Mercury	UF	Developed	All locations	No	µg/L	NR
Mercury	UF	Undeveloped	Western and Northern Reference, excluding E240 gage	No	µg/L	0.21
Mercury	UF	Undeveloped	SEP and Bandelier Reference	No	µg/L	0.10
Nickel	F	Developed	All locations	No	µg/L	3.1
Nickel	F	Undeveloped	Chupaderos, Garcia, and Mortandad Watersheds	No	µg/L	3.1

Pollutant of Concern	Sample Preparation[1]	Landscape	Data Subset Description	SSC-Normalized?	Units	90th Percentile BTV
Nickel	F	Undeveloped	Watersheds other than Chupaderos, Garcia, and Mortandad	No	µg/L	1.7
Lead	F	Developed	All locations	No	µg/L	2.0
Lead	F	Undeveloped	All Reference except Bandelier	No	µg/L	1.5
Total PCBs	UF	Developed	All watersheds except South Fork Acid	No	µg/L	0.028
Total PCBs	UF	Developed	South Fork Acid watershed	No	µg/L	NR
Total PCBs	UF	Undeveloped	Northern and Western Reference	No	µg/L	0.012
Total PCBs	UF	Undeveloped	SEP Reference	No	µg/L	NR
Radium-226 and radium-228	UF	Developed	All locations	Yes	pCi/g SSC	10
Radium-226 and radium-228	UF	Undeveloped	All locations	Yes	pCi/g SSC	7.5
Antimony	F	Developed	All locations	No	µg/L	NR
Selenium	UF	Developed	All locations	No	µg/L	5.6
Selenium	UF	Undeveloped	Watersheds other than Mortandad	No	µg/L	4.8
Thallium	F	Developed	All locations	No	µg/L	NR
Vanadium	F	Developed	All locations	No	µg/L	5.5
Vanadium	F	Undeveloped	Watersheds other than Mortandad	No	µg/L	4.3
Zinc	F	Developed	All locations	No	µg/L	77
Zinc	F	Undeveloped	Watersheds other than Garcia	No	µg/L	10

[1] Sample preparation: F = filtered using a 0.45 µm filter (i.e., dissolved), UF = not filtered (i.e., total).

[2] SEP = Supplemental Environmental Project.

[3] NR = not recommended.

Total, unless indicated	CAS No.		MQL (µg/l)(*1)	ATAL (µg/l)(*2)	MTAL (µg/l)(*3)
RADIOACTIVITIES					
Ra-226 and Ra-228 (pCi/l)				30	---
~~Gross alpha (pCi/l)~~				~~15~~	~~---~~
METALS					
Aluminum, total recoverable	7429-90-5		2.5	---	~~3421~~(*4)(*5)
Antimony, dissolved (P)	7440-36-0		60	640	---
Arsenic, dissolved (P)	7440-38-2		0.5	9	340
Boron, dissolved	7440-42-8		100	5000	---
Cadmium, dissolved	7440-43-9		1	---	(*5)
Chromium~~VI~~, dissolved	18540-29-9		10	---	(*5)(*6)~~16~~
Cobalt, dissolved	7440-48-4		50	1000	---
Copper, dissolved	7440-50-8		0.5	---	(*5)
Lead, dissolved	7439-92-1		0.5	---	(*5)
~~Mercury, dissolved~~	~~7439-97-6~~		~~0.005~~	~~0.77~~	~~1.4~~
Mercury, total	7439-97-6		0.005	0.77	---
Nickel, dissolved (P)	7440-02-0		0.5	---	(*5)
Selenium, total recoverable	7782-49-2		5	5	20
Silver, dissolved	7440-22-4		0.5	---	(*5)
Thallium, dissolved (P)	7440-28-0		0.5	0.47	---
Vanadium, dissolved	7440-62-2		50	100	---
Zinc, dissolved	7440-66-6		20	---	(*5)
CYANIDE					
Cyanide, total recoverable	57-12-5		10	5.2	22
DIOXIN					
2,3,7,8-TCDD (P)	1746-01-6		0.00001	5.1E-08	---
SEMIVOLATILE COMPOUNDS					
Pentachlorophenol	87-86-5		5	---	19
Benzo(a)pyrene (P)	50-32-8		5	0.18	---

Total, unless indicated	CAS No.		MQL (μg/l)(*1)	ATAL (μg/l)(*2)	MTAL (μg/l)(*3)
Hexachlorobenzene (P)	118-74-1		5	0.0029	---
PESTICIDES					
Aldrin (P)	309-00-2		0.01	0.0005	3
Gamma-BHC	58-89-9		0.05	---	0.95
Chlordane (P)	57-74-9		0.2	0.0081	2.4
4,4'-DDT and derivatives (P)	50-29-3		0.02	0.001	1.1
Dieldrin (P)	60-57-1		0.02	0.00054	0.24
Alpha-Endosulfan	959-98-8		0.01	---	0.22
Beta-Endosulfan	33213-65-9		0.02	---	0.22
Endrin	72-20-8		0.02	---	0.086
Heptachlor	76-44-8		0.01	---	0.52
Heptachlor Epoxide	1024-57-3		0.01	---	0.52
Toxaphene	8001-35-2		0.3	---	0.73
PCBS					
PCBs (P)	1336-36-3		(*7)	(*8)~~0.00064~~	---
HIGH EXPLOSIVES					
RDX	121-82-4		---	200	---
2,4,6-Trinitrotoluene (TNT)	118-96-7		---	20	---

Note: The target action levels (TALs) ~~established below~~ are based on and equivalent to New Mexico State water quality criteria for the subject pollutants. The applicable TALs are not themselves effluent limitations, but are benchmarks to determine the effectiveness of control measures implemented to meet the non-numeric technology-based effluent limitations. ~~Monitoring results based on analytical data showing pollutant concentrations above applicable target action levels at any Site indicate that further corrective action may be required.~~

Footnotes:

(*1) MQL is the minimum quantification level. EPA approved analytical methods with the same or more sensitive detectable level (DL) than MQL shall be used. If an individual analytical test result is smaller than the MQL or the more sensitive DL, a value of zero (0) or “ND” may be used for reporting and action purpose.

The Permittees shall use sufficiently sensitive EPA-approved analytical methods (under 40 CFR part 136 and 40 CFR chapter I, subchapters N and O) when quantifying the presence of POCs in a discharge for analyses of POCs or pollutant parameters under the permit. In case the minimum quantification levels (MQLs) are not sufficiently sensitive to the limits, the actual detected values, instead of zeros, need to be reported. If there is a sensitive method with MDL (method detection limit) below the TAL/BTV, but the MQL is above the TAL/BTV, they cannot report zero based on MQL but must report actual value. If any individual analytical test result is less than the MQL listed in Appendix C, or the more sensitive MDL, a value of zero (0) may be used for that individual result for reporting purpose.

The Permittees may develop an effluent specific method detection limit (MDL) in accordance with the monitoring requirements in the SIP and 40 CFR 136. For any POC for which the Permittees determine an effluent specific MDL, the Permittees shall send to the

EPA Region 6 NPDES Permits Branch (6WQ-P) a report containing QA/QC documentation, analytical results, and calculations necessary to demonstrate that the effluent specific MDL was correctly calculated. An effluent specific minimum quantification level (MQL) shall be determined in accordance with the following calculation: MQL = 3.3 x MDL. Upon written approval by the EPA Region 6 NPDES Permits Branch (6WQ-P), the effluent specific MQL may be utilized by the Permittees for all future Compliance Status Report (CSR) reporting requirements. The PCB congener-specific MQLs are listed in footnote (*7) below.

(*2) ATAL stands for Average Target Action Level. The average is the geometric mean of applicable monitoring results at the SMA. If all analytical results are below analytical method detect level, a value of "zero" may be reported. If one or more data are above detect level, a value of ½ detect level shall be assigned to those below detect level data for calculation purpose. If the average value of a specific POC is below its MQL, a value of "zero" may be reported for the average. If a new or an enhanced best management practice (BMP) is installed, the average is calculated based on analytical results from samples taken after installation of the BMP.

(*3) MTAL stands for Maximum Target Action Level.

(*4) See Section H.3 for compliance schedule details.

(*5) Hardness-dependent metals target action levels. See Table C-1 below.

(*6) While the 20.6.4 New Mexico Administrative Code (NMAC) aquatic life standard is for chromium III, analyzing this in storm water is operationally infeasible because of the 24-~~hour~~ hr preservation requirement. Therefore, for the purposes of this Permit, total dissolved chromium will be analyzed and compared to the hardness-dependent criteria (see Table C-1 below).

(*7) Method 1668 Revision C or the most current revision of the Congener Method shall be used for PCB analysis. Per Appendix C of 2010 Permit, the MQLs for PCB congeners 4/10, 5/8, 6, 7/9, 11, 12/13, 14, and 15 will be 50 pg/l, and the MQLs for all other PCB Congeners will be 25 pg/l. If adjusted Reporting Limits (RL) are used to adjust MQLs due to laboratory's contemporary ambient background, such adjusted RL shall be updated no less than once per ~~six months~~6 mo. If laboratory method blank, field blank, or trip blank subtraction are used in calculation of sample analytical result, supporting document shall be submitted with the Annual Report.

(*8) If the stream reach that an SMA drains to is classified as ephemeral (per the Clean Water Act 303(d)/305(b) Integrated Report), the total PCB wildlife habitat surface water quality criterion (0.014 µg/l from 20.6.4 NMAC) will be used as the ATAL; if the stream reach that an SMA drains to is classified as intermittent or perennial, the total PCB human health-organism aquatic life criterion (0.00064 µg/l) will be used as the ATAL.

Table C-1

Proposed Metals MTALs (*1)

Major Canyon	Hardness (*2) (mg/L)	Aluminum	Cadmium (dissolved)	Chromium (dissolved)	Copper (dissolved)	Lead (dissolved)	Nickel (dissolved)	Silver (dissolved)	Zinc (dissolved)
Ancho	35.7	830	0.69	250	5.1	20.7	200	0.55	63
Chaquehui	30.0	660	0.59	210	4.3	17.0	170	0.41	54
Los Alamos/Pueblo	34.5	800	0.67	240	4.9	19.9	190	0.52	61
Mortandad	29.4	640	0.58	210	4.2	16.7	170	0.39	43
Pajarito	30.2	660	0.59	210	4.3	17.2	170	0.41	54
Sandia	44.8	1140	0.83	300	6.3	26.7	240	0.81	77
Water/Cañon de Valle	47.7	1240	0.88	310	6.7	28.6	250	0.90	82

(*1) MTALs are based on acute aquatic life criteria contained in New Mexico ~~WQS~~ Water Quality Standards in 20.6.4.900 NMAC ~~20.6.4.900~~, computed at the hardness values listed.

(*2) Geometric mean receiving water hardness for each major canyon, based on calculated hardness using dissolved (0.45-µm filtered) calcium and magnesium results (SM 2340B).

Changes Accepted Version of the 2015 Draft Individual Permit

Region 6
1445 Ross Avenue
Dallas, Texas 75202-2733 **NPDES Permit No. NM0030759**

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATIONSYSTEM

In compliance with the provisions of the Clean Water Act, as amended,
(33 U.S.C. 1251 et. seq; the "Act"),

Los Alamos National Laboratory (LANL), managed and owned by Permittees

Newport News Nuclear BWXT-Los Alamos, LLC and	U.S. Department of Energy
600 Sixth Street	Office of Environmental Management
Los Alamos, New Mexico 87544	Los Alamos Field Office
	P.O. Box 1663
	Los Alamos, New Mexico
	87545-1663

is authorized to discharge storm water associated with industrial activities from specified solid waste management units (SWMUs) and areas of concern (AOCs) (as identified in Appendix A and referred to herein as "Sites") from the facility located at Los Alamos, New Mexico, to receiving waters named:

Tributaries or main channels of Mortandad Canyon, Canada del Buey, Los Alamos Canyon, DP Canyon, Sandia Canyon, Ten Site Canyon, Canyon de Valle, Water Canyon, Ancho Canyon, Bayo Canyon, Chaquehui Canyon, Fence Canyon, Pajarito Canyon, Twomile Canyon, Threemile Canyon, Potrillo Canyon, Pueblo Canyon, and Rendija Canyon, in Water Body Segment No. 20.6.4.98, 20.6.4.126 or 20.6.4.128 of the Rio Grande Basin,

in accordance with this cover page and monitoring requirements, and other conditions set forth in the Requirements for NPDES Permits and Appendices A through C, hereof.

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Issued on	Prepared by
______________________	______________________
Charles Maguire	Isaac Chen
Director	Environmental Engineer
Water Quality Protection Division (6WQ)	NPDES Permits Branch (6WQ-P)

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REQUIREMENTS FOR NPDES PERMITS

This Permit authorizes only those storm water discharges associated with inactive solid waste management units (SWMUs) and areas of concern (AOCs) listed in the Hazardous Waste Permit (Permit No. NM0890010515) for Los Alamos National Laboratory (LANL). The SWMUs and AOCs applicable to this permit are listed in Appendix A. The SWMUs and AOCs identified in Appendix A are collectively referred to throughout this Permit as "Sites." This Permit does not authorize storm water discharges associated with current conventional industrial activities at LANL. Storm water discharges associated with current conventional industrial activities are covered under U.S. Environmental Protection Agency's (EPA's) National Pollutant Discharge Elimination System (NPDES) general permit for storm water discharges from industrial activity, also known as the Multi-Sector General Permit (MSGP). Unless otherwise specified, references to "industrial activity" or "industrial storm water" under this Permit refer to the definition of "storm water discharge associated with industrial activity" at 40 C.F.R. § 122.26(b)(14).

This Permit contains non-numeric technology-based effluent limitations, coupled with a comprehensive, coordinated monitoring program and corrective action where necessary, to minimize pollutants of concern (POC), or site-related constituents, in Permittees' storm water discharges. As used in this Permit, "minimize" means to reduce and/or eliminate discharges of POCs in storm water to the extent achievable using site-specific control measures (including best management practices) that reflect best industry practice considering their technological availability, economic achievability and practicability.

The Permittees are required to implement site-specific control measures (including best management practices) to address the non-numeric technology-based effluent limits contained in this Permit, followed by confirmation monitoring screened against New Mexico water-quality criteria-equivalent target action levels (TALs) to determine the effectiveness of the site-specific measures. Any TAL exceedances will be evaluated and informed by background threshold values (BTVs) for those POCs that are released by natural or urban environments and are not Site-related. The Permittees must also develop, maintain, and update a Site Discharge Pollution Prevention Plan (SDPPP) and Sampling Implementation Plan (SIP) consistent with Parts D.1 and F.1 of this Permit. Collectively, these plans describe the control measures used to meet the requirements of this Permit.

A. MAINTENANCE OF CONTROL MEASURES

For all Sites identified in Appendix A of this Permit, the Permittees shall install and maintain structural and nonstructural control measures to meet the non-numeric technology-based effluent limits, as necessary, to minimize Site-related POCs in storm water discharges. Nothing in this Permit relieves the Permittees of the obligation to implement additional control measures required by other Federal authorities or by a State or local authority. Structural control measures, the installation of which involve the discharge of dredge or placement of fill material into any receiving waters (e.g., wetlands), may require a separate permit under section 404 of the Clean Water Act (CWA) before installation.

Permittees' Recommendations for NPDES Storm Water Individual Permit (NM0030759):

1. **Structural Control Measures**

   (a) Basic structural control measures include:

   (i) **Erosion and Sedimentation Controls.** The Permittees must minimize discharges of POCs caused by onsite erosion and sedimentation. The Permittees must implement structural, vegetative, and/or stabilization control measures as necessary to achieve this requirement.

   (ii) **Management of Run-on and Runoff.** The Permittees must, to the extent practicable, divert, infiltrate, reuse, contain, detain, or otherwise reduce storm water run-on/runoff to minimize Site-related POCs from discharging to receiving waters.

   (iii) **Unauthorized Discharges.** The Permittees must eliminate non-storm water discharges (e.g., process wastewater, spills or leaks of toxic or hazardous materials, contaminated groundwater, or any contaminated non–storm water) not authorized by an NPDES permit.

   (iv) **Other Controls.** The Permittees must do the following where applicable:

   (a) Implement controls to prevent the discharge of waste, garbage, or floatable debris to receiving waters, except as authorized by a permit issued under section 404 of the CWA;

   (b) Minimize the generation of dust, along with vehicles tracking raw, final, or waste materials or sediments off-site;

   (c) Minimize the introduction of raw, final, or waste materials to exposed areas;

   (d) Minimize the effects of any increase in downstream erosion resulting from the construction and operation of structural controls; and

   (e) Place flow velocity dissipation devices at discharge locations and along the length of any discharge channel if the flows would otherwise create erosive conditions.

   (b) The Permittees must maintain control measures in effective operating condition. Failure to do so is a violation of this Permit. These maintenance requirements under this Permit do not apply to:

   (i) Controls installed for a Site that has been removed from the Permit so that discharges from that Site are no longer authorized under this permit, or

   (ii) A control measure that has been replaced by another control measure, or

   (iii) A control measure that has been retired because it is no longer necessary to perform the functions of a control as defined by Part A.1(a)(i) or (ii).

The Permittees must keep documentation onsite that describes procedures and a plan for inspection and preventative maintenance of all control measures and specifies backup practices to be used should a runoff event occur while a control measure is off-line. Nonstructural control measures must also be diligently maintained (e.g., employee training described in Part A.2). Nothing in this Permit shall be construed to prevent the Permittees from taking action(s) to modify control measures as appropriate to address deficiencies.

If, during an inspection or other event, a control measure is identified as not operating effectively, the Permittees must repair or replace the control before the next anticipated storm event if possible, or as soon as practicable, following that storm event. In the interim, the Permittees must have backup measures in place.

Requirements of inspection and maintenance of existing control measures described in this part, Part A, also apply to additional, enhanced, or advanced control measures.

2. Nonstructural Control Measures

The Permittees must provide training at least once per year to employees who are responsible for implementing activities identified in the Permit and the SDPPP (e.g., inspectors, maintenance personnel), including members of the Site Discharge Pollution Prevention Team (referred to as Pollution Prevention Team in this Permit). Training must cover the specific components of the Permit, the scope of the SDPPP, and the control measures required under this Part. The Permittees shall maintain records of employee training.

B. CONFIRMATION MONITORING REQUIREMENTS

The Permittees shall monitor POCs in storm water discharges from Sites at specified sampling points known as site monitoring areas (SMAs). The Permittees shall perform confirmation monitoring as detailed below following installation of each site-specific control measure.

1. Confirmation Sampling

If, during the previous permit, all analytical results(s) for a particular POC at a particular SMA listed in Appendix A were at or below the maximum target action level (MTAL) and/or the geomean of all analytical sampling result(s) was at or below the average target action level (ATAL), monitoring of that POC at the same SMA is not required.

If corrective action was initiated during the previous Permit, the Permittees shall determine confirmation monitoring requirements based on the Annual Sampling Implementation Plan (SIP; Part D.1). Annual confirmation monitoring requirements shall be maintained in the SIP. If confirmation monitoring is required, the Permittees shall collect two confirmation samples.

Confirmation sampling is used to determine the effectiveness of baseline and enhanced control measure installations, and to inform the Permittees if additional corrective actions are necessary. There are several categories of confirmation monitoring required by this Permit;

(a) After baseline or enhanced control measures are installed, the Permittees shall collect two confirmation samples. The Permittees shall continue to sample after collection of the first sample, unless the end of monitoring season weather makes this impractical.

(b) After construction of a cap or other engineered cover, one confirmation sample is required if the capped area is smaller than the SMA drainage area. Otherwise, no further confirmation sampling is required, unless required by Part B.5.

(c) Following certification of completion of soil removal, the Permittees shall perform storm water confirmation sampling. The Permittees shall collect two confirmation samples. If a TAL is not exceeded for two samples, then further monitoring is not required for the remainder of Permit and the Permittees may seek to delete the Site or Sites from the Permit pursuant to Part I.2(d).

(d) After installation of control measures that retain a volume of storm water runoff from a Site or SMA that is equivalent to a 3-year, 24-hour storm event or greater, the Permittees will be in compliance with this Permit at that Site or SMA once they have certified through the submission of certified as-built drawings, that such measures have been properly installed to perform their function to totally retain the appropriate design volume of storm water. No further confirmation monitoring is required post-certification, unless required by Part B.5.

2. Sampling Locations

All samples collected for purposes of confirmation monitoring shall be collected in accordance with the monitoring requirements specified below at the SMAs identified in Appendix A of this Permit. SMA locations are based on reasonable site accessibility for sampling purposes and the Permittees' best judgment that samples taken will be representative of discharges of storm water from Site-affected media (soil, sediment, or bedrock) as determined by the SIP. The drainage area of each SMA shall be representative of the Site or Sites within the SMA.

(a) **Sampler location adjustments.** The Permittees may move a sampler to make adjustments that arise from changes in natural conditions, installation of structural controls, unexpected events, or as otherwise necessary to ensure the sampling location is representative of storm water discharges from the Site-affected media as delineated by soil sampling data. Such changes may include minor updates in Site boundaries, changes in storm water drainage patterns, or adjustments due to logistical or security issues. Any such movement of a sampler shall be documented in the annual SIP and SDPPP.

(b) **Sampler additions**: In the event that the annual SIP identifies potential discharges from a Site within an SMA that may not flow through the current monitoring location, the Permittees shall add additional sampling locations during the Permit term in order to collect additional investigation samples. Each additional sampling location and the corresponding sampling results are subject to the sampling, reporting, inspection, and corrective action requirements of this Permit.

3. Sampling Procedures

Any sampling performed for purposes of confirmation monitoring at a particular SMA must be performed after installation of applicable control measures and following a storm event that results in an actual discharge from the Site or Sites and that produces sufficient volume to perform the required analyses (referred to herein as a "measurable storm event"). For each sampling event, the Permittees must identify the date and duration (in hours) of the storm event(s) sampled, rainfall measurements or estimates (in inches) of the storm event that generated the sampled runoff, and the duration between the storm event sample collection and the end of the previous measurable storm event. The Permittees may take meteorological information from the nearest meteorological tower or rain gage. Snowmelt samples shall not be used for purposes of confirmation monitoring.

Grab samples shall be taken within the first thirty (30) minutes of (or as soon after as practical, but beginning no later than one (1) hour after) a measurable storm event.

4. Collection of Partial Samples

In the event the collected volume is insufficient to perform all required analyses listed in the SIP, the partial sample shall be analyzed in accordance with a priority list of Site-specific POCs determined by the Permittees based upon a review of site history, soil data, and other acceptable knowledge. The priority list for each Site is documented in the SIP.

In the event that a partial sample is collected, the Permittees shall immediately reactivate the sampler to attempt to complete the full Site-specific POC suite listed in the SIP.

5. Additional Sampling Requirements

(a) If soil disturbance within the Site-affected media occurs, storm water samples collected by the Permittees following these activities shall be analyzed for all POCs listed in the SIP for that SMA. Installation of controls and routine maintenance of monitoring devices are not subject to the requirements of this Part.

(b) Notwithstanding the provisions of Parts B.1 and C.1, and except as provided in Part I.1, if a Site for which monitoring has ceased later exhibits evidence of a discharge of contaminated runoff or conditions that could lead to a discharge of contaminated runoff, such as control measure failure, erosion problems, re-exposure of "no exposure" Sites, or if monitoring data (from the facility, state or local agency) show an exceedance of applicable TALs, the Permittees shall initiate appropriate actions to correct the problems within thirty (30) days of being made aware of such information and shall report the problem and the corrective actions taken to EPA, with a copy to the New Mexico Environment Department (NMED).

C. CORRECTIVE ACTION SCREENING

A corrective action evaluation will be conducted if any validated analytical result for a particular POC from a confirmation sample at an individual SMA is greater than the MTAL (Appendix C) or the geomean of all applicable sampling results is greater than the ATAL (Appendix C) or BTV (Appendix B).

If a Site(s) is in corrective action as a result of activity completed under the 2010 Permit, the Permittees shall follow the requirements pursuant to Part C.2 to continue towards a certification of completion.

1. Site-Specific Demonstration

The Permittees may choose to demonstrate that a TAL exceedance is beyond the Permittees' control. Sources that are outside the Permittees' control include natural background and aerial deposition of contaminants not associated with the current or historic activities conducted by the Permittees. The demonstration must include data previously collected by the Permittees or others (including literature studies) that describe the levels of natural background and baseline concentrations of pollutants in storm water in the local area.

The Permittees may choose one or more of the following methods to perform a site-specific demonstration (SSD) showing that the Site or Sites are not reasonably expected to be the source for one or more of the remaining POCs that have exceeded applicable TALs. For Sites where data has been collected under the 2010 Permit, this demonstration must be conducted within 1 year of the effective date of this Permit. The results shall be provided in the initial SIP pursuant to Part D.1 and annually thereafter.

(a) **Run-on /runoff evaluation.** This demonstration may include the collection of storm water run-on data for all POCs that exceeded the TALs, from a sampler located above the Site. In addition, the Permittees may choose to collect additional runoff data below a Site or Sites. The runoff sampler may or may not be the SMA sampler location, but the runoff sampler location should be representative of runoff from Site-affected media for the Site(s) being evaluated by the SSD. An example where a runoff sampler is not the SMA sampler is where two or more Sites exist within an SMA and the Permittees choose to monitor runoff from a single Site in the SMA.

If the following condition is met, the Permittees will have demonstrated that the Site or Sites are not reasonably expected to be the sole source for one or more of the remaining POCs and the Permittees will have also demonstrated that discharges from the Site or Sites do not contribute to the exceedance of TALs. Further confirmation sampling for those POCs are not required.

Geomean (runoff) – Geomean (run-on/precipitation) <= TAL

(b) **Site-specific information.** If the Permittees collect a minimum of one confirmation sample that exceeds a TAL, the Permittees may use this data, along with other Site-specific information, to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TAL(s). Sources of site-specific information include, but are not limited to, site history, validated surface soil data (i.e., collected in top 3 feet), BTVs, information on land use upstream of and within the SMA, and scientific literature.

(i) **Storm Water (SW):** If Permittees choose to use Site-specific information in the SSD, confirmation storm water monitoring results shall be compared to the TALs (Appendix C) and to the BTVs (Appendix B) using the composite BTV formula below. Permittees shall compare the confirmation sample results to the composite BTV.

90^{th} percentile composite BTV = (% impervious SMA area * 90^{th} percentile developed landscape BTV) + (% pervious SMA area * 90^{th} percentile undeveloped landscape BTV)

where the % impervious SMA area is the % impervious, or developed, area of the SMA, and the % pervious SMA area is the % pervious, or undeveloped, area of the SMA. The % impervious and pervious SMA areas and the resulting composite BTV for each Site shall be listed in an appendix of the annual SIP. The Permittees shall provide the results of the screening process in the annual SIP based on the comparison of confirmation sample results with composite BTVs and TALs. The results of the comparison shall be sorted into the following tiers:

SW Tier 1: When the confirmation sample result is less than the TAL, the Permittees can cease monitoring for that POC for the remainder of the permit and it is not considered as a Site-related POC.

SW Tier 2: When the confirmation sample result of one or more POCs exceeds the TAL but is less than the 90^{th} percentile composite BTV, the SMA shall enter into long-term stewardship (LTS) and meet the requirements of Part G.3. However, if the BTV and the confirmation sample result are less than the TAL, SW Tier 1 applies.

SW Tier 3: When the confirmation sample result of one or more POCs exceeds the 90^{th} percentile composite BTV, the SMA shall enter into corrective action per Part E. However, if the BTV and the confirmation sample result are less than the TAL, SW Tier 1 applies.

(ii) **Soil Data (SD):** Using validated surface soil data results (i.e., within 3 feet below ground surface) from Consent Order soil characterization efforts, the following comparison can be made: 95-95 upper tolerance limit (UTL) BTVs for inorganic POCs (LANL 1998, "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory"), and 2019 NMED soil screening levels (SSLs) for organic POCs and inorganic POCs with no BTV. The results of the comparison shall be sorted into the following tiers:

SD Tier 1: When the soil sample result is less than the 95-95 UTL BTV for inorganic POCs or less than 10% of the SSL for organic POCs and inorganic POCs with no BTV, the Permittees can cease monitoring for that POC and it is not considered as a Site-related POC. If SW Tier 1 conditions are also met, Permittees may request the Site be deleted from the Permit.

SD Tier 2: When the soil sample result of one or more POCs exceed the 95-95 UTL BTV for inorganic POCs or 10% of the SSL for organic POCs and inorganic POCs with no BTV, the POC shall remain or be added to storm water monitoring requirements for that SMA if it is considered as a Site-related POC.

The tier results of the confirmation and/or soil data comparisons shall be used to determine annual sampling requirements and whether POCs are reasonably expected to be the source for one or more of the POCs (see Part D).

(iii) **Site History**: In order for a POC to be determined as Site-related and added to the SIP for monitoring, documentation should provide evidence that the POC was managed or released at the Site during historic industrial activities; as well as evidence that supports that the Site is exposed to storm water and that the Site generated storm water runoff while exposed. Relevant documentation of Site-related knowledge shall be reported in the SIP.

When confirmation monitoring or soil data is unavailable, and no relevant Site history exists, Consent Order sample collection may be accelerated and results can be used to assess appropriate SMA monitoring.

2. <u>Monitoring at Sites in Corrective Action</u>

For each SMA with Sites in corrective action, the following requirements apply:

(a) If the Permittees have collected a confirmation sample and are currently in corrective action, they shall complete the corrective action and proceed to confirmation monitoring pursuant to Part B.

(b) If the Permittees have previously installed and certified enhanced controls, they shall collect two confirmation samples if no sample has been collected, or one confirmation sample if a sample has already been collected.

(c) If the Permittees have submitted requests (e.g., Alternative Compliance, or force majeure) to EPA that are pending, the Permittees shall complete an SSD pursuant to Part C.1 to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TALs or BTVs.

(d) If the Permittees have achieved Resource Conservation and Recovery Act (RCRA) corrective action complete status under the NMED Consent Order and have, by definition, collected at least one confirmation sample, the Permittees shall complete an SSD pursuant to Part C.1 to determine if the Site or Sites are reasonably expected to be the source of the POC that exceeds the applicable TALs or BTVs.

For Sites with a completed SSD, the tier results of the confirmation monitoring and/or soil data comparisons shall be used to determine annual sampling requirements.

D. ANNUAL SAMPLING IMPLEMENTATION PLAN

Within 1 year of the effective date of the Permit, the Permittees, in consultation with NMED Surface Water Quality Bureau (SWQB), shall evaluate the appropriate monitoring requirements and representative sampling locations for all Sites covered under this permit per Part C. Before May 1 of subsequent years, the Permittees shall review all new available information to determine if the current SMA storm water sampling location is representative of storm water discharges from Site-affected media and determine the appropriate monitoring requirements list for the upcoming field season.

1. Annual Sampling Implementation Plan

Any changes shall be documented in the annual SIP update. EPA may require the Permittees to submit additional information to justify proposed changes or document site knowledge regarding a Site in the SIP. If sampler moves are required by the SIP, samplers shall be moved to more representative locations at the initiation of the storm water sampling season or as soon as practicable to facilitate sample collection.

The SIP shall include the following:

(a) **Monitoring location list** - For each SMA, if the sampler location changed or a new location was added as an investigative sample location from the previous year, report any updated latitude and longitude and indicate the reason for the change in the appropriate SIP section. The representative sampling location review conducted in 2016–2018 resulted in new sample locations for several SMAs, and constitutes an initial review that shall be provided in the first SIP update following the issuance of this Permit. Monitoring locations shall be reviewed annually to ensure representative samples will continue to be collected.

When a Site and the associated controls are designated as a LTS location, monitoring is no longer required. The Permittees shall update the list of these Sites annually in the SIP. The Permittees shall meet the inspection requirements per Part G.3 and must track the status of inspections and maintenance completed.

(b) **Monitoring requirements list –** For each SMA, the Permittees must annually complete an SSD screening of new confirmation samples or soil data received during the previous year as required by Part C.1.

If the SIP requires the addition of one or more POCs for monitoring and the Site has previously entered corrective action, the Permittees are required to complete all applicable requirements of Part B.1 and initiate confirmation monitoring for all added POCs.

In the event that a POC that has been added for monitoring does not have a TAL or BTV listed in this Permit, the Permittees shall collect two samples. If there is an associated water quality standard for that water POC that is Site-related, the monitoring result shall be compared to that standard. Permittees will evaluate current and necessary best management practices to address any exceedance. The Permittees shall document analytical results and any voluntary actions taken in the SIP.

The results of the SIP updates must be presented in the annual update to the SDPPP as required by Part F.1. Additionally, the SIP updates must be published on the IP Public website per Part I.7(a).

E. CORRECTIVE ACTION

Once corrective action has been initiated, the Permittees are required to implement Site-specific control measures to address the non-numeric technology-based effluent limits contained in the Permit. The options for completion of corrective action include installation of enhanced control measures, elimination of exposure to POCs, or retention of a 3-year, 24-hour storm event as described below.

1. Evaluation of Corrective Action Measures

Once a TAL or BTV has been exceeded for a Site-related POC, the Permittees shall perform a corrective action evaluation to determine the appropriate method for completion of corrective action. At a minimum, this corrective action evaluation shall consider the following: volume of storm water currently retained and the potential for additional retention of storm water; potential and physical limitation for installation of Site-appropriate storm water controls (with consideration of technological availability); evaluation of the efficacy, limitations, and predicted water quality improvement performance of any proposed storm water controls based on published literature; or distribution of contaminants in soil and the predicted efficacy of any proposed soil removal on removal of POCs from storm water.

(a) Installation of Enhanced Control Measures

Enhanced (i.e., additional, expanded or better-tailored) control measures may be used to complete corrective action. Where feasible, these enhanced controls shall incorporate low-impact design and green infrastructure design features.

The enhanced control process may include more than one iteration of control measure installation followed by confirmation monitoring, pursuant to Parts B and C.1, after each control measure installation.

Permittees shall certify completion of installation of control measures under this subpart to EPA, with a copy to NMED, within 30 days of completion of all such measures at the Site. Such certification shall be signed in accordance with 40 CFR 122.22(b) and shall include a description and photographs of all completed measures and the results of the corrective action measures evaluation performed in Part E.1. Except as provided in Part I.2, the Permittees are required to continue to inspect the Site in accordance with Part G and to maintain all control measures in effective operating condition as required by Part A.

(b) Total Elimination of Exposure of Site-Related POCs to Storm Water

To complete corrective action at a Site or Sites within an individual SMA, the Permittees may decide to pursue total elimination of exposure of Site-related POCs to storm water. Total elimination of exposure of Site-related POCs to storm water may be achieved in one of two ways:

(i) **Constructing a cap or other engineered cover.** If the Permittees choose this method to achieve total elimination of exposure of Site-related POCs to storm water, the Permittees shall demonstrate that a cap or other engineered cover has been constructed. The Permittees shall be in compliance with this Permit once they have certified and demonstrated to EPA, through the submission of certified as-built drawings, that such measures have been properly installed to perform their function to totally eliminate exposure of Site-related POCs to storm water. One confirmation sample is required if capped area is smaller than the SMA drainage area. Otherwise, no further confirmation sampling is required, unless required by Part B.5.

(ii) **Soil removal.** If the Permittees chose this method to achieve total elimination of exposure of Site-related POCs to storm water, the Permittees shall demonstrate and certify to EPA, with a copy to NMED, that soil removal meets the requirements of this Part through collection and evaluation of confirmation soil sampling results. Following certification of completion of soil removal, the Permittees shall perform storm water confirmation sampling.

If the Permittees certify to EPA, with a copy to NMED, that 3 feet or more depth of soils are removed and replaced with clean soils and EPA determines new soil data has demonstrated that no significant amount of industrial materials remain on the Site, the Permittees will have demonstrated completion of corrective action. The Permittees may submit soil data for new fill soil, or soil data from upstream background soil to demonstrate no significant materials from past industrial activities would remain exposed to storm water. EPA may require soil testing for some radius outside the remediated area to ensure "no significant industrial materials remain" in the soil on the water pathway (Note: If evidence shows that surface runoff from that Site will penetrate deeper than 3 feet, the Permittees may not use this approach.)

The Permittees shall certify elimination of exposure under this Part to EPA, with a copy to NMED, within 30-days of completion of all such measures at the Site. Such certification shall be signed in accordance with 40 CFR 122.22(b) and shall include a description and photographs of all completed measures and the results of the corrective action measures evaluation performed in Part E.1. Except as provided in Part. I.2, the Permittees are required to continue to inspect the Site in accordance with Part G and to maintain all control measures in effective operating condition as required by Part A.

(c) **Retention of a 3-Year, 24-Hour Storm**

The Permittees may decide to achieve completion of corrective action under this Part through installation of control measures that retain a volume of storm water runoff from a Site or SMA that is equivalent to a 3-year, 24-hour storm event based on the most representative rain gage historic records from the nearest meteorological tower or rain gage. The Permittees shall be in compliance with this Permit at that Site or SMA once they have certified and demonstrated to EPA, with a copy to NMED, through the submission of certified as-built drawings, that such measures have been properly installed to perform their function to totally retain the appropriate design volume of storm water. No further confirmation sampling is required post-certification, unless required by Part B.5.

Identification of the rain gage applicable to each Site shall be maintained within the SDPPP. The Permittees shall provide information (e.g., sediment removal, sediment depth, water level, estimated capacity remaining, evidence of discharges, or others) to demonstrate the retention facility maintains capacity to store a 3-year, 24-hour storm.

The Permittees may choose to install run-on control measures to reduce run-on and sediment (i.e., low impact development, green infrastructure, sediment detention basin or berm, etc.), and such installations shall minimize discharges to the equivalent of a 3-year, 24-hour storm event.

In an event of discharge, the Permittees shall report such a discharge in the annual SDPPP and demonstrate that such a discharge is caused by a storm event that is equivalent to a 3-year, 24-hour or greater storm. The Permittees are required to continue to inspect the Site in accordance with Part G (as applicable) and to maintain all control measures in effective operating condition as required by Part A.

2. <u>Completion of Corrective Action</u>

The Permittees must certify to EPA, pursuant to 40 CFR 122.22(b), completion of corrective action wherever applicable. Under this Permit, completion of corrective action shall mean:

(a) No applicable TAL or BTV exceedances are reasonably expected to be Site-related as demonstrated under Part C.1; or

(b) The installation of enhanced control measures under Part E.1(a) with confirmation monitoring analytical results less than the applicable TALs or BTVs as demonstrated under Part C.1; or

(c) The installation of control measures that totally eliminate exposure of Site-related POCs to storm water under Part E.1(b), with confirmation monitoring analytical results less than the applicable TALs or BTVs as demonstrated under Part C.1, if confirmation monitoring is required; or

(d) The installation of control measures that retains a volume of storm water runoff or minimize discharges from a Site or SMA that is equivalent to a 3-year, 24-hour storm event under Part E.1(c).

3. <u>Alternative Compliance</u>

(a) Where the Permittees believe, based upon a technical evaluation of existing control measures, that they will be unable to certify corrective actions under Part E.1(a) through (c) above (individually or collectively) due, for instance, to site conditions that make it impracticable to install further control measures, or POCs that exceed BTVs and are contributed by sources beyond the Permittees control, the Permittees may seek to place a site into Alternative Compliance, whereby completion of corrective action shall be accomplished on a case-by-case basis, and as necessary, pursuant to an individually tailored control measure by EPA.

(b) To seek to place a Site or Sites into Alternative Compliance, the Permittees must file a written request with EPA and provide written notice to the public and opportunity for public comment, within 90-days of validated confirmation of TAL or BTV exceedance but not later than 180-days prior to the expiration date of the permit. However, the EPA Director may grant an extension, not to exceed the expiration date of the permit. Such a request must include the following:

(i) A comprehensive description of the control measures installed at the Site or Sites;

(ii) A list of additional on-the-ground actions or a watershed protection approach (see Part I.4) which have resulted in a reduction in the potential for Site-related POC discharges to reach downstream canyons; and

(iii) A detailed demonstration, including any underlying studies and technical information, of how the Permittees reached the conclusion that they are unable to certify completion of corrective action under Parts E.1(a) through (c) (individually or collectively).

Upon submitting such a request to EPA, the Permittees shall make the request and all supporting information available to NMED and the public for review and comment for a period of forty-five (45) days and shall develop and provide to the commenters a written response document addressing all relevant and significant concerns raised during the comment period. The Permittees' request under this Part, along with the complete record of public comment and the Permittees' response to comments, shall be submitted to EPA Region 6 for a final determination on the request. The Permittees' response to comments may include a revision to the Alternative Compliance request and/or the proposed individually tailored work plan.

(c) The Permittees shall not be out of compliance with the applicable requirements for achieving completion of corrective action with respect to the Site or Sites covered by a request. The Permittees shall continue to conduct inspections and maintenance of existing control measures on those Sites.

(d) If EPA, after considering all the information submitted by the Permittees, including all comments received on the request and the Permittees response to those comments, denies the request, EPA may require the Permittees to install Site-specific control measures to complete the corrective action, in writing.

(e) If EPA approves the request, EPA may set site-specific requirements for inspection, maintenance, and/or monitoring.

(f) Unless EPA acts to disapprove within 90-days of the completion of the public comment period, the request shall be considered approved.

4. Schedules for Corrective Actions

If one or more POCs exceeding the applicable TALs or BTVs cannot be excluded as the source of the exceedance pursuant to Part C.1, the Permittees shall take proper corrective actions and complete installation of additional control measures no later than 24 months from the date when the Permittees have knowledge of TAL or BTV exceedance. The Permittees shall make reasonable efforts, in good faith, to achieve completion of corrective actions within the 24-month compliance schedule.

(a) **"Force Majeure."** The Permittees may seek EPA approval for an extension to a deadline if the Permittees can demonstrate that "force majeure" has resulted, or will result, in a delay in meeting the obligation to confirm completion of corrective action by the specified deadline. An event that constitutes "force majeure," includes, but is not limited to (a) Acts of God, natural disasters such as fire or flood, war, terrorism, insurrection, civil disturbance, or explosion; (b) a federal government shut down, such as the ones that occurred in 1996 and 2018; (c) unanticipated breakage or accident to machinery, equipment or lines of pipe; (d) restraint by court order; (e) inability to obtain the necessary authorizations, approvals, permits or licenses due to an action or inaction caused by another governmental authority; (f) unanticipated delays caused by compliance with applicable statutes or regulations governing contracting, procurement or acquisition procedures; and (g) inability to secure the reasonable cooperation of any other property owner in addressing storm water run-on to a Site or Sites from such property.

To obtain an extension from EPA, the Permittees shall describe in detail (a) the cause or causes of the delay; (b) the expected duration of the delay, including any obligations that would be affected; (c) the actions taken or to be taken by the Permittees to minimize the delay; and (d) the timetable by which those actions are expected to be implemented. EPA will notify the Permittees whether an extension is reasonably justified and provide a new reasonable deadline that takes into account the actual delay resulting from the event, anticipated seasonal construction conditions, and any other relevant factors. If EPA does not agree to the extension, it will notify the Permittees in writing and provide the basis for its conclusion.

F. SITE DISCHARGE POLLUTION PREVENTION PLAN (SDPPP)

The Permittees shall update the facility's SDPPP annually, submit it to EPA and copy NMED by May 1 of each calendar year of the Permit and post the SDPPP on the Permittees' Individual Permit public website within 30-days after the submittal. The annual update shall fully incorporate all changes made during the previous year and reflect any changes projected for the following year. The facility's SDPPP must remain compliant with relevant State, Tribal, and local regulations, if applicable.

Permittees' Recommendations for NPDES Storm Water Individual Permit (NM0030759):

1. Contents of SDPPP

The facility's SDPPP must describe all control measures installed to meet the requirements of this Permit. In addition, the facility's SDPPP must contain all of the elements described below. The SDPPP must also address the inspection requirements set forth in Part G below.

(a) **Site Discharge Pollution Prevention Team.** The Permittees must identify the staff members (by name or title) that comprise the facility's Site Discharge Pollution Prevention Team (Pollution Prevention Team). The Permittees' Pollution Prevention Team is responsible for assisting the facility manager in developing and revising the facility's SDPPP as well as maintaining control measures and taking corrective actions for deficiencies. Specific responsibilities of each staff individual on the Team must be identified and listed in the SDPPP. Each member of the Pollution Prevention Team must have ready access to either an electronic or paper copy of applicable portions of this Permit and the facility's SDPPP.

(b) **Site Description.** The facility's SDPPP must include a description of historical activities at each Site, precipitation information, general location map, and Site maps.

(c) **Receiving Waters and Wetlands.** The SDPPP must include the name(s) of all receiving waters that receive discharges from Sites covered by this permit. The SDPPP must also include the size and description of wetlands or other special aquatic sites.

(d) **Summary of Potential POC Sources.** The SDPPP must identify each Site at the facility where industrial materials or activities were previously exposed to storm water and from which allowable non–storm water discharges were released. The SDPPP must also identify the POCs associated with those activities.

(e) **Description of Control Measures.** The Permittees must update the SDPPP as needed to document all structural control measures installed at a Site as well as the dates installation was completed. The SDPPP must include sufficient detail to identify and describe the Site-specific control measures.

(f) **Schedules for Control Measure Installation.** The Permittees shall update the SDPPP as necessary to include schedules for additional control measure installation and implementation resulting from corrective action under Part E of this Permit.

(g) **Monitoring and Inspection Procedures.** The Permittees must document in the SDPPP schedules and planned procedures for sample collection and site inspection. For each sample to be collected, the SDPPP must identify:

(i) Locations where samples are to be collected, including coordinates for sampling locations, and any determination that two or more Sites are substantially identical;

(ii) Person(s) or positions of person(s) responsible for sample collection;

(iii) Parameters to be sampled and frequency of sampling for each parameter;

(iv) Procedures for gathering storm event data.

The Permittees must document in the SDPPP all tentative schedules and procedures for erosion and post-storm inspections as described in Parts G.1 and G.2 of this Permit.

(h) **SMA Maps.** The Permittees must include a map with the following information in their SDPPP regarding each SMA:

(i) Location of each Site within the SMA drainage area;

(ii) Coordinates and locations of the SMA samplers (with updates as adjustments occur). ~~and~~

(iii) Estimates of the size (in acres) of the SMA and of Site(s) within the SMA.

(iv) Any adjustments/changes to sampler locations under Parts B.2 and the associated documentation for the sampler move.

(v) Coordinates and identification of any run-on sampler locations.

(i) **Annual Compliance Status Reports.** Annual Compliance Status Reports as specified in Part H shall be integrated into the SDPPP.

(j) **Annual SIP.** The annual SIP, as specified in Part D shall be integrated into the SDPPP.

(k) **Signature Requirements.** The SDPPP shall be signed, certified and dated in accordance with 40 CFR 122.22(b) prior to submittal of annual updates.

2. <u>Documentation</u>

The Permittees are required to maintain inspection, monitoring, and certification documentation with the SDPPP that together keep the records complete and support ongoing SDPPP implementation activities. These records are maintained alongside the SDPPP document, thereby providing a consolidated record of documented storm water requirements and implementation procedures.

The Permittees must, at a minimum, keep the following records and documentation alongside the SDPPP:

(a) Dates of training sessions, names of employees trained, and subject matter of training under Part A.2.;

(b) Sampling reports including sampling dates, analytical results, outfall locations, name and qualifications of technician;

(c) Annual SIP: monitoring location lists, monitoring requirements lists including storm water and sediment sample screening results, adjustments to annual monitoring plan, and re-initiating monitoring requirements where applicable;

(d) Inspection reports and any other information required to be included in an Inspection Report under Part G.4;

(e) An accounting and an explanation of the length of time it takes to modify control measures or implement additional control measures following the discovery of a deficiency or the need for modification;

(f) Documentation of maintenance and repairs of control measures, including the date(s) of regular maintenance, date(s) of discovery of areas in need of repair/replacement, and for repairs, the date(s) that control measure(s) were returned to full function and the justification for any extended maintenance/repair schedules.

3. <u>Required Modifications</u>

The Permittees must keep documents and records with the SDPPP as necessary to reflect:

(a) Construction or a change in design, operation, or maintenance at the facility having a significant impact on the discharge, or potential for discharge, of POCs from the facility;

(b) Findings of deficiencies in control measures during inspection or based on analytical monitoring results;

(c) Any change of monitoring requirement or compliance status;

(d) Any change of SMA location in accordance with Part B.2; and

(e) Summary of changes from the last year's SDPPP.

If any of the circumstances described above occur at any Site, the Permittees must address these changes or deficiencies to ensure compliance with this Permit's conditions and applicable monitoring requirements. All changes must be incorporated into the SDPPP and a summary of these changes must be included in the Annual Report.

4. <u>SDPPP Availability</u>

The Permittees must retain a paper copy of the current SDPPP required by this Permit at the facility, and it must be immediately available to EPA, a State, Tribal or local agency approving storm water management plans, the Pollution Prevention Team members, and representatives of the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS) at the time of an on-site inspection or upon request. A copy of the SDPPP shall also be made available on the Permittees' Individual Permit public website.

G. <u>INSPECTIONS</u>

The Permittees must conduct the following inspections for every Site. The facility's Pollution Prevention Team may conduct a combined inspection for a Site, if appropriate.

1. <u>Significant Event Inspections</u>

The facility's Pollution Prevention Team must inspect and re-evaluate all Sites after notice of a significant event, such as a fire or flood, which could significantly impact the control measures and environmental conditions in the affected area. Such inspection and reevaluation should be conducted before the next anticipated storm event or as early as practicable.

2. **Post-Storm Inspection**

The facility's Pollution Prevention Team must inspect control measures and storm water management devices at any Site affected by a "storm rain event" defined below, within fifteen (15) days after such storm rain event. The occurrence of a "storm rain event" as defined below shall be determined based on data from the nearest meteorological tower to any particular Site. A "storm rain event" under this paragraph means a 0.50 inches or more intensive rain event within 30 -minutes.

If several storms exceeding the above intensity threshold occur over a period not to exceed fifteen (15) days from the first event, a single inspection following these storms is sufficient for compliance with this requirement, provided that the inspection occurs no more than fifteen (15) days from the date of the first storm. If adverse weather conditions prevent a site inspection within the required time period, the Permittees shall inspect the Site as soon as practicable. Adverse weather events shall be documented and this information shall be maintained with the SDPPP. Adverse weather conditions include dangerous weather-related events (e.g., flooding, wildfires, hail, or lightning) that make site inspection dangerous for worker safety.

3. **Long-Term Stewardship Inspections**

When a Site and its associated controls are designated as a LTS location under Part C.1(b), Permittees shall inspect and evaluate each Site and its associated controls annually (a) for a 5-year period (a Permit cycle) and (b) after a 3-year, 24-hour return period storm. The reporting of inspection results shall meet all requirements set forth in Part G.4. An assessment shall be conducted at the end of each Permit cycle to determine if the storm water runoff or erosion potential at each Site is in a stable condition and if adjustments should be made to the control measure inspection frequency set forth in this Part. A determination of future inspection frequency or termination of LTS shall be included with subsequent re-application submittals. Sites in LTS will be tracked by Site, not to the individual control, and the inspection dates, maintenance dates, maintenance activities, and LTS listing date will be tracked for each Site.

4. **Inspection Report**

All inspection reports shall include, at a minimum, the following items:

(a) The personnel who conduct the inspections;

(b) Date(s) on which inspection was performed;

(c) A written summary of major observations, including observation of deficiency;

(d) A summary of evidence of potential contaminants, failure of a best management practice, or alteration of management structure or runoff pathway, etc;

(e) Actions that should be taken to correct noted deficiencies;

(f) Photo documentation of findings at the Site, if necessary; and

(g) The signature of the delegated official of the Permittees and certification of findings, including observation of no deficiency.

H. REPORTING

1. Annual Compliance Status Reports

The Permittees shall submit Annual Compliance Status Reporting (CSR) information. The reporting period is from January 1 to December 31. The reporting requirements shall be integrated into the SDPPP, due by May 1 of the following year, and shall include the following:

(a) For each SMA (or Site), a summary of the Site-specific compliance status during the report period;

(b) Monitoring information which shows the results available during the reporting period and that include the following information required in (i) through (iii) below;

(i) SMA and associated outfall and Site(s) numbers/identifications;

(ii) Monitoring results available during the reporting period;

(iii) Identification of POCs that exceed the applicable TAL or BTV;

(c) Description of control measures installed during the reporting period, including the certification of completion date;

(d) Description of corrective actions required under Part E of this Permit to be taken, or having been taken, including completion date or targeted completion date, and progress update;

(e) Description of sampler maintenance and identification of all missed sample opportunities during storm rain events and the cause of missed opportunity (i.e., sampling equipment malfunctioning, repairs, construction activities) with an explanation of circumstances;

(f) Highlights of any change of compliance status from the previous Annual Compliance Status Report;

(g) Lists of requests, including any requests for change of monitoring location or Site deletion and any requests to place a Site or Sites into Part E.3, Alternative Compliance; and

(h) A summary of inspections performed in accordance with Part G.

EPA may require the Permittees to submit additional information. This CSR information shall be signed, certified, and dated in accordance with 40 CFR 122.22(b). One signature is sufficient for all CSR forms.

I. OTHER CONDITIONS

1. Soil Disturbance Associated with the Installation of Control Measures

If the installation of control measures at a Site involves soil disturbance of Site-affected soils, the Permittees shall temporarily suspend sampling activities and take all necessary steps to minimize migration of sediments and runoff from disturbed sites. Steps taken to minimize discharges of contaminated runoff during remediation activity shall be included in the SDPPP update. The Permittees shall conduct site inspections once a week while installing control measures to ensure sediment and runoff control measures are maintained in good order. Corrective actions shall be taken immediately if deficiencies of sediment and runoff control measures are noticed either by inspectors or contractors. After completion of such mitigation measures, the Permittees shall reactivate the sampler and analyze the storm water sample in accordance with Part C.1.

Storm water discharges associated with construction activity disturbing 1 acre or more are not covered under this permit. Storm water discharges associated with construction activity disturbing one acre or more must be covered under EPA's Construction General Permit (CGP) or through a separate individual NPDES permit.

2. **Deletion of Site**

The Permittees may submit a written request to remove a Site from coverage under the Permit if the Permittees can demonstrate that the Site no longer has "storm water discharges associated with industrial activity" under 40 CFR 122.26(b)(14) as follows:

(a) No industrial activities as specified under 40 CRF 122.26(b)(14) ever took place at the Site;

(b) Site-related POCs have never been exposed, or will no longer be exposed, to storm water. A request to EPA to remove a Site meeting the conditions of this Part shall include documentation that demonstrates historic activities that led the Site to be a SWMU or AOC did not result in significant materials exposed to storm water (e.g. Site-related POCs are a minimum of 3 feet below the ground surface, below existing building);

(c) Sites have no significant industrial materials remaining that are exposed to storm water after installation of permanent control measures. For all SMAs that contain the Site, a minimum of two confirmation storm water samples were collected, no POCs exceeded the applicable TALs, and therefore, the Permittees demonstrated that the Site is no longer considered an industrial activity for areas where industrial activity has taken place in the past and pursuant to 40 CFR 122.26(b)(14);

(d) The Permittees certified corrective action complete under Part E.1(b) by removing soil that contained a release of Site-related POCs that were exposed to storm water and demonstrating that no significant materials from previous industrial activity remain in the Site. A request to EPA to remove a Site meeting the conditions of this Part shall include the certification of correction action complete under Part E.1(b) and storm water confirmation sampling results, if applicable;

(e) Storm water discharges associated with industrial activity no longer occur at the Site when the SSD shows that the data screening for all POCs resulted in a SW Tier 1 and SD Tier 1 result per Part C.1(b); or

(f) Insufficient storm water runoff results in confirmation samples not being collected at the associated SMA during the previous permit cycle. If the following criteria are met, the Sites are not discharging into a receiving stream or canyon:

(i) Active samplers are in representative locations;
(ii) No confirmation sample has been collected after a 25-year, 24-hour return period storm; and
(iii) Inspection records validate full operability of sampler.

EPA may approve such a request in writing by issuing a minor permit modification pursuant to 40 CFR 122.63(e)(2). Documents to support such requests and decisions must be kept with facility's SDPPP and published on the Permittees' Individual Permit public website. If EPA decides to disapprove the request, it shall provide the Permittees a detailed written response stating the technical and regulatory reasons for the decision. Once a Site is removed from the Permit, a discharge of contaminated point-source runoff is no longer authorized by this Permit.

3. Compliance Schedule Requests

A period of 24 months from the effective date of this Permit is provided for the Permittees to complete their ongoing study of aluminum and its potential toxicity in Pajarito Plateau waters, and for the State of New Mexico to review the findings and conclusions from that study and potentially update its guidance for sampling to minimize non-toxic forms of aluminum consistent with the State of New Mexico Water Quality Standards. This compliance schedule requires the Permittees to complete the aluminum characterizations, toxicity testing, and associated evaluations and submit a report discussing results to NMED for review and comment. During the compliance schedule, compliance requirements in this Permit triggered by exceedances of the aluminum MTALs in Appendix C are deferred until the Permit has been modified to reflect updated sampling and analysis methods for aluminum, unless other information arises that determines that the aluminum at a particular SMA/Site is attributable to historic Site activities or significant industrial material.

4. Watershed Protection Approach

EPA encourages the Permittees to voluntarily install watershed-based control measures, such as sediment barriers, to mitigate sediment or storm water runoff reaching the main channels of the canyons and/or the Rio Grande. The Permittees should include information and monitoring data regarding the installation of any such watershed-based control measures in the SDPPP. If the Permittees submit to EPA a Watershed Protection Plan which can demonstrate significant reduction of nonpoint-source and point-source water POCs from being discharged into major canyons and therefore will result in improvement of receiving water quality, EPA may consider such a Watershed Protection Plan as Alternative Compliance for associated Sites within the scope of the Plan.

5. **Record Keeping**

The Permittees shall retain records of all monitoring information and reports, Site inspections and reports, decision-making procedures and supporting documents and records, and annual SDPPP updates with supplemental information for at least three (3) years after the issuance of the next permit renewal.

6. **Permit Compliance**

Any noncompliance with any of the requirements of this Permit, except for exceptions provided in the permit, constitutes a violation of the CWA. Failure to take any required corrective actions constitute an independent violation of this Permit and the CWA. Where corrective action is triggered by an event that does not itself constitute Permit noncompliance, such as an exceedance of applicable TALs or BTVs, there is no violation of the Permit, provided the Permittees take the required corrective action within the relevant deadlines.

7. **Public Involvement**

(a) **Individual Permit Public Website**: The Permittees shall maintain a public website where information on the Permit, including the SDPPP, SIP, Annual Reports, CSRs, transmittal correspondence including Alternative Compliance requests between Permittees and EPA, and other relevant data and documents, shall be made available. A copy (either paper or electronic) of these documents shall also be made available by the Permittees as soon as practicable to any member of the public who makes such a request in writing. Confidential Business Information (CBI) may not be withheld from regulatory agencies but may be withheld from the public. All portions of the SDPPP not identified as CBI, pursuant to 40 CFR Part 2, must be provided to the public upon request.

(b) **E-mail notification**: The Permittees shall provide the opportunity for members of the public to register for and receive e-mail notifications on compliance with the Permit on the public website. E-mail notifications shall provide notice of completion of installation of control measures, updates on Permit compliance, any requests for time extensions, spill information, and notification of any modification to the Permit, SIP, or SDPPP including changing SMA locations, removing, deleting, or adding Sites, and completion of corrective actions. Such notifications shall have a direct link to the specific document to which it relates. Notice shall also be provided for any request to complete correction action under Alternative Compliance, Part E.3 of this Permit.

(c) **Public Meetings**: The Permittees shall publish a public notice and send an e-mail notification to members of the public who have registered as provided in Part I.7(b) about public meetings that shall be held approximately every six (6) months. The Permittees shall update the public on implementation of and compliance with the Permit and provide an opportunity for both written and oral public comment. The meetings may be combined with other public meetings, but the Permittees shall provide a discrete, separate time for comment and discussion of this Permit. The Permittees shall e-mail a draft agenda at least one (1) week before the meeting, publish the draft agenda on the Permittees' Individual Permit public website, and consider suggestions from the public for changes or additions to the agenda. The Permittees shall publish the final agenda on the Permittees' Individual Permit public website no later than three (3) days before the meeting.

J. PERMIT REOPENER

The Permit may be reopened and modified during the life of the Permit if relevant portions of New Mexico's Water Quality Standards for Interstate and Intrastate Streams are revised, or new state water quality standards are established and/or remanded by the New Mexico Water Quality Control Commission. The Permit also may be reopened and modified if new information, e.g., EPA approved TMDLs, etc., is received that was not available at the time of permit issuance that would have justified the application of different permit conditions at the time of permit issuance.

APPENDIX A

SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos/Pueblo	Rendija Canyon	R003	R-SMA-1.95	00-015	Rendija Canyon
		R006	R-SMA-2.5	00-011(a)	Rendija Canyon
	Pueblo Canyon	P007	P-SMA-2.15	31-001	Pueblo Canyon
	Los Alamos Canyon	L001	LA-SMA-0.85	03-055(c)	Los Alamos Canyon
		L002	LA-SMA-0.9	00-017	Los Alamos Canyon
				C-00-044	
		L003	LA-SMA-1	00-017	Los Alamos Canyon
				C-00-044	
		L004	LA-SMA-1.1	43-001(b2)	Los Alamos Canyon
		L005	LA-SMA-1.25	C-43-001	Los Alamos Canyon
		L006	LA-SMA-2.1	01-001(f)	Los Alamos Canyon
		L007	LA-SMA-2.3	01-001(b)	Los Alamos Canyon
	Los Alamos Canyon	L008	LA-SMA-3.1	01-003(a)	Los Alamos Canyon
		L009	LA-SMA-3.9	01-001(g)	Los Alamos Canyon
		L010	LA-SMA-4.1	01-003(b2)	Los Alamos Canyon
		L011	LA-SMA-4.2	01-001(c)	Los Alamos Canyon
		L012	LA-SMA-5.01	01-001(d3)	Los Alamos Canyon
		L012A	LA-SMA-5.02	01-003(e)	Los Alamos Canyon
		L013	LA-SMA-5.2	01-003(d)	Los Alamos Canyon
		L015	LA-SMA-5.31	41-002(c)	Los Alamos Canyon
		L016	LA-SMA-5.33	32-004	Los Alamos Canyon
		L014	LA-SMA-5.35	C-41-004	Los Alamos Canyon
		L017	LA-SMA-5.361	32-002(b1)	Los Alamos Canyon
				32-002(b2)	
		L017A	LA-SMA-5.362	32-003	Los Alamos Canyon
		L018	LA-SMA-5.51	02-003(a)	Los Alamos Canyon
				02-003(e)	
				02-004(a)	
				02-005	
				02-006(b)	
				02-006(c)	
				02-006(d)	
				02-006(e)	
				02-008(a)	
				02-009(b)	
				02-011(a)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos/Pueblo	Los Alamos Canyon	L018	LA-SMA-5.51	02-011(b)	Los Alamos Canyon
				02-011(c)	
				02-011(d)	
				02-014	
		L018A	LA-SMA-5.52	02-003(b)	Los Alamos Canyon
				02-007	
				02-008(c)	
		L018B	LA-SMA-5.53	02-009(a)	Los Alamos Canyon
		L018C	LA-SMA-5.54	02-009(c)	Los Alamos Canyon
		L019	LA-SMA-5.91	21-021	BV Canyon - Tributary to Los Alamos Canyon
		L019A	LA-SMA-5.92	21-021	BV Canyon - Tributary to Los Alamos Canyon
		L020	LA-SMA-6.25	21-021	Los Alamos Canyon
				21-024(d)	
				21-027(c)	
		L022	LA-SMA-6.3	21-006(b)	Los Alamos Canyon
		L022A	LA-SMA-6.31	21-027(a)	Los Alamos Canyon
		L023	LA-SMA-6.32	21-021	Los Alamos Canyon
		L024	LA-SMA-6.34	21-021	Los Alamos Canyon
				21-022(h)	
		L026	LA-SMA-6.38	21-021	Los Alamos Canyon
				21-024(c)	
		L027	LA-SMA-6.395	21-021	Los Alamos Canyon
				21-024(j)	
		L028	LA-SMA-6.5	21-021	Los Alamos Canyon
				21-024(i)	
		L029	LA-SMA-9	26-001	Los Alamos Canyon
				26-002(a)	
				26-002(b)	
				26-003	
		L030A	LA-SMA-10.12	53-008	Los Alamos Canyon

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Los Alamos Pueblo	DP Canyon	D001	DP-SMA-0.3	21-029	DP Canyon
		D002	DP-SMA-0.4	21-021	DP Canyon
		D003	DP-SMA-0.6	21-021	DP Canyon
				21-024(l)	
		D004	DP-SMA-1	21-011(k)	DP Canyon
				21-021	
		D005	DP-SMA-2	21-021	DP Canyon
				21-024(h)	
		D006	DP-SMA-2.35	21-021	DP Canyon
				21-024(n)	
		D007	DP-SMA-3	21-013(c)	DP Canyon
				21-021	
Sandia	Sandia Canyon	S001	S-SMA-0.25	03-013(a)	Sandia Canyon
				03-052(f)	
		S002	S-SMA-1.1	03-029	Sandia Canyon
		S003	S-SMA-2	03-012(b)	Sandia Canyon
				03-045(b)	
				03-045(c)	
				03-056(c)	
		S003A	S-SMA-2.01	03-052(b)	Sandia Canyon
		S004	S-SMA-2.8	03-014(c2)	Sandia Canyon
		S005	S-SMA-3.51	03-009(i)	Sandia Canyon
		S005A	S-SMA-3.52	03-021	Sandia Canyon
		S005B	S-SMA-3.53	03-014(b2)	Sandia Canyon
		S006	S-SMA-3.6	60-007(b)	Sandia Canyon
		S007	S-SMA-3.7	53-012(e)	Sandia Canyon
		S008	S-SMA-3.71	53-001(a)	Sandia Canyon
		S009	S-SMA-3.72	53-001(b)	Sandia Canyon
		S010	S-SMA-3.95	20-002(a)	Sandia Canyon
		S011	S-SMA-4.1	53-014	Sandia Canyon
		S013	S-SMA-5	20-002(c)	Sandia Canyon
		S014	S-SMA-5.2	20-003(c)	Sandia Canyon
		S015	S-SMA-5.5	20-005	Sandia Canyon
		S016	S-SMA-6	72-001	Sandia Canyon
Mortandad	Cañada del Buey	C001	CDB-SMA-0.15	04-003(a)	Cañada del Buey
				04-004	
		C002	CDB-SMA-0.25	46-004(c2)	Cañada del Buey
				46-004(e2)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Mortandad	Cañada del Buey	C003	CDB-SMA-0.55	46-004(g)	Cañada del Buey
				46-004(m)	
				46-004(s)	
				46-006(f)	
		C004	CDB-SMA-1	46-003(c)	SWSC Canyon - Tributary to Canada del Buey
				46-004(d2)	
				46-004(f)	
				46-004(t)	
				46-004(w)	
				46-008(g)	
				46-009(a)	
		C005	CDB-SMA-1.15	46-004(b)	Cañada del Buey
				46-004(y)	
				46-004(z)	
				46-006(d)	
		C010	CDB-SMA-4	54-017	Cañada del Buey
				54-018	
				54-020	
	Mortandad Canyon	M001	M-SMA-1	03-050(a)	Mortandad Canyon
				03-054(e)	
		M002	M-SMA-1.2	03-049(a)	Mortandad Canyon
		M002A	M-SMA-1.21	03-049(e)	Mortandad Canyon
		M002B	M-SMA-1.22	03-045(h)	Mortandad Canyon
		M003	M-SMA-3	48-001	Mortandad Canyon
				48-005	
				48-007(c)	
		M004	M-SMA-3.1	48-001	Mortandad Canyon
				48-007(b)	
		M005	M-SMA-3.5	48-001	Mortandad Canyon
				48-003	
		M006	M-SMA-4	48-001	Effluent Canyon - Tributary to Mortandad Canyon
				48-005	
				48-007(a)	
				48-007(d)	
				48-010	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Mortandad	Mortandad Canyon	M007	M-SMA-5	42-001(a)	Effluent Canyon - Tributary to Mortandad Canyon
				42-001(b)	
				42-001(c)	
				42-002(a)	
				42-002(b)	
		M008	M-SMA-6	35-016(h)	Effluent Canyon - Tributary to Mortandad Canyon
		M009	M-SMA-7	35-016(g)	Effluent Canyon - Tributary to Mortandad Canyon
		M010	M-SMA-7.9	50-006(d)	Effluent Canyon - Tributary to Mortandad Canyon
		M012	M-SMA-10	35-008	Mortandad Canyon
				35-014(e)	
		M012A	M-SMA-10.01	35-016(e)	Mortandad Canyon
		M013	M-SMA-10.3	35-014(e2)	Mortandad Canyon
				35-016(i)	
		M014	M-SMA-11.1	35-016(o)	Mortandad Canyon
		M015	M-SMA-12	35-016(p)	Mortandad Canyon
		M016	M-SMA-12.5	05-005(b)	Mortandad Canyon
				05-006(c)	
		M017	M-SMA-12.6	05-004	Mortandad Canyon
		M018	M-SMA-12.7	05-002	Mortandad Canyon
				05-005(a)	
				05-006(b)	
				05-006(e)	
		M019	M-SMA-12.8	05-001(a)	Mortandad Canyon
				05-002	
		M020	M-SMA-12.9	05-001(b)	Mortandad Canyon
				05-002	
		M021	M-SMA-12.92	00-001	Mortandad Canyon
		M022	M-SMA-13	05-001(c)	Mortandad Canyon
	Ten-Site Canyon	T001	Pratt-SMA-1.05	35-003(h)	Pratt Canyon - Tributary to Ten-Site Canyon
				35-003(p)	
				35-003(r)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Mortandad	Ten-Site Canyon	T001	Pratt-SMA-1.05	35-009(d)	Pratt Canyon - Tributary to Ten-Site Canyon
				35-016(k)	
				35-016(l)	
		T002	T-SMA-1	50-006(a)	Ten-Site Canyon
				50-009	
		T003	T-SMA-2.5	35-014(g3)	Ten-Site Canyon
		T004	T-SMA-2.85	35-014(g)	Ten-Site Canyon
				35-016(n)	
		T005	T-SMA-3	35-016(b)	Ten-Site Canyon
		T006	T-SMA-4	35-004(a)	Ten-Site Canyon
				35-009(a)	
				35-016(c)	
				35-016(d)	
		T007	T-SMA-5	35-004(a)	Ten-Site Canyon
				35-009(a)	
				35-016(a)	
				35-016(q)	
		T008	T-SMA-6.8	35-010(e)	Ten-Site Canyon
		T009	T-SMA-7	04-003(b)	Ten-Site Canyon
		T010	T-SMA-7.1	04-001	Ten-Site Canyon
				04-002	
Pajarito	Twomile Canyon	E001	2M-SMA-1	03-010(a)	Twomile Canyon
		E002	2M-SMA-1.42	06-001(a)	Twomile Canyon
		E003	2M-SMA-1.43	22-014(a)	Twomile Canyon
				22-015(a)	
		E004	2M-SMA-1.44	06-001(b)	Twomile Canyon
		E005	2M-SMA-1.45	06-006	Twomile Canyon
		E006	2M-SMA-1.5	22-014(b)	Twomile Canyon
		E007	2M-SMA-1.65	40-005	Twomile Canyon
		E008	2M-SMA-1.67	06-003(h)	Twomile Canyon
		E009	2M-SMA-1.7	03-055(a)	Twomile Canyon
		E010	2M-SMA-1.8	03-001(k)	Twomile Canyon
		E011	2M-SMA-1.9	03-003(a)	Twomile Canyon
		E012	2M-SMA-2	03-050(d)	Twomile Canyon
				03-054(b)	
		E013	2M-SMA-2.2	03-003(k)	Twomile Canyon
		E014	2M-SMA-3	07-001(a)	Twomile Canyon
				07-001(b)	
				07-001(c)	
				07-001(d)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Pajarito	Twomile Canyon	E015	2M-SMA-2.5	40-001(c)	Twomile Canyon
	Threemile Canyon	H001	3M-SMA-0.2	15-010(b)	Threemile Canyon
		H002	3M-SMA-0.4	15-006(b)	Threemile Canyon
		H003	3M-SMA-0.5	15-006(c)	Threemile Canyon
				15-009(c)	
		H004	3M-SMA-0.6	15-008(b)	Threemile Canyon
		H005	3M-SMA-2.6	36-008	Threemile Canyon
				C-36-003	
		H006	3M-SMA-4	18-002(b)	Threemile Canyon
				18-003(c)	
				18-010(f)	
	Pajarito Canyon	J001	PJ-SMA-1.05	09-013	Pajarito Canyon
		J002	PJ-SMA-2	09-009	Pajarito Canyon
		J003	PJ-SMA-3.05	09-004(o)	Pajarito Canyon
		J004	PJ-SMA-4.05	09-005(g)	Pajarito Canyon
		J005	PJ-SMA-5	22-015(c)	Pajarito Canyon
		J006	PJ-SMA-5.1	22-010(b)	Pajarito Canyon
		J007	PJ-SMA-6	40-010	Pajarito Canyon
		J008	PJ-SMA-7	40-006(c)	Pajarito Canyon
		J009	PJ-SMA-8	40-006(b)	Pajarito Canyon
		J010	PJ-SMA-9	40-009	Pajarito Canyon
		J012	PJ-SMA-10	40-006(a)	Pajarito Canyon
		J013	PJ-SMA-11	40-003(a)	Pajarito Canyon
		J014	PJ-SMA-11.1	40-003(b)	Pajarito Canyon
		J016	PJ-SMA-13.7	18-010(b)	Pajarito Canyon
		J018	PJ-SMA-14.2	18-012(b)	Pajarito Canyon
		J019	PJ-SMA-14.3	18-003(e)	Pajarito Canyon
		J020	PJ-SMA-14.4	18-010(d)	Pajarito Canyon
		J021	PJ-SMA-14.6	18-010(e)	Pajarito Canyon
		J022	PJ-SMA-14.8	18-012(a)	Pajarito Canyon
		J023	PJ-SMA-16	27-002	Pajarito Canyon
		J024	PJ-SMA-17	54-018	Pajarito Canyon
		J026	PJ-SMA-18	54-014(d)	Pajarito Canyon
				54-017	
		J025	PJ-SMA-19	54-013(b)	Pajarito Canyon
				54-017	
				54-020	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Pajarito	Pajarito Canyon	J027	PJ-SMA-20	54-017	Pajarito Canyon
		J028	STRM-SMA-1.05	08-009(f)	Pajarito Canyon/Starmers Gulch
		J029	STRM-SMA-1.5	08-009(d)	Pajarito Canyon/Starmers Gulch
		J030	STRM-SMA-4.2	09-008(b)	Pajarito Canyon/Starmers Gulch
		J031	STRM-SMA-5.05	09-013	Pajarito Canyon/Starmers Gulch
Water/Cañon de Valle	Cañon de Valle	V001	CDV-SMA-1.2	16-017(b)-99	Cañon de Valle
				16-029(k)	
		V002	CDV-SMA-1.3	16-017(a)-99	Cañon de Valle
				16-026(m)	
		V003	CDV-SMA-1.4	16-020	Cañon de Valle
				16-026(l)	
				16-028(c)	
		V004	CDV-SMA-1.45	16-026(i)	Cañon de Valle
		V005	CDV-SMA-1.7	16-019	Cañon de Valle
		V006	CDV-SMA-2	16-021(c)	Cañon de Valle
		V007	CDV-SMA-2.3	13-001	Cañon de Valle
				13-002	
				16-003(n)	
				16-003(o)	
				16-029(h)	
				16-031(h)	
		V009	CDV-SMA-2.5	16-028(a)	Cañon de Valle
		V009A	CDV-SMA-2.51	16-010(i)	Cañon de Valle
		V010	CDV-SMA-3	14-009	Cañon de Valle
		V011	CDV-SMA-4	14-010	Cañon de Valle
		V012	CDV-SMA-6.01	14-001(g)	Cañon de Valle
				14-006	
		V012A	CDV-SMA-6.02	14-002(c)	Cañon de Valle
		V013	CDV-SMA-7	15-008(d)	Cañon de Valle
		V014	CDV-SMA-8	15-011(c)	Cañon de Valle
		V015	CDV-SMA-8.5	15-014(a)	Cañon de Valle
		V016	CDV-SMA-9.05	15-007(b)	Cañon de Valle
	Fence Canyon	F001	F-SMA-2	36-004(c)	Fence Canyon
	Potrillo Canyon	I001	PT-SMA-0.5	15-009(e)	Potrillo Canyon
				C-15-004	
		I002	PT-SMA-1	15-004(f)	Potrillo Canyon
				15-008(a)	

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Water/Cañon de Valle	Potrillo Canyon	I003	PT-SMA-1.7	15-003	Potrillo Canyon
		I004	PT-SMA-2	15-008(f)	Potrillo Canyon
				36-003(b)	
				36-004(e)	
		I004A	PT-SMA-2.01	C-36-001	Potrillo Canyon
				C-36-006(e)	
		I005	PT-SMA-3	36-004(a)	Potrillo Canyon
				36-006	
		I007	PT-SMA-4.2	36-004(d)	Potrillo Canyon
	Water Canyon	W001	W-SMA-1	16-017(j)-99	Water Canyon
				16-026(c2)	
				16-026(v)	
		W002	W-SMA-1.5	16-026(b2)	Water Canyon
				16-028(d)	
		W003	W-SMA-2.05	16-028(e)	Water Canyon
		W004	W-SMA-3.5	16-026(y)	Water Canyon
		W005	W-SMA-4.1	16-003(a)	Water Canyon
		W006	W-SMA-5	16-001(e)	S-Site Canyon - Tributary to Water Canyon
				16-003(f)	
				16-026(b)	
				16-026(c)	
				16-026(d)	
				16-026(e)	
		W007	W-SMA-6	11-001(c)	Water Canyon
		W008	W-SMA-7	16-029(e)	Water Canyon
		W009	W-SMA-7.8	16-031(a)	Water Canyon
		W010	W-SMA-7.9	16-006(c)	Water Canyon
		W011	W-SMA-8	16-016(g)	Water Canyon
				16-028(b)	Water Canyon
		W012	W-SMA-8.7	13-001	Water Canyon
				13-002	
				16-004(a)	
				16-026(j2)	
				16-029(h)	
				16-035	
		W012A	W-SMA-8.71	16-004(c)	Water Canyon
		W013	W-SMA-9.05	16-030(g)	Water Canyon

APPENDIX A
SITE MONITORING AREA, SITE INFORMATION, AND FEATURE

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Water/Cañon de Valle	Water Canyon	W014	W-SMA-9.5	11-012(c)	S-Site Canyon - Tributary to Water Canyon
		W015	W-SMA-9.7	11-011(a)	S-Site Canyon - Tributary to Water Canyon
				11-011(b)	
		W016	W-SMA-9.8	11-005(c)	S-Site Canyon - Tributary to Water Canyon
		W017	W-SMA-9.9	11-006(b)	S-Site Canyon - Tributary to Water Canyon
		W018	W-SMA-10	11-002	S-Site Canyon - Tributary to Water Canyon
				11-003(b)	
				11-005(a)	
				11-005(b)	
				11-006(c)	
				11-006(d)	
				11-011(d)	
		W019	W-SMA-11.7	49-008(c)	Water Canyon
		W020	W-SMA-12.05	49-001(g)	Water Canyon
		W021	W-SMA-14.1	15-004(h)	Water Canyon
				15-014(l)	
		W022	W-SMA-15.1	49-005(a)	Water Canyon
Ancho	Ancho Canyon	A001	A-SMA-1.1	39-004(a)	North Ancho Canyon
				39-004(d)	
		A002	A-SMA-2	39-004(b)	North Ancho Canyon
				39-004(e)	
		A003	A-SMA-2.5	39-010	North Ancho Canyon
		A004	A-SMA-2.7	39-002(c)	North Ancho Canyon
				39-008	
		A005	A-SMA-2.8	39-001(b)	North Ancho Canyon
		A006	A-SMA-3	39-002(b)	North Ancho Canyon
				39-004(c)	
		A007	A-SMA-3.5	39-006(a)	South Ancho Canyon
		A008	A-SMA-4	33-010(d)	South Ancho Canyon
		A009	A-SMA-6	33-004(k)	South Ancho Canyon
				33-007(a)	
				33-010(a)	
Chaquehui	Chaquehui Canyon	Q001	CHQ-SMA-0.5	33-004(g)	Chaquehui Canyon
				33-007(c)	
				33-009	
		Q002	CHQ-SMA-1.01	33-002(d)	Chaquehui Canyon
		Q002A	CHQ-SMA-1.02	33-004(h)	Chaquehui Canyon
				33-008(c)	

Watershed	Canyon	Permitted Feature	Site Monitoring Area	Site ID	Receiving Water
Chaquehui	Chaquehui Canyon	Q002A	CHQ-SMA-1.02	33-011(d)	Chaquehui Canyon
				33-015	
		Q002B	CHQ-SMA-1.03	33-008(c)	Chaquehui Canyon
				33-012(a)	
				33-017	
				C-33-001	
				C-33-003	
		Q003	CHQ-SMA-2	33-004(d)	Chaquehui Canyon
				33-007(c)	
				C-33-003	
		Q004	CHQ-SMA-3.05	33-010(f)	Chaquehui Canyon
		Q005	CHQ-SMA-4	33-011(e)	Chaquehui Canyon
		Q006	CHQ-SMA-4.1	33-016	Chaquehui Canyon
		Q007	CHQ-SMA-4.5	33-011(b)	Chaquehui Canyon
		Q008	CHQ-SMA-5.05	33-007(b)	Chaquehui Canyon
		Q009	CHQ-SMA-6	33-004(j)	Chaquehui Canyon
				33-006(a)	
				33-007(b)	
				33-010(c)	
				33-010(g)	
				33-010(h)	
				33-014	
		Q010	CHQ-SMA-7.1	33-010(g)	Chaquehui Canyon

Pollutant of Concern	Sample Preparation[1]	Landscape	Data Subset Description	SSC-Normalized?	Units	90th Percentile BTV
Aluminum	F	Developed	All locations	Yes	mg/kg SSC	2100
Aluminum	F	Undeveloped	SEP Reference[2]	No	µg/L	3200
Aluminum	F	Undeveloped	Locations other than SEP Reference and E240 gage	No	µg/L	1200
Aluminum	F	Undeveloped	E240 gage	No	µg/L	2200
Aluminum	UF	Developed	All locations	Yes	mg/kg SSC	34,000
Aluminum	UF	Undeveloped	SEP and Western Reference	Yes	mg/kg SSC	36,000
Aluminum	UF	Undeveloped	Northern and Bandelier Reference	Yes	mg/kg SSC	12,000
Arsenic	F	Developed	All locations	No	µg/L	NR[3]
Arsenic	F	Undeveloped	All locations	No	µg/L	6.0
Boron	F	Developed	Lab Developed	No	µg/L	NR
Boron	F	Developed	Town Developed	No	µg/L	NR
Boron	F	Undeveloped	Western and Northern Reference	No	µg/L	23
Boron	F	Undeveloped	SEP and Bandelier Reference	No	µg/L	21
Benzo(a)pyrene	UF	Developed	All locations	No	µg/L	0.067
Cadmium	F	Developed	All locations	No	µg/L	NR
Cadmium	F	Undeveloped	All locations	No	µg/L	NR
Cobalt	F	Developed	All locations	No	µg/L	5.0
Cobalt	F	Undeveloped	Western and Northern Reference	No	µg/L	4.3
Cobalt	F	Undeveloped	SEP and Bandelier Reference	No	µg/L	1.9
Chromium	F	Developed	All locations	No	µg/L	NR
Chromium	F	Undeveloped	All locations	No	µg/L	NR
Copper	F	Developed	Lab Developed	No	µg/L	11
Copper	F	Developed	Town Developed	No	µg/L	8.0
Copper	F	Undeveloped	All Reference except Bandelier	No	µg/L	3.3
Gross alpha	UF	Developed	All locations	Yes	pCi/g SSC	47
Gross alpha	UF	Undeveloped	All locations	Yes	pCi/g SSC	66
Mercury	UF	Developed	All locations	No	µg/L	NR
Mercury	UF	Undeveloped	Western and Northern Reference, excluding E240 gage	No	µg/L	0.21
Mercury	UF	Undeveloped	SEP and Bandelier Reference	No	µg/L	0.10
Nickel	F	Developed	All locations	No	µg/L	3.1
Nickel	F	Undeveloped	Chupaderos, Garcia, and Mortandad Watersheds	No	µg/L	3.1

Pollutant of Concern	Sample Preparation[1]	Landscape	Data Subset Description	SSC-Normalized?	Units	90th Percentile BTV
Nickel	F	Undeveloped	Watersheds other than Chupaderos, Garcia, and Mortandad	No	μg/L	1.7
Lead	F	Developed	All locations	No	μg/L	2.0
Lead	F	Undeveloped	All Reference except Bandelier	No	μg/L	1.5
Total PCBs	UF	Developed	All watersheds except South Fork Acid	No	μg/L	0.028
Total PCBs	UF	Developed	South Fork Acid watershed	No	μg/L	NR
Total PCBs	UF	Undeveloped	Northern and Western Reference	No	μg/L	0.012
Total PCBs	UF	Undeveloped	SEP Reference	No	μg/L	NR
Radium-226 and radium-228	UF	Developed	All locations	Yes	pCi/g SSC	10
Radium-226 and radium-228	UF	Undeveloped	All locations	Yes	pCi/g SSC	7.5
Antimony	F	Developed	All locations	No	μg/L	NR
Selenium	UF	Developed	All locations	No	μg/L	5.6
Selenium	UF	Undeveloped	Watersheds other than Mortandad	No	μg/L	4.8
Thallium	F	Developed	All locations	No	μg/L	NR
Vanadium	F	Developed	All locations	No	μg/L	5.5
Vanadium	F	Undeveloped	Watersheds other than Mortandad	No	μg/L	4.3
Zinc	F	Developed	All locations	No	μg/L	77
Zinc	F	Undeveloped	Watersheds other than Garcia	No	μg/L	10

[1] Sample preparation: F = filtered using a 0.45 μm filter (i.e., dissolved), UF = not filtered (i.e., total).

[2] SEP = Supplemental Environmental Project.

[3] NR = not recommended.

Total, unless indicated	CAS No.		MQL (µg/l)(*1)	ATAL (µg/l)(*2)	MTAL (µg/l)(*3)
RADIOACTIVITIES					
Ra-226 and Ra-228 (pCi/l)				30	---
METALS					
Aluminum, total recoverable	7429-90-5		2.5	---	(*4)(*5)
Antimony, dissolved (P)	7440-36-0		60	640	---
Arsenic, dissolved (P)	7440-38-2		0.5	9	340
Boron, dissolved	7440-42-8		100	5000	---
Cadmium, dissolved	7440-43-9		1	---	(*5)
Chromium, dissolved	18540-29-9		10	---	(*5)(*6)
Cobalt, dissolved	7440-48-4		50	1000	---
Copper, dissolved	7440-50-8		0.5	---	(*5)
Lead, dissolved	7439-92-1		0.5	---	(*5)
Mercury, total	7439-97-6		0.005	0.77	---
Nickel, dissolved (P)	7440-02-0		0.5	---	(*5)
Selenium, total recoverable	7782-49-2		5	5	20
Silver, dissolved	7440-22-4		0.5	---	(*5)
Thallium, dissolved (P)	7440-28-0		0.5	0.47	---
Vanadium, dissolved	7440-62-2		50	100	---
Zinc, dissolved	7440-66-6		20	---	(*5)
CYANIDE					
Cyanide, total recoverable	57-12-5		10	5.2	22
DIOXIN					
2,3,7,8-TCDD (P)	1746-01-6		0.00001	5.1E-08	---
SEMIVOLATILE COMPOUNDS					
Pentachlorophenol	87-86-5		5	---	19
Benzo(a)pyrene (P)	50-32-8		5	0.18	---
Hexachlorobenzene (P)	118-74-1		5	0.0029	---

Total, unless indicated	CAS No.		MQL (µg/l)(*1)	ATAL (µg/l)(*2)	MTAL (µg/l)(*3)
PESTICIDES					
Aldrin (P)	309-00-2		0.01	0.0005	3
Gamma-BHC	58-89-9		0.05	---	0.95
Chlordane (P)	57-74-9		0.2	0.0081	2.4
4,4'-DDT and derivatives (P)	50-29-3		0.02	0.001	1.1
Dieldrin (P)	60-57-1		0.02	0.00054	0.24
Alpha-Endosulfan	959-98-8		0.01	---	0.22
Beta-Endosulfan	33213-65-9		0.02	---	0.22
Endrin	72-20-8		0.02	---	0.086
Heptachlor	76-44-8		0.01	---	0.52
Heptachlor Epoxide	1024-57-3		0.01	---	0.52
Toxaphene	8001-35-2		0.3	---	0.73
PCBS					
PCBs (P)	1336-36-3		(*7)	(*8)	---
HIGH EXPLOSIVES					
RDX	121-82-4		---	200	---
2,4,6-Trinitrotoluene (TNT)	118-96-7		---	20	---

Note: The target action levels (TALs) are based on and equivalent to New Mexico State water quality criteria for the subject pollutants. The applicable TALs are not themselves effluent limitations, but are benchmarks to determine the effectiveness of control measures implemented to meet the non-numeric technology-based effluent limitations.

Footnotes:

(*1) MQL is the minimum quantification level. EPA approved analytical methods with the same or more sensitive detectable level (DL) than MQL shall be used. If an individual analytical test result is smaller than the MQL or the more sensitive DL, a value of zero (0) or “ND” may be used for reporting and action purpose.

The Permittees shall use sufficiently sensitive EPA-approved analytical methods (under 40 CFR part 136 and 40 CFR chapter I, subchapters N and O) when quantifying the presence of POCs in a discharge for analyses of POCs or pollutant parameters under the permit. In case the minimum quantification levels (MQLs) are not sufficiently sensitive to the limits, the actual detected values, instead of zeros, need to be reported. If there is a sensitive method with MDL (method detection limit) below the TAL/BTV, but the MQL is above the TAL/BTV, they cannot report zero based on MQL but must report actual value. If any individual analytical test result is less than the MQL listed in Appendix C, or the more sensitive MDL, a value of zero (0) may be used for that individual result for reporting purpose.

The Permittees may develop an effluent specific method detection limit (MDL) in accordance with the monitoring requirements in the SIP and 40 CFR 136. For any POC for which the Permittees determine an effluent specific MDL, the Permittees shall send to the EPA Region 6 NPDES Permits Branch (6WQ-P) a report containing QA/QC documentation, analytical results, and calculations necessary to demonstrate that the effluent specific MDL was correctly calculated. An effluent specific minimum quantification level (MQL) shall be determined in accordance with the following calculation: MQL = 3.3 x MDL. Upon written approval by the EPA Region 6 NPDES Permits Branch (6WQ-P), the effluent specific MQL may be utilized by the Permittees for all future Compliance Status Report (CSR) reporting requirements. The PCB congener-specific MQLs are listed in footnote (*7) below.

(*2) ATAL stands for Average Target Action Level. The average is the geometric mean of applicable monitoring results at the SMA. If all analytical results are below analytical method detect level, a value of “zero” may be reported. If one or more data are above detect level, a value of ½ detect level shall be assigned to those below detect level data for calculation purpose. If the average value of a specific POC is below its MQL, a value of “zero” may be reported for the average. If a new or an enhanced best management practice (BMP) is installed, the average is calculated based on analytical results from samples taken after installation of the BMP.

(*3) MTAL stands for Maximum Target Action Level.

(*4) See Section H.3 for compliance schedule details.

(*5) Hardness-dependent metals target action levels. See Table C-1 below.

(*6) While the 20.6.4 New Mexico Administrative Code (NMAC) aquatic life standard is for chromium III, analyzing this in storm water is operationally infeasible because of the 24-hr preservation requirement. Therefore, for the purposes of this Permit, total dissolved chromium will be analyzed and compared to the hardness-dependent criteria (see Table C-1 below).

(*7) Method 1668 Revision C or the most current revision of the Congener Method shall be used for PCB analysis. Per Appendix C of 2010 Permit, the MQLs for PCB congeners 4/10, 5/8, 6, 7/9, 11, 12/13, 14, and 15 will be 50 pg/l, and the MQLs for all other PCB Congeners will be 25 pg/l. If adjusted Reporting Limits (RL) are used to adjust MQLs due to laboratory’s contemporary ambient background, such adjusted RL shall be updated no less than once per 6 mo. If laboratory method blank, field blank, or trip blank subtraction are used in calculation of sample analytical result, supporting document shall be submitted with the Annual Report.

(*8) If the stream reach that an SMA drains to is classified as ephemeral (per the Clean Water Act 303(d)/305(b) Integrated Report), the total PCB wildlife habitat surface water quality criterion (0.014 µg/l from 20.6.4 NMAC) will be used as the ATAL; if the stream reach that an SMA drains to is classified as intermittent or perennial, the total PCB human health-organism aquatic life criterion (0.00064 µg/l) will be used as the ATAL.

Table C-1
Proposed Metals MTALs (*1)

Major Canyon	Hardness (*2) (mg/L)	Aluminum	Cadmium (dissolved)	Chromium (dissolved)	Copper (dissolved)	Lead (dissolved)	Nickel (dissolved)	Silver (dissolved)	Zinc (dissolved)
Ancho	35.7	830	0.69	250	5.1	20.7	200	0.55	63
Chaquehui	30.0	660	0.59	210	4.3	17.0	170	0.41	54
Los Alamos/Pueblo	34.5	800	0.67	240	4.9	19.9	190	0.52	61
Mortandad	29.4	640	0.58	210	4.2	16.7	170	0.39	43
Pajarito	30.2	660	0.59	210	4.3	17.2	170	0.41	54
Sandia	44.8	1140	0.83	300	6.3	26.7	240	0.81	77
Water/Cañon de Valle	47.7	1240	0.88	310	6.7	28.6	250	0.90	82

(*1) MTALs are based on acute aquatic life criteria contained in New Mexico Water Quality Standards in 20.6.4.900 NMAC, computed at the hardness values listed.

(*2) Geometric mean receiving water hardness for each major canyon, based on calculated hardness using dissolved (0.45-µm filtered) calcium and magnesium results (SM 2340B).

Attachment 2

Windward 2018 Background Threshold Value Report

DEVELOPMENT OF BACKGROUND THRESHOLD VALUES FOR STORM WATER RUNOFF ON THE PAJARITO PLATEAU, NEW MEXICO

FINAL

Prepared for

N3B
Los Alamos National Laboratory
Los Alamos, New Mexico

January 18, 2019

Prepared by: Windward environmental LLC

200 West Mercer Street, Suite 401 • Seattle, Washington • 98119

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Acronyms

AOC	area of concern
ATAL	average target action level
BCF	background characterization framework
BLM	biotic ligand model
BTV	background threshold value
DBG	developed background
DF	detection frequency
DQO	data quality objective
EIM	Environmental Information Management
EPA	US Environmental Protection Agency
FFCA	Federal Facilities Compliance Act
FMB	fixed monitoring benchmark
HW	Hawkins-Wixley
IID	independently and identically distributed
IP	Individual NPDES Permit for LANL SWMUs and AOCs
ITRC	Interstate Technology and Regulatory Council
IWQC	instantaneous water quality criteria
K-W	Kruskal-Wallis
KM	Kaplan-Meier
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security
LOESS	local regression
LOE	line of evidence
MLE	maximum likelihood estimation
MSGP	multi-sector general permit
MTAL	maximum target action level
NBG	natural background
NMAC	New Mexico Administrative Code

NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
pCi	picocurie
POC	pollutant of concern
Q-Q	quantile-quantile
RCRA	Resource Conservation and Recovery Act
ROS	regression on order statistics
SEP	Supplemental Environmental Project
SIP	Sampling Implementation Plan
SMA	Site monitoring area
SSC	suspended sediment concentration
SSWQC	site-specific water quality criteria
SWMU	solid waste management unit
TAL	target action level
TCDD	tetrachlorodibenzo-*p*-dioxin
UPL	upper prediction limit
USGS	US Geological Survey
USL	upper simultaneous limit
UTL	upper tolerance limit
WH	Wilson-Hilferty
WQC	water quality criteria
WQCC	water quality control commission
WQS	water quality standards

Executive Summary

Concentrations of constituents in surface waters downstream of the Los Alamos National Laboratory (LANL) are influenced by storm water runoff from upstream sources associated with background conditions related to both undeveloped and developed land on the Pajarito Plateau, New Mexico. Constituent concentrations are also influenced by storm water runoff from developed areas that generate anthropogenic baseline inputs (e.g., atmospheric deposition). The purpose of this report is to characterize these sources in a statistically rigorous and defensible manner, thereby yielding a set of background threshold values (BTVs) that can be compared to water quality concentrations of pollutants of concern (POCs) measured in storm water as regulated by LANL's 2010 National Pollutant Discharge Elimination System (NPDES) Individual Permit (IP) No. NM0030759 (EPA 2010). The BTVs could also be useful for other purposes such as evaluating industrial storm water runoff regulated by the NPDES multi-sector general permit (MSGP), municipal storm water runoff, and biennial 305(b) water quality standard assessments conducted by the New Mexico Environment Department (NMED).

This report (Section 3.1) provides the results of 5-step background characterization framework (BCF) employed for quantifying background conditions on the Pajarito Plateau:

Step 1. Identify sufficient independently and identically distributed (IID) datasets (or data "populations") of POC concentrations.

Step 2. Explore and describe dependencies within the dataset that may drive differences in POC concentrations over space or time.

Step 3. If dependencies exist, create additional subpopulations or normalize data as appropriate to meet stability requirements.

Step 4. Calculate BTVs.

Step 5. Characterize uncertainty of the BTVs calculated/quantified by this BCF.

The above BCF was generally described in Appendix B of the LANL 2017 data quality objectives (DQO) report for the sampling and monitoring supplement environmental project (SEP) (LANL 2017b). This report presents a range of preliminary BTVs calculated for each POC dataset (Table 3-4 and Appendix B). The dataset includes surface water data collected by LANL and by the NMED through 2017. The set of preliminary BTVs based on data through 2017 is provided based on the outcome of the BCF assessments (Table 5-1 and Appendix G). Finally, the preliminary BTVs are compared with storm water monitoring target action levels (TALs) prescribed in LANL's 2010 IP (EPA 2010), historical BTVs developed by LANL via earlier reports (LANL 2012, 2013, 2014), and potential ambient water quality criteria for copper, lead and zinc based on application of the biotic ligand model (BLM) to Pajarito Plateau receiving waters.

The preliminary BTVs developed in this report exceed the 2010 IP maximum target action levels (MTALs) for dissolved aluminum (undeveloped landscape), copper, and zinc; and total polychlorinated biphenyls (PCBs).Although normalization to suspended sediment concentration (SSC) makes a direct comparison difficult, the preliminary BTVs are likely to exceed 2010 IP MTALs for dissolved aluminum (developed landscape), total gross alpha, and radium-226 and radium-228, each of which are strongly correlated with SSC.

The preliminary BTVs developed in this report differ from those previously reported by LANL (2012, 2013, 2014) in several ways, driven primarily by the inclusion of new data as well as the use of the BCF to evaluate and develop stable BTV datasets. The PCB BTV reported by LANL (2012) was also based on a different statistic, which also contributed to the greater preliminary BTV reported herein (for undeveloped baseline conditions). In general, the preliminary BTVs in this report are of a similar magnitude to previously reported BTVs. It is recommended that BTVs reported herein, which are based on the statistically rigorous BCF and a larger background dataset, replace those BTVs previously reported by LANL.

The potential uncertainties associated with each step of the BCF and with the resulting preliminary BTVs are described throughout this report (e.g., Sections 3.4 and 4.3, Table 3-4, and Appendix B). The following key uncertainties are stated:

- Many of the evaluations in the BCF are based on best professional judgment (e.g., data visualization) and therefore subject to some degree of human bias or error.
- The spatial classification of sampling locations is based in part on historical Site knowledge, which is imperfect. Anthropogenic impacts may be over- or understated as a result at some locations.
- Temporal stability could not be directly evaluated because different areas were sampled during different time periods and sampling campaigns (rather than the same areas over time).
- Sample sizes and detection frequencies were often fairly low for storm water data subsets, resulting in uncertain BTVs for those subsets.
- Though specific BTVs are recommended for use, the ultimate selection and application of BTVs remains a policy decision requiring additional discussion between LANL and stakeholders and regulators.

A supplement to this report is anticipated in early 2019 whereby additional SEP data collected in 2018 will be integrated and the BCF repeated to provide updated BTVs.

1 Introduction

The Los Alamos National Laboratory (LANL) is in the process of re-applying for its National Pollutant Discharge Elimination System (NPDES) Individual Permit (IP) No. NM0030759 for solid waste management units (SWMUs) and areas of concern (AOCs), collectively referred to as "Sites" (EPA 2010). The purpose of this report is to document the data, methods, rationale, and results of the assessment and characterization of background concentrations in surface water during periods of storm water runoff from developed and undeveloped landscapes on the Pajarito Plateau, New Mexico, near LANL (Figure 1-1).[1]

The key results of the analysis are background threshold values (BTVs) for pollutants of concern (POCs) regulated in LANL's 2010 IP (EPA 2010).[2] Specifically, the BTVs are intended to be used for purposes described in the 2010 IP as characterizations of the background concentrations needed for determining "alternative compliance" in the 2010 and 2015 draft IP and in completing the "Site contributing evaluations" described in the 2015 draft IP. LANL, EPA and NMED have the common goal for the 2010 IP to regulate and control Site runoff, while minimizing the need to control non-Site, e.g., background POCs.

The data, methods, and results described herein build upon previous assessments conducted by LANL to characterize surface water and storm water background conditions in its vicinity. The methods used to characterize background conditions have been revised from those described in the original memoranda. The revisions address feedback LANS[3] received from the New Mexico Environment Department (NMED) during meetings held in 2017. During these meetings, NMED indicated that POC concentrations in samples intended to characterize background should be sufficiently "stable" over space and time. The assessment described herein evaluates and accounts for such dataset stability using the background characterization framework (BCF) established by LANS in collaboration with NMED in 2017 (Section 3.1).

Regional context (including a conceptual site model) and definitions for background conditions are provided Sections 1.1 and 1.2, respectively. The synthesis and evaluation of storm water datasets based on the BCF are described in Section 3. The BTVs developed and reported herein are described in Section 4, and the intended use of these BTVs—to inform 2010 IP compliance monitoring—is described in Section 5. A

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[1] The physical area of LANL, shown on Figure 1-1, is sometimes referred to in this report as "the Laboratory."

[2] In addition to BTVs for regulated POCs, BTVs for other analytes of interest to LANL were also considered herein (i.e., unfiltered aluminum and filtered uranium, selenium, and mercury).

[3] On April 30, 2018, the role of collection and evaluation of storm water data for purposes of the IP (and several other programs) shifted from LANS to N3B due to the award by US Department of Energy of the Los Alamos Legacy Cleanup contract to N3B.

supplement to this report is anticipated in 2019 whereby additional SEP data collected in 2018 will be integrated and the BCF repeated to provide updated BTVs.

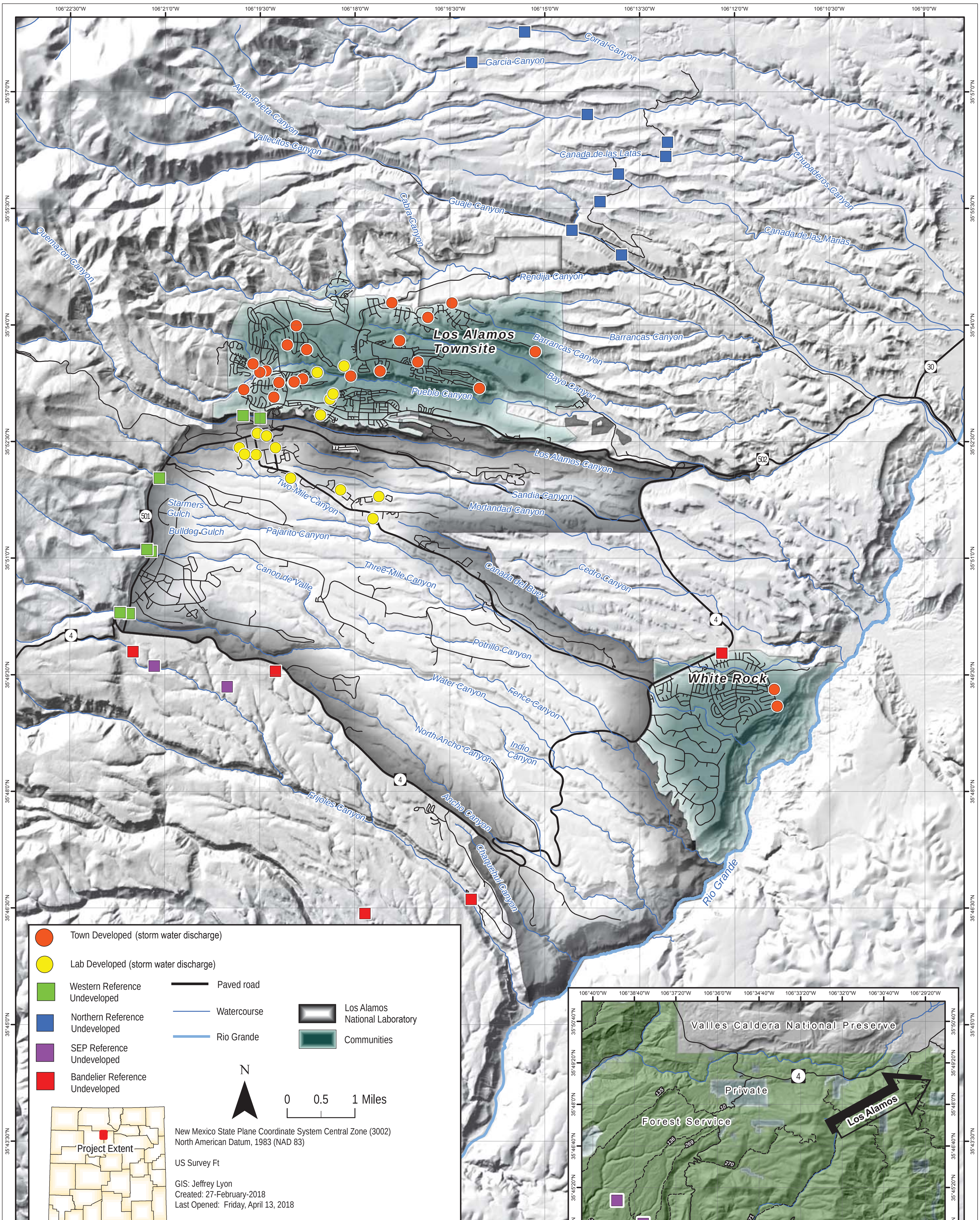


Figure 1-1. **Map of sampling locations for Los Alamos National Laboratory background water quality dataset**

Several appendices and attachments to this report are also provided with this report (in electronic format only):

- Attachment A provides 60 pages of supporting figures generated for and evaluated as part of the data assessment described in Section 3.[4]
- Appendix A provides details on the compilation of surface and storm water data from the Pajarito Plateau.
- Appendix B provides a narrative discussion (rather than tabular) of the data evaluation of surface and storm water POCs, as well as a comprehensive compilation of figures generated to evaluate surface and storm water datasets and establishing dataset stability.
- Appendix C provides tabular information about surface and storm water sampling locations.
- Appendix D provides a tabular compilation of the BTVs developed and reported herein. These BTVs are described in Section 4 and elaborated upon in Section 5.
- Appendix E provides a series of quantile-quantile (Q-Q) plots used to aid in the selection of appropriate BTVs. These plots are described in Section 4.
- Appendix F provides the full dataset used to calculate BTVs in ProUCL software (EPA 2016), as well as a compilation of results exported from ProUCL when developing BTVs.
- Appendix G provides a summary table of BTVs with a comparison to historical BTVs, 2010 IP TALs, and other relevant surface and storm water concentration thresholds.

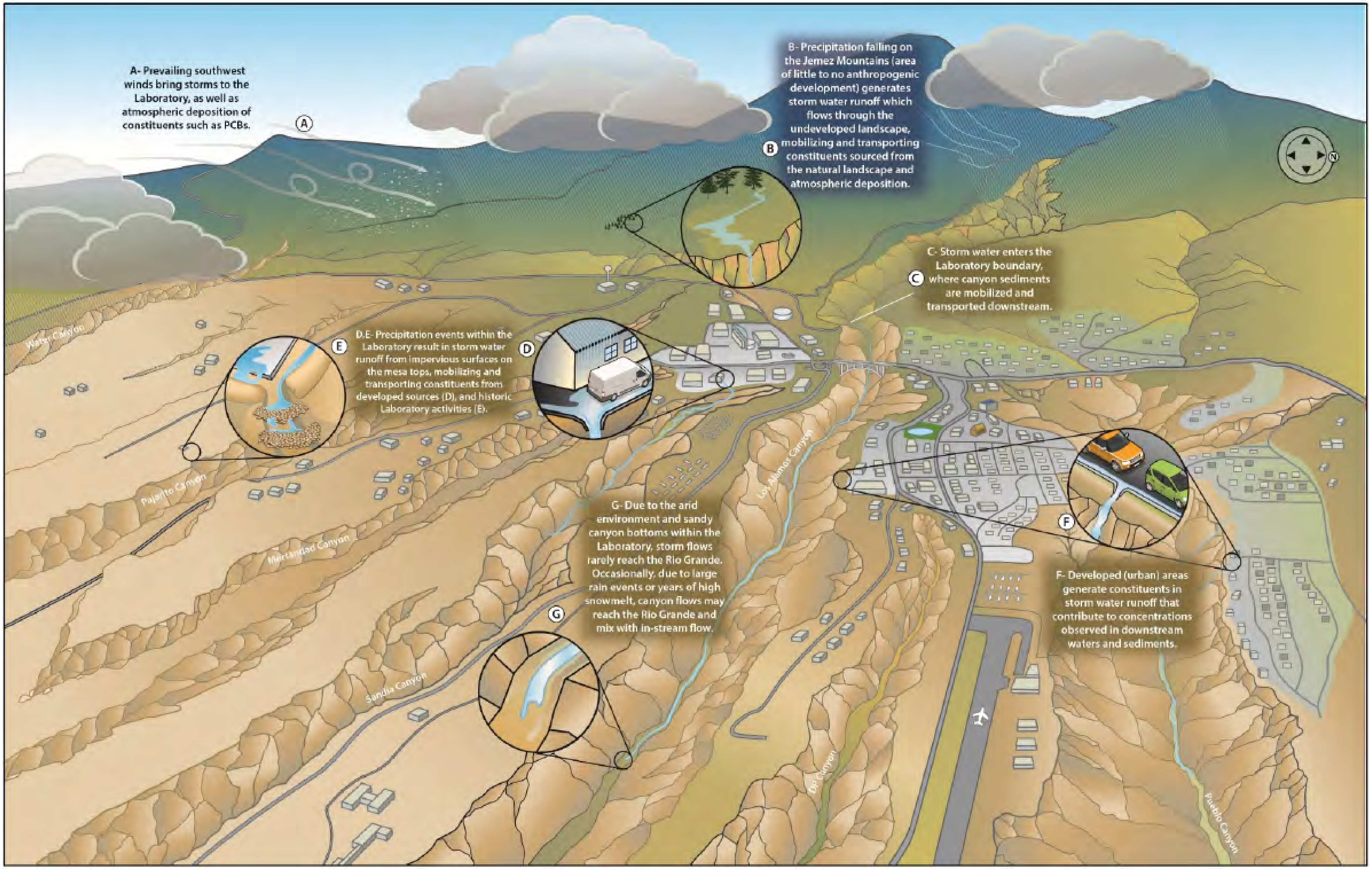
1.1 Regional Setting

This section describes the regional setting of the Pajarito Plateau. Figure 1-1 provides the spatial context for the Laboratory, as well as the sampling locations from which background water quality data (evaluated herein) were generated.

Figure 1-2 provides the conceptual site model for LANL and the Pajarito Plateau. Surface water runs off the Pajarito Plateau via the many steep and narrow canyons of the Jemez Mountains to the west and flows east to the Rio Grande. Natural springs and treated industrial and municipal effluent provide flow to maintain some limited, perennially flowing stream segments on the plateau, although these perennial flows do not reach the Rio Grande. However, most streams in the region are either intermittent or ephemeral that flow for limited periods only in response to snowmelt, or rainfall, respectively. Summer monsoonal thunderstorms are the sole contributors to flow in the

[4] The figures included in Attachment A are similar or identical to figures contained in Appendix B; however, the figures in Attachment A have been reformatted and presented in a consistent and condensed manner, per LANS/N3B's request.

many ephemeral water bodies, which otherwise remain dry for most of the year. The perennial surface waters within and around LANL are defined in segment 126 of the New Mexico water quality standards (20.6.4.126 NMAC). Many of the ephemeral and intermittent waters are defined in segment 128 (20.6.4.128 NMAC), while others fall within default intermittent segments (20.6.4.98 NMAC). For purposes of conducting biennial 305(b) assessments of water quality standards attainment, the NMED AWQB subdivides segments into assessment units based. The classified and unclassified segments of the Pajarito Plateau surface waters encompass approximately 50 assessment units. The surface waters sampled for purposes of characterizing NBG (e.g., Western Boundary, Northern Reference, and SEP reference locations) are not specifically classified segments in NMAC, but would be expected to be predominantly ephemeral or intermittent waters. The DBG locations are not themselves classified segments because they represent storm water discharges to surface waters.



Source: LANL (2017b)

Figure 1-2.Conceptual site model for surface and storm water on the Pajarito Plateau with focus on non-Site sources

The predominant soil type on the Pajarito Plateau is an erodible, volcanic ash substrate called Bandelier tuff. Stormflow events (e.g., those triggered by monsoonal thunderstorms) erode soils and can mobilize large volumes of sediment and the sediment-associated POCs found in natural landscapes into streams. Many of these POCs (e.g., metals) are naturally present in the local geology and thus directly link the soils and fluvial sediments derived from parent rock. Aluminum, for example, is among the most abundant elements in Earth's crust, and therefore ubiquitous in soil and sediment. The background concentrations of aluminum in Pajarito Plateau soil (non-tuff), canyon sediments, and Bandelier tuff range from 490 to 61,500 mg/kg (up to 6% of the total soil mass), with the range specifically in tuff being from 350 to 8,370 mg/kg (Ryti et al. 1998). Relative to non-tuff soils, the Bandelier tuff on the Pajarito Plateau is naturally enriched with lead, uranium, and other POCs (Longmire et al. 1996). These naturally occurring POCs contribute to the total POC load found in streams on the Pajarito Plateau. Anthropogenic baseline sources also influence the undeveloped portions of watersheds on the Pajarito Plateau. For example, long-range atmospheric transport and deposition causes the occurrence of measurable concentrations of mercury, polychlorinated biphenyls (PCBs), and other pollutants commonly associated with anthropogenic activities (e.g., fossil fuel burning, vehicle use, and industrial activity), even in places where local sources are absent (LANL 2012; NADP 2011; EPA 2013a).

Development on the Pajarito Plateau is moderate; the town of Los Alamos has an area of 11.1 mi^2 and a population density of approximately 950 residents per mi^2 (Los Alamos County 2018). Within the LANL property, there are more than 1,000 buildings and 100 mi of paved roads (LANL 2018b). Development alters natural landscapes and significantly changes hydrology, increasing runoff. Runoff from developed areas is also known to affect storm water quality. Key examples of how development can affect storm water discharges include, but are not limited to:

- Buildings—Roofing, gutters, and downspouts can be significant sources of copper and zinc, linked to typical metal construction materials.
- Paved surfaces—Roads and parking lots can generate pollutants associated with vehicles (e.g., copper from brake pads, zinc from tire wear, and organic POCs related to vehicle lubricants and petroleum combustion products). Asphalt pavement can also contribute organic POCs including but not limited to semi volatile organic compounds and polycyclic aromatic hydrocarbons.
- Certain paints, electrical fixtures, and caulks/sealants—In some cases, these items have been identified as the sources of PCBs that can be found in urban media, including storm water (Ecology 2011; Spokane Wastewater Management 2015; SAIC 2011).

Storm water discharges from developed landscapes can contribute significant loads of certain POCs that can overshadow natural background sources of the same POCs. Inevitably, storm water concentrations measured in samples collected at LANL Site

Monitoring Areas (SMAs) will include POCs associated with runoff from undeveloped, developed, and Sites (SWMUs and AOCs) located within the particular SMA drainage area. The 2010 IP regulates over 400 Sites at 250 SMAs, many of which contain non-Site runoff from adjacent developed impervious areas. For example, some of the SMAs in Sandia and Mortandad Canyons are located high in the watersheds where developed impervious areas represent 50% to over 90% of SMA drainage areas. Understanding these non-Site contributions to POCs measured in SMA samples is a key goal for the usage of BTVs.

Though this has not been directly confirmed, exceedances of TALs in SMA samples could be attributable to any of the sources noted above, alone or in combination with one another and/or Site releases. Therefore, eventual attainment of the IP TALs might be unrelated, in part or in whole, to controlling Site releases regulated by the 2010 IP. BTVs will help provide support for future evaluations of the contribution of background to IP TAL exceedances (e.g., through site-specific demonstration or alternative compliance requests).

1.2 BACKGROUND DEFINITIONS

Background conditions for surface and storm water, as described in this report, are defined using water quality data from sampling locations that are not influenced by historical contamination associated with Site activities. The following terms are used throughout this report:

- Natural background (NBG) represents natural background conditions exhibited by undeveloped watersheds with no local anthropogenic inputs. This definition is similar to that defined in 20.6.4.7 New Mexico Administrative Code [NMAC]).[5] The NBG condition is illustrated by inset B in Figure 1-2.
- Baseline refers to man-made POCs subject to atmospheric transport and thus found in wet and dry deposition and thus, in turn, the runoff from natural, undeveloped landscapes as well developed landscapes. Specifically, PCBs are synthetic organic chemicals that would not be in the environment but for human activities, so they cannot, by definition, be associated with NBG (as defined in 20.6.4.7 NMAC). Baseline is shown by inset A in Figure 1-2. This report focuses on characterizing the net baseline PCB concentrations in surface water, as found at locations represented by Figure 1-2 insets B and C, which integrate baseline sources shown in inset A. Previous reports have provided limited characterizations of baseline PCBs measured in wet and dry deposition directly

[5] Long-range atmospheric transport (e.g., in precipitation-driven deposition) of certain water quality constituents may still contribute to the NBG condition. There are few, if any, truly natural areas left on Earth that do not receive some amount of anthropogenic contamination via long-range transport pathways. Some of the undeveloped reference watersheds used to develop NBG datasets and BTVs contain some dirt roads, trails and other minimal human disturbances that are believed to be insignificant in their potential impacts on the data collected.

(LANL 2012). The 2017 SEP DQO called for additional wet and dry deposition sampling at several locations outside the general LANL vicinity, however this report does not evaluate the wet/dry deposition data directly.

- Developed background (DBG) conditions are those affected by modern development that has introduced impervious surfaces and storm water drainage infrastructure that generate storm water runoff. Runoff from impervious surfaces and existing storm water drainage infrastructure associated with the Los Alamos County town site is included in the DBG condition (i.e., a measure of anthropogenic background). DBG conditions are illustrated by processes D and F in Figure 1-2 but exclude historic POCs linked to LANL Sites (process E).

Based on federal guidance (EPA 2015b) and New Mexico water quality standards (WQS) (20.6.4.10(E) NMAC), NBG concentrations can be used to establish site-specific water quality criteria (SSWQC) if it can be determined that natural conditions result in exceedances of established federal or state ambient WQS. According to New Mexico WQS, NBG conditions can be used to establish SSWQC if, once NBG conditions have been appropriately characterized, it is determined that natural conditions protect the designated use and support the levels of aquatic life and wildlife habitat expected to occur naturally (absent human interference). The appropriate characterization of NBG and baseline includes the consideration of historical and ongoing natural sources of the POC and its spatial and temporal variability under natural conditions. However, portions of pollutant loads generated by historical or ongoing anthropogenic sources are not considered as part of the NBG (20.6.4.7 NMAC).

In their recommendations for characterizing NBG conditions in Idaho waters, Mebane and Essig (2003) noted that, "'natural' is a relative, rather than an absolute concept," in that background conditions represent those conditions with the greatest potential to attain WQS within the area.[6] Therefore, baseline conditions, while they may contain some degree of anthropogenic contamination (e.g., PCBs in wet and dry atmospheric deposition), could be considered "natural" in Idaho by Mebane and Essig's definition.

Similarly, the Washington State Model Toxics Control Act (Ecology 2013) defines "low concentrations of some particularly persistent organic compounds such as polychlorinated biphenyls (PCBs)…found in surficial soils and sediment throughout much of the state due to global distribution of these hazardous substances… [and] concentrations of various radionuclides that are present at low concentrations throughout the state due to global distribution of fallout from bomb testing and nuclear accidents" to be part of the natural background condition in Washington.

Regardless of the alternative definitions of natural conditions in Idaho and Washington, New Mexico water quality standards do not consider ubiquitous anthropogenic contaminants to be part of the natural background condition.

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[6] Section 200.09 of Idaho's WQS indicate that standards must be no lower than NBG conditions. Florida and Kansas regulations provide similar stipulations (Gallaher 2009).

2 Previous LANL Background Condition Evaluations

This section provides an overview of LANL's prior efforts to characterize and establish background concentrations in various media in undeveloped and developed landscapes. These efforts include relevant internal guidance documents, reports of statistical evaluations, and interactions with NMED. Past LANL efforts to characterize and determine background concentrations in surface waters and storm water discharges are summarized in Table 2-1.

2.1 Historical BTVs

Various statistical approaches have been used to characterize background conditions in the LANL vicinity. Longmire et al. (1996) and Ryti et al. (1998) derived soil BTVs by calculating upper tolerance limits (UTLs) using background soil concentrations. Early guidance on the use of the 95% UTL of the 95th percentile (95-95 UTL) by LANL was provided by Dewart (1998). More recently, the US Environmental Protection Agency (EPA) established the 95-95 UTL as the default statistic for characterizing background concentrations using EPA's ProUCL software (EPA 2013b). Consistent with these recommendations, LANL has used the 90-95 UTL or 95-95 UTL in various reports to characterize background concentrations in storm water (LANL 2007, 2013, 2014, 2012). Some guidance (e.g., ITRC 2013) also recommends the upper prediction limit (UPL) to characterize background conditions in groundwater. Consistent with that guidance, LANL (2010) also calculated the 95% UPL for NBG.

The 95-95 UTL, though commonly calculated to characterize soil (e.g., per NMED 2014a guidance), sediment, and groundwater conditions, is not frequently used to characterize storm water or surface water background concentrations, however it has been used by the Alaska Department of Environmental Conservation (ADEC) in several instances to evaluate the background metals concentrations upstream of mining activities (ADEC 2018) and associated with drinking water sources (ADEC 2006). Similarly, the US Army Corps of Engineers used the 95-95 UTL to characterize background surface water concentrations of metals for the evaluation of a pond downstream of a former firing site in Alabama (CB&I 2017). Based on these examples, there is precedent for applying the UTL for storm water and surface water conditions.

To-date, LANL has typically used storm water BTVs for the purpose of alternative compliance requests per the 2010 IP; BTVs used for this purpose were reported by LANL in a draft report that was never finalized (LANL 2014). These requests have been made by LANL to EPA in response to TAL exceedances at SMAs for analytes that were not associated with legacy LANL operations at those Sites.

2.2 Statistical Hypothesis Testing

Hypothesis tests provide a means of comparing entire groups of data to one another. For example, such a test could determine if, in general, background concentrations differ from Site-affected concentrations. This approach differs from the use of a BTV in that while a BTV would be compared to concentration data on a point-by-point basis (e.g., data for an SMA), a hypothesis test would compare the data as an entire group. Based on statistical methods described by Dewart (1998), LANL has used hypothesis tests to compare site and background datasets in several studies (e.g., LANL 2017c). Hypothesis tests suggested by Dewart (1998) include the Student's t-test, Wilcoxon rank-sum test, Gehan test, quantile test, and slippage test. The last three of these tests were used most recently by LANL (2017c). They observed that several key POCs (i.e., aluminum, copper, zinc, and gross alpha) were similar in storm water between background (either natural, developed, or both) and Site samples.

To establish meaningful and appropriate BTVs, background concentration data should be stable or independently and identically distributed (IID). In other words, a background dataset should characterize conditions that are spatially and temporally consistent, rather than multiple different conditions (e.g., where conditions vary significantly among watersheds). The BCF assessments detailed in this report (Sections 3 and 4) build on the background assessments conducted by LANL to-date (Table 2-1). Section 5 provides a comparison of historical BTVs generated by LANL to the BTVs generated herein.

Table 2-1. Summary of LANL reports and other documents related to characterizing background concentrations

Document Title	Author	Year	Publication No.	Status	Parameters	Datasets (locations/years)	Medium Evaluated	Method of Characterization
Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico	LANL (Longmire et al.)	1996	LA-12913-MS	final	particle size, pH, calcium carbonate, organic carbon, cation exchange capacity, metals	1992–1993; 2 locations in Frijoles Canyon (Bandelier Tuff), 6 locations within LANL (next to major roads); 1 location along western boundary	soil, Bandelier tuff alluvium, and rock	95-99 UTL
Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory	LANL (Ryti et al.)	1998	LA-UR-98-4847	draft	metals and radionuclides (rads)	1995–1996; mesa tops around boundary of LANL: 174 samples for metals and 56 for rads; canyon sediments (western boundary and within LANL): 31 samples for metals and 24 for rads; rock from Frijoles Canyon: 64 samples for metals and 23 for rads	soil, sediment, and rock	95-95 UTL
Statistical Methods for Background Comparisons 1998	LANL (Dewart)	1998	LA-UR-11-11061	draft	metals and rads	na	na	recommend 95-95 UTL, hypothesis tests (i.e., Gehan, slippage, and quantile tests)
Preliminary Comments Regarding Use of Statistical Methods to Evaluate Background Surface Water Quality and Identify Laboratory Impacts	LANL	2007	LA-UR-07-8120	final, submitted to EPA with IP application	aluminum, radium-226, gross alpha	not specified, but compares Mortandad Canyon with other LANL canyons and “above LANL” (likely western boundary locations)	ambient surface water (storm flow)	95-95 UTL

Document Title	Author	Year	Publication No.	Status	Parameters	Datasets (locations/years)	Medium Evaluated	Method of Characterization
Some Basic Statistical Techniques to Estimate Natural Background Water Quality of Surface Waters (2009 WQCC triennial review, Exhibit 2 of Direct Testimony of Bruce M. Gallaher, P.Hg.)	Gallaher	2009	Na	final, presented at New Mexico WQCC hearing	copper, aluminum	copper: 1997–2007; Rio Grande – Taos, Otowi, and Isleta locations (USGS dataset) aluminum: 2002; Jemez River and its tributaries (NMED dataset)	ambient surface water	Q-Q plots, histograms, probability plots, mean plus 2 standard deviations (after excluding high concentrations)
Stormwater Background Concentrations for MSGP Pollutants of Concern	LANL	2010	LA-UR-10-07291	final	11 metals	2009, 9 locations: 4 western boundary, 4 northern reference, E099	ambient surface water (storm flow)	95% UPL
Comparison of 2009-2010 MSGP Monitoring Data With Natural Background Concentrations	LANL	2010	LA-UR-10-07292	final	11 metals	NBG from LANL (2010) (LA-UR-10-07291); MSGP outfall data	ambient surface water (storm flow) & storm water discharges	95% UPL
Polychlorinated Biphenyls in Precipitation and Stormwater Within the Upper Rio Grande Watershed	LANL	2012	LA-UR-12-1081	final	PCBs	2006–2010 Rio Grande and Rio Chama; LANL 2009–2010 & NMED 2006–2007 Pajarito Plateau storm water (urban runoff, western boundary, northern reference, Frijoles and Lummis Canyons); 2009–2010 Jemez and Sangre de Cristo Mountains (snowpack)	snowpack, ambient surface water, & storm water discharges	95-90 UTL
Background Metals Concentrations and Radioactivity in Stormwater on the Pajarito Plateau, Northern New Mexico	LANL	2013	LA-UR-13-22841	final	24 metals, water quality parameters, SSC	2009–2010; 3 western boundary, 7 northern reference, and 14 urban run-on monitoring locations	ambient surface water (storm flow) & storm water discharges	95-95 UTL

Document Title	Author	Year	Publication No.	Status	Parameters	Datasets (locations/years)	Medium Evaluated	Method of Characterization
Natural Background Metals Concentrations and Radioactivity in Stormwater for the Individual Permit	LANL	2014	LA-UR-14-27067	draft; submitted to EPA and NMED	24 metals, water quality parameters, SSC	NBG from LANL (2013) report (urban runoff not included)	ambient surface water (storm flow)	95-95 UTL
October 20, 2014 letter from NMED to LANL with comments on LANL 2014 draft report (LA-UR-14-27067)	NMED	2014	Na	final, provided to LANL	na	NMED comments based on review of LANL (2014) report	na	8 comments with recommendations towards use of central tendency
Methods and Applicability for Determining Site-Specific Natural Background for Stormwater under the Clean Water Act	LANL	2015	LA-UR-29565	final	16 metals, gross alpha, and radium-226 and radium-228	LANL 2014 NBG report datasets	ambient surface water (storm flow)	evaluated 2014 data using proposed methods for establishing stable distributions; recommend 95-95 UTL or maximum (if UTL exceeds the maximum)
Individual Permit Stormwater Data Background Comparisons	LANL	2017	LA-UR-27715	final	aluminum, copper, zinc, gross alpha, and PCBs; SSC	LANL 2012 & 2013 report datasets for Northern Reference NBG and urban background (including additional locations); 2000–2016 IP SMA samples,	ambient surface water (storm flow) & storm water discharges	hypothesis tests (i.e., Gehan, slippage, and quantile tests); boxplots

EPA – US Environmental Protection Agency
IP – Individual Permit
LANL – Los Alamos National Laboratory
MSGP – multi-sector general permit
na – not applicable
NBG – natural background
NMED – New Mexico Environment Department
PCB – polychlorinated biphenyl
Q-Q – quantile-quantile
SMA – site monitoring area
SSC – suspended sediment concentration
UPL – upper prediction limit
USGS – US Geological Survey
UTL – upper tolerance limit
WQCC –water quality control commission

3 Background Characterization

The purpose of this section is to provide an overview of the initial evaluation of background surface and storm water datasets following the BCF. Appendix A describes how the LANL dataset was prepared and reduced. The development and reporting of BTVs is discussed in Section 4.

3.1 Background Characterization Framework

In 2017, based on recommendations from NMED (2014b), LANL integrated statistical guidance from the Interstate Technology and Regulatory Council (ITRC 2013) with its existing approaches to create a BCF to evaluate the stability of water quality data to characterize background conditions. The current statistical approach used in this report was generally described in two reports that were developed for the 2017-2018 Sampling and Monitoring Supplemental Environmental Project (SEP) (LANL 2017b, 2018a). The Sampling and Monitoring SEP called for collecting a new datasets in 2017 and 2018 , some of which were collected expressly for the purposes of augmenting existing storm water and sediment background datasets for developed and undeveloped landscapes , (see Appendix B and C in LANL 2017b) Based on the current BCF, if a background dataset is determined to be of sufficient quantity, quality, and stability, then the calculation of a BTV is warranted. There are five general steps in the BCF:

Step 1. Identify sufficient independently and identically distributed (IID) datasets (or data “populations”)[7] of POC concentrations.

Step 2. Explore and describe dependencies within the dataset that may drive differences in POC concentrations over space or time.

Step 3. If dependencies exist, create additional subpopulations or normalize data as appropriate to meet stability requirements.

Step 4. Calculate BTVs.

Step 5. Characterize uncertainty of the BTVs calculated/quantified by this BCF.

The first three steps are addressed in Sections 3.2 and 3.3. The last two steps are addressed in Section 4. The overall process is shown in Figures 3-1 and 3-2. The POCs evaluated using the BCF were limited to those regulated in the 2010 LANL IP. These POCs and their associated sample preparation methods are identified in Table 3-1.

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[7] A population of data can be characterized by one or more theoretical distribution types, open exhibiting a single “peak” associated with the most likely value in the dataset. IID populations have little evidence of changes in concentrations over time, over space, or in relation to SSC. SSC-normalized datasets can be used to establish IID populations, when appropriate. Sufficient populations have enough samples with detected concentrations to reasonably characterize background conditions. Whether or not a population has sufficient samples is determined primarily by professional judgment based on data variability.

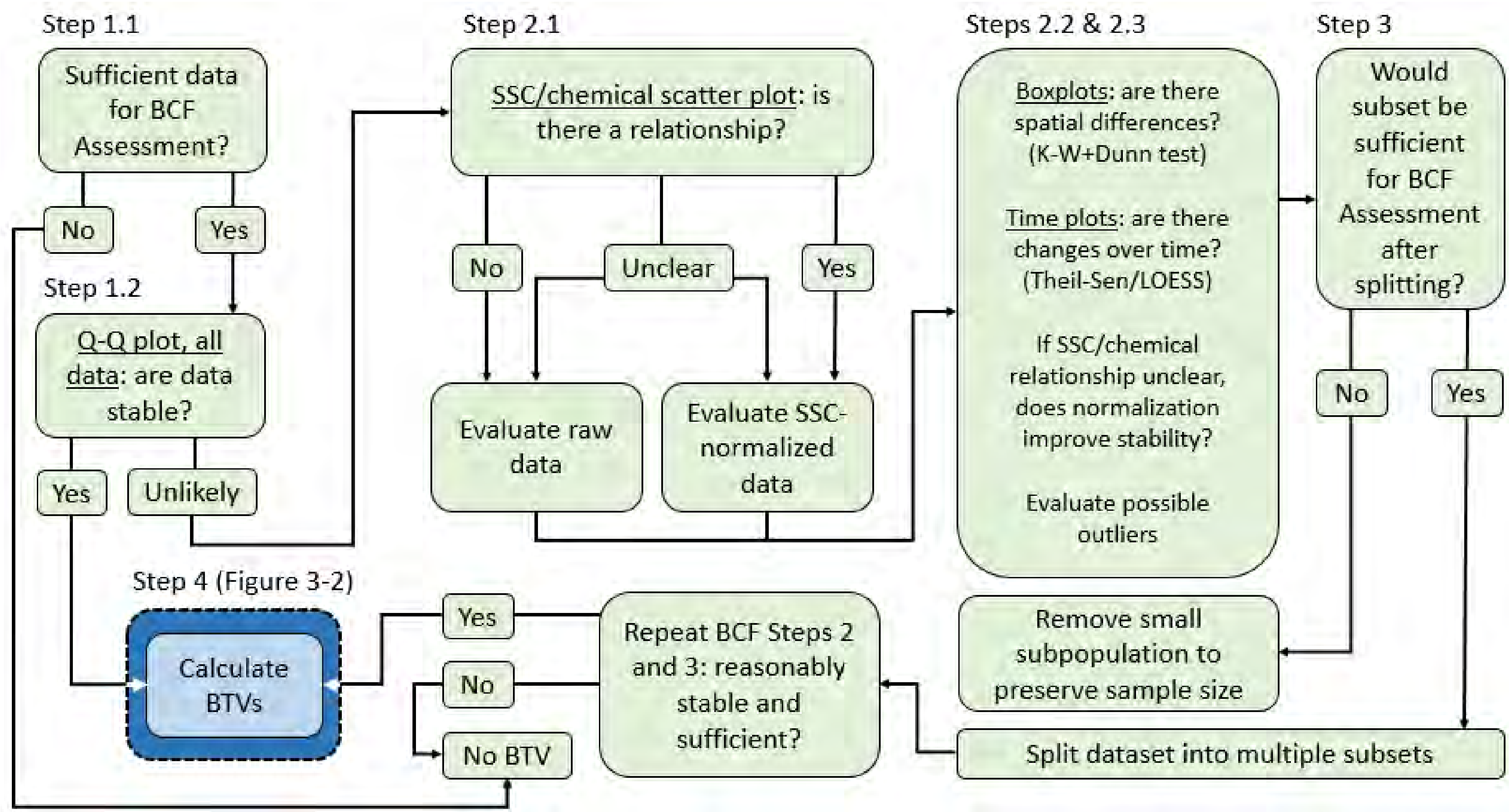


Figure 3-1.Decision flow chart for the background characterization framework, Steps 1 to 3

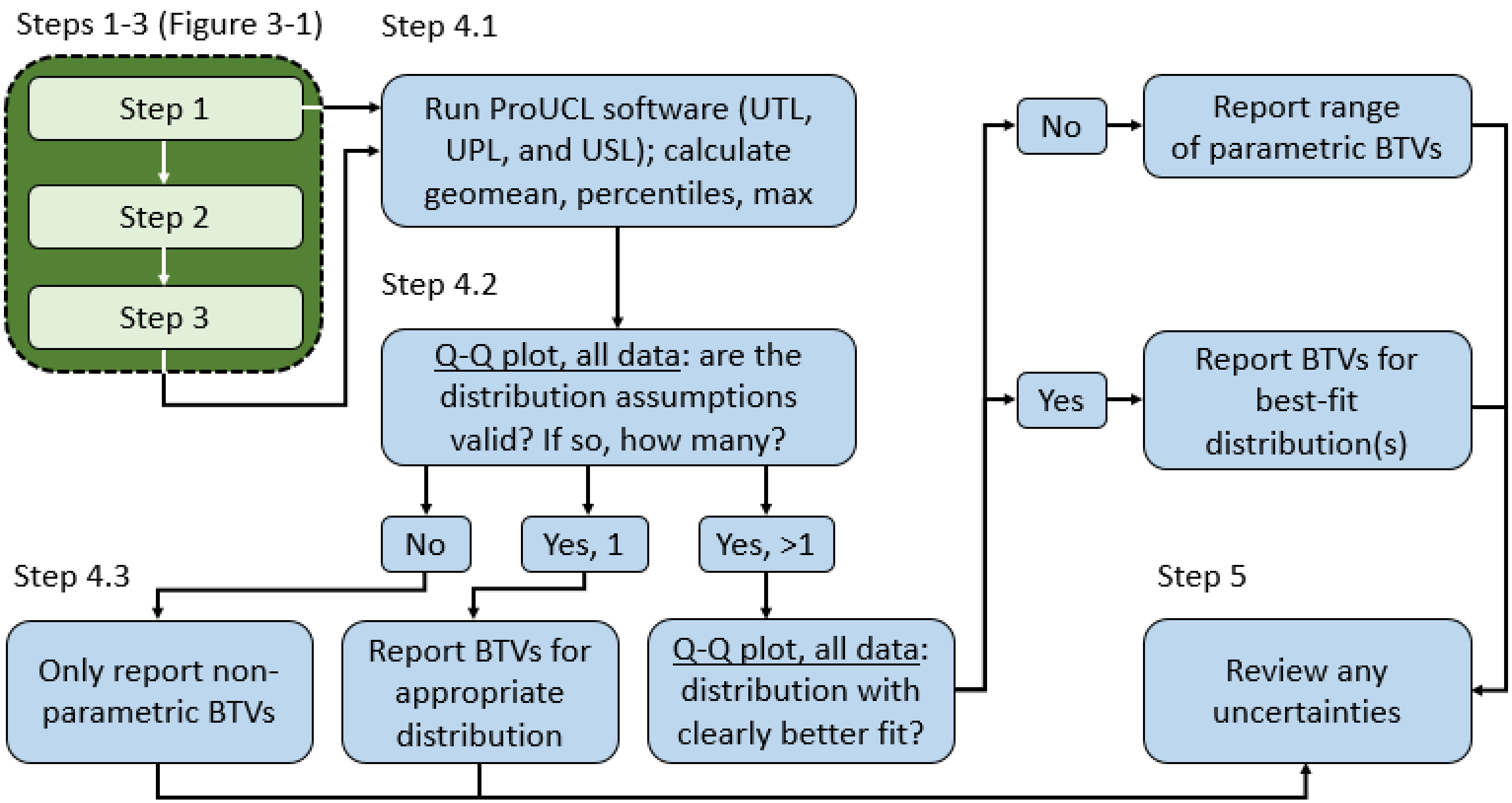


Figure 3-2.Decision flow chart for the background characterization framework, Steps 4 and 5

3.2 DATA EVALUATION METHODS

This section describes how the LANL dataset was evaluated in concert with the BCF (Section 3.1). The methods used to evaluate the LANL dataset are described in terms of the steps outlined in the Section 3.1. Refer to Figures 3-1 and 3-2, which identify the specific BCF steps described below.

3.2.1 Step 1.2 – Identification of potential subpopulations and dataset instability

Step 1.2 of the BCF determines whether BCF Steps 2 and 3 are warranted. Step 1.2 involves the visual evaluation of Q-Q plots to identify patterns indicative of multiple subpopulations. If a distribution appears to be stable (i.e., consist of one population) based on the Q-Q plot, the dataset can progress directly to Step 4. In general, even slight deviations from lognormality (in Q-Q plots) or "wiggle" in the data relative to the Q-Q line are considered sufficient to evaluate dependencies in Step 2. Thus, dependencies were investigated for most datasets. The only instances in which dependencies were not considered were when detection frequencies were so low that the figures and tests used to evaluate dependencies in Step 2 (discussed in the next section) would have been unreliable.

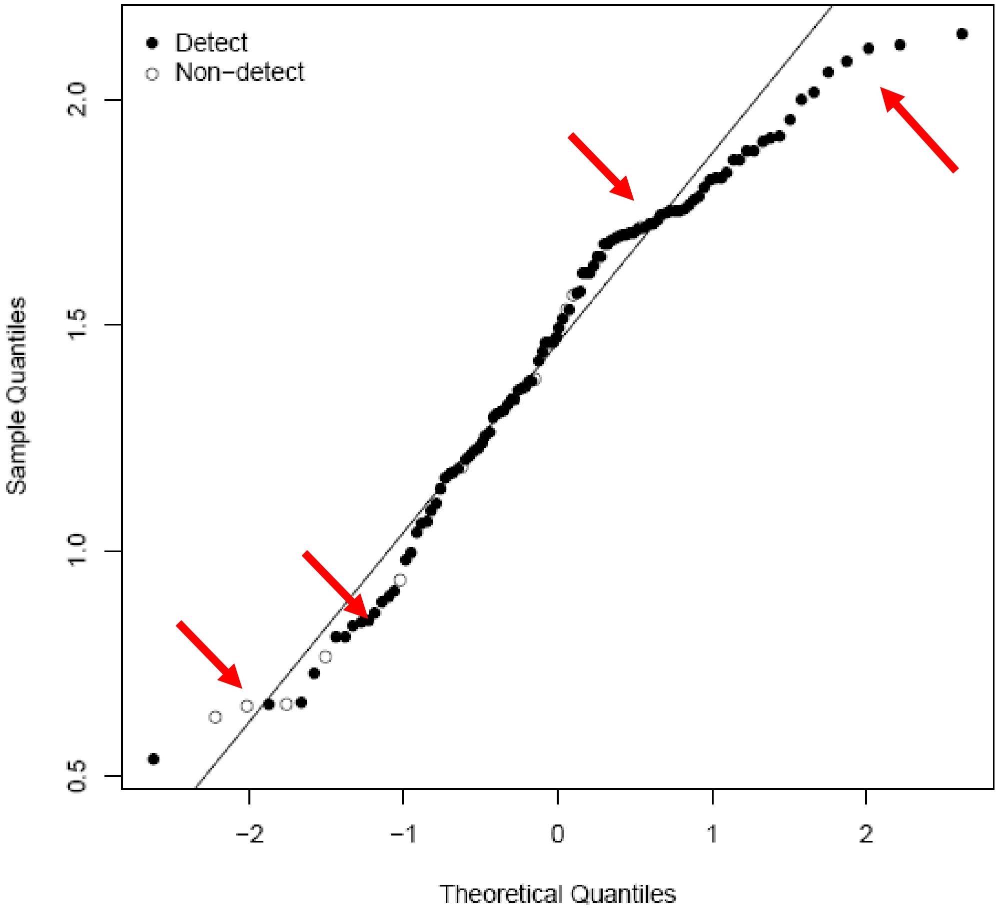
Q-Q plots present a dataset as a scatterplot, with the x-axis as the theoretical quantile based on an assumed distribution and the y-axis as the observed sample quantile. For example, if a distribution is normally distributed, then data plotted in a normal Q-Q plot will appear as a straight line; otherwise, the data will deviate from the line. If multiple populations exist in a dataset, patterns will emerge that can be visually detected on the Q-Q plots. Often these patterns will appear as marked shifts in the slope of the observed quantiles or a stair-step pattern relative to the theoretical quantiles (Figure 3-3). The key assumption when interpreting Q-Q plots is that the sample population is distributed approximately the same as the theoretically assumed population. Environmental chemistry distributions are typically right skewed (i.e., mostly low values with some higher values), so lognormal or gamma distributions are reasonable assumptions (Helsel and Hirsch 2002; Bolks et al. 2014; Clarke 1998).

Table 3-1. POCs evaluated using the BCF

Pollutant of Concern	Sample Preparation Method	
	Filtered	Unfiltered
2,3,7,8-TCDD		X
Aluminum	X	X
Antimony	X	
Arsenic	X	
Benzo(a)pyrene		X
Boron	X	
Cadmium	X	
Chromium	X	
Cobalt	X	
Copper	X	
Cyanide, total recoverable		X
Cyanide, weak acid dissociable		X
Gross alpha		X
Hexachlorobenzene		X
Lead	X	
Mercury	X	X
Nickel	X	
Total PCBs		X
Pentachlorophenol		X
Radium-226 and radium-228		X
Selenium	X	X
Silver	X	
Thallium	X	
Uranium	X	
Vanadium	X	
Zinc	X	

[a] The POCs evaluated using the BCF correspond to those regulated by the LANL 2010 IP. Unfiltered aluminum, filtered and unfiltered selenium and mercury, and weak acid-dissociable cyanide were added to the list because of changes reflected in the 2015 draft IP. Uranium was included as an important component of gross alpha. "Filtered" means that the laboratory analysis was conducted on the filtrate passing through a 0.45-µm filter. NMED has recommended that future measurements of "total recoverable aluminum" be measured after 10-µm filtration (rather than being unfiltered); the current background dataset does not reflect this change in sample preparation.

BCF – background characterization framework
IP – Individual Permit
LANL – Los Alamos National Laboratory
PCBs – polychlorinated biphenyls
TCDD – tetrachlorodibenzo-*p*-dioxin



Notes: The Q-Q plot compares the sample quantile values on the y-axis, and the quantiles for a selected theoretical distribution on the x-axis. Higher and lower quantiles correspond to higher and lower concentrations, respectively. A line is drawn through the data to show perfect agreement between the actual distribution and the theoretical distribution. The shape of the actual distribution provides information about multiple populations, which are indicated with red arrows (added to this example, but generally not included in Q-Q plots). The arrows point to parts of the distribution where the slope of the line levels off. By comparison, a single continuous slope (without points of leveling off) suggests a stable, single population. The POC depicted is zinc.

Figure 3-3. Example Q-Q plot with arrows identifying evidence for multiple populations

3.2.2 Step 2. Explore and describe dependencies within the dataset

The objective of BCF Step 2 is to determine if each dataset can be used as-is to calculate BTVs, or if a potential underlying dependency may need to be considered in Step 3 (splitting datasets) of the BCF.

Prior to conducting Step 2 of the BCF assessment, non-detected POC concentrations are estimated for each dataset using conventional statistical methods. Analytical limitations on the detection of POC concentrations result in “left-censored” datasets, which are statistically problematic (Helsel 2010). The variance in censored concentration datasets is artificially low if censored concentrations are set at one or more detection limits. By replacing detection limit values with a non-static estimate, the influence of non-detected values on variance is reduced, allowing for more reasonable calculations of statistical parameters that incorporate some measure of variance (e.g., UTLs).[8] Based on the number of samples in each dataset and the detection frequency (DF), either a maximum likelihood estimation (MLE) method or a regression on order statistics (ROS) method can be used to replace non-detected values with predicted values (Helsel 2012).[9]

For Step 2 of the BCF assessment, this process was conducted in R using the NADA package (Lee 2017) with the default assumption of lognormality for each dataset. The graphical results of Step 2 (presented in Attachment A and Appendix B) often showed statistics or regressions that were based on datasets with estimated non-detect values. This situation was true of the following items:

- The lognormal Q-Q line shown on Q-Q plots (but not the individual points)
- The linear regression comparing suspended sediment concentration (SSC) to water quality constituent concentration
- The boxes, "whiskers," and individual points of boxplots
- The Theil-Sen and local regression (LOESS) of water quality POC concentrations over time (but not the individual points)

Because individual non-detect concentrations estimated using MLE or ROS methods are not generally meant to be evaluated separately, the original data points are shown on the plots, including detection limits for non-detect values. The resulting incongruity between individual points and statistics shown on some figures conveys the uncertainty associated with BCF Step 2 for those figures. For example, in some figures that describe datasets with low detection frequencies, regression lines do not pass through the actual data points. These uncertainties are described in Appendix B.

The following variables were used to explore potential dependencies (i.e., to determine whether potential certain subpopulations [identified in BCF Step 1.2] might exist):

- SSC (as a surrogate for storm intensity or severity; see Section 3.2.2.1)
- Watershed name: major and minor
- Location grouping: major and minor

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[8] Estimated non-detect values are intended to be used for the estimation of statistical parameters but are not meant to be evaluated individually. In Step 2 of the BCF, individual non-detect estimates were discussed only if they were extreme high concentrations, such that the estimate of a non-detect concentration would have undue influence on the final BTV. As noted in following sections, extremely high estimates of non-detect values (with respect to all other data) were excluded when finalizing data subsets in Step 3.

[9] Following EPA guidance (Bolks et al. 2014), the MLE method was used if the sample size was fewer than 50 and the DF less than 50%. If the sample size exceeded 50 or the DF exceeded 50%, then the ROS method was used. If the DF was less than 20%, the dataset was flagged as very highly uncertain, but MLE was still used prior to conducting the BCF assessment. The use of non-detect estimation methods is generally not recommended for datasets with detection frequencies less than 20%, because estimation becomes inaccurate (Bolks et al. 2014).

- Date/time

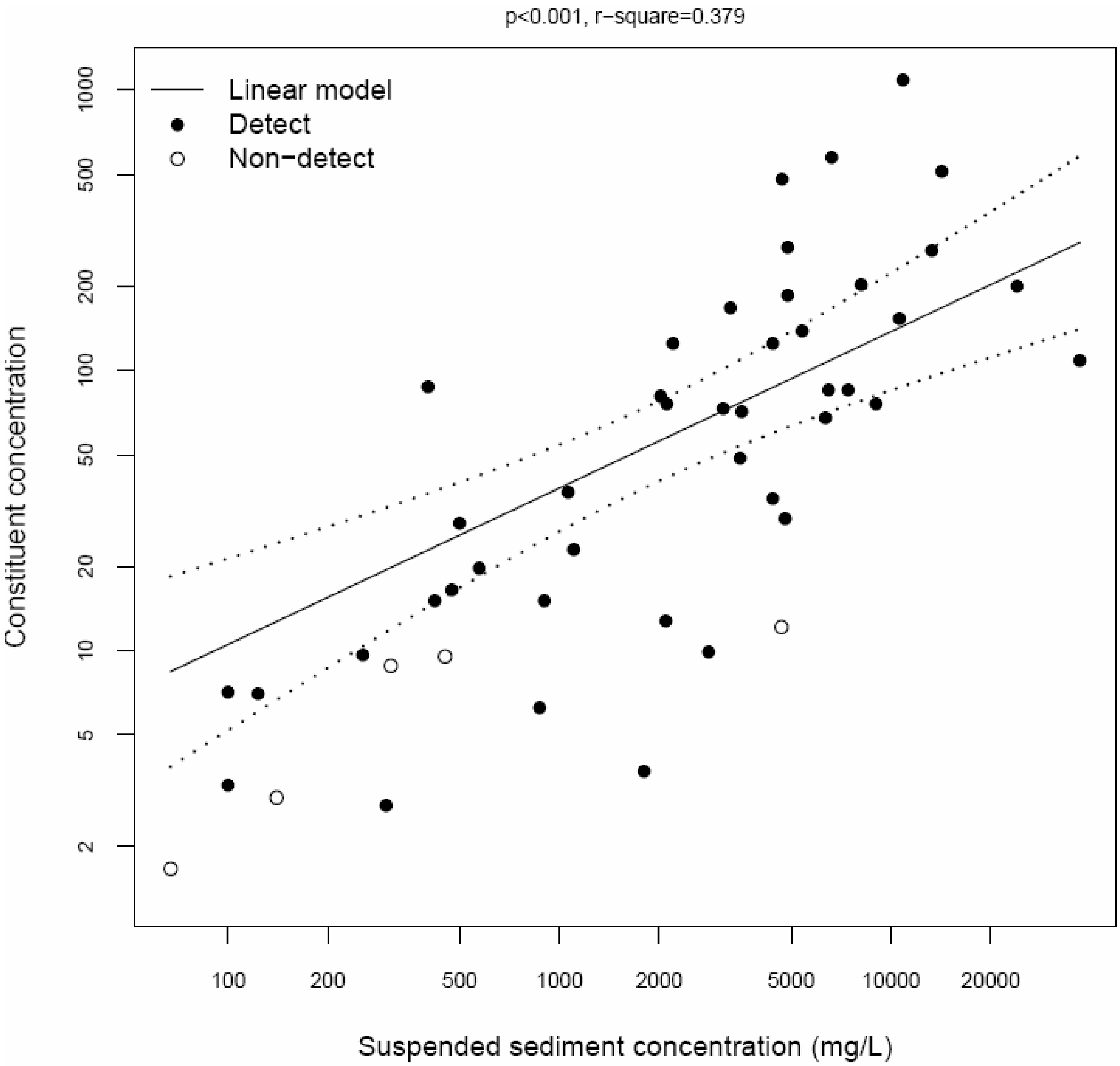
Watershed names and location groupings were assigned to each sample location by LANS/N3B. Other location-specific information provided in the LANL's Environmental Information Management (EIM) system dataset was also used, as necessary, when evaluating subpopulations; such information included sampling method, sampling plan or event, analytical laboratory, and individual sampling location. See Appendix A for additional information.

3.2.2.1 Step 2.1 – Evaluate SSC dependencies in water quality POC data

Of the potential dependencies explored, the relationship between water quality POC concentrations and SSC was evaluated first. Ordinary least-squares linear regression using log-transformed data was used to determine if a significant relationship existed between SSC and analyte concentrations (Figure 3-4). When the regression slope was significant ($p < 0.05$), analyte concentrations were normalized to SSC by dividing the analyte concentration by paired SSC concentrations. This same approach has been used by LANL in the past (e.g., LANL 2007) and frequently has been found to stabilize the distribution of analyte concentrations, most likely by removing the effect of storm intensity on concentrations.

The strength of the SSC-POC relationship (determined using the r^2 statistic) was also considered. When the r^2 value was relatively weak (e.g., $r^2 < 0.5$), spatial and temporal dataset dependencies were evaluated using both SSC-normalized and raw concentrations. Thus, when the r^2 was relatively weak, the selection of the final dataset depended on the ability of SSC normalization to stabilize the concentration dataset over space and time. This ability was assessed by comparing analogous boxplots and time plots (visually inspected), as well as by comparing statistical tests for raw and SSC-normalized datasets (Attachment A). For example, if there were significant differences in raw concentrations between watersheds but not in SSC-normalized concentrations, then the SSC-normalization was considered to have improved the stability of the dataset.[10]

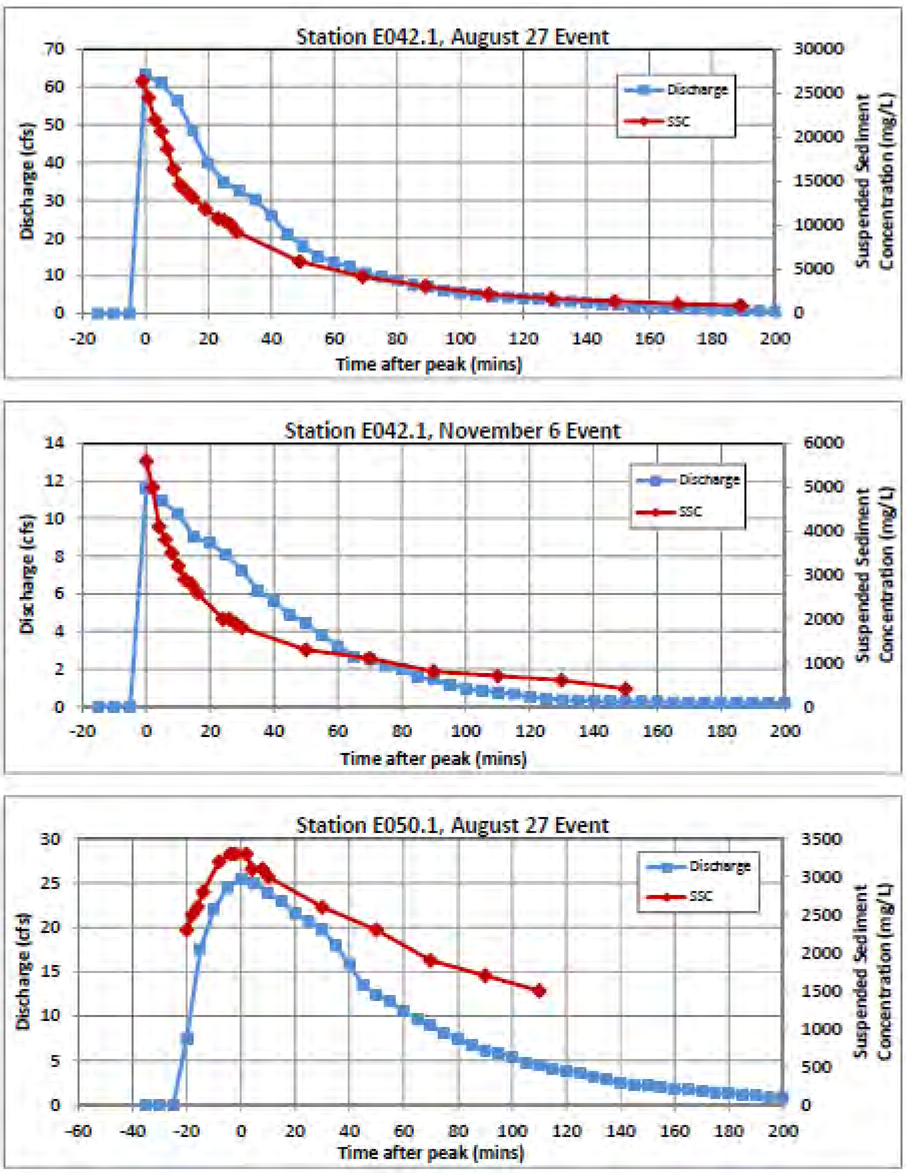
[10] Sample sizes were reduced when SSC-normalizing water quality constituent concentration data because not all samples had paired SSC and constituent concentration values. This affected statistical comparisons of subsets such as those shown in boxplots (K-W/Dunn test).



Notes: The scatterplot compares two variables on the x- and y-axes. The solid line is the linear regression, which is the predicted mean POC concentration at a given SSC. The dashed lines provide the 95% confidence intervals for the linear regression (an indication of uncertainty in the relationship). Above the figure, the p-value and r^2 value are reported. The p-value indicates the degree of significance, with $p < 0.05$ being significant. The r^2 value indicates the strength of the relationship, with values of $r^2 > 0.5$ being reasonably strong for an environmental dataset. Non-detect concentrations are shown as open circles. The individual data points shown on the graph correspond to concentrations. POC depicted is gross alpha (with units of pCi/L).

Figure 3-4.Example SSC-POC scatterplot and linear regression

Based on prior evaluations, LANS had determined that SSC can often serve as a surrogate measure for flow rate as an overall indicator of the severity of a particular storm event sampled. LANS has shown that SSC variation is proportional to flow rate, as measured at a number of surface water gaging stations (LANL 2017a). This pattern is shown in Figure 3-5. Flow rate represents the ultimate expression of weather, climate, and hydrological variables that determine runoff rates, volumes, energy, and resulting sediment transport. However, flow rate is not monitored at all LANL gaging stations. While rainfall intensity is measured at several LANL meteorological towers, extending the data to particular sampling locations as a surrogate for flow rate would require extrapolation (and therefore uncertainty) in associating particular sample times with some type of estimated or modeled flow rate. Thus, as guided by LANS/N3B, using the directly measured SSC data provides an efficient means of quantifying the effects of other variables that are either not measured routinely or that cannot be estimated accurately but are known to affect POC concentrations.



Source: Figure 3.2-4 in LANL (2017a)

Figure 3-5. Example relationship between discharge and suspended sediment concentration for Los Alamos Canyon gage stations, 2017

3.2.2.2 Step 2.2 – Visualize data using boxplots for spatial differences

Concentration differences among watersheds were visualized using boxplots separating the dataset into major watersheds, minor watersheds, major location groupings, and minor location groupings (Figure 3-6). Significant differences among watershed subsets were tested using the non-parametric Kruskal-Wallis (K-W) test (alpha = 0.05) and the non-parametric *post hoc* Dunn test of multiple comparisons (family-wise alpha = 0.05, Bonferroni corrected).[11,12] The K-W test determines whether differences exist among watershed median concentrations; the Dunn test determines, in a pair-wise manner, which watersheds differ significantly from one another. Non-parametric tests were used for all comparisons since the assumption of normality required for parametric tests is often invalid for skewed environmental datasets.[13]

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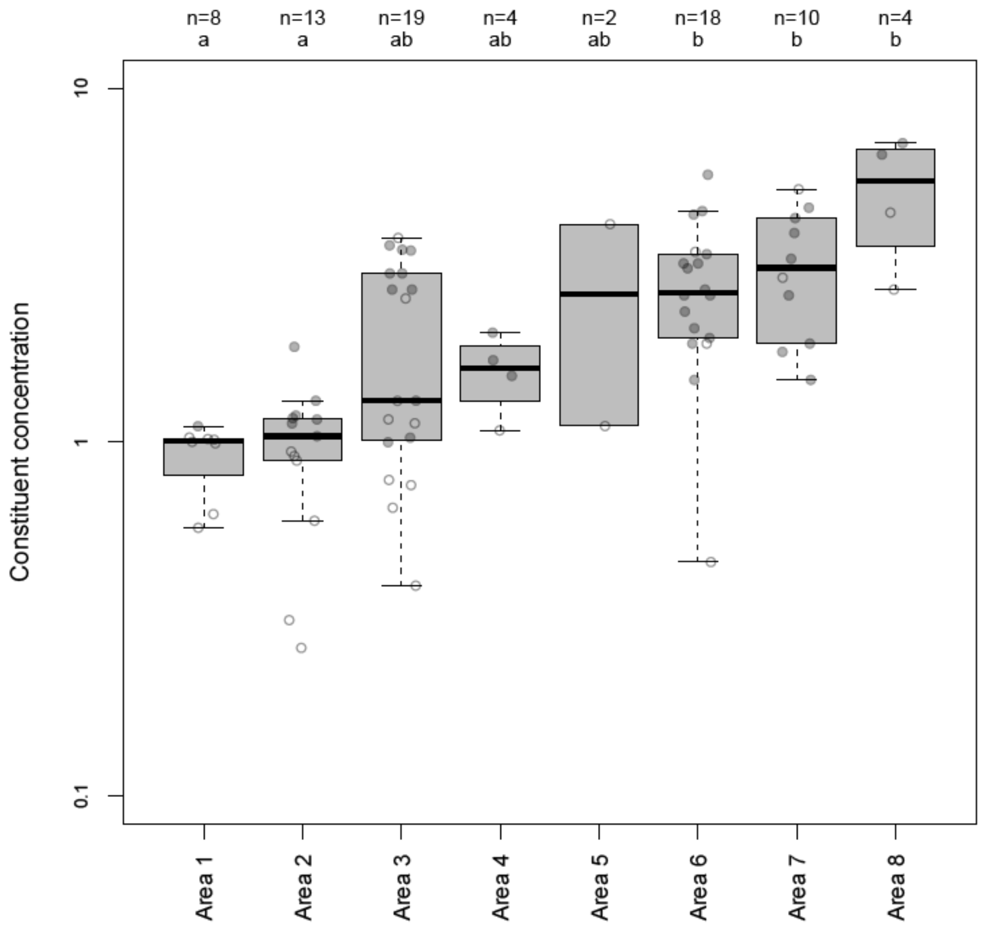
[11] Family-wise error refers to the joint probability of a type I error when making multiple comparisons. Typically, this error probability level is set at 5% for a test, but when conducting many interrelated tests, this probability is multiplied by itself for each test subsequent to the first. Bonferroni correction accounts for this by dividing the desired probability (5% in this case) by the number of tests.

[12] K-W and Dunn tests were conducted using the "kruskalmc" function from the "pgirmess" package in R (Giraudoux 2016).

[13] Non-parametric tests are approximately as powerful as parametric tests when the data are normally distributed and more powerful than parametric tests when the data are skewed.



Note: Horizontal lines of the boxes are the quartiles for each area subset. Points represent all of the individual data that are included in each dataset, with open circles being non-detect values and closed circles being detects. The dashed “whiskers” correspond to the lowest or highest concentration within 1.5 times the interquartile range below or above the 1st or 3rd quartiles, respectively; the interquartile range equals the 3rd quartile minus the 1st quartile for each subset. Above the plot is a series of numbers and letters. The numbers indicate the sample size (n) for each spatial group. The letters correspond to the conclusions of the Dunn test (familywise alpha = 0.05), which compares concentrations between spatial groups. If two spatial groups share a letter, then the two subsets are not significantly different. Boxplots show points and statistics that are based on datasets adjusted for non-detect concentrations (using either the MLE or ROS method, assuming lognormality). Non-detect values are estimated using either the MLE or ROS method. POC depicted is cobalt (with units of µg/L).

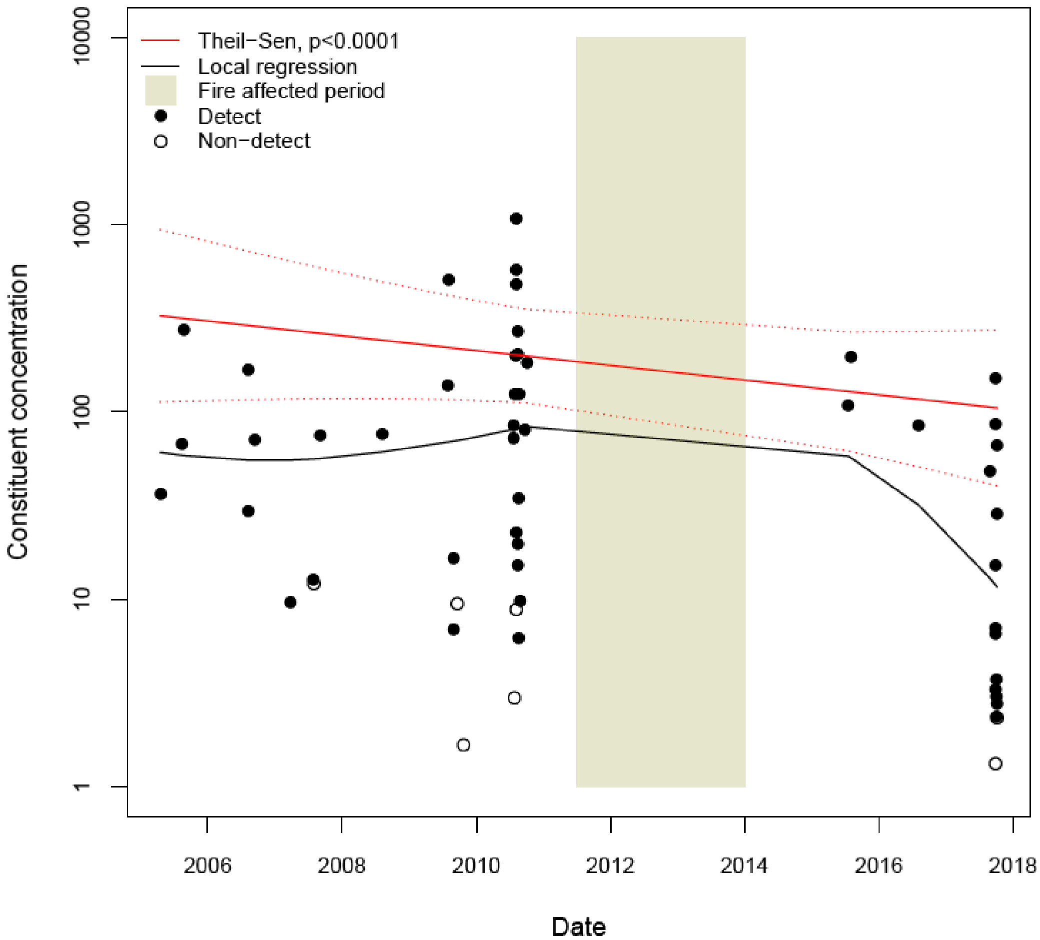
Figure 3-6.Example boxplot of major watersheds

3.2.2.3 Step 2.3 – Visualize data using time plots for temporal differences

Concentration data were plotted against dates to identify distinct time periods with higher or lower analyte concentrations or apparent trends (e.g., decreasing concentrations over time). Theil-Sen regression, which is a method for fitting a median regression line, was used to characterize linear trends over time.[14] Where there was a significant slope ($p < 0.05$), the time trend was investigated further. LOESS was also

[14] Thiel-Sen regression was conducted in R using the “mblm” function in the “mblm” package (Komsta 2013).

used to fit a smoothed trend line to the data, which can also aid interpretation. Figure 3-7 shows an example time plot.



Notes: The red solid line is the Theil-Sen regression line, which predicts a median concentration over time. The dashed red lines are the 95% confidence intervals for the Theil-Sen regression. The solid black line is the LOESS line, which is a "local" estimate of the mean concentration over time. The shaded time period indicates when data were excluded from areas affected by the Las Conchas fire in 2011. Data points within the shaded region (not shown in Figure 3-7) are from areas not affected by the fire. Points represent the concentrations of a POC (prior to the estimation of non-detect values). Non-detect values are shown as open circles. Time trends are based on datasets with estimated non-detect values. POC depicted is cobalt (with units of µg/L).

Figure 3-7.Example time plot

The temporal plots provided in Attachment A also use colors to indicate the major location groupings that were sampled typically during limited time periods. Because of such non-uniform sampling over both space and time, the apparent trends shown in time plots are mostly considered artificial, so time plots are unreliable for evaluating dependencies.

3.2.2.4 Additional considerations under Step 2

When the potential dependencies described above (i.e., spatial groups, temporal trends, or SSC) were insignificant, the potential effects of several other independent variables (as available) were explored, including specific sampling location, sampling method, analytical laboratory, and sampling plan or program. Extreme values were also assessed.

3.2.3 Step 3. Create stable subpopulations, as appropriate

Based on the results from Step 2, it was determined whether and how to split the water quality datasets into subsets. If a significant spatial difference was determined for location groupings or watersheds, then a split to isolate statistically similar spatial groups was considered. If extreme values were identified in a distribution, those samples were also investigated. Outliers were not removed as part of this analysis unless the outlier represented an extreme high estimate of a non-detect value (using the MLE or ROS method) or a clearly definable subpopulation (e.g., related to a single location with extreme values or a watershed with significantly different concentrations). The treatment of potential outliers is detailed in Appendix B.

In many cases, professional judgment was required to combine visually different but statistically indistinct (K-W/Dunn test, $p \geq 0.05$) spatial subsets (e.g., data for different watersheds) into larger subsets. Visually similar spatial subsets (based on boxplots) were combined to maintain robust data subsets that were also spatially stable (i.e., no significant spatial differences within subsets). In a few cases where minor watershed or minor location grouping subsets were significantly different but small (e.g., $n < 5$), the entire minor watershed or minor location grouping was considered insufficient for further evaluations (e.g., BTV calculations) (Appendix B). This approach was meant to achieve spatial stability without sacrificing the robustness of the final dataset.

After splitting or otherwise reducing datasets into subsets, each subset was evaluated using Q-Q plots to determine if additional subpopulations might remain in the subsets. As necessary, Step 2.2 was repeated to determine whether observed differences were due to spatial differences. When each subset was deemed sufficiently stable given the available data, the subsetting process was determined to be complete. Finalized datasets were used to calculate BTVs for NBG/baseline and DBG landscapes (and subsets of those landscapes) per BCF Step 4 (Section 4).

3.3 Results of BCF Assessments of Water Quality Datasets

This section describes the results of the BCF assessments of water quality datasets following the methods described in Section 3.2. A total of 58 datasets were initially identified based on unique combinations of each POC, landscape category, and relevant sample preparation method(s). Each of the 58 potential datasets identified was screened for sufficiency (BCF Step 1.1); the results of this screening are provided in Table 3-2.

Table 3-2. Results of BCF Step 1.1

Pollutant of Concern	Landscape	Sample Preparation Method	Sample Size	No. of Detects	DF (%)	Data Sufficient for Full BCF Assessment?
Aluminum	developed	F	115	111	97	yes

Pollutant of Concern	Landscape	Sample Preparation Method	Sample Size	No. of Detects	DF (%)	Data Sufficient for Full BCF Assessment?
Aluminum	undeveloped	F	81	81	100	yes
Aluminum	developed	UF	68	68	100	yes
Aluminum	undeveloped	UF	80	80	100	yes
Antimony	developed	F	112	17	15	yes
Antimony	undeveloped	F	77	**0**	**0**	**no**
Arsenic	developed	F	114	9	7.9	yes
Arsenic	undeveloped	F	78	10	13	yes
Benzo(a)pyrene	developed	UF	30	11	37	yes
Benzo(a)pyrene	undeveloped	UF	4	**0**	**0**	**no**
Boron	developed	F	112	32	29	yes
Boron	undeveloped	F	65	25	38	yes
Cadmium	developed	F	114	3	2.6	yes
Cadmium	undeveloped	F	78	3	3.8	yes
Chromium	developed	F	114	15	13	yes
Chromium	undeveloped	F	78	6	7.7	yes
Cobalt	developed	F	112	37	33	yes
Cobalt	undeveloped	F	78	46	59	yes
Copper	developed	F	114	113	99	yes
Copper	undeveloped	F	76	63	83	yes
Cyanide (total)	developed	UF	4	**0**	**0**	**no**
Cyanide (total)	undeveloped	UF	6	**2**	33	**no**
Cyanide, weak acid dissociable	developed	UF	6	**1**	17	**no**
Cyanide, weak acid dissociable	undeveloped	UF	**0**	**0**	**0**	**no**
Gross alpha	developed	UF	56	44	79	yes
Gross alpha	undeveloped	UF	55	48	87	yes
Hexachlorobenzene	developed	UF	**0**	**0**	**0**	**no**
Hexachlorobenzene	undeveloped	UF	**0**	**0**	**0**	**no**
Lead	developed	F	114	33	29	yes
Lead	undeveloped	F	78	38	49	yes
Mercury	developed	F	107	**1**	0.93	**no**
Mercury	undeveloped	F	64	**1**	1.6	**no**
Mercury	developed	UF	85	7	8.2	yes
Mercury	undeveloped	UF	76	31	41	yes
Nickel	developed	F	112	105	94	yes
Nickel	undeveloped	F	78	71	91	yes
Pentachlorophenol	developed	UF	**0**	**0**	**0**	**no**
Pentachlorophenol	undeveloped	UF	**0**	**0**	**0**	**no**
Radium-226 and Radium-228	developed	UF	40	25	62	yes
Radium-226 and Radium-228	undeveloped	UF	15	11	73	yes
Selenium	developed	F	109	**0**	**0**	**no**

Pollutant of Concern	Landscape	Sample Preparation Method	Sample Size	No. of Detects	DF (%)	Data Sufficient for Full BCF Assessment?
Selenium	undeveloped	F	78	**1**	1.3	**no**
Selenium	developed	UF	88	4	4.5	yes
Selenium	undeveloped	UF	79	27	34	yes
Silver	developed	F	114	**1**	0.88	**no**
Silver	undeveloped	F	78	**0**	**0**	**no**
2,3,7,8-TCDD	developed	UF	**0**	**0**	**0**	**no**
2,3,7,8-TCDD	undeveloped	UF	**2**	**0**	**0**	**no**
Thallium	developed	F	114	3	2.6	yes
Thallium	undeveloped	F	78	**1**	1.3	**no**
Total PCB	developed	UF	96	96	100	yes
Total PCB	undeveloped	UF	56	50	89	yes
Uranium	developed	F	101	38	38	yes
Uranium	undeveloped	F	65	44	68	yes
Vanadium	developed	F	113	109	96	yes
Vanadium	undeveloped	F	78	73	94	yes
Zinc	developed	F	114	104	91	yes
Zinc	undeveloped	F	78	49	63	yes

Note: **Bold** text indicates unacceptable values based on Step 1.1 sufficiency rules of the BCF.

BCF – background characterization framework
DF – detection frequency
F – filtered
PCB – polychlorinated biphenyl
TCDD – tetrachlorodibenzo-*p*-dioxin
UF – unfiltered

After completing the three screening steps described below, the remaining 39 datasets were carried forward to Step 1.2:

1. If no data were available for a potential dataset (Table 3-2) in either the NBG/baseline or DBG landscape categories, then no analysis could be conducted. Six datasets were thus removed from further consideration: cyanide (weak acid dissociable) in NBG, hexachlorobenzene and pentachlorophenol in both landscape categories, and 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in DBG.
2. Next, all datasets with only non-detected results were removed. Six datasets were thus removed from further consideration: filtered antimony, filtered silver, benzo(a)pyrene, and 2,3,7,8-TCDD in NBG/baseline and total cyanide and filtered selenium in DBG.[15]
3. Finally, all datasets with fewer than three detected concentrations were excluded, because ProUCL and NADA functions (in R) do not accept datasets with fewer than three detected data points. Seven datasets were thus removed from further consideration: filtered cadmium, filtered mercury, and filtered thallium in both

[15] Exclusion at this point does not necessarily indicate a data gap, but it can be an indication that there are no detectable sources of the constituent in the background landscape.

landscape types; filtered selenium and total cyanide in NBG; and cyanide (weak acid dissociable) and filtered silver in DBG.

Many plot figures were developed to support decision making throughout the BCF assessment process, particularly for BCF Steps 1.2 through 3. Table 3-3 provides a list of these types of figures, the type of information conveyed in each figure, and the specific step of the BCF to which each figure corresponds. Figures of the types described in Table 3-3 are provided in Attachment A.[16] For ease of comparison, all plots of a single type for a particular POC are included in one figure; for example, Q-Q plots for all four aluminum datasets (Table 3-2) are included in Figure 1-a in Attachment A. Figures 3-3, 3-4, 3-6, and 3-7 (in Section 3.2) provide general information on how these figures were interpreted for BCF assessments, and Appendix B provides specific details.

Table 3-4 contains a complete summary of the results from BCF Steps 1 through 3 (including the results of Step 1.1, described above) for all 39 datasets. These results are discussed in greater detail in Appendix B. Based on the results of BCF Step 3, the 39 datasets were subdivided into a total of 51 data subsets (Table 3-4).

Table 3-3. Description of BCF Steps 1 and 2 result figures in Attachment A

Figure No.[a]	Plot Type and Information Conveyed	Associated BCF Step
x-a	raw Q-Q plots – evidence for multiple subpopulations	1.2
x-b	dependency on SSC – appropriateness of normalization	2.1
x-c	SSC-normalized Q-Q plots – potential change in multiple subpopulations	2.1
x-d	major watershed boxplots – spatial differences	2.2
x-e	major watershed boxplots with SSC-normalization (only for SSC-dependent analytes) – spatial differences	2.2
x-f	minor watershed boxplot – spatial differences (only if minor watershed was used to split datasets)	2.2
x-g	major location grouping boxplots – spatial differences	2.2
x-h	major location grouping boxplots with SSC normalization (only for SSC-dependent analytes) – spatial differences	2.2
x-i	minor location grouping boxplots – spatial differences	2.2
x-j	time plot – temporal trends	2.3
x-k	time plot – temporal trends with SSC-normalization	2.3

[a] Figure numbering is based on the specific water quality POC. The value of “x” in the figure number corresponds to the ordering of POC, split by analytical group (i.e., metals, followed by radionuclides, other inorganics, and organics), similar to the ordering of datasets presented in Appendix B.

BCF – background characterization framework

Q-Q – quantile-quantile

SSC – suspended sediment concentration

[16] The figures are provided in a separate attachment rather than in the main text because of the large number of figures provided. The same is true of similar figures provided in Appendix B.

Table 3-4. Results of BCF assessments, Steps 1 through 3

	Dataset Description			Step 1.1 - Data Sufficiency				Step 1.2	Step 2.1 - SSC Dependence			Step 2.2 - Spatial Dependence				Step 2.3 - Temporal Dependence	Step 3 – Establishing Data Subsets		
								Q-Q Plots	Scatter Plots	Q-Q Plots (Normalized)		Boxplots - Watersheds		Boxplots - Location Groups		Time Plots			
Dataset No.	Parameter	Landscape	Sample Prep.	N	No. of Detects	DF (%)	Sufficient Data?	Multiple Populations?	SSC Relationship?	SSC Improve Stability?	Dataset Normalized?	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Time Trend?	No. of Subsets	Outliers Removed?	Description of Subsets
1	aluminum	undeveloped	F	81	81	100	yes	yes	no	na	no	none	none	SEP reference higher than other groups	SEP reference higher than NR or WR	yes (driven by 2017 SEP reference dataset)	3	no	SEP reference (major location group) vs. E240 d/s of SR-501 (location) vs. all other major location groups
2	aluminum	developed	F	115	111	97	yes	maybe	yes (weak)	not markedly	yes	none	none	none	none	none	1	no	--
3	aluminum	undeveloped	UF	80	80	100	yes	maybe	yes (relatively strong)	yes (though still trend in high values)	yes	none	none	SEP reference and WR higher than NR	SEP reference and WR higher than NR	yes (driven in part by 2017 SEP dataset)	2	no	WR/SEP reference vs. NR/Bandelier reference (major location groups)
4	aluminum	developed	UF	68	68	100	yes	maybe (extreme values)	yes (moderate to weak)	not markedly (based on relevant boxplots and time plots)	yes	none	none	none	none	yes (likely driven by extreme values)	1	no	--
5	antimony	developed	F	112	17	15	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	yes (1 high non-detect estimate)	--
6	arsenic	undeveloped	F	78	10	13	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	no	--
7	arsenic	developed	F	114	9	7.9	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	yes (1 high non-detect estimate)	--
8	boron	undeveloped	F	65	25	38	yes	maybe (note high detection limit non-detects)	no	na	no	Los Alamos higher than Frijoles or Jemez River	Guaje higher than Frijoles or Jemez River mainstems	NR and WR higher than SEP reference; NR greater than Bandelier reference	NR higher than Bandelier and SEP reference; WR higher than Bandelier	yes (shallow slope; driven in part by 2017 SEP reference dataset and 2015 Bandelier reference dataset)	2	no	NR/WR vs. Bandelier/SEP reference (major location groups)
9	boron	developed	F	112	32	29	yes	maybe (note high detection limit non-detects)	no	na	no	Sandia higher than Los Alamos	Acid and Sandia mainstem higher than Bayo	Lab developed higher than Town Developed	Runon higher than Townsite	yes (likely driven by estimated non-detect values)	2	no	lab vs. town (major location group)

Dataset No.	Dataset Description				Step 1.1 - Data Sufficiency				Step 1.2 Q-Q Plots	Step 2.1 - SSC Dependence Scatter Plots	Step 2.1 - SSC Dependence Q-Q Plots (Normalized)		Step 2.2 - Spatial Dependence Boxplots - Watersheds		Step 2.2 - Spatial Dependence Boxplots - Location Groups		Step 2.3 - Temporal Dependence Time Plots	Step 3 – Establishing Data Subsets		
	Parameter	Landscape	Sample Prep.	N	No. of Detects	DF (%)	Sufficient Data?	Multiple Populations?	SSC Relationship?	SSC Improve Stability?	Dataset Normalized?	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Time Trend?	No. of Subsets	Outliers Removed?	Description of Subsets
10	cadmium	undeveloped	F	78	3	3.8	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	yes (1 high non-detect estimate)	--
11	cadmium	developed	F	114	3	2.6	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	yes (1 high non-detect estimate)	--
12	chromium	undeveloped	F	78	6	7.7	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	no	--
13	chromium	developed	F	114	15	13	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	no	--
14	cobalt	undeveloped	F	78	46	59	yes	maybe (4–8 highest points)	no	na	no	Pajarito, Chupaderos, and Garcia higher than Jemez River and Frijoles	Pajarito mainstem higher than Jemez River and Frijoles mainstems	NR higher than SEP reference and Bandelier reference; WR higher than SEP reference	NR higher than SEP reference and Bandelier WR higher than SEP reference	yes (driven by 2017 SEP reference dataset and 2015 Bandelier reference dataset)	2	no	NR/WR/Bandelier-like vs. Bandelier/SEP reference (minor location groups)
15	cobalt	developed	F	112	37	33	yes	maybe (highest 3 points)	no	na	no	none	Sandia mainstem higher than Rendija	Lab Developed higher than Town Developed	Runon higher than Townsite	yes (trend may be driven by estimates of non-detects; visually does not pass through recent data)	1	no	excludes S-ROM-2(a) location
16	copper	undeveloped	F	76	63	83	yes	maybe (many similar data throughout)	no	na	no	none	none	none	WR and Bandelier-like higher than other groups	yes (shallow trend; partly due to older WR samples)	1	no	excludes Bandelier minor location group
17	copper	developed	F	114	113	99	yes	yes (highest 7 points)	no	na	no	Sandia higher than Trib. to Rio Grande and Pueblo	Sandia mainstem higher than Trib. to Rio Grande and Rendija	Lab Developed higher than Town Developed	Runon higher than Townsite	no	2	no	Lab vs. Town (major location group)
18	lead	undeveloped	F	78	38	49	yes	likely no, though some extreme values	no	na	no	none	none	NR higher than Bandelier reference	NR higher than Bandelier	no	1	no	excludes Bandelier minor location group

Dataset No.	Dataset Description			Step 1.1 - Data Sufficiency				Step 1.2	Step 2.1 - SSC Dependence			Step 2.2 - Spatial Dependence				Step 2.3 - Temporal Dependence	Step 3 – Establishing Data Subsets		
								Q-Q Plots	Scatter Plots	Q-Q Plots (Normalized)		Boxplots - Watersheds		Boxplots - Location Groups		Time Plots			
	Parameter	Landscape	Sample Prep.	N	No. of Detects	DF (%)	Sufficient Data?	Multiple Populations?	SSC Relationship?	SSC Improve Stability?	Dataset Normalized?	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Time Trend?	No. of Subsets	Outliers Removed?	Description of Subsets
19	lead	developed	F	114	33	29	yes	likely no, though at least 1 extreme value	no	na	no	none	none	Lab Developed higher than Town Developed	Runon higher than Townsite	no	1	no	--
20	mercury	undeveloped	UF	76	31	41	yes	maybe (highest 11 values)	yes (very weak)	no (based on relevant boxplots and time plots rather than Q-Q plot)	no	Frijoles less than Los Alamos, Chupaderos, Pajarito, Garcia, and Mortandad	Frijoles mainstem less than Pajarito and Mortandad mainstems	WR and NR higher than SEP reference	WR, NR, and Bandelier-like higher than Bandelier and SEP reference	no	2	yes (8 high non-detect estimates)	NR/WR vs. SEP/Bandelier reference (minor location groups); NR/WR subset excludes E240 gage location (high mercury); SEP/Bandelier subset exclude Bandelier-like minor group
21	mercury	developed	UF	85	7	8.2	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	yes (2 high non-detect estimates)	--
22	nickel	undeveloped	F	78	71	91	yes	maybe (2–3 small subpopulations where data level off)	no	na	no	Chupaderos higher than Los Alamos	Cañada de las Latas higher than Los Alamos mainstem or Guaje	none	Bandelier less than SEP reference, Northern, and Bandelier-like	yes (shallow slope results in insubstantial change over time)	2	no	Chupaderos/ Garcia /Mortandad vs. all other major watersheds
23	nickel	developed	F	112	105	94	yes	likely no, though at least 2 extreme values; small subpopulations possible (e.g., 3 points at upper end of distribution)	yes (very weak)	not markedly (based on relevant boxplots and time plots)	no	none	none	none	none	no	1	no	--

Dataset No.	Dataset Description			Step 1.1 - Data Sufficiency				Step 1.2 Q-Q Plots	Step 2.1 - SSC Dependence: Scatter Plots	Step 2.1 - SSC Dependence: Q-Q Plots (Normalized)		Step 2.2 - Spatial Dependence: Boxplots - Watersheds		Step 2.2 - Spatial Dependence: Boxplots - Location Groups		Step 2.3 - Temporal Dependence: Time Plots	Step 3 – Establishing Data Subsets		
	Parameter	Landscape	Sample Prep.	N	No. of Detects	DF (%)	Sufficient Data?	Multiple Populations?	SSC Relationship?	SSC Improve Stability?	Dataset Normalized?	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Time Trend?	No. of Subsets	Outliers Removed?	Description of Subsets
24	selenium	undeveloped	UF	79	27	34	yes	likely no	yes (very weak)	no	no	Mortandad, Los Alamos, and Chupaderos higher than Frijoles	Mortandad mainstem, Guaje, and Cañada de las Marias higher than Frijoles mainstem	NR higher than SEP reference	Bandelier-like higher than Bandelier, SEP reference, and WR; NR higher than SEP reference	yes (trend due in large part to estimated non-detect values in early WR dataset); appears to be valid trend for NR dataset; remains generally unclear	1	yes (4 high non-detect estimates)	excludes Mortandad major watershed
25	selenium	developed	UF	88	4	4.5	yes	unclear due to many non-detects	no	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	no	--
26	thallium	developed	F	114	3	2.6	yes	unclear due to many non-detects	yes (artificially driven by non-detect values; very weak)	na	no	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	unclear due to many non-detects	1	yes (1 high non-detect estimate)	--
27	uranium	undeveloped	F	65	44	68	yes	yes	no	na	no	Mortandad higher than Jemez River or Pajarito	Mortandad mainstem higher than Jemez River or Pajarito mainstems	none	Bandelier-like higher than Bandelier and SEP reference	no	2	no	Jemez River vs. all other major watersheds except Mortandad
28	uranium	developed	F	101	38	38	yes	likely no, though at least 2 extreme values	no	na	no	none	none	Lab Developed higher than Town Developed	Runon higher than Townsite	no	1	no	--
29	vanadium	undeveloped	F	78	73	94	yes	likely no (possible highest 6 samples are different)	no	na	no	Mortandad higher than Frijoles, Pajarito, and Los Alamos	Mortandad mainstem higher than Frijoles and Pajarito mainstems	NR higher than WR	Bandelier-like higher than Bandelier, WR, and SEP reference	no	1	no	excludes Mortandad major watershed
30	vanadium	developed	F	113	109	96	yes	likely no, though at least 2 extreme values	no	na	no	none	none	none	none	no	1	no	--

	Dataset Description			Step 1.1 - Data Sufficiency				Step 1.2	Step 2.1 - SSC Dependence			Step 2.2 - Spatial Dependence				Step 2.3 - Temporal Dependence	Step 3 – Establishing Data Subsets		
								Q-Q Plots	Scatter Plots	Q-Q Plots (Normalized)		Boxplots - Watersheds		Boxplots - Location Groups		Time Plots			
Dataset No.	Parameter	Landscape	Sample Prep.	N	No. of Detects	DF (%)	Sufficient Data?	Multiple Populations?	SSC Relationship?	SSC Improve Stability?	Dataset Normalized?	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Time Trend?	No. of Subsets	Outliers Removed?	Description of Subsets
31	zinc	undeveloped	F	78	49	63	yes	maybe (highest 10)	no	na	no	Garcia higher than Jemez River and Frijoles	none	none	NR higher than Bandelier	yes (suspected spatial influence - SEP and Bandelier reference are somewhat lower and more recent than NR or WR)	1	yes (2 high non-detect estimates)	excludes Garcia major watershed
32	zinc	developed	F	114	104	91	yes	maybe (sharp bend in distribution)	no	na	no	none	none	none	none	no	1	No	--
33	gross alpha	undeveloped	UF	55	48	87	yes	yes	yes (weak)	yes	yes	none	none	none	none	yes (likely related to high non-detect estimates in early samples)	1	no	--
34	gross alpha	developed	UF	56	44	79	yes	yes (highest 9 values)	yes (very weak)	yes	yes	none	none	Lab Developed > Town Developed (based on non-detect estimates)	Runon > Townsite (based on non-detect estimates)	yes (trend likely related to high non-detect estimates in early Lab Developed samples)	1	yes (6 high SSC-normalized non-detect estimates)	All locations kept together—differences between Lab and Town Developed groupings are artificial, driven by non-detect estimates. Detected activities are not different between these groupings.
35	radium-226 and radium-228	undeveloped	UF	15	11	73	yes	yes (highest 7 values)	yes (relatively strong)	not markedly	yes	none	none	none	none	No (few data to discern trend)	1	yes (1 high non-detect estimate)	--
36	radium-226 and radium-228	developed	UF	40	25	62	yes	maybe (3 higher values and one extreme value)	yes (very weak)	not markedly (3 highest values form possible subpopulation)	yes	none	none	none	none	No (few data to discern trend)	1	no	--

	Dataset Description			Step 1.1 - Data Sufficiency				Step 1.2	Step 2.1 - SSC Dependence			Step 2.2 - Spatial Dependence				Step 2.3 - Temporal Dependence	Step 3 – Establishing Data Subsets		
								Q-Q Plots	Scatter Plots	Q-Q Plots (Normalized)		Boxplots - Watersheds		Boxplots - Location Groups		Time Plots			
Dataset No.	Parameter	Landscape	Sample Prep.	N	No. of Detects	DF (%)	Sufficient Data?	Multiple Populations?	SSC Relationship?	SSC Improve Stability?	Dataset Normalized?	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Time Trend?	No. of Subsets	Outliers Removed?	Description of Subsets
37	total PCB	undeveloped	UF	56	50	89	yes	maybe (6 lower values from SEP reference dataset)	yes (very weak)	no (based on relevant boxplots and time plots)	no	Los Alamos higher than Jemez River	Los Alamos mainstem higher than Jemez River and Frijoles mainstems	NR and WR higher than SEP reference	NR and WR higher than SEP reference	yes (likely driven by spatial bias - SEP reference dataset is most recent)	2	no	SEP reference vs. all other major location groups
38	total PCB	developed	UF	96	96	100	yes	maybe (highest 4 values and jump in the middle of dataset)	no	na	no	none	South Fork Acid higher than Bayo	none	none	yes (trend appears to be curved and not very clear due to little data between 2010 and 2014)	2	no	South Fork Acid vs. all other minor watersheds
39	benzo(a)pyrene	developed	UF	30	11	37	yes	maybe (highest 3 values; unclear due to many non-detects)	no	na	no	none (few to compare)	none (few to compare)	not determined (only Town Developed data)	not determined (only Townsite data)	not determined (too few sampling events over time)	1	no	--

Note: BCF Steps 1 through 3 are presented in this table. BCF Steps 4 and 5 are presented Section 4. A total of 51 subsets were established based on Steps 1 through 3 of the BCF. Additional details about Steps 1 through 3 are provided in Appendix B.

BCF – background characterization framework
DF – detection frequency
F – filtered
na – not applicable
NR – Northern Reference
PCB – polychlorinated biphenyl
Q-Q – quantile-quantile
SEP – Supplemental Environmental Project
SSC – suspended sediment concentration
UF – unfiltered
WR – Western Reference

3.4 LIMITATIONS AND UNCERTAINTY OF THE BCF ASSESSMENT STEPS 1 TO 3

The recognized limitations and uncertainties about the methods, analyses, and results described in Sections 3.2 and 3.3 are:

- Six DBG locations are categorized by LANS/N3B as "Lab Developed" but fall within the Los Alamos townsite (outside the Laboratory) (Figure 1-1). LANS/N3B has indicated that these six locations were at one time influenced by contaminated Sites. However, storm water sampled at these locations may be more representative of the Los Alamos townsite than of the LANL facility.[17] It is not clear what effect, if any, reclassifying these six locations as "Town Developed" would have on the interpretation of the BCF assessment results.
- Although many data subsets were considered sufficient based on sample size, DF, and number of detects, several subsets (e.g., NBG filtered cadmium and chromium) are highly uncertain due to low DFs and/or small sample sizes. These uncertainties are discussed throughout Section 4 (and in Appendix B).
- The estimation of non-detects using the methods described in Section 3.2 may have been influenced by multiple detection limits, resulting in somewhat inaccurate estimates (Bolks et al. 2014). In assessments with high DFs (e.g., ≥ 85%), this influence is expected to introduce insubstantial bias. Uncertainty associated with datasets with low DFs is discussed in Appendix B, including the influence of non-detect estimation methods on the assessment of certain datasets. When calculating BTVs (Section 4), methods more appropriate to the data subsets were used. For example, the Kaplan-Meier (KM) method was used when multiple detection limits were present in the dataset and/or when DFs and sample sizes were high (Bolks et al. 2014). The ROS method was used when there were single detection limits, DFs lower than 50%, and/or sample sizes smaller than 50 (Annan et al. 2009).
- The comparability of the LANL and NMED storm water datasets (Appendix A) is unclear, although for the purposes of the assessments herein, the datasets were assumed to be comparable.
- The classification of sampling location WR-REF-3 (in Mortandad Canyon) as "undeveloped" might be incorrect, as evidenced by higher concentrations of several POCs (e.g., filtered arsenic, selenium, and uranium and unfiltered mercury) leading to spatial instability. In several final data subsets, this location was excluded to increase spatial stability without removing a substantial number of samples from the final data subsets.

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[17] The LANL facility and Los Alamos townsite are being treated as potentially different developed conditions. The LANL facility is limited to the DOE land ownership and the Los Alamos townsite is limited to public lands within Los Alamos County, generally located within the municipality of Los Alamos.

- The classification of the “Pajarito downstream of SR-501” sampling location (gage station E240 downstream of the highway) as “undeveloped” may have been inappropriate, given that the data from that location occasionally exhibited elevated concentrations of certain POCs (i.e., filtered aluminum and unfiltered mercury) relative to Pajarito data from above the highway or to other watersheds or location groupings. Concentrations of most POCs measured at the E240 gage location (excluding filtered aluminum and unfiltered mercury) were similar enough to concentrations in other spatial groups that the data from E240 (downstream of the road) could be retained. Thus, the classification of Pajarito downstream of SR-501 as undeveloped appears to be a minor point of uncertainty.
- Temporal trends could not be distinguished from spatial trends due to spatial differences in sampling programs over time. Temporal dependency remains an uncertainty for all subsets.

3.5 Summary of Background Storm Water Dataset Development

This section provides a general summary of the results of Steps 1 through 3 of BCF assessments for LANL background water quality datasets:

- A total of 58 water quality datasets were considered in BCF Step 1, corresponding to 26 unique POCs, filtered and/or unfiltered (corresponding to the 2015 draft IP), from sampling locations representing developed and undeveloped landscapes.
    - Of the 58 datasets, 19 were excluded during Step 1 (insufficient data or detections), resulting in 39 datasets that met the needs for further evaluations in Steps 2 and 3.
    - Although many samples were analyzed for filtered mercury, selenium, silver antimony, and thallium, these POCs were very rarely, if ever, detected. Based on the sample size and DF of these POCs, it is concluded that there are likely no detectable natural sources of these POCs on the Pajarito Plateau. Additionally, there are likely no detectable anthropogenic sources of mercury, selenium, or silver.
- The 39 datasets were subdivided into a total of 51 sufficiently stable subsets that reduced dependencies on spatial groupings or SSC.
    - No more than three subsets were generated for any single dataset.
    - Although SSC was expected to be related to many unfiltered storm water POCs, relationships were generally not significant and/or were weak. Consequently, only 7 of 39 datasets (and 8 total subsets) were normalized to SSC (Table 3-4). The lack of correlations with SSC is not unexpected for the filtered sample types, although it is interesting that DBG filtered aluminum was correlated with SSC.

- Depending on the dataset, major or minor watershed or major or minor location groupings appeared to separate the data into stable subsets. Data for individual locations were identified as drivers only for certain subsets or were removed in only a few instances.

4 BTV Development

Steps 4 and 5 of the BCF (Figure 3-2), which are used to derive storm water BTVs and evaluate sensitivities and uncertainties in the BTVs, are presented in this section. By generating reasonably stable distributions (Section 3), BTVs can be calculated and appropriately applied to watersheds or location groupings. Data subsets are also stable in terms of SSC (as a surrogate for storm intensity).

Because BTVs are not associated with any particular statistic, a suite of statistics are provided in Section 4 as potential BTV options. Specific BTVs are recommended in Section 5 (based on rationale provided in Section 5.2.3).

4.1 Calculating BTVs (BCF Step 4)

This section describes the various potential BTV statistics calculated herein, as well as the methods used for completing Steps 4 and 5 of the BCF. Section 4.1.1 provides an overview of the different statistics that could serve as BTVs for data subsets (Table 3-4), and Section 4.1.2 provides other factors taken into account when considering potential BTV statistics. Sections 4.2 and 4.3 present results and uncertainties associated with BCF Step 4. The BTVs evaluated and reported in past LANL storm water background reports are summarized in Appendix G, where they are compared to the recommended BTVs developed in Section 5.

4.1.1 Description of Potential BTV Statistics (Step 4.1)

BTVs are statistics that summarize background conditions in various ways, with different implications for the management of storm water depending on the chosen statistic. BTVs provide a line of evidence (LOE) for determining whether or not a detected concentration of a POC above the 2010 IP TAL can be attributed to the background landscape (developed or undeveloped). This determination will be accomplished by comparing concentrations measured in SMA samples with one or more BTVs.

The potential BTV statistics discussed in this section represent possible reasonable upper bounds for background water quality datasets, such that an exceedance of a BTV corresponds with a concentration in excess of the background condition. Sample POC concentrations that are less than or equal to the BTV are considered consistent with background conditions, suggesting that Sites (and urban development, in the case of NBG BTVs) do not meaningfully contribute to the measured concentrations.

Table 4-1 provides an overview of the potential BTV statistics, including estimated exceedance rates of background datasets and the degree of confidence associated with the exceedance rates. Each BTV is associated with some level of inherent error.[18] The potential BTV statistics were calculated for each subset using either the statistical program ProUCL (EPA 2016) or R software (R Core Team 2016).[19] Sections 4.1.1.1 through 4.1.1.5 provide more details on each statistic.

Table 4-1. Potential BTV statistic comparison

Potential BTV Statistic	Expected Rank of Statistic[a]	Parametric or Nonparametric	Expected Exceedance (100% - Coverage)[b]	Confidence in Expected Exceedance[c]
Geometric mean	9	nonparametric	50% (approximate)	not quantified
75^{th} percentile	8	nonparametric	25%	not quantified
80^{th} percentile	7	nonparametric	20%	not quantified
90^{th} percentile	6	nonparametric	10%	not quantified
95^{th} percentile	5[d]	nonparametric	5%	not quantified
95% UPL (k = 1)[e]	4[d]	either	0%[d]	95%
95-95 UTL	3[d]	either	5%	95%
95% USL	2[d]	either	0%[f]	95%
Maximum	1[c]	nonparametric	0%	not quantified

Note: Expected exceedances correspond to a false positive rate associated with the background dataset. False positives corresponding to SMA data have not been quantified. False negatives are unquantifiable for background data and have not been quantified for SMA data.

a Rank is from most conservative (maximum) to least conservative (80^{th} percentile).

b Coverage is the percent of the dataset associated with the statistic; for example, the 80^{th} percentile has 80% coverage, and 20% of background values are expected to exceed the 80^{th} percentile.

c Confidence corresponds to the likelihood of future concentrations being less than the BTV.

d The rank of UPL, UTL, and USL depends on the dataset. These ranks are typical rather than the rule.

e The value of k is used to identify the number of samples associated with the 95% UPL.

f The UPL and USL do not correspond to specific coverages of a dataset. In Table 4-1, 100% coverage is assumed because future sample are not expected to exceed the UPL or USL.

BTV – background threshold value
k – number of future samples
SMA – site monitoring area
UPL – upper prediction limit
USL – upper simultaneous limit
UTL – upper tolerance limit

The potential BTV statistics listed in Table 4-1 differ in statistical complexity and conservatism. The more complex statistics (i.e., UTLs, UPLs, and USLs) are useful

[18] Errors can be either be positive or negative. A “false positive” error means that a measured concentration is incorrectly labeled an exceedance of the background condition, even though it does not exceed the background condition. A “false negative” error means that a measured concentration is incorrectly ascribed to a background condition, even though it actually does exceed the background condition.

[19] UTLs, UPLs, and upper simultaneous limits (USLs) were calculated using ProUCL software for multiple potential distribution types. Non-detect values were estimated when calculating these statistics using ProUCL’s built-in methods (i.e., KM or ROS). Percentiles and maxima were calculated in R using the default methods provided in that statistical program. All ProUCL inputs and outputs for calculating the UTLs, UPLs, and USLs are provided in Appendix F.

because they incorporate uncertainty associated with concentration distributions. Of the potential BTV statistics, UTLs, UPLs, and USLs are perhaps the most commonly applied when defining background conditions, due in part to EPA recommendations (EPA 2013b).

Figure 4-1 shows the relationship among potential BTV statistics (Table 4-1) for a hypothetical storm water concentration distribution.

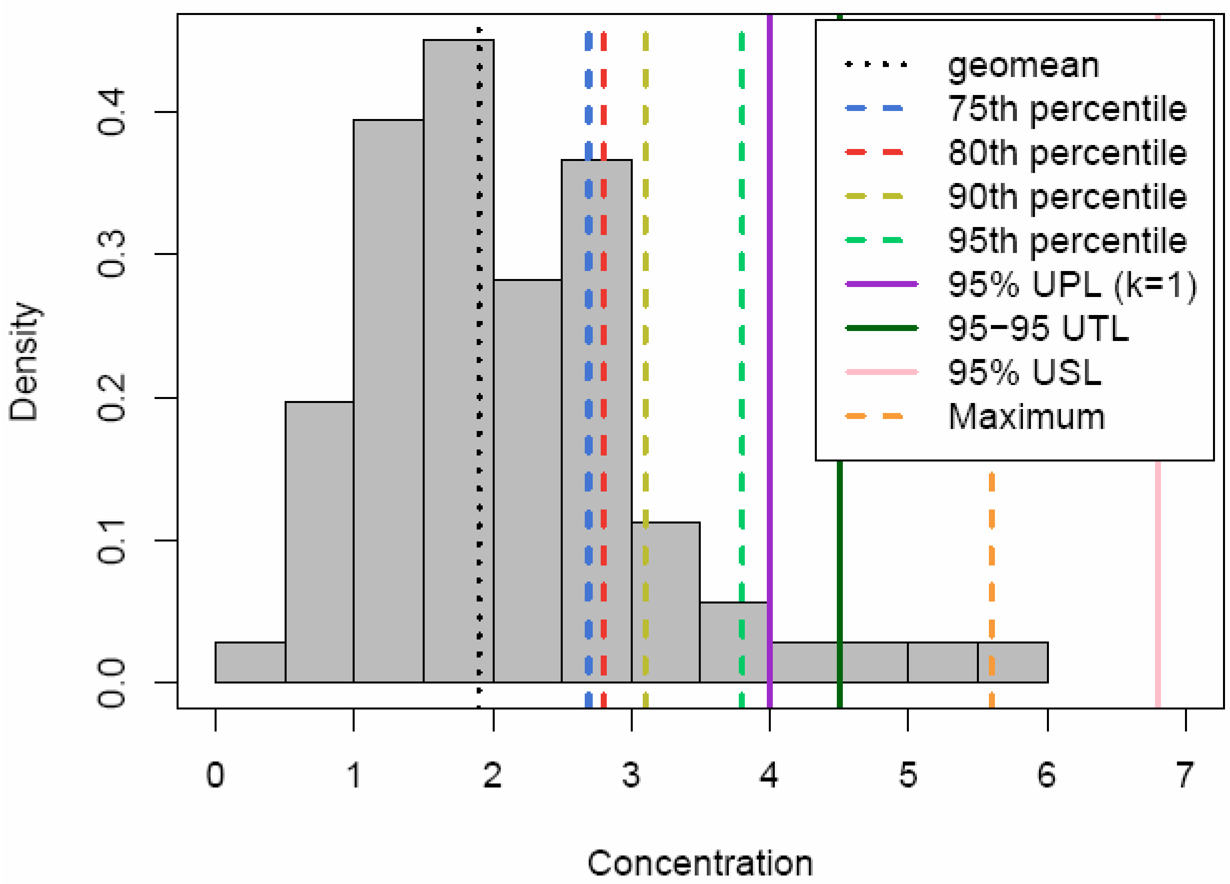

Figure 4-1.Example BTVs for a hypothetical data distribution

4.1.1.1 Maximum value

The maximum value is a nonparametric statistic[20] estimated as the highest concentration observed among detected concentrations in a dataset. If used as a BTV, a maximum value has the potential to over-represent typical background variation due to the existence of one or more extreme concentrations represented in background datasets. Although some extreme conditions were identified and removed from subsets of the data (see Table 3-4 or Appendix B), most maximum concentrations were

[20] Parametric statistics are calculated using an assumed theoretical distribution type. The form of the distribution is used to quantify the error associated with the statistic. Conversely, the calculation of nonparametric statistics is not based on any assumed, underlying distribution type.

considered to be valid and consistent with a continuous and stable background distribution. Environmental datasets are commonly right-skewed by extreme values.

Because the maximum value might represent an extreme circumstance (e.g., associated with a particularly intense storm event), the probability of typical background concentrations exceeding the maximum value threshold (false positive) might be exceedingly low. If the data do not include information about an extreme circumstance, then a false positive result (concluding that background was exceeded when, in fact, it was not) might be high. If concentrations in SMA samples are similar to the maximum background concentration, then the potential for false negatives (i.e., incorrectly determining that the concentrations in SMA samples are consistent with background) is also high.

In general, the maximum value should not be used as a BTV because it is prone to represent infrequent or aberrant background conditions. The maximum could reasonably be selected as a BTV if the DF and/or sample size of a dataset are too low to generate one of the more complex statistics described in Sections 4.1.1.3 through 4.1.1.5 (i.e., UTLs, UPLs, and USLs) (EPA 2013b). For example, it is possible for UTLs, UPLs, and USLs to exceed the maximum value; this would result in a questionable BTV when parametric assumptions are unclear (i.e., when the sample size and/or DF is low). In such cases, the use of the maximum value instead of a UTL, UPL, or USL might be reasonable. For this reason, the maximum was considered as a potential BTV.

4.1.1.2 Upper percentiles

Percentile values are nonparametric statistics that define the threshold below which the specified percentage of a dataset falls; for example, 95% of observed results are less than the 95th percentile. This also corresponds to a hypothetical false positive rate of 5%, in that 5% of all background concentrations exceed the 95th percentile; this rate increases as the percentile decreases. Like a maximum value, percentiles do not incorporate uncertainty resulting from dataset variability, giving them limited potential for predictions of future background conditions. However, percentiles are “robust” to extreme values that increase dataset variability and drive UTLs, UPLs, and USLs to be high (e.g., above the maximum value). Also, percentiles are easily interpretable and have broad application in environmental guidance and regulation. For example, EPA’s ambient water quality criteria (WQC) for aquatic life are derived using percentile values (EPA 1985). For these reasons, upper percentiles were considered as potential BTVs.

4.1.1.3 UTL - upper tolerance limit

The UTL, which is calculated using ProUCL, is the statistic representing the upper limit of confidence in the prediction of a given percentile. For the 95-95 UTL, one can be 95% confident that the 95th percentile of a future dataset will be less than the 95-95 UTL. In other words, in 5 of 100 future sampling events, the calculated 95th percentile of background concentrations will exceed the 95-95 UTL. This statistic incorporates uncertainty associated with the distribution of the concentration dataset in order to make predictions about future datasets. In order to make this prediction, it must be assumed that the distribution of concentrations is reasonably stable. The results presented in Section 3.3 confirm this assumption for most data subsets (Table 3-4). In terms of storm water management, the UTL provides a reasonable upper bound for managing future samples at some predetermined majority of storm water concentrations.

The 95-95 UTL is the preferred BTV for several reasons, including LANL's history of using it to characterize background conditions (LANL 2012, 2013, 2014, 2017c). The UTL is also recommended by several other entities, including regulatory agencies, to characterize background conditions for various media (EPA 2013b; ITRC 2013; NMED 2014a); it was used by NMED to characterize background water quality in the Pajarito Plateau regional aquifer near LANL (Dale et al. 2013).

When uncertainty associated with the 95-95 UTL is so high that it exceeds the maximum value, then an upper percentile or maximum BTV might be considered more reasonable, particularly if the parametric assumption of the UTL is unclear (e.g., due to small sample size, low DF, or deviation of the actual distribution from the theoretical distribution). The nonparametric 95-95 UTL tends to equal the maximum observed value.

4.1.1.4 UPL - upper prediction limit

The UPL, which is calculated using ProUCL, is a threshold pertaining to a fixed number (k) of hypothetical future samples. Based on the underlying distribution of the observed data, the concentrations in k future samples will be below the UPL with a defined level of confidence. For example, there is a 5% probability that a single future sample will exceed the 95% UPL (k = 1). This differs from the 95-95 UTL: the expectation for the 95-95 UTL is that 5% of samples will exceed the UTL in any future scenario, with only a 5% chance that more than 5% of samples will exceed the UTL.

The UPL value increases as k increases. The UPL for a single future sample should not be applied to multiple future samples, because the rate of error increases for each sample added beyond the first.

4.1.1.5 USL - upper simultaneous limit

The USL, which is calculated using ProUCL, is the value that any number of future samples will not exceed with some defined level of statistical confidence. For example, in 5 of 100 future sampling events, there will be 1 or more samples with concentrations that exceed the 95% USL. The USL differs from the UPL, in that the UPL is specific to a predefined number of future samples (e.g., k = 1); also, the USL tends to be a higher value than the UPL at the same level of confidence.

From a management standpoint, the USL may be useful due to the indeterminate number of samples that will be collected in the future (given constraints on storm events and the remoteness of sampling locations on the Pajarito Plateau). The 95% USL has a low potential for false positives (5%), although the potential for false negatives will be higher for the USL than for the UTL or UPL.

4.1.1.6 Geometric mean

The geometric mean is provided in this report as a potential BTV that brackets the lower, conservative end of potential values for characterizing background conditions. The geometric mean (or "geomean") is commonly calculated to estimate central tendency for skewed datasets (similarly to the arithmetic mean for unskewed datasets). As a measure of central tendency, it tends to be approximately similar to a median value; therefore, approximately half of all background values will exceed the geomean. The use of the geomean as a BTV is overly conservative, in that it should lead to incorrect conclusions regarding background-associated POCs at SMA sampling locations in half of all samples, in turn resulting in the installation of unnecessary control measures to reduce background conditions. For this reason, the geomean is not a recommended BTV statistic. Regardless, the geomean has been identified as a BTV statistic of interest by N3B, regulators, and stakeholders for use in the 2010 IP, so it is reported herein.

4.1.2 Additional considerations under Step 4

This section provides other considerations for the calculation of BTVs provided herein. Considerations are provided for normalization to SSC (based on results reported in Section 3.3), handling of non-detected results, and distribution assumptions for parametric statistics.

4.1.2.1 SSC-normalized statistics

Of the 51 data subsets for which BTVs are generated herein, 11 subsets are based on SSC-normalized concentrations. These BTVs are conceptually comparable to BTVs based on raw concentrations (i.e., calculated the same way), but their implementation for storm water management will differ. To apply the SSC-normalized BTVs, a representative SSC value will need to be used to normalize raw concentrations measured in future storm water samples. This could be SSC measured in a concurrent sample (e.g., in future samples), or it could be a statistic that represents the appropriate spatial context for the BTV (e.g., a percentile of SSC among relevant watersheds from historical samples). Data from concurrent samples are to be preferred.

4.1.2.2 Handling of non-detected results

Many of the water quality datasets included concentration values equal to a detection limit when the concentration may actually have been less than the detection limit. In order to account for the bias introduced into the calculation of UTLs, UPLs, and USLs by left-censored concentration data, non-detect values were estimated for all subsets, as applicable. Non-detect values were estimated using either the nonparametric KM method or parametric ROS method, depending on the subset-specific DF, sample size, potential distribution type, and number of detection limits (EPA 2013b; Annan et al.

2009; Bolks et al. 2014; Antweiler and Taylor 2008).[21,22] Neither method was appropriate to estimate non-detects when detection frequencies were < 20%, so UTLs, UPLs, and USLs were not calculated when detection frequencies were < 20% (to avoid a left-censored bias in those statistics). Instead, upper percentiles or maximum values may be more appropriate BTVs.

When the DF was < 20% and the upper percentile or maximum value was equal to a detection limit, a BTV is not reported herein (Appendix D). BTVs that are calculated as equal to a high detection limit are suspect because they are likely driven by non-detect values, which are essentially artificial. Additional considerations for BTV selection and recommendations are provided in Section 5.2.3.

4.1.3 Evaluation of potential BTVs (Step 4.2)

Distribution assumptions underpin the calculation of parametric statistics such as UTLs, UPLs, and USLs, except when nonparametric methods are used to calculate those statistics (EPA 2013b). The primary evaluation conducted in BCF Step 4 was to assess the accuracy of parametric assumptions for calculating BTVs using both Q-Q plots of detected POC concentrations and goodness-of-fit tests conducted in ProUCL (Appendix E).[23] The use of Q-Q plots is semi-quantitative, in that professional judgment is used to visually assess differences between the actual distribution and a theoretical distribution, or to visually evaluate the relative goodness-of-fit among theoretical distribution types (i.e., normal, lognormal, and gamma).[24]

If none of the theoretical distribution types were valid based on goodness-of-fit tests conducted by ProUCL or on visual evaluation of Q-Q plots, then only nonparametric UTL, UPL, and USL values were calculated and reported (Table 4-2 and Appendix D). While nonparametric statistics do not rely on distribution assumptions, they can have

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[21] ProUCL does not generate UTLs, UPLs, or USLs using the maximum likelihood estimation approach, although it is recommended in the literature for certain datasets (Bolks et al. 2014).

[22] The KM method was used in cases where there were multiple detection limits in a dataset among non-detect values and/or when the DF was between 20 and 50%. The KM method was also used when the DF was > 85% and sample size was ≥ 50. Above 85%, the KM and ROS methods are expected to result in similar estimates if both datasets are sufficiently large (n ≥ 50) (Annan et al. 2009). The ROS method was used when there was only 1 detection limit among non-detect values, the DF was between 50 and 85%, and the dataset was not large (n < 50). Also, the ROS method was used at DFs exceeding 85% when n < 50 and there was only 1 detection limit among non-detect values.

[23] This type of plot is discussed in Section 3.2 (Figure 3-3). Only detected concentrations were visually evaluated using Q-Q plots (Appendix E), because ProUCL software determines the goodness-of-fit for various distribution assumptions (by conducting statistical tests) using only detected concentrations.

[24] Two methods, the Hawkins-Wixley (HW) and Wilson-Hilferty (WH) methods, are used by ProUCL to approximate a normal distribution when calculating gamma statistics (i.e., UTLs, UPLs, and USLs). When a gamma distribution is highly skewed, the HW method results in higher BTV estimates than does the WH method. Gamma BTVs calculated using the more conservative (lower value) WH method are reported herein (Table 4-2). Both HW- and WH-based BTVs are reported in Appendix D.

similar statistical power to that of parametric statistics. Generally, nonparametric methods require large sample sizes to achieve power similar to that of parametric methods, so nonparametric UTL, UPL, and USL BTVs are less appropriate for datasets with small sample sizes (e.g., < 20 samples) (EPA 2013b). Another important characteristic of nonparametric statistics is that, using bootstrapping methods, they cannot exceed the maximum value.

4.2 RESULTS OF BACKGROUND THRESHOLD VALUE CALCULATION FOR STORM WATER DATASETS (STEP 4.3)

This section provides the results of the BTV calculations (BCF Step 4.3). Considerations regarding BTV uncertainty (BCF Step 5) are discussed in Section 4.3. The BTVs provided in Table 4-2 were developed using the methods in Section 4.1. Parametric BTVs are reported as single values or a range, depending on the validity of distribution assumptions (among normal, lognormal, and gamma). Nonparametric BTVs are also reported. All BTVs are also provided in Appendix D. In cases where there were insufficient data or detects to reasonably calculate a BTV (n < 10 or DF < 20%), then BTVs were not reported herein (or in Appendix D).

Table 4-2. Storm water background threshold values, result of BCF Step 4

Pollutant of Concern	Sample Prep.	Land-scape	Data Subset Description[a]	Units	N	DF	Distribution Assumption[b]: Based on ProUCL Test (Step 4.1)	Distribution Assumption[b]: Confirmed with Q-Q Plots (Step 4.2)	Geomean	95-95 UTL[c]: Parametric Range[d]	95-95 UTL[c]: Non-param.	95% UPL[c]: Parametric Range[d]	95% UPL[c]: Non-param.	95% USL[c]: Parametric Range[d]	95% USL[c]: Non-param.	Upper Percentiles[c]: 75th	Upper Percentiles[c]: 80th	Upper Percentiles[c]: 90th	Upper Percentiles[c]: 95th	Max.	Notes on BTVs
Aluminum	F	DBG	all locations	mg/kg SSC	76	96%	lognormal	lognormal	280	5,300	11,000	3,400	11,000	31,000	13,000	600	780	2,100	5,100	13,000	none
Aluminum	F	NBG	SEP Reference	µg/L	16	100%	all	any	1,400	4,300–9,100	3,600	3,600–5,400	6,300	4,200–8,600	3,600	2,400	2,800	3,200	3,400	3,600	limited spatial scope
Aluminum	F	NBG	Locations other than SEP Reference (major group) and E240 (d/s of SR-501)	µg/L	51	100%	lognormal	lognormal	370	2,400	2,600	1,700	4,900	5,400	6,700	570	730	1,200	1,400	6,700	none
Aluminum	F	NBG	E240 gage location (d/s of SR-501)	µg/L	14	100%	lognormal	lognormal	1,300	15,000	12,000	7,200	15,000	12,000	12,000	1,700	1,800	2,200	5,500	12,000	limited spatial scope
Aluminum	UF	DBG	all locations	mg/kg SSC	44	100%	gamma	gamma	9,100	61,000	100,000	48,000	95,000	97,000	100,000	19,000	22,000	34,000	39,000	100,000	none
Aluminum	UF	NBG	SEP and Western Reference	mg/kg SSC	39	100%	lognormal or gamma	lognormal or gamma	13,000	76,000–110,000	130,000	59,000–70,000	130,000	110,000–220,000	130,000	26,000	28,000	36,000	47,000	130,000	none
Aluminum	UF	NBG	Northern and Bandelier Reference	mg/kg SSC	30	100%	all	any	4,100	17,000–46,000	20,000	15,000–27,000	29,000	20,000–82,000	20,000	9,500	9,900	12,000	15,000	20,000	none
Arsenic	F	DBG	all locations	µg/L	113	8%	all	any	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	DF insufficient to reasonably estimate non-detect concentrations; percentiles, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Arsenic	F	NBG	all locations	µg/L	78	13%	all	any	2.3	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	6.2	DF insufficient to reasonably estimate non-detect concentrations, therefore UTLs, UPLs, and USLs are not recommended. Percentiles based on detection limits.
Boron	F	DBG	Lab Developed	µg/L	35	40%	lognormal or gamma	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	Dataset has a relatively high degree of instability, the source of which could not be identified (Appendix B, Section 9). Because of instability, no BTVs are recommended.
Boron	F	DBG	Town Developed	µg/L	77	23%	all	any	21	24–34	nr	23–30	32	28–56	nr	24	nr	nr	nr	nr	Percentiles (except 75th), maximum value, and nonparametric UTL and USL represent analytical detection limits.
Boron	F	NBG	Western and Northern Reference	µg/L	40	38%	all	any	17	25–38	nr	24–31	34	28–52	nr	20	20	23	28	nr	Maximum and non-parametric UTL, UPL, and USL represent an analytical detection limit.

Pollutant of Concern	Sample Prep.	Land-scape	Data Subset Description[a]	Units	N	DF	Distribution Assumption[b]: Based on ProUCL Test (Step 4.1)	Distribution Assumption[b]: Confirmed with Q-Q Plots (Step 4.2)	Geomean	95-95 UTL[c]: Parametric Range[d]	95-95 UTL[c]: Non-param.	95% UPL[c]: Parametric Range[d]	95% UPL[c]: Non-param.	95% USL[c]: Parametric Range[d]	95% USL[c]: Non-param.	Upper Percentiles[c]: 75th	Upper Percentiles[c]: 80th	Upper Percentiles[c]: 90th	Upper Percentiles[c]: 95th	Max.	Notes on BTVs
Boron	F	NBG	SEP and Bandelier Reference	µg/L	25	40%	all	any	17	20–23	nr	19–21	nr	21–25	nr	17	17	21	45	nr	Maximum and non-parametric UTL, UPL, and USL represent an analytical detection limit.
Benzo(a)pyrene	UF	DBG	all locations	µg/L	30	37%	all	any	0.051	0.10–0.12	0.13	0.087–0.092	0.16	0.11–0.16	0.13	0.062	0.062	0.067	0.10	0.13	none
Cadmium	F	DBG	all locations	µg/L	113	3%	normal or lognormal	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cadmium	F	NBG	all locations	µg/L	77	4%	normal or lognormal	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cobalt	F	DBG	all locations	µg/L	112	33%	lognormal	lognormal	1.6	3.2	5.2	2.9	6.6	6.1	7.2	2.3	2.8	nr	nr	7.2	none
Cobalt	F	NBG	Western and Northern Reference	µg/L	57	67%	all	lognormal	1.9	6.5	6.5	5.3	8.8	12	7.0	3.2	3.4	4.3	4.8	7.0	Review of Q-Q plot indicates lognormal as most accurate of distribution assumptions.
Cobalt	F	NBG	SEP and Bandelier Reference	µg/L	21	38%	none	none	1.2	nc	nr	nc	2.0	nc	nr	1.2	1.2	1.9	nr	nr	None of the distributions fit to the cobalt data due to the presence of a single extreme concentration. There is no clear reason to exclude the extreme value (Appendix B, Section 14). There is a high degree of uncertainty associated with all BTVs. Maximum, 95th percentile, and non-parametric UTL and USL represent detection limits.
Chromium	F	DBG	all locations	µg/L	114	13%	lognormal	none	3.6	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	33	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit. This BTV is highly uncertain because the error rate associated with the maximum is unknown.
Chromium	F	NBG	all locations	µg/L	78	8%	all	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Copper	F	DBG	Lab Developed	µg/L	33	100%	all	lognormal or gamma	5.0	14-17	13	12-13	19	18-24	13	6.8	8.1	11	12	13	Review of Q-Q plot indicates lognormal and gamma distribution assumptions as more accurate than normality.

Pollutant of Concern	Sample Prep.	Land-scape	Data Subset Description[a]	Units	N	DF	Distribution Assumption[b]: Based on ProUCL Test (Step 4.1)	Distribution Assumption[b]: Confirmed with Q-Q Plots (Step 4.2)	Geomean	95-95 UTL[c]: Parametric Range[d]	95-95 UTL[c]: Non-param.	95% UPL[c]: Parametric Range[d]	95% UPL[c]: Non-param.	95% USL[c]: Parametric Range[d]	95% USL[c]: Non-param.	Upper Percentiles[c]: 75th	Upper Percentiles[c]: 80th	Upper Percentiles[c]: 90th	Upper Percentiles[c]: 95th	Max.	Notes on BTVs
Copper	F	DBG	Town Developed	µg/L	77	99%	none	none	4.0	nc	20	nc	24	nc	26	5.2	5.9	8.0	15	26	None of the distribution types attempted explain the copper distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Copper	F	NBG	minor groups other than Bandelier	µg/L	71	82%	lognormal or gamma	lognormal or gamma	1.9	4.5-5.2	5.1	4-4.4	6.7	6.8-9.5	5.6	2.9	3.0	3.3	4.0	5.6	none
Gross alpha	UF	DBG	all locations	pCi/g SSC	46	93%	normal or gamma	normal or gamma	22	59-76	63	53-63	95	72-110	66	36	40	47	53	66	none
Gross alpha	UF	NBG	all locations	pCi/g SSC	45	96%	lognormal or gamma	lognormal	22	190	100	130	200	450	220	38	53	66	98	220	Review of Q-Q plot indicates lognormal distribution assumption as more accurate than gamma.
Mercury	UF	DBG	all locations	µg/L	83	8%	all	any (unclear)	0.073	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	0.48	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit.
Mercury	UF	NBG	Western and Northern Reference, excluding E240 gage location	µg/L	40	38%	all	any	0.094	0.23–0.31	0.60	0.20–0.22	0.40	0.29–0.57	0.60	0.14	0.17	0.21	0.29	0.60	none
Mercury	UF	NBG	SEP and Bandelier Reference	µg/L	21	43%	none	none	0.079	nc	0.42	nc	0.42	nc	0.42	0.079	0.079	0.10	0.11	0.42	None of the distributions fit the mercury data due to the presence of a single extreme concentration. There does not appear to be a clear reason to exclude the single high value (Appendix B, Section 20).
Nickel	F	DBG	all locations	µg/L	112	94%	lognormal or gamma	lognormal or gamma	1.5	4.4–4.8	4.4	3.9–4.1	7.6	7.6–11	11	2.2	2.4	3.1	3.8	11	none
Nickel	F	NBG	Chupaderos, Garcia, and Mortandad	µg/L	18	100%	all	lognormal or gamma	1.9	4.8–5.4	4.5	3.8–4.1	6.1	4.9–5.5	4.5	2.5	2.6	3.1	3.6	4.5	Review of Q-Q plot indicates lognormal and gamma distribution assumptions as more accurate than normality.
Nickel	F	NBG	Watersheds other than Chupaderos, Garcia, and Mortandad	µg/L	60	88%	gamma	gamma	0.99	2.4	2.1	2.2	3.9	3.5	4.6	1.4	1.5	1.7	1.8	4.6	none

Pollutant of Concern	Sample Prep.	Land-scape	Data Subset Description[a]	Units	N	DF	Distribution Assumption[b] Based on ProUCL Test (Step 4.1)	Distribution Assumption[b] Confirmed with Q-Q Plots (Step 4.2)	Geomean	95-95 UTL[c] Parametric Range[d]	95-95 UTL[c] Non-param.	95% UPL[c] Parametric Range[d]	95% UPL[c] Non-param.	95% USL[c] Parametric Range[d]	95% USL[c] Non-param.	Upper Percentiles[c] 75th	Upper Percentiles[c] 80th	Upper Percentiles[c] 90th	Upper Percentiles[c] 95th	Max.	Notes on BTVs
Lead	F	DBG	all locations	µg/L	114	29%	none	none	0.87	nc	7.1	nc	22	nc	50	nr	nr	nr	2.9	50	None of the distribution types attempted explain the lead distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset apart from several percentiles which are equal to a detection limit.
Lead	F	NBG	minor groups other than Bandelier	µg/L	73	51%	none	none	0.72	nc	4.6	nc	6.6	nc	10	0.91	0.99	1.5	2.2	10	None of the distribution types attempted explain the lead distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Total PCBs	UF	DBG	minor watersheds other than South Fork Acid	µg/L	87	100%	lognormal	lognormal	0.0046	0.064	0.13	0.044	0.14	0.33	0.19	0.012	0.014	0.028	0.048	0.19	none
Total PCBs	UF	DBG	South Fork Acid	µg/L	9	100%	lognormal or gamma	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	Insufficient samples to estimate BTVs.
Total PCBs	UF	NBG	Northern and Western Reference	µg/L	41	100%	lognormal	lognormal	0.0010	0.058	0.13	0.027	0.098	0.25	0.13	0.0043	0.0055	0.012	0.017	0.13	none
Total PCBs	UF	NBG	SEP Reference	µg/L	9	100%	none	none	nr	nc	nr	nc	nr	nc	nr	nr	nr	nr	nr	nr	Insufficient samples to estimate BTVs.
Radium-226 and radium-228	UF	DBG	all locations	pCi/g SSC	39	62%	lognormal or gamma	lognormal	3.0	17	27	12	25	36	27	5.4	6.1	10	11	27	Review of Q-Q plot indicated that lognormal distribution assumption was more accurate than gamma (based on upper tail of distribution).
Radium-226 and radium-228	UF	NBG	all locations	pCi/g SSC	13	85%	lognormal or gamma	lognormal or gamma	2.5	15–23	15	9.4–11	19	12–17	15	3.5	4.1	7.5	11	15	none
Antimony	F	DBG	all locations	µg/L	111	15%	gamma	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	There appears to be instability in this dataset (Appendix B, Section 5), but the source of the instability cannot be determined; thus, BTVs are recommended.

Pollutant of Concern	Sample Prep.	Land-scape	Data Subset Description[a]	Units	N	DF	Distribution Assumption[b]		Geomean	95-95 UTL[c]		95% UPL[c]		95% USL[c]		Upper Percentiles[c]				Max.	Notes on BTVs
							Based on ProUCL Test (Step 4.1)	Confirmed with Q-Q Plots (Step 4.2)		Parametric Range[d]	Non-param.	Parametric Range[d]	Non-param.	Parametric Range[d]	Non-param.	75th	80th	90th	95th		
Selenium	UF	DBG	all locations	µg/L	88	5%	all	none	2.4	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	15	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit.
Selenium	UF	NBG	Watersheds other than Mortandad	µg/L	71	32%	lognormal or gamma	lognormal or gamma	2.0	7.0–7.2	15	5.6–6.0	15	16–13	17	2.5	3.5	4.8	7.5	17	none
Thallium	F	DBG	all locations	µg/L	113	3%	normal or lognormal	none	0.68	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	Percentiles, maximum, and nonparametric UTL and USL represent an analytical detection limit. Insufficient DF to estimate parametric statistics. Although the geomean was estimated as a BTV (approximately 10% of LANL's 2010 IP ATAL), geomeans are generally not recommended for use as BTVs. The geomean BTV is highly uncertain due to the low DF.
Uranium	F	DBG	all locations	µg/L	101	38%	none	none	0.095	nc	0.33	nc	0.59	nc	0.98	0.12	0.19	0.20	0.22	0.98	None of the distribution types attempted explain the uranium distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Uranium	F	NBG	Watersheds other than Mortandad and Jemez River	µg/L	53	68%	lognormal	lognormal	0.12	0.68	0.70	0.49	0.83	1.6	0.71	0.19	0.23	0.31	0.48	0.71	none
Uranium	F	NBG	Jemez River	µg/L	8	50%	all	none	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	nr	Insufficient samples to estimate BTVs.

Pollutant of Concern	Sample Prep.	Land-scape	Data Subset Description[a]	Units	N	DF	Distribution Assumption[b] Based on ProUCL Test (Step 4.1)	Distribution Assumption[b] Confirmed with Q-Q Plots (Step 4.2)	Geomean	95-95 UTL[c] Parametric Range[d]	95-95 UTL[c] Non-param.	95% UPL[c] Parametric Range[d]	95% UPL[c] Non-param.	95% USL[c] Parametric Range[d]	95% USL[c] Non-param.	Upper Percentiles[c] 75th	Upper Percentiles[c] 80th	Upper Percentiles[c] 90th	Upper Percentiles[c] 95th	Max.	Notes on BTVs
Vanadium	F	DBG	all locations	µg/L	113	96%	none	none	2.6	nc	9.7	nc	18	nc	24	3.9	4.4	5.5	8.2	24	None of the distribution types attempted explain the vanadium distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Vanadium	F	NBG	Watersheds other than Mortandad	µg/L	74	93%	none	none	2.3	nc	8.8	nc	27	nc	49	3.2	3.4	4.3	4.9	49	None of the distributions fit the vanadium data due to the presence of 1 or 2 extreme concentrations. There does not appear to be a clear reason to exclude the high values (Appendix B, Section 29).
Zinc	F	DBG	all locations	µg/L	114	91%	gamma	gamma	25	120	120	100	180	240	140	55	58	77	100	140	none
Zinc	F	NBG	Watersheds other than Garcia	µg/L	72	62%	none	none	5.4	nc	31	nc	35	nc	43	7.2	7.6	10	16	43	None of the distribution types attempted explain the zinc distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.

Note: Recommended BTVs among those presented in Table 4-2 are provided in Section 5 and Appendix G. Appendix D provides an expanded version of Table 4-2.

[a] Subsets were generated in Section 3 (Table 3-4). Subsets are reasonably stable over space and time and sufficiently large for ProUCL software to calculate BTVs.

[b] The selected distribution (confirmed with Q-Q plots) is based on results of goodness-of-fit tests conducted in ProUCL and visual confirmation with Q-Q plots. “Any” indicates that all three of the distributions (i.e., normal, lognormal, and gamma) appear valid. “None” indicates that none of the distributions appear valid (e.g., because of low number of detections resulting in high uncertainty in distribution selection).

[c] No potential BTV values are reported in cases where parametric statistics are not warranted (i.e., no distribution assumption is valid, or all assumptions are unclear due to low DF or number of detected samples). In this case, the value “nc” is reported instead of a BTV. The value “nr” is reported for BTVs that are not recommended; see the “Note on BTVs” column for rationale. These values are reported in Appendix D, with table cells shaded gray.

[d] A range of values is provided for parametric statistics when multiple distribution types appeared to be reasonable (based on both statistical tests and visualizing Q-Q plots). Though both the WH and HW methods are valid for calculating gamma BTVs, results based on the WH method are provided in Table 4-2. The WH method results in more conservative (lower) gamma BTVs when the distribution is highly skewed (EPA 2013b). Table 4-2 is similar to the table in Appendix D, although more information is provided in Appendix D about each data subset and individual parametric BTVs.

BCF – background characterization framework
BTV – background threshold value
d/s – downstream
DBG – developed background
DF – detection frequency
F – filtered
HW – Hawkins-Wixley
n – sample size
NBG – natural background
nc – not calculated
nr – not recommended/not reported
PCB – polychlorinated biphenyl
pCi – picocurie
Q-Q – quantile-quantile
SEP – Supplemental Environmental Project
SR – state route
SSC – suspended sediment concentration
UPL – upper prediction limit
USL – upper simultaneous limit
UF – unfiltered
UTL – upper tolerance limit
WH – Wilson-Hilferty

4.3 UNCERTAINTY OF BACKGROUND THRESHOLD VALUES (STEP 5)

This section reviews general limitations and points of uncertainty regarding the methods, analyses, and results described in Table 4-2. Some uncertainties associated with specific data subsets and related BTV statistics calculated herein are provided in Table 4-2 (and Appendix D). In addition, the following limitations and uncertainties should be considered:

- There are often multiple distribution types that are reasonable for describing the background water quality for Pajarito Plateau surface waters and storm water discharges. Ranges of values are provided in Table 4-2 (and multiple values are reported in Appendix D) to quantify the uncertainty associated with different distribution assumptions. Nonparametric BTVs are also provided for comparison.
- The semi-quantitative assessment of goodness-of-fit of distribution types (Step 4.2) introduces some inherent uncertainty into the BCF and resulting BTV calculations. The visual assessment of Q-Q plots (Appendix E) is based on professional judgment. However, uncertainties associated with professional judgment may be offset by the fully quantitative goodness-of-fit tests (conducted by ProUCL) that provide objective evaluations of distribution fits (Appendix F). These two LOEs are used to confirm a theoretical distribution type using a weight-of-evidence approach. When none of the distributions clearly fit the storm water concentration data subsets, there remains some uncertainty of stability (potentially resulting from the presence of extreme values or undiscerned factors).
- The inclusion of non-detected values in data subsets introduces left-censored bias into the datasets, which can influence the calculation of BTVs (due to the artificial reduction in dataset variability). This tendency is overcome, to some extent, by applying various estimation techniques to replace non-detect values (using ProUCL). These methods have varying degrees of accuracy (for calculating summary statistics) depending on the particular dataset, the DF, the number of unique detection limits, and the sample size. Recommendations from the literature regarding appropriate methods were considered and applied for each data subset. The methods applied for each dataset are noted in Appendix D.

5 Applicability of BTVs to the 2010 IP and 2015 Draft IP

Section 5 describes the utility and applicability of the BTVs that were calculated in Section 4 to LANL's 2010 IP (and other relevant storm water programs) and includes recommendations for which BTVs among those reported in Table 4-2 should be used for purposes of the 2010 IP. Section 5.1 outlines the relationship between BTVs and LANL storm water compliance monitoring under the 2010 IP. Section 5.2 provides a comparison of BTVs to 2010 IP TALs and 2015 draft IP TALs (among other values). Appendix G provides a more comprehensive, tabular summary of comparisons between BTVs and other relevant storm water concentration thresholds, including but not limited to 2010 or 2015 draft IP TALs.

5.1 Relationship Between BTVs and LANL's 2010 IP Compliance Monitoring Program

This section provides an outline of how the BTVs relate to the storm water collection program currently underway at LANL to monitor compliance with the 2010 IP:

- The water quality POCs evaluated in this report are limited to those specified in the LANL 2010 IP.
- LANL's 2010 IP is a NPDES permit for storm water discharges from "Sites," defined as SWMUs and AOCs under a Resource Conservation and Recovery Act (RCRA) consent order. Sites are sampled at SMAs.
- LANL's first IP was issued in 2010 as a replacement permit under the Federal Facilities Compliance Act (FFCA), effective between approximately 2005 and 2010. The FFCA permit replaced the EPA NPDES MSGP,[25] which was effective between 2000 and 2005. The 2010 IP acknowledged that background concentrations could be taken into account, but the 2010 IP provided no guidance or further details on how to use background conditions to alter the 2010 IP TALs. LANL submitted an IP renewal application in 2014. EPA issued a draft IP in 2015, which included additional details for consideration of background as part of the "Site Contributing Evaluation" process.
- The NMED issued its §401 certification in 2015, which directed EPA to add expanded language on the use of background and overlaid some additional requirements for EPA to integrate into the final IP (namely the Sampling Implementation Plan [SIP], which is described below). The draft 2015 IP provides the current context for BTVs developed herein; BTVs may need to be revisited as appropriate after the IP is finalized.

[25] An EPA MSGP is intended for industrial storm water discharges, but it was used as an initial NPDES permit for LANL's RCRA Sites.

- Under the 2010 IP, storm water runoff is sampled at a location that is representative of discharges from one or more Sites (i.e., the SMA). The SMA sampling locations may also include runoff generated by urban development, such as roads, parking lots, and buildings that are within the SMA drainage area but that are not part of a Site. Such typical urban runoff is not regulated by the 2010 IP, but it may contribute to exceedances of 2010 IP TALs.
- In the 2010 IP and 2015 draft IP, EPA set numeric TALs for specific POCs based on New Mexico WQS (e.g., for aquatic life, human health, and livestock watering). When SMA storm water sample concentrations exceed TALs, certain corrective actions are triggered (e.g., construction of engineered controls). Some New Mexico WQS for metals have changed since the 2010 IP, so maximum target action levels (MTALs) in the 2015 draft IP reflect those changes (EPA 2015a). The 2015 draft MTALs for hardness-dependent metals vary for each minor canyon drainage as a function of historical hardness data (Appendix F to the 2015 draft IP Fact Sheet), rather than being based on a static 30-mg/L hardness assumption. BTVs for some storm water POCs exceed the MTALs (Appendix G).
- The 2015 draft IP (specifically subsection I.D.1(a).ii) allows SMA concentrations to be compared to background concentrations generated from local (i.e., site-specific) or literature-based natural or developed background datasets. LANL recognizes that such background levels (i.e., NBG/baseline and DBG BTVs) could supersede TALs in compliance decision making.

5.2 Comparison of BTVs to 2010 and Draft IP TALs and Other Relevant Thresholds

This section provides a comparison of the BTVs generated in Section 4 to current TALs specified in the 2010 IP (EPA 2010), the proposed new TALs reflected in the 2015 draft IP (EPA 2015a), and previous LANL BTVs (i.e., UTLs). In addition, potential acute water quality thresholds for copper, lead, zinc, and aluminum (Windward 2018) are compared to BTVs. These thresholds are each described briefly, then compared graphically and in a tabular summary. Appendix G provides a comprehensive tabular comparison of BTVs and the other relevant thresholds.

5.2.1 Description of thresholds

This section describes the various storm water concentration thresholds that are compared to BTVs in Section 5.2.4.

5.2.1.1 Individual permit target action levels

The 2010 IP requires compliance with MTALs and average target action levels (ATALs), both of which are based on New Mexico WQC. Typically, MTALs are based on acute aquatic life WQC, and ATALs are based on human health WQC. Of the 2010 IP TALs, only the hardness-based MTALs for metals take into account local water quality variability. In this case, the 2010 IP metals MTALs are based on a geometric mean hardness of 30 mg/L measured across all LANL waters, while the 2015 draft IP metals MTALs are based on watershed-specific hardness values, with a total of 25 different canyon-specific MTALs specified in Appendix F of the fact sheet for the 2015 draft IP.

5.2.1.2 Acute Water Quality Criteria

For copper, lead, zinc, and aluminum, acute aquatic life water quality threshold values are provided herein based on the biotic ligand model (BLM),[26] EPA's proposed aluminum WQC (EPA 2017), and current New Mexico WQC. The criteria are provided as instantaneous water quality criteria (IWQC) that are based on sample-specific water chemistry datasets collected by LANL at 12 NBG locations and 36 surface water gage stations located within or downstream of the Laboratory.[27] The IWQC are provided herein as a range of median values from 17 locations that had 10 or more BLM datasets.[28] For aluminum, IWQC are also provided on the basis of EPA's draft ambient WQC, which employs a multiple linear regression (MLR)-approach to generate IWQC (EPA 2017).

In addition, fixed monitoring benchmarks (FMBs) are provided for BLM-based IWQC and aluminum MLR-based IWQC (EPA 2017). FMBs relate patterns in IWQC to observed concentrations over time (EPA 2012; Ryan et al. 2018), providing a single value that corresponds to a given exceedance frequency of BLM IWQC concentrations (i.e., a once-in-three-years basis, typical of state and federal ambient WQC).

5.2.1.3 Previous LANL BTVs

In 2012 and 2013, LANL characterized NBG and DBG concentrations for PCBs, metals, and radionuclides (LANL 2012, 2013). For total PCBs, LANL developed 95% UTLs on the 90th percentile (95-90 UTLs) of DBG and baseline concentrations; for metals and radionuclides, LANL developed 95-95 UTLs (consistent with the BTVs calculated in Section 4). Metal and radionuclide UTLs were calculated for filtered, unfiltered, and SSC-normalized datasets, and PCB UTLs were calculated for unfiltered concentrations. The datasets and methods used by LANL in 2012 and 2013 to develop BTVs differ from the current LANL dataset and methods in several ways; known and potential differences are described in Appendix A.

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[26] Specifically, EPA's 2007 nationally recommended freshwater aquatic life criteria for copper (EPA 2007) based on the BLM, and BLM-based aquatic life criteria for lead, zinc, and aluminum developed consistently with EPA guidelines (EPA 1985) as described in DeForest et al. (2017); DeForest and Van Genderen (2012); and Santore et al. (2018).

[27] Data for the locations within or downstream of the Laboratory were not evaluated in Sections 3 and 4 because they do not represent background.

[28] A BLM dataset is defined as a single sample with enough water quality parameter data to calculate an IWQC for that sample.

5.2.2 Consideration of SSC

Datasets for aluminum, gross alpha, and radium-226 and radium-228 were significantly correlated with SSC (Table 3-4), and the normalization of those datasets to SSC resulted in more stable distributions (over spatial and temporal scales). In the future, BTVs based on SSC-normalized data can be compared with POC values in SMA samples by measuring SSC at the same time as the POC of interest. However, historical storm water datasets do not always include paired SSC data, nor were historical BTVs always calculated for SSC-normalized datasets; therefore, for the purposes of comparing SSC-normalized BTVs to aqueous (non-SSC normalized) thresholds herein, SSC-normalized BTVs have been transformed from units of mg/kg SSC or picocurie (pCi)/g SSC to µg/L or pCi/L (aqueous), making the BTVs comparable to non-normalized thresholds. This transformation was accomplished by multiplying the SSC-normalized BTVs by the 25th, 50th, and 75th percentile SSC values from respective DBG or NBG datasets (as well as a unit conversion factor of 0.001). The result is a range of hypothetical BTVs that can be compared with non-normalized TALs and previous LANL UTLs, across a range considered "typical" of developed or undeveloped landscapes. Based on the current LANL dataset used to calculate BTVs, the 25th-, 50th-, and 75th-percentile SSC values for DBG landscapes are 200, 318, and 3,510 mg/L, respectively, and the analogous statistics for NBG landscapes are 900, 4,410, and 10,200 mg/L, respectively.

5.2.3 BTV recommendations

This section provides rationale for recommending and selecting BTVs for the purpose of evaluating storm water samples collected for 2010 IP compliance monitoring. BTVs are recommended based on the following decision steps:

Step 1. Sample size is recommended to be at least 10 samples. If 10 or more samples exist, proceed to Step 2. If fewer than 10 samples exist, a BTV is not recommended.

Step 2. DF is recommended to be at least 20%. If the DF is greater than 20%, proceed to Step 3b. If not, proceed to Step 3a.

Step 3a. BTVs for highly left-censored datasets should not be equal to a detection limit. If either statistic is not equal to a detection limit, then use the more conservative of the 95th percentile and maximum value.[29] If either statistic is equal to a detection limit, then do not use that statistic.[30]

[29] The 90th percentile for NBG cobalt at SEP and Bandelier locations is recommended over either the 95th percentile or maximum value (Table 5-1). The 95th percentile and maximum values are both equal to high detection limits, whereas the 90th percentile is equal to the maximum detected concentration.

[30] Analytical results reported as less than the detection limit are reported in the LANL database as the detection limit. Percentile or maximum values were not recommended as BTVs if the concentration was below an analytical detection limit.

Step 3b. If a distribution is valid for a data subset, use a parametric 95-95 UTL. If multiple distribution types are reasonable, select the distribution assumption that yields the most conservative 95-95 UTL. If no distribution appears valid, and there are more than 20 samples, use a non-parametric 95-95 UTL. Otherwise, consider the 95th percentile or maximum value as a BTV (Step 3a).[31]

Additional rationale for selecting the 95-95 UTL over other potential BTV statistics is provided in Section 4.1.1.

5.2.4 BTV Comparisons

This section provides a comparison of the recommended 2018 BTVs to 2010 IP and 2015 draft IP TALs, historical LANL BTVs, and other relevant storm water threshold concentrations. Table 5-1 provides a tabular summary of these comparisons, and Table 5-2 provides a summary of key comparisons (i.e., BTVs that exceed current or draft IP TALs), which indicate that BTVs will be useful for IP compliance monitoring purposes. All of the BTVs, 2010 and draft 2015 IP TALs, and other water quality thresholds are also described in tabular form in Appendix G.

Figures 5-1 through 5-9 compare BTVs, 2010 and draft 2015 IP TALs, and new WQC-based thresholds (as applicable for copper, lead, zinc and aluminum). Figure 5-1 provides a generic example with detailed notes explaining what is shown in Figures 5-2 through 5-9. Figures 5-2 through 5-6 compare BTVs and the new water quality thresholds for aluminum (filtered and unfiltered), filtered copper, lead, and zinc, respectively. Figures 5-7 through 5-9 provide comparisons of gross alpha, radium-226 and radium-228, and total PCB BTVs, respectively, with previous LANL UTLs and applicable 2010 and draft 2015 IP TALs. [32]

[31] ProUCL technical guidance indicates that nonparametric bootstrap methods are suitable for datasets with more than 20 samples (EPA 2013b).

[32] Figures were not developed for all datasets (Table 3-4), but BTVs for all datasets are provided in Appendix G with comparisons to other thresholds, as available. The figures included herein are meant to be illustrative rather than comprehensive.

Table 5-1. Recommended BTVs with comparison to previous BTVs and Current and Draft IP TALs

								IP TALs (µg/L or pCi/L)[c]			Historical LANL BTVs[c]			
Pollutant of Concern	Sample Prep.	Landscape	Data Subset Description	Selected Distribution Assumption[a]	Suggested Statistic	BTV Units	Recommended 2018 BTV[b]	2010 IP ATAL	2010 IP MTAL	2015 Draft IP MTAL (Range)[d]	Northern Reference (LANL 2013)	Western Boundary (LANL 2013)	Baseline (LANL 2012)	Urban (LANL 2012, 2013)
Aluminum	F	developed	all locations	lognormal	95-95 UTL	mg/kg SSC	5,300	—	—	na	—		—	91,500 (total Al)
Aluminum	F	undeveloped	E240 gage location (d/s of SR-501)	lognormal	95-95 UTL	µg/L	15,000	—	—	270–4,100	2,210	1,780	—	—
Aluminum	F	undeveloped	locations other than SEP Reference (major group) and E240 (d/s of SR-501)	lognormal	95-95 UTL	µg/L	2,400	—	—	270–4,100	2,210	1,780	—	—
Aluminum	F	undeveloped	SEP Reference	normal	95-95 UTL	µg/L	4,300	—	—	270–4,100	2,210	1,780	—	—
Aluminum	UF	developed	all locations	gamma	95-95 UTL	mg/kg SSC	61,000	—	—	na	—	—	—	91,500
Aluminum	UF	undeveloped	Northern and Bandelier Reference	normal	95-95 UTL	mg/kg SSC	17,000	—	—	na	29,000	53,030	—	—
Aluminum	UF	undeveloped	SEP and Western Reference	gamma	95-95 UTL	mg/kg SSC	76,000	—	—	na	29,000	53,030	—	—
Antimony	F	developed	all locations	none	nr	na	nr (instability)	640	—	—	—	—	—	9.25
Arsenic	F	developed	all locations	none	nr	na	nr (n < 10)	9	340	—	—	—	—	2.55
Arsenic	F	undeveloped	all locations	none	maximum	µg/L	6.2	9	340	—	—	—	—	—
Benzo(a)pyrene	UF	developed	all locations	normal	95-95 UTL	µg/L	0.10	0.18	—	—	—	—	—	—
Boron	F	developed	Lab Developed	nonparametric	nr	na	nr (instability)	5,000	—	—	—	—	—	47.3
Boron	F	developed	Town Developed	normal	95-95 UTL	µg/L	24	5,000	—	—	—	—	—	47.3
Boron	F	undeveloped	SEP and Bandelier Reference	normal	95-95 UTL	µg/L	20	5,000	—	—	30	—	—	—
Boron	F	undeveloped	Western and Northern Reference	normal	95-95 UTL	µg/L	25	5,000	—	—	30	—	—	—
Cadmium	F	developed	all locations	none	nr	na	nr (DF < 20%)	—	0.6	0.34 -1.9	—	—	—	0.36
Cadmium	F	undeveloped	all locations	none	nr	na	nr (DF < 20%)	—	0.6	0.34 -1.9	—	—	—	—
Chromium	F	developed	all locations	none	maximum	µg/L	33	—	210	—	—	—	—	4.07
Chromium	F	undeveloped	all locations	none	nr	na	nr (DF < 20%)	—	210	—	—	—	—	—
Cobalt	F	developed	all locations	lognormal	95-95 UTL	µg/L	3.2	1,000	—	—	—	—	—	9.2
Cobalt	F	undeveloped	SEP and Bandelier Reference	nonparametric	90th percentile[e]	µg/L	1.9	1,000	—	—	7.53	4.64	—	—
Cobalt	F	undeveloped	Western and Northern Reference	lognormal	95-95 UTL	µg/L	6.5	1,000	—	—	7.53	4.64	—	—
Copper	F	developed	Lab Developed	gamma	95-95 UTL	µg/L	14	—	4.3	2.4–15	—	—	—	32.3
Copper	F	developed	Town Developed	nonparametric	95-95 UTL	µg/L	20	—	4.3	2.4–15	—	—	—	32.3
Copper	F	undeveloped	minor groups other than Bandelier	gamma	95-95 UTL	µg/L	4.5	—	4.3	2.4–15	3.43	5.7	—	—
Gross alpha	UF	developed	all locations	normal	95-95 UTL	pCi/g	59	na	—	—	—	—	—	118
Gross alpha	UF	undeveloped	all locations	lognormal	95-95 UTL	pCi/g	190	na	—	—	184	82.1	—	—
Lead	F	developed	all locations	nonparametric	95-95 UTL	µg/L	7.1	—	17	8.3–75	—	—	—	3.3
Lead	F	undeveloped	minor groups other than Bandelier	nonparametric	95-95 UTL	µg/L	4.6	—	17	8.3–75	9.03	—	—	—

Pollutant of Concern	Sample Prep.	Landscape	Data Subset Description	Selected Distribution Assumption[a]	Suggested Statistic	BTV Units	Recommended 2018 BTV[b]	IP TALs (µg/L or pCi/L)[c] 2010 IP ATAL	2010 IP MTAL	2015 Draft IP MTAL (Range)[d]	Historical LANL BTVs[c] Northern Reference (LANL 2013)	Western Boundary (LANL 2013)	Baseline (LANL 2012)	Urban (LANL 2012, 2013)
Mercury	UF	developed	all locations	none	maximum	µg/L	0.48	0.77	1.4	—	—	—	—	—
Mercury	UF	undeveloped	SEP and Bandelier Reference	nonparametric	95-95 UTL	µg/L	0.42	0.77	1.4	—	—	—	—	—
Mercury	UF	undeveloped	Western and Northern Reference, excluding E240 gage location	normal	95-95 UTL	µg/L	0.23	0.77	1.4	—	—	—	—	—
Nickel	F	developed	all locations	gamma	95-95 UTL	µg/L	4.4	—	170	99–730	—	—	—	7.57
Nickel	F	undeveloped	Chupaderos, Garcia, and Mortandad	gamma	95-95 UTL	µg/L	4.8	—	170	99–730	3.53	1.54	—	—
Nickel	F	undeveloped	watersheds other than Chupaderos, Garcia, and Mortandad	gamma	95-95 UTL	µg/L	2.4	—	170	99–730	3.53	1.54	—	—
Radium-226 and radium-228	UF	developed	all locations	lognormal	95-95 UTL	pCi/g	17	na	—	—	52.7	—	—	78.1
Radium-226 and radium-228	UF	undeveloped	all locations	gamma	95-95 UTL	pCi/g	15	na	—	—	6.3	39	—	—
Selenium	UF	developed	all locations	none	maximum	µg/L	15	5	20	—	—	—	—	—
Selenium	UF	undeveloped	watersheds other than Mortandad	lognormal	95-95 UTL	µg/L	7.0	5	20	—	—	—	—	—
Thallium	F	developed	all locations	none	nr	na	nr (DF < 20%)	6.3	—	—	—	—	—	—
Total PCBs	UF	developed	minor watersheds other than South Fork Acid	lognormal	95-95 UTL	µg/L	0.064	0.00064	—	—	—	—	—	0.098
Total PCBs	UF	developed	South Fork Acid	none	nr	na	nr (n < 10)	0.00064	—	—	—	—	—	0.098
Total PCBs	UF	undeveloped	Northern and Western Reference	lognormal	95-95 UTL	µg/L	0.058	0.00064	—	—	—	—	0.013	—
Total PCBs	UF	undeveloped	SEP Reference	none	nr	na	nr (n < 10)	0.00064	—	—	—	—	0.013	—
Uranium	F	developed	all locations	nonparametric	95-95 UTL	µg/L	0.33	—	—	—	—	—	—	—
Uranium	F	undeveloped	Jemez River	none	nr	na	nr (n < 10)	—	—	—	0.52	—	—	—
Uranium	F	undeveloped	watersheds other than Mortandad and Jemez River	lognormal	95-95 UTL	µg/L	0.68	—	—	—	0.52	—	—	—
Vanadium	F	developed	all locations	nonparametric	95-95 UTL	µg/L	9.7	100	—	—	—	—	—	10.6
Vanadium	F	undeveloped	watersheds other than Mortandad	nonparametric	95-95 UTL	µg/L	8.8	100	—	—	5.77	5.86	—	—
Zinc	F	developed	all locations	gamma	95-95 UTL	µg/L	120	—	42	30–180	—	—	—	1,120
Zinc	F	undeveloped	watersheds other than Garcia	nonparametric	95-95 UTL	µg/L	31	—	42	30–180	109	43.3	—	—

Note: IP TALs reported as "na" are based on units incomparable with the new BTV (due to SSC normalization). Appendix G provides an expanded version of Table 5-1.

a Distribution assumptions were evaluated using goodness-of-fit statistical tests (Appendix F) and visual inspection of Q-Q plots (Appendix E). If no distribution appeared to be reasonable, then "none" is reported.

b If no value could be recommended, "nr" is reported; the reason is provided in parentheses as either "n < 10" (i.e., sample size is too small) or "DF < 20%" (i.e., DF is too low).

c Values reported in IP documents or LANL (2012, 2013) reports. If no applicable value exists for a given POC, landscape, and basis, then "—" is reported. If the existing IP TAL is not in the same units as the BTV, then "na" is reported.

d The range of 2015 draft IP TALs for metals is based on watershed-specific hardness-adjusted criteria. The range corresponds to the minimum and maximum TALs (draft) among watersheds regulated under LANL's IP.

e The 90th percentile value was selected in one case because the nonparametric UTL, maximum, and 95th percentile values were all equal to high detection limits (2.4 and 5.0 µg/L). The 90th percentile is equivalent to the maximum detected concentration (1.9 µg/L).

ATAL – average target action level
BTV – background threshold value
d/s – downstream
DF – detection frequency
F – filtered
IP – Individual Permit
LANL – Los Alamos National Laboratory
MTAL – maximum target action level
n – sample size
na – not applicable
nr – none recommended
PCB – polychlorinated biphenyl
pCi – picocurie
Q-Q – quantile-quantile
SEP – Supplemental Environmental Project
SR – state route
SSC – suspended sediment concentration
TAL – target action level
UF – unfiltered
UTL – upper tolerance limit

Table 5-2. Review of BTVs equal to or exceeding 2010 or draft 2015 IP TALs

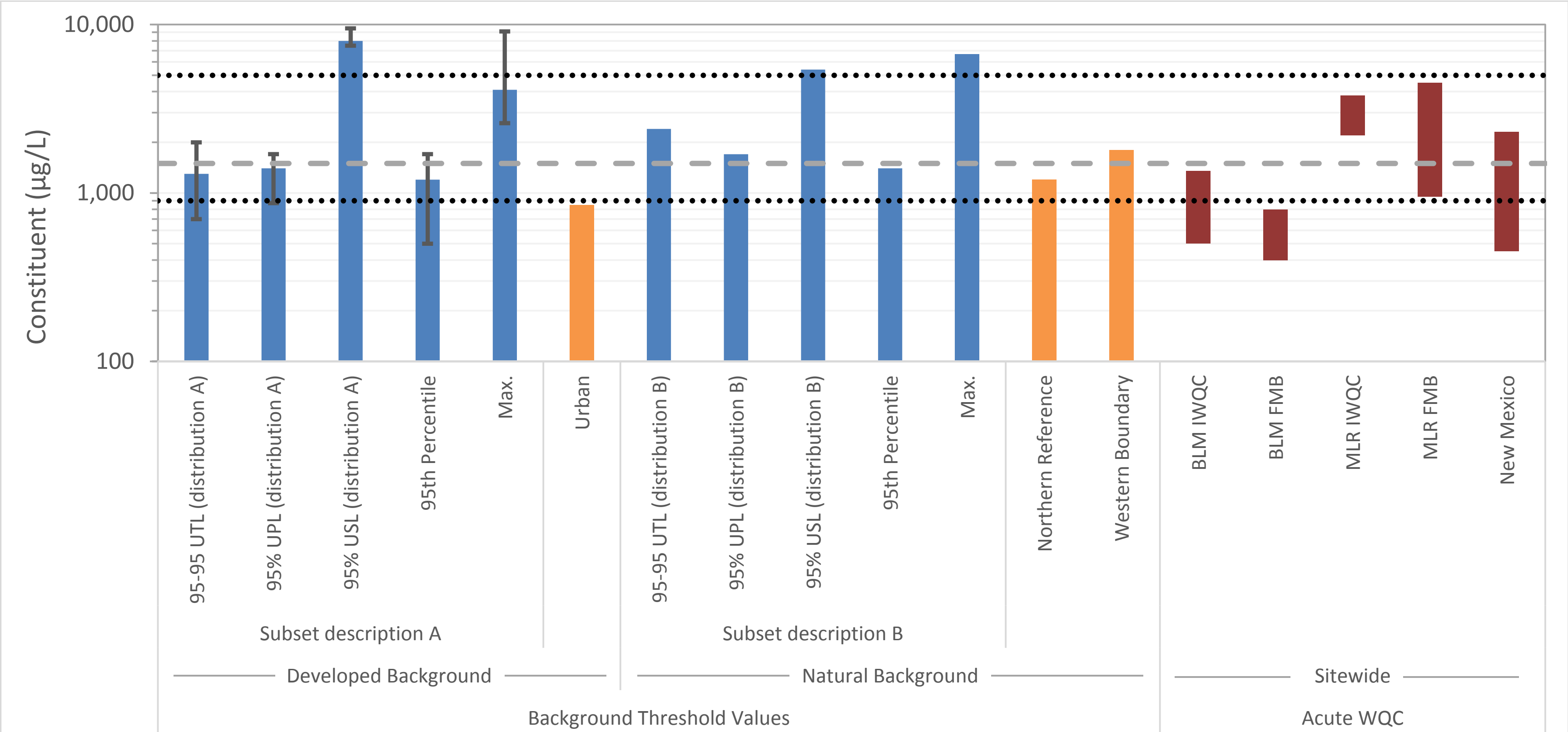
Pollutant of Concern	Sample Prep.	Landscape	Data Subset Description	2010 IP ATAL	2010 IP MTAL	2015 Draft IP MTAL (Range)	Notes
Aluminum	F	undeveloped	E240 gage location (d/s of SR-501)			+	Limited spatial range and elevated aluminum make the BTV for this dataset of questionable use for the SIP process; BTV is uncertain due to relatively small dataset (n = 14).
Aluminum	F	undeveloped	locations other than SEP Reference and E240 (d/s of SR-501)			=	BTV is within the range of draft MTALs, so it may provide support for alternative compliance in some watersheds, but not all. This BTV is the most broadly applicable over space. Although the 2010 IP MTAL is based on total aluminum, this BTV for filtered aluminum exceeds that IP.
Aluminum	F	undeveloped	SEP Reference			+	Limited spatial range exists for this BTV. BTV is uncertain due to relatively small dataset (n = 16).
Aluminum	UF	developed	all locations		na[a]		Unfiltered aluminum BTVs will likely provide support for alternative compliance (Figure 5-3).
Aluminum	UF	undeveloped	Northern and Bandelier Reference		na[a]		Unfiltered aluminum BTVs will likely provide support for alternative compliance (Figure 5-3).
Aluminum	UF	undeveloped	SEP and Western Reference		na[a]		Unfiltered aluminum BTVs will likely provide support for alternative compliance (Figure 5-3).
Copper	F	developed	Lab Developed		+	=	The BTV provides a reasonable LOE for alternative compliance, but the BLM provides a much stronger LOE.
Copper	F	developed	Town Developed		+	+	The BTV provides a reasonable LOE for alternative compliance, but the BLM provides a much stronger LOE.
Copper	F	undeveloped	minor groups other than Bandelier		+	=	The BTV provides a reasonable LOE for alternative compliance, but the BLM provides a much stronger LOE.
Gross alpha	UF	developed	all locations	na[a]			Unfiltered gross alpha BTVs will likely provide support for alternative compliance (Figure 5-7).
Gross alpha	UF	undeveloped	all locations	na[a]			Unfiltered gross alpha BTVs will likely provide support for alternative compliance (Figure 5-7).

Pollutant of Concern	Sample Prep.	Landscape	Data Subset Description	2010 IP ATAL	2010 IP MTAL	2015 Draft IP MTAL (Range)	Notes
Radium-226 and radium-228	UF	developed	all locations	na[a]			Unfiltered DBG radium BTVs will likely not provide support for alternative compliance (Figure 5-8).
Radium-226 and radium-228	UF	undeveloped	all locations	na[a]			Unfiltered NBG radium BTVs will likely provide support for alternative compliance (Figure 5-8). The BTV is uncertain due to relatively small sample size (n = 13).
Selenium	UF	developed	all locations	**+**	**-**		Maximum BTV used due to high degree of dataset uncertainty. BTV does not exceed the MTAL, so does not provide a great deal of support for alternative compliance.
Selenium	UF	undeveloped	watersheds other than Mortandad	**+**	**-**		none
Total PCBs	UF	developed	minor watersheds other than South Fork Acid	**+**			none
Total PCBs	UF	undeveloped	Northern and Western Reference	**+**			none
Zinc	F	developed	all locations		**+**	**=**	The BTV provides a reasonable LOE for alternative compliance, but the BLM provides a much stronger LOE.
Zinc	F	undeveloped	watersheds other than Garcia		**-**	**=**	The BTV provides a reasonable LOE for alternative compliance, but the BLM provides a much stronger LOE.

Note: Color shading and **bold** plus, minus, and equals symbols are used to indicate the relative values of BTVs to associated IP TALs or previous LANL BTVs. Plus symbols (shaded orange) indicate that the new BTV exceeds the associated value(s); minus symbols (shaded blue) indicate that the BTV does not exceed the associated value(s); and equals symbols (shaded green) indicate that the BTV falls within the range of 2015 draft MTALs. No symbols or shading are used where comparisons could not be made. The only POCs shown in Table 5-2 are those for which the new BTV exceeds an existing or draft IP TAL.

[a] IP TAL is not directly comparable to the new BTV, because the new BTV is SSC normalized rather than a raw value. The BTV is included in this table based on relevant visual comparison (Figures 5-2 through 5-9), which includes a range of likely BTVs based on the interquartile range of SSC values.

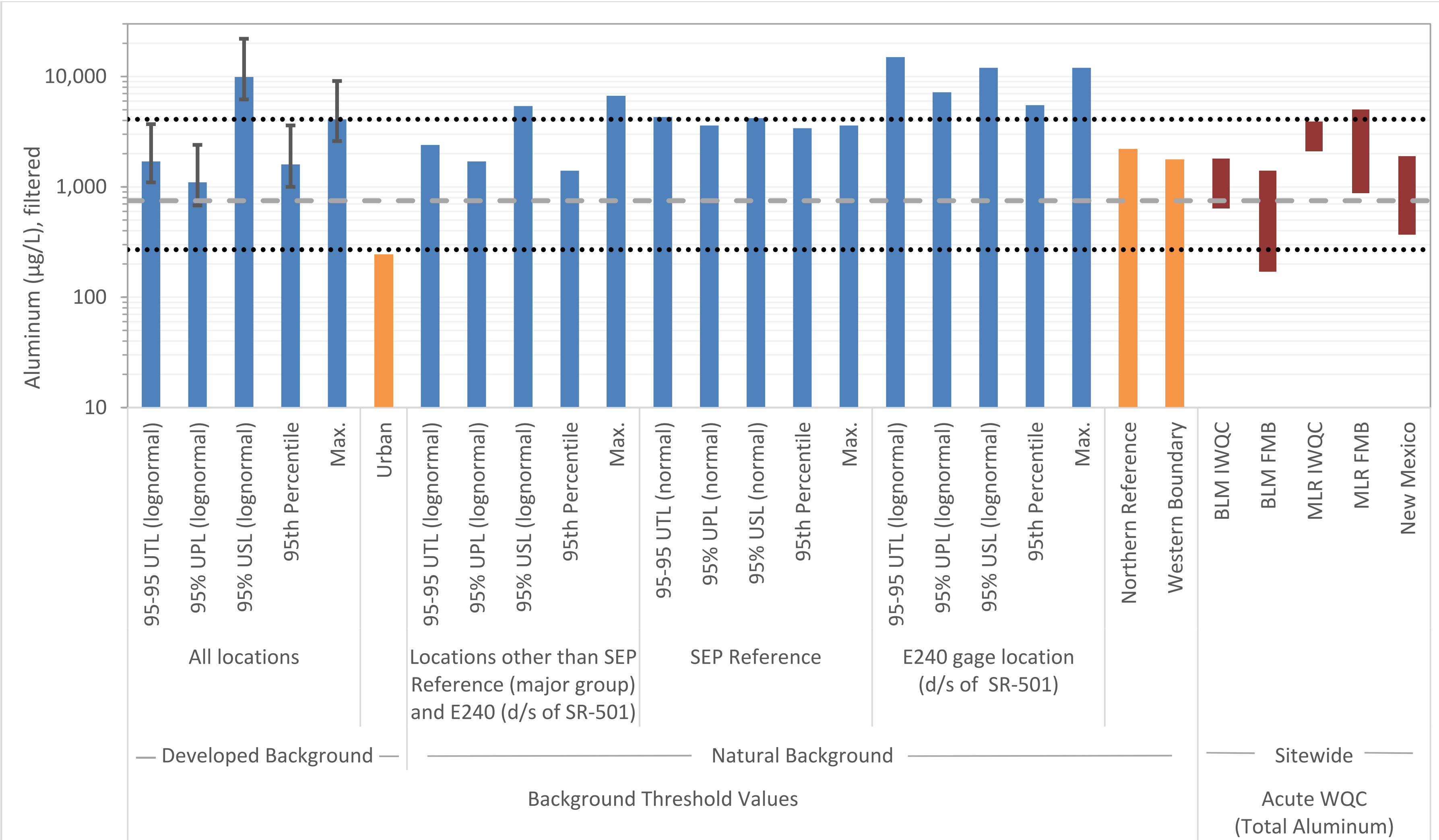
ATAL – average target action level
BLM - biotic ligand model
BTV – background threshold value
d/s – downstream
DBG – developed background
F – filtered
IP – Individual Permit
LANL – Los Alamos National Laboratory
LOE – line of evidence
MTAL – maximum target action level
NBG – natural background
PCB – polychlorinated biphenyl
SEP – Supplemental Environmental Project
SIP – Sampling Implementation Plan
SR – state route
SSC – suspended sediment concentration
TAL – target action level
UF – unfiltered



Notes: Multiple sets of new BTVs may be presented for a landscape type; these types correspond to different subsets described in Table 3-4. The six components provided in this example figure and in Figures 5-2 through 5-9 are:

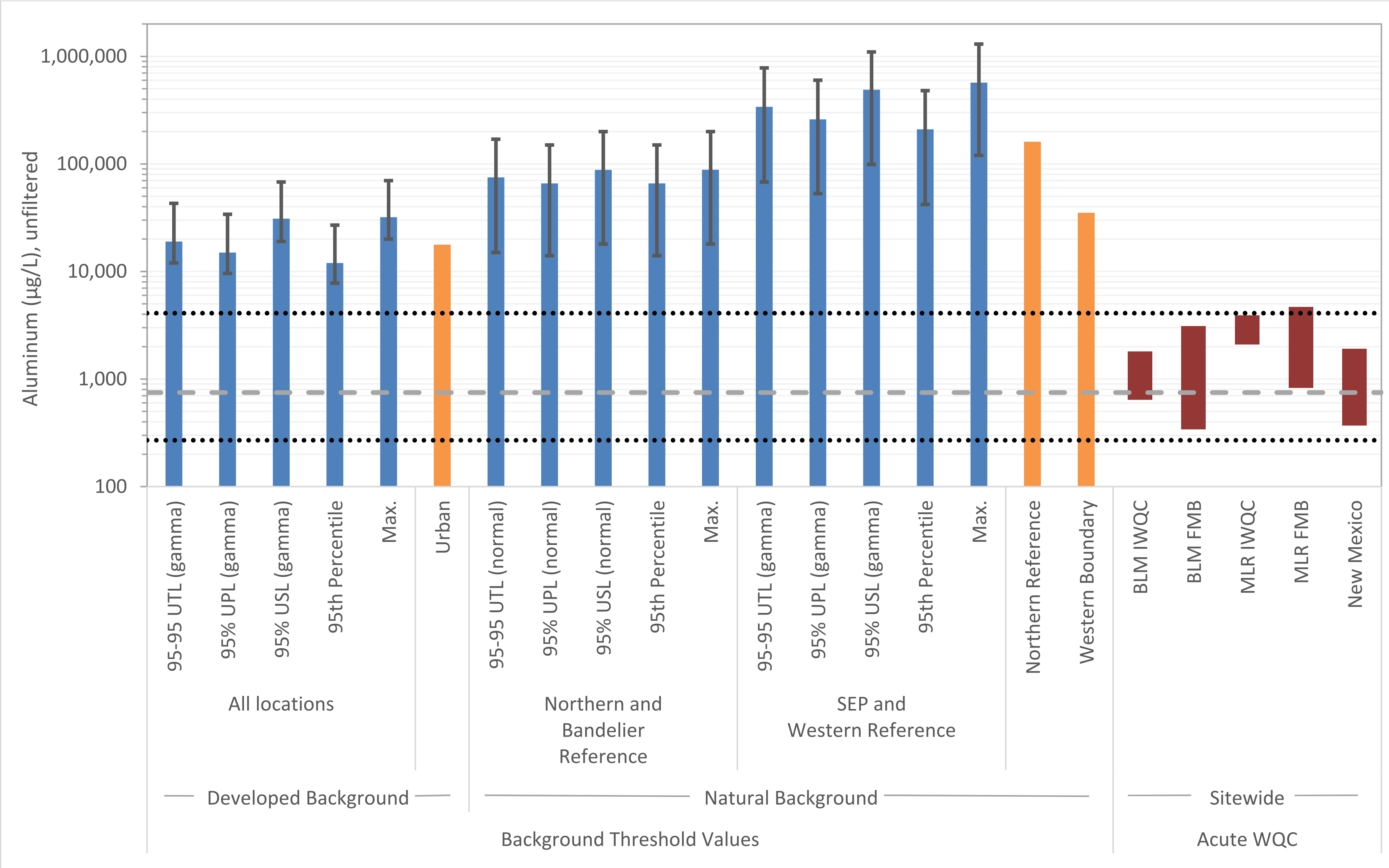
1) Blue bars, which show new BTVs (Appendix G)
2) Orange bars, which show LANL (2013) 95-95 UTLs, unless otherwise stated (e.g., Figure 5-9)
3) Dark red bars, which show ranges of median acute IWQC values and FMBs;
4) The gray dashed line, which is the 2010 IP MTAL;
5) The horizontal dotted lines, which show the range of 2015 watershed-specific, hardness-adjusted draft IP MTAL values (which apply to select metals)
6) Vertical "whiskers," (up- and down-bars on some plots), which are estimated from SSC-normalized BTVs; the BTV bar (blue) in this case is calculated by multiplying the SSC-normalized BTV (Appendix G) by the 50th-percentile SSC value for the associated landscape type (i.e., DBG in this example). The lower and upper whiskers are calculated by multiplying the SSC-normalized BTV by the 25th- and 75th-percentile SSC values, respectively, for the associated landscape type. The interquartile range (25th to 75th percentile) provides an estimate of the "typical" range of SSC values.

Figure 5-1.Example BTV comparison plot



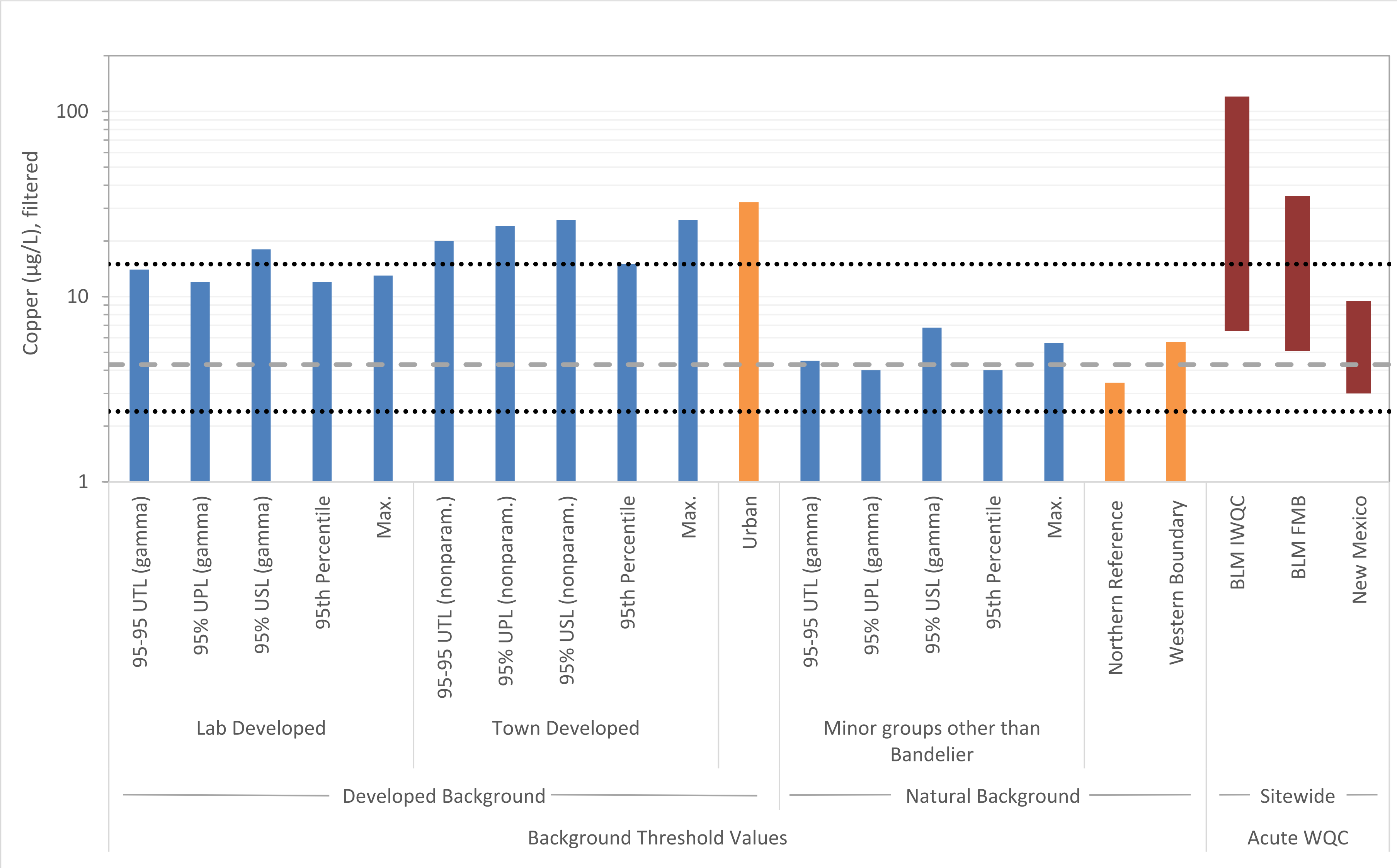
For explanation of figure components, see Figure 5-1. Acute WQCs shown in Figure 5-2 are based on total aluminum concentrations rather than dissolved. There is uncertainty associated with how to apply WQCs to aluminum; this uncertainty is detailed by Windward (2018) and Windward and LANL ([in press]).

Figure 5-2.Filtered aluminum BTVs, IP TALs, and acute WQC



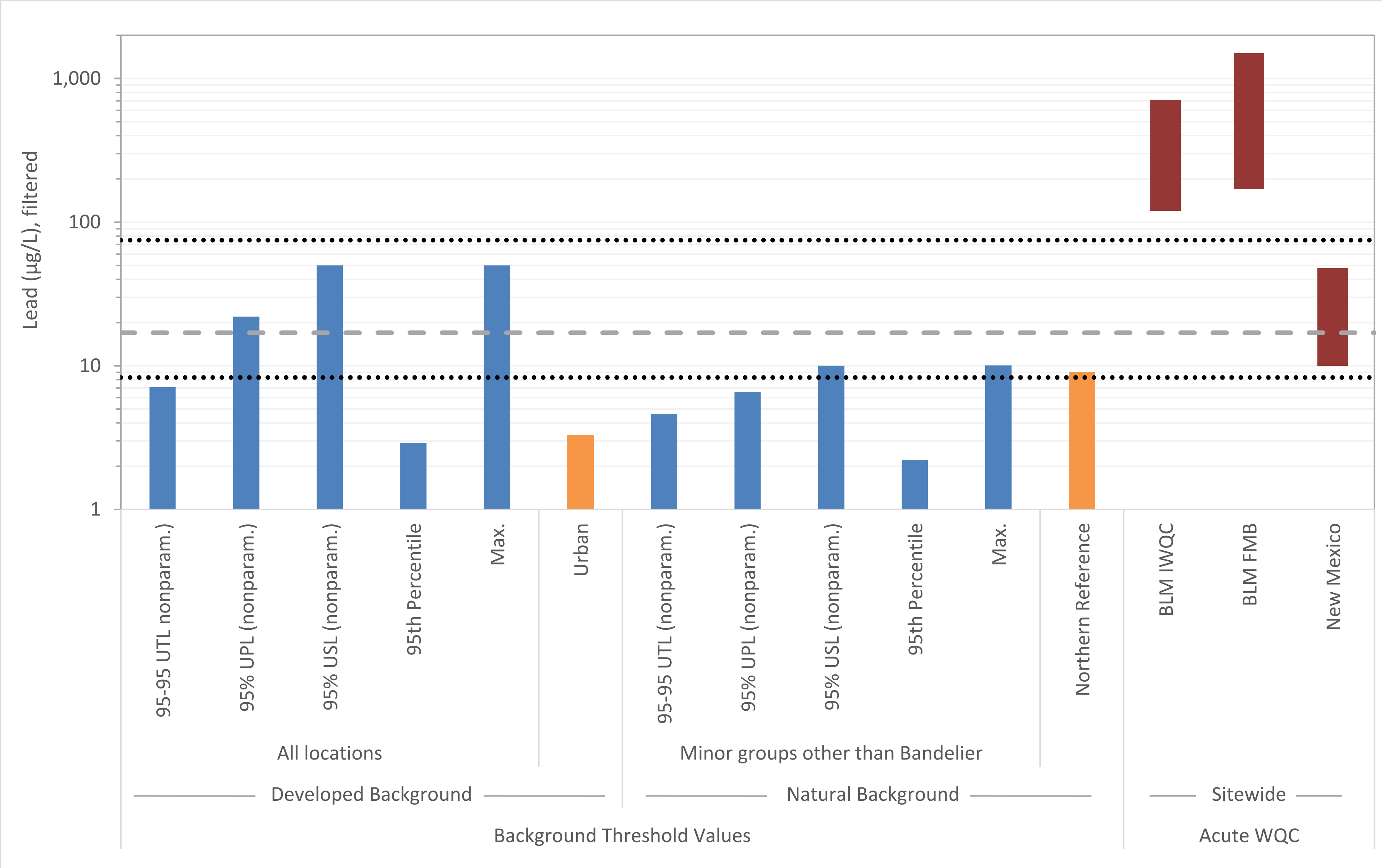
For explanation of figure components, see Figure 5-1.

Figure 5-3.Unfiltered aluminum BTVs, IP TALs, and acute WQC



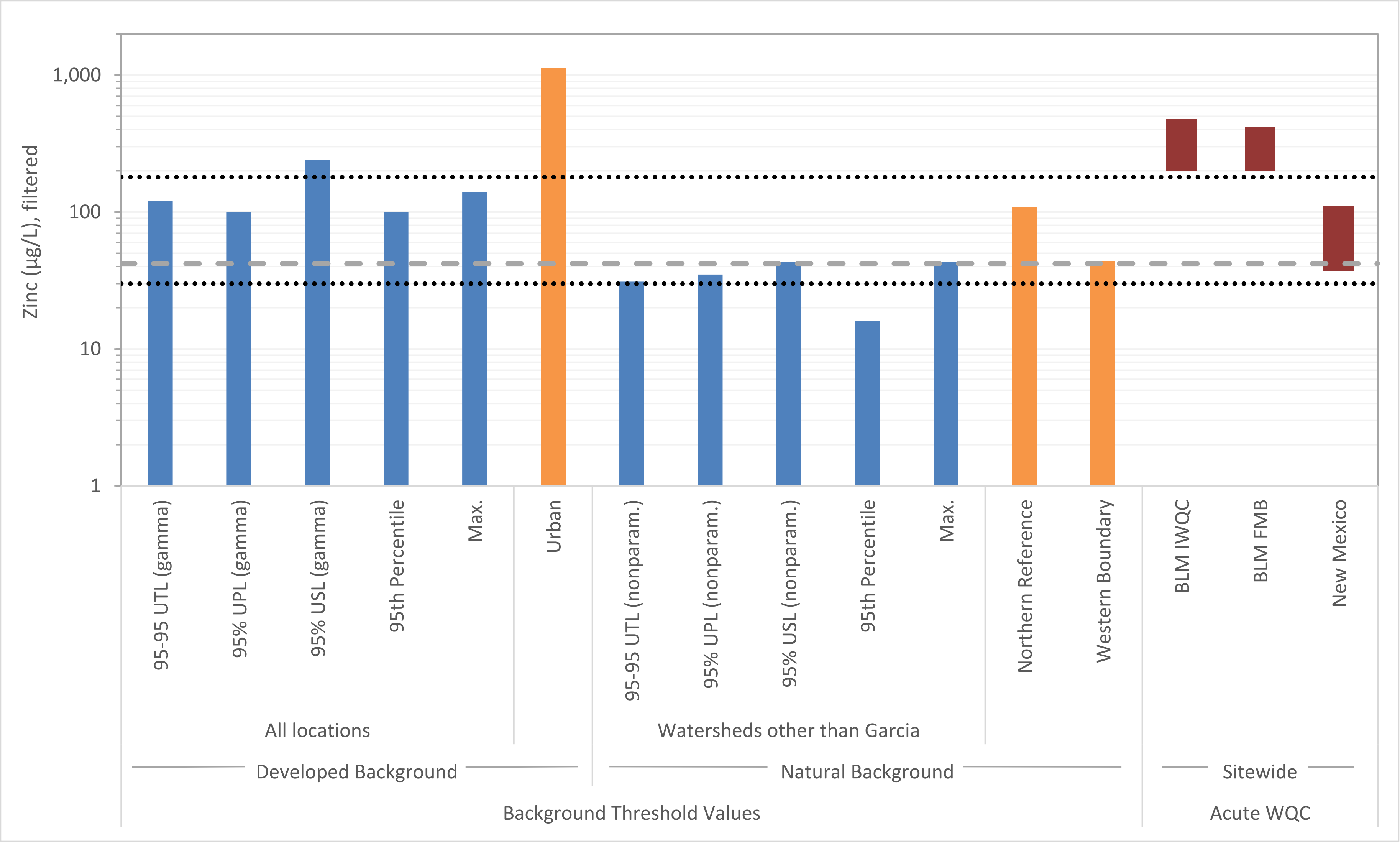
For explanation of figure components, see Figure 5-1.

Figure 5-4.Filtered copper BTVs, IP TALs, and acute WQC



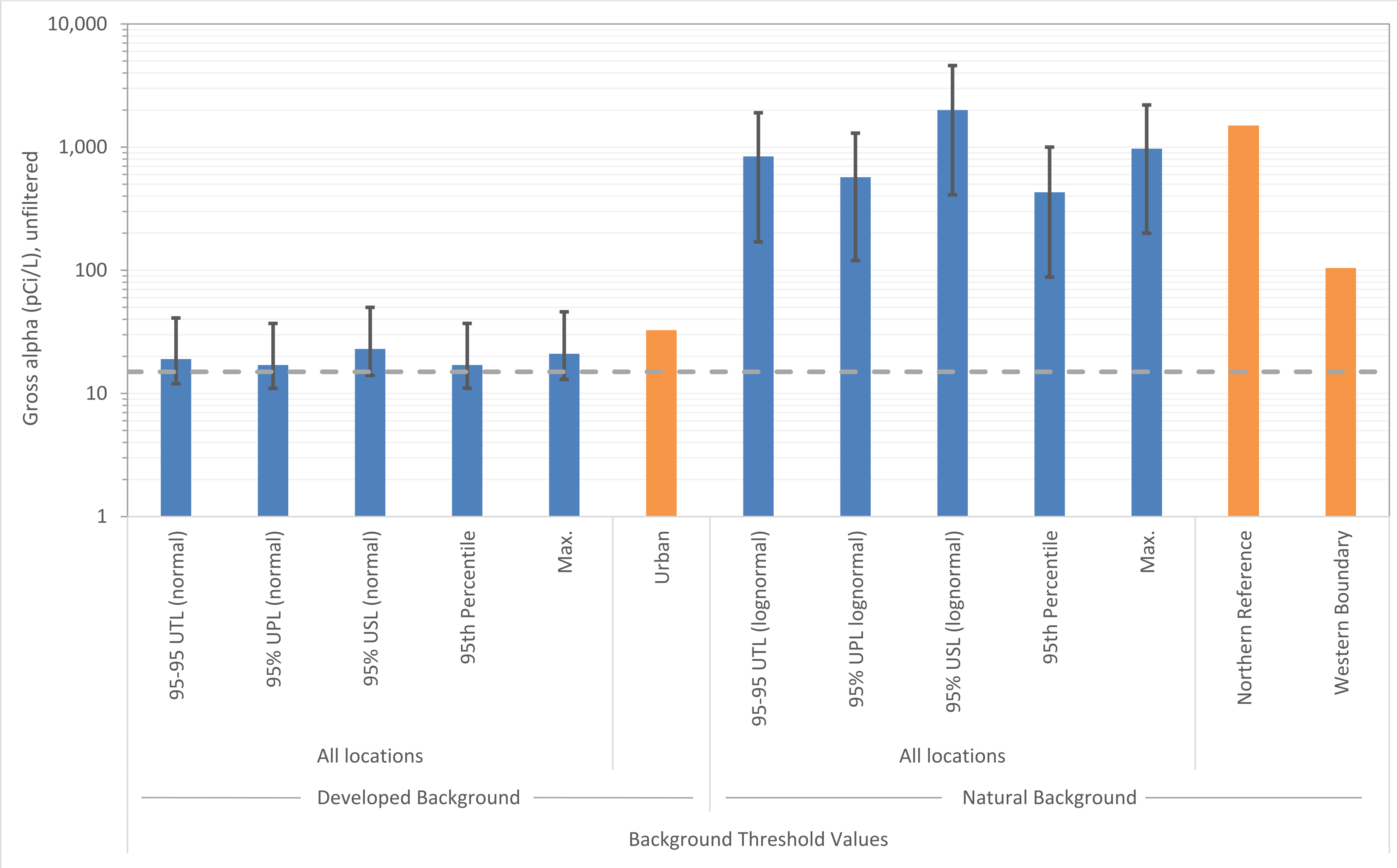
For explanation of figure components, see Figure 5-1.

Figure 5-5.Filtered lead BTVs, IP TALs, and acute WQC



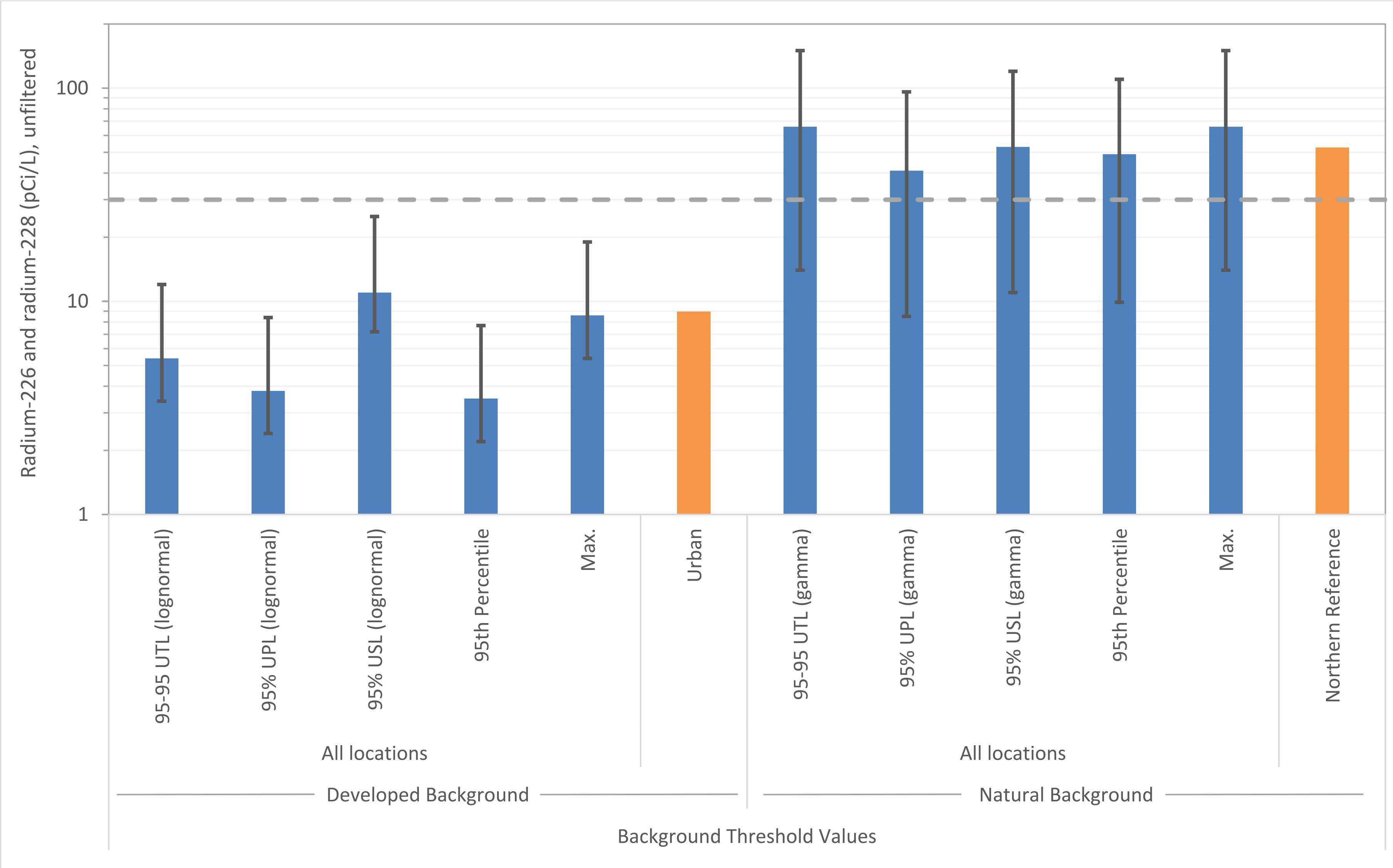
For explanation of figure components, see Figure 5-1.

Figure 5-6.Filtered zinc BTVs, IP TALs, and acute WQC



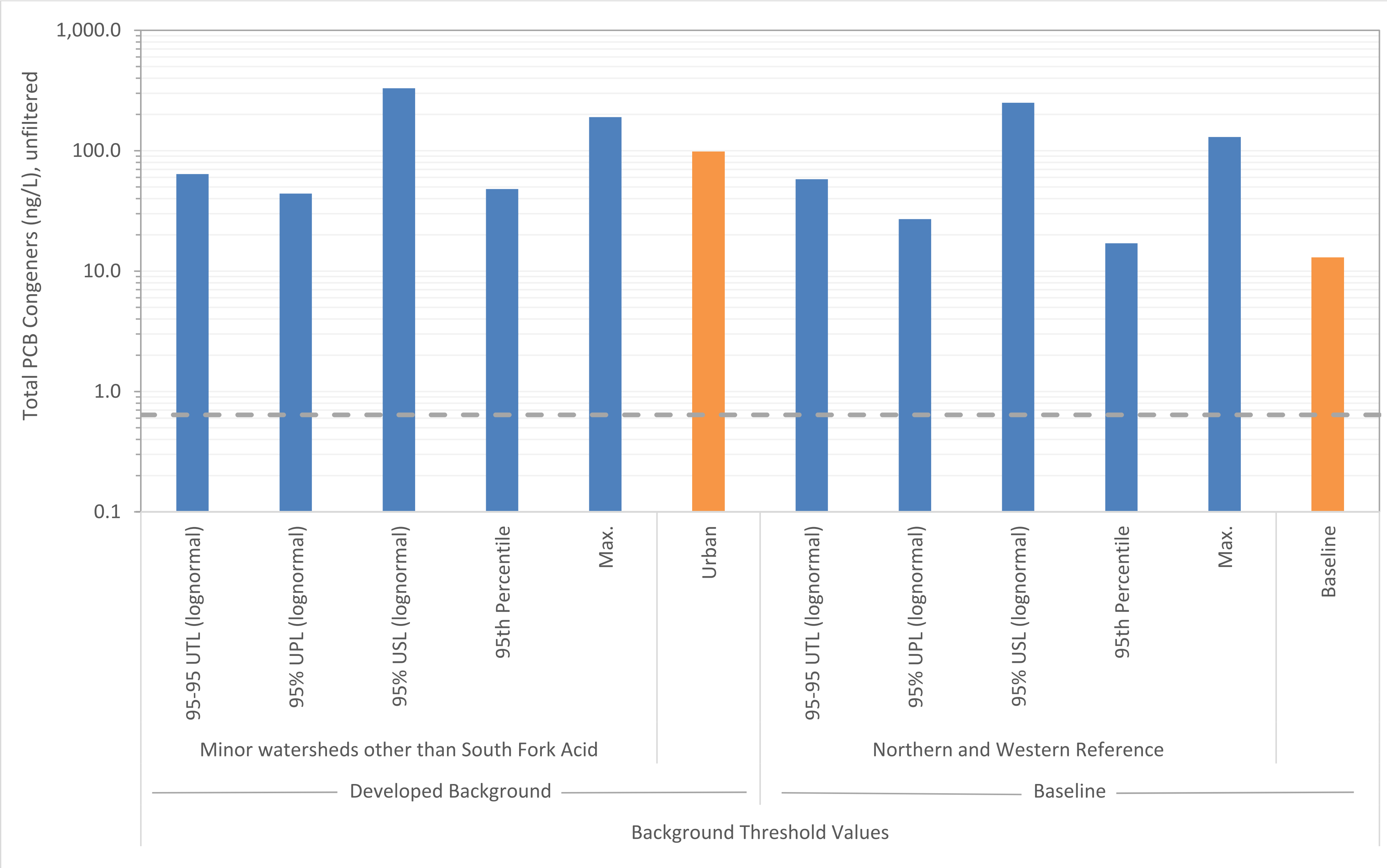
For explanation of figure components, see Figure 5-1. The 2010 IP ATAL is based on adjusted gross alpha, whereas all BTVs are based on total gross alpha.

Figure 5-7.Unfiltered gross alpha BTVs and the 2010 IP ATAL



For explanation of figure components, see Figure 5-1.

Figure 5-8.Unfiltered radium-226 and radium-228 BTVs and the 2010 IP ATAL



For explanation of figure components see Figure 5-1. Urban and baseline BTVs reported by LANL (2012) are 95-90 UTLs rather than 95-95 UTLs.

Figure 5-9.Unfiltered total PCB BTVs and the 2010 IP ATAL

6 References

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Attachment A. Key Figures Used in the Background Characterization Framework, Steps 1 to 3

This attachment provides key figures generated for the BCF assessments (Steps 1 to 3) of different water quality constituents and associated datasets. The types of figures presented herein are described in Table 3-3 (and Figures 3-3, 3-4, 3-6, and 3-7). The results of the BCF assessments (Steps 1 to 3), which were based primarily on the evaluation of these figures, are presented in Table 3-4. Additional discussion of the figures presented herein (as well as supplemental figures used for BCF assessments) are provided in Appendix B. The results of subsequent steps of the BCF (Steps 4 and 5) are presented in Section 4 (and Appendices D, E, and F).

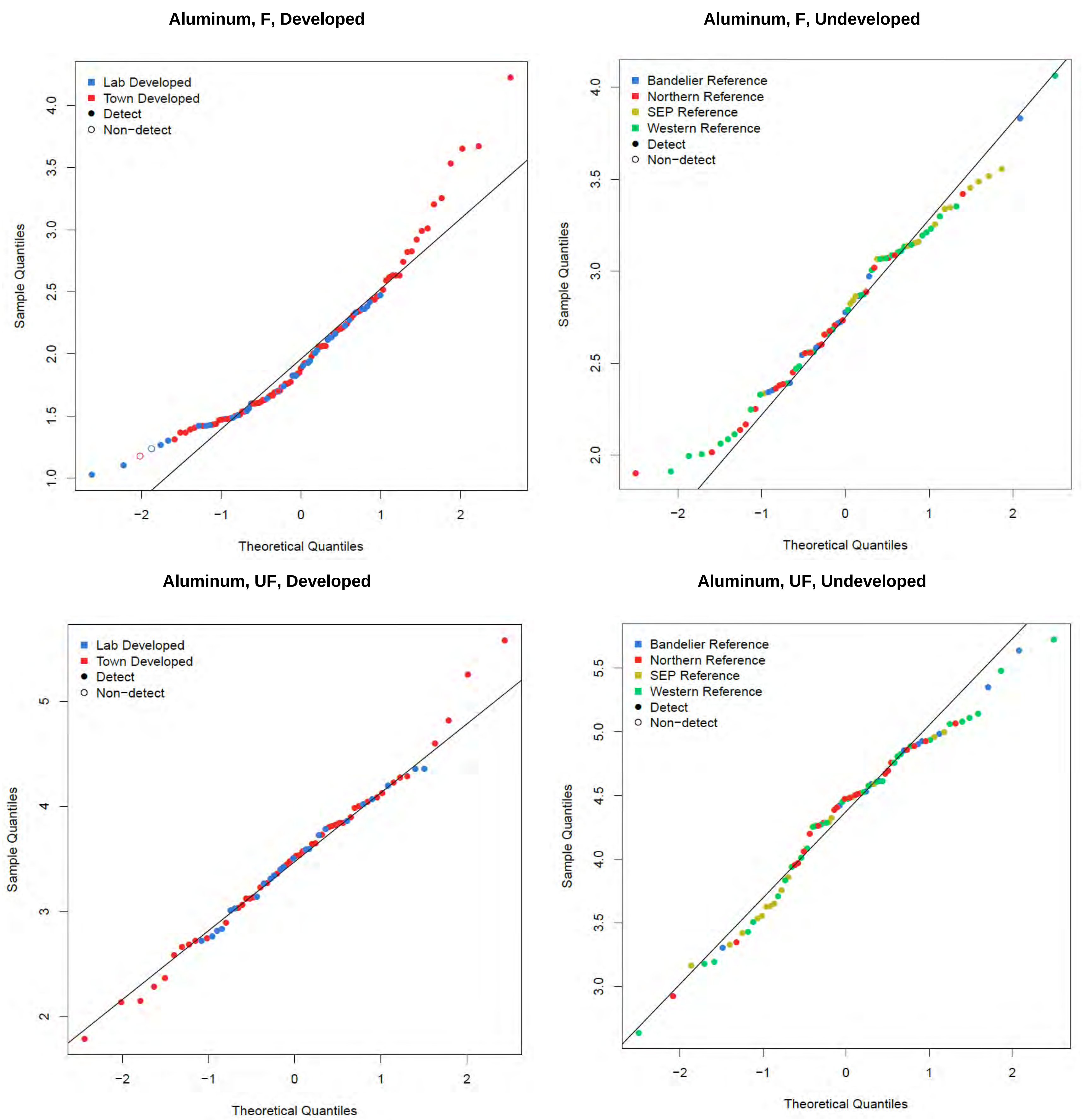


Figure 1a: Aluminum raw Q-Q plots

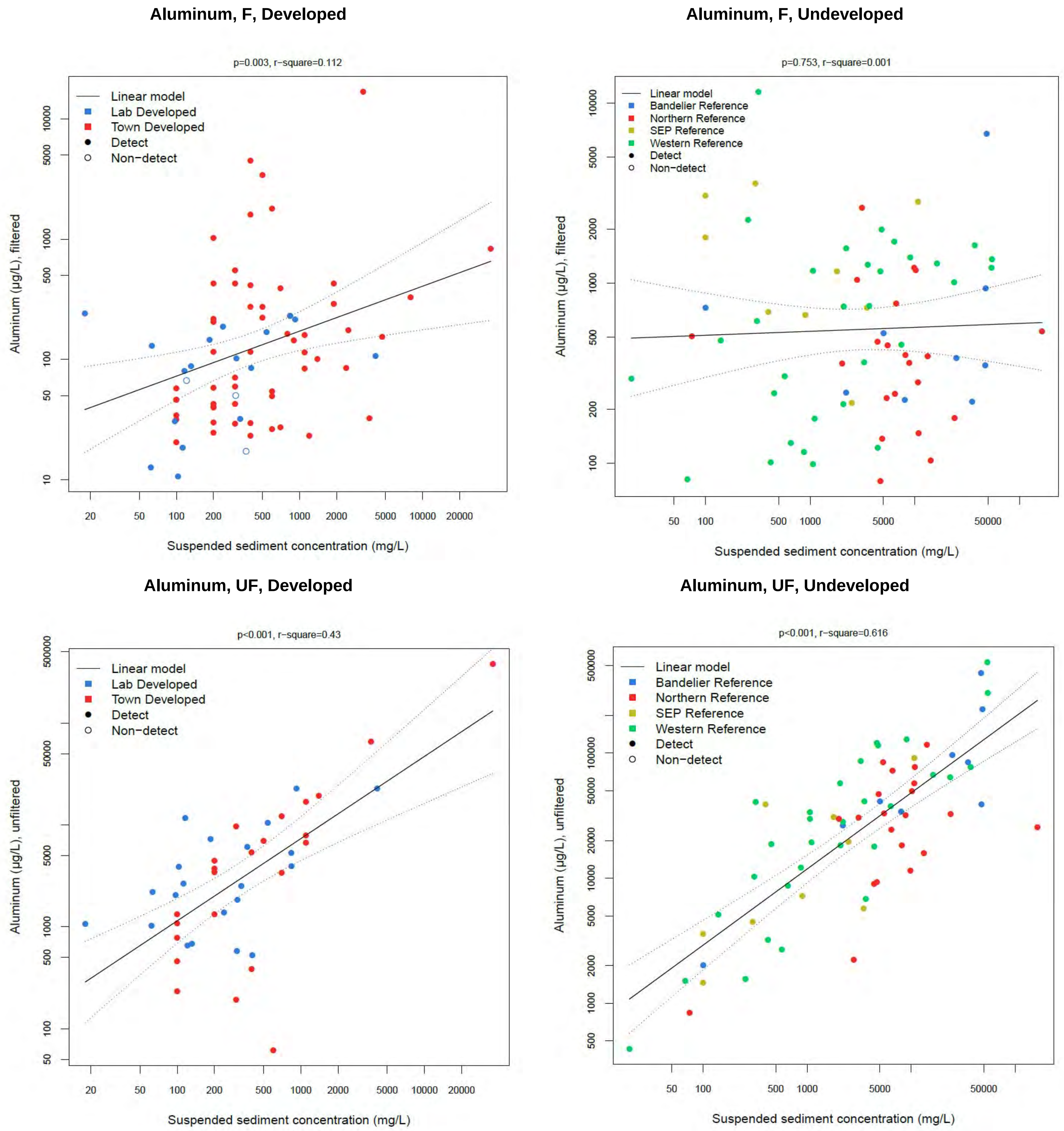
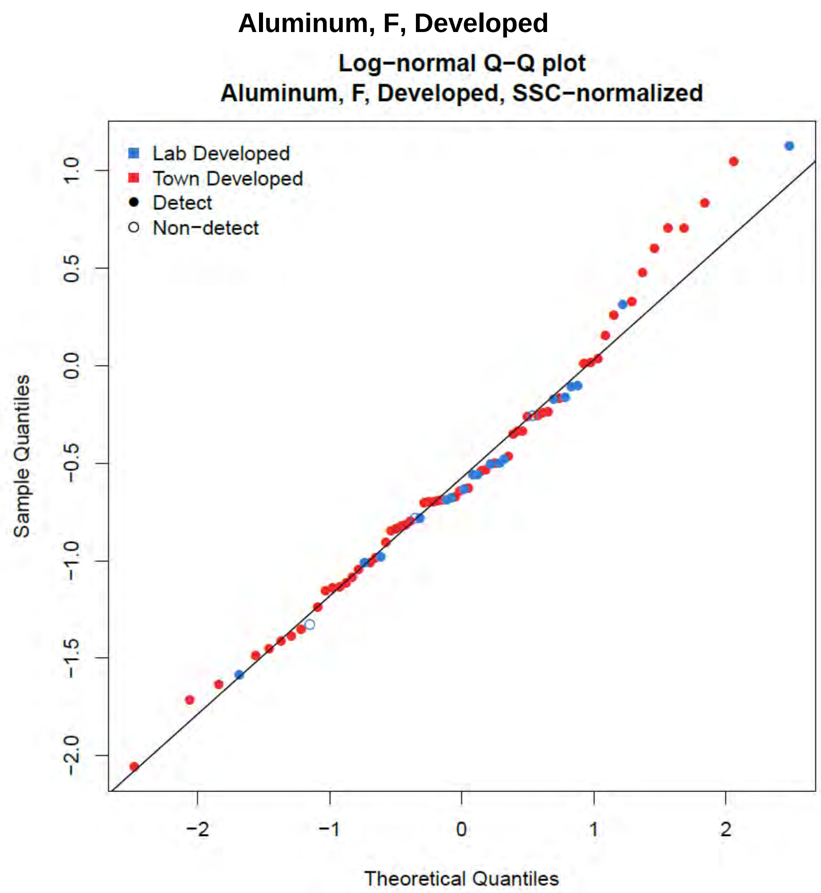
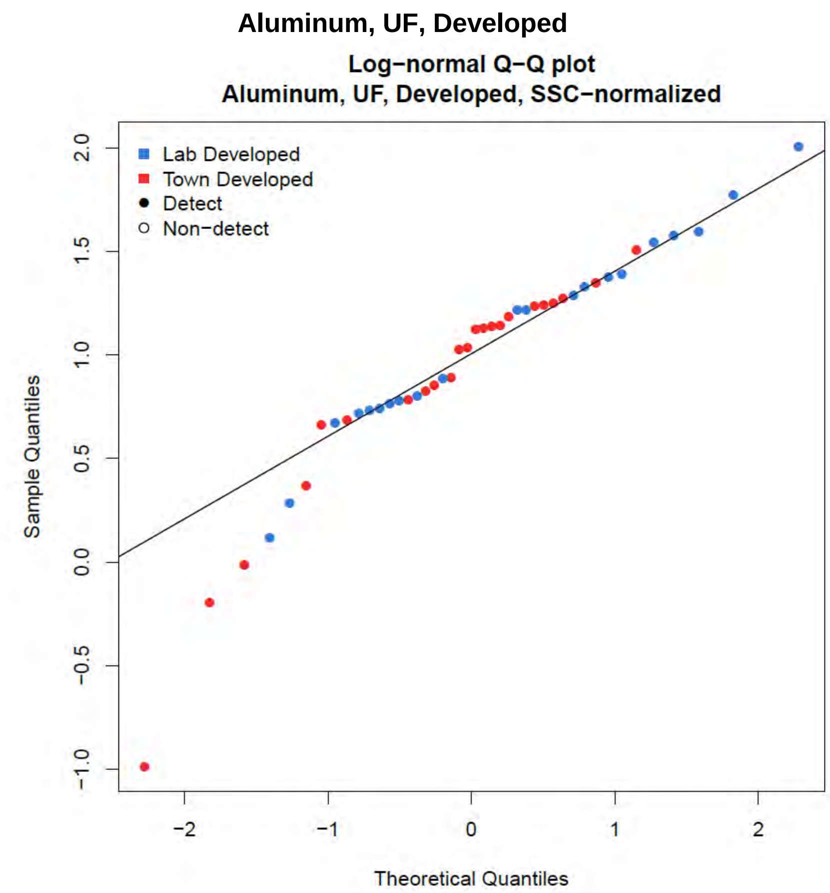


Figure 1b: Aluminum-SSC scatterplots





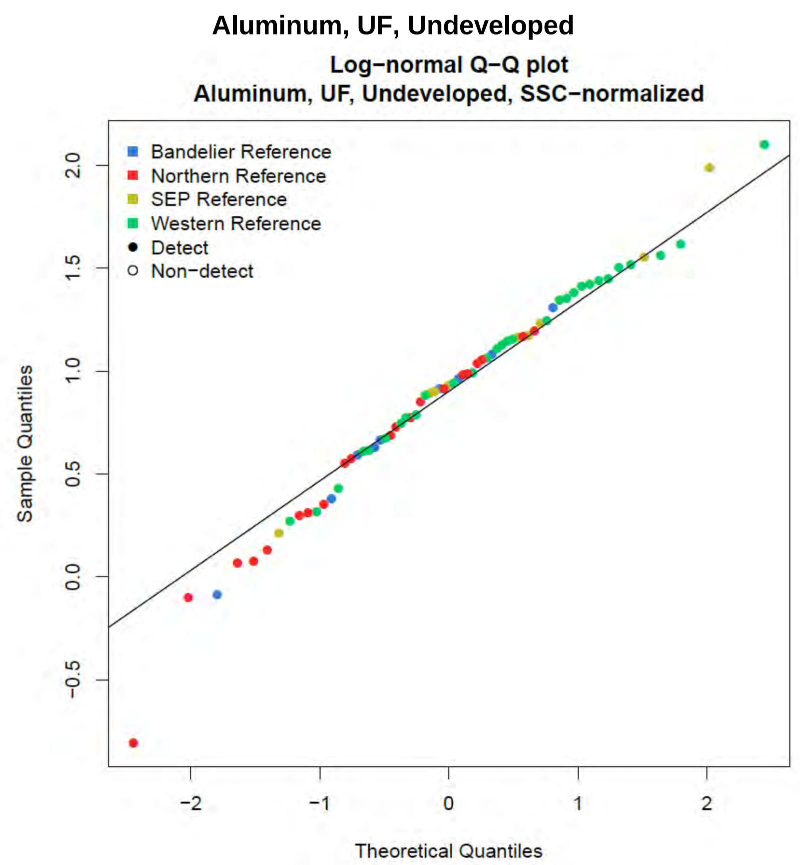


Figure 1c: SSC-normalized aluminum Q-Q plots

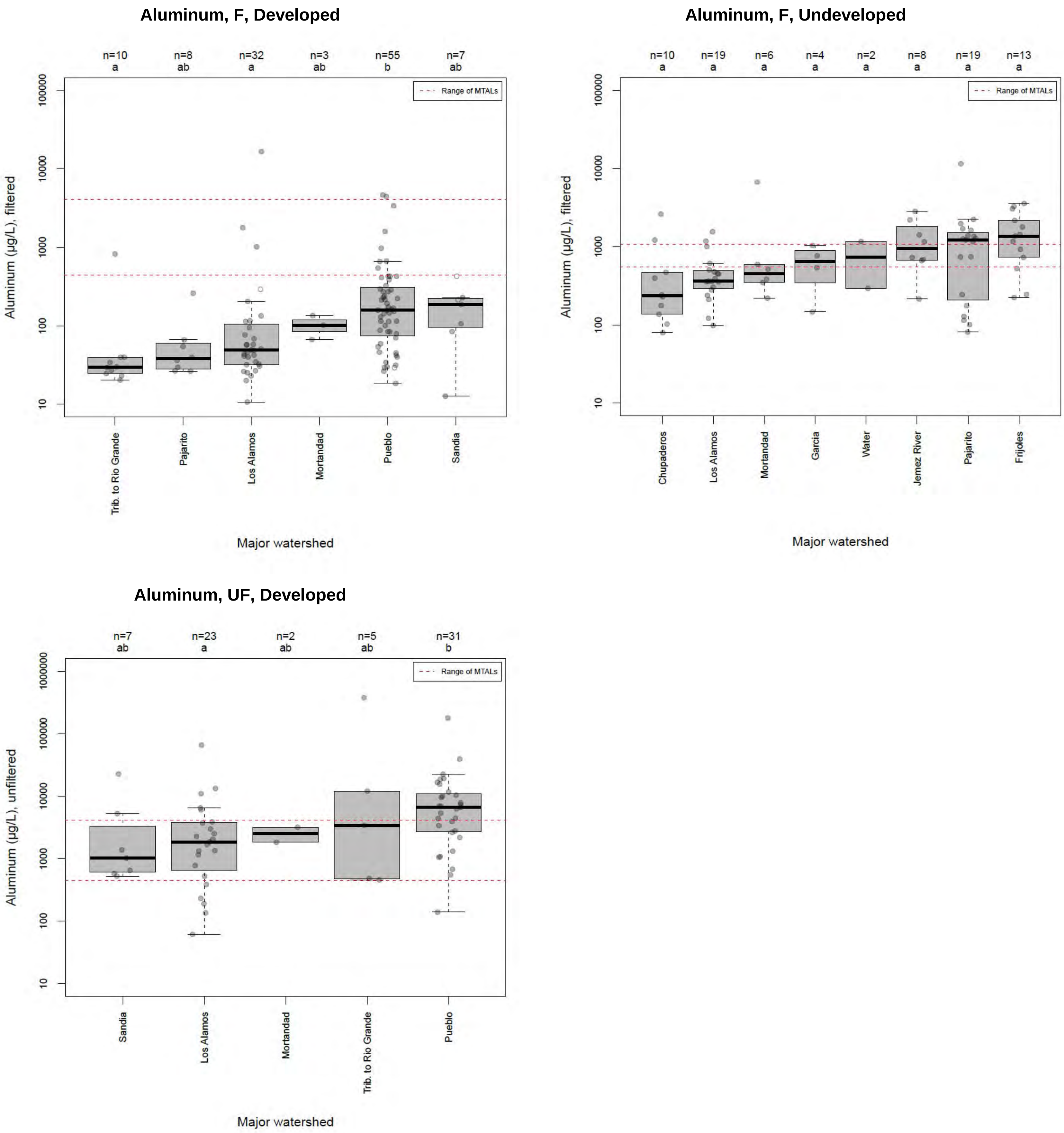


Figure 1d: Aluminum raw data boxplots by major watershed

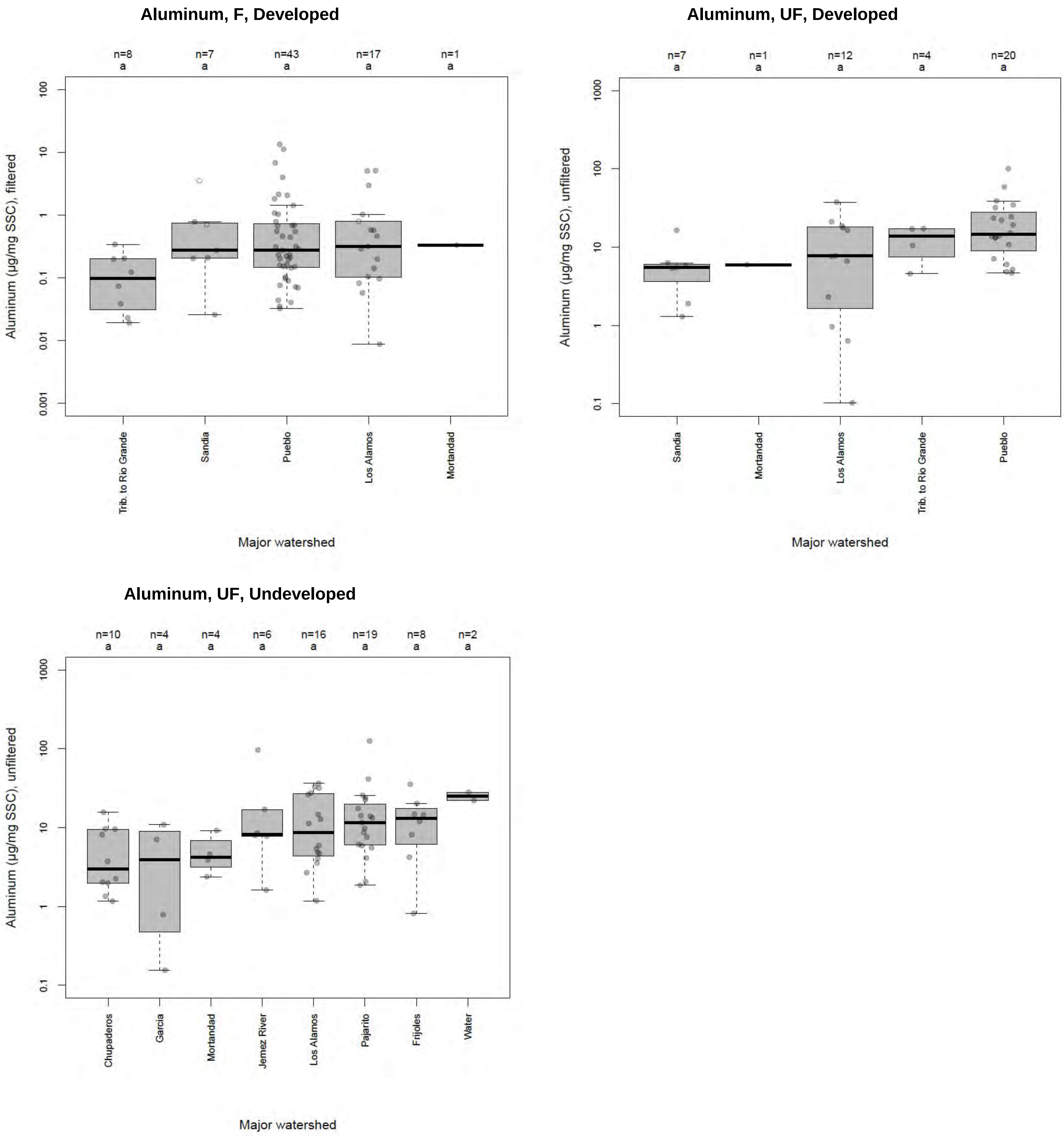
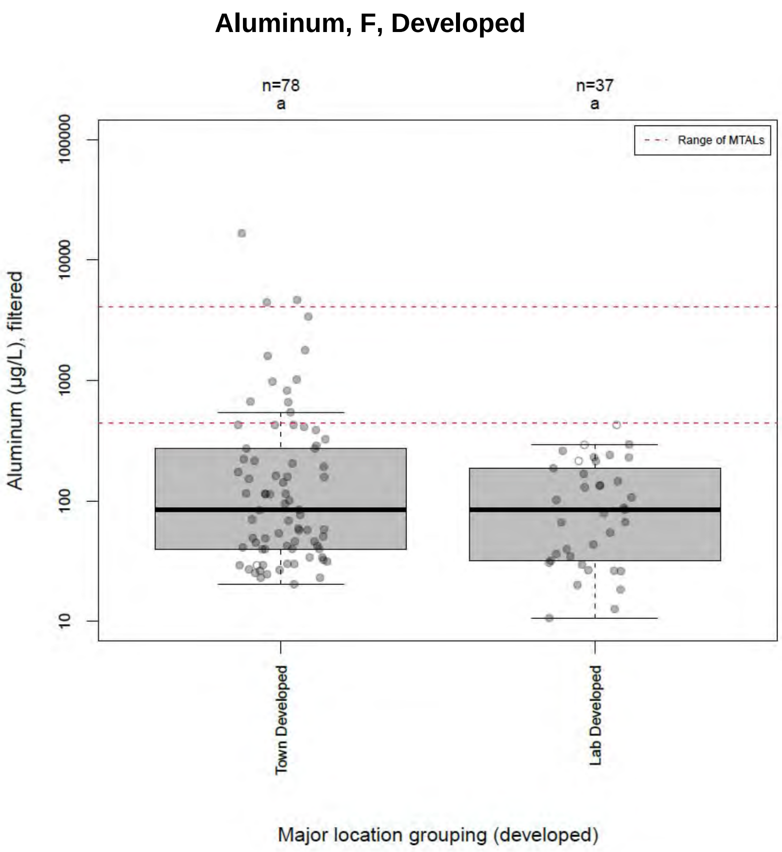
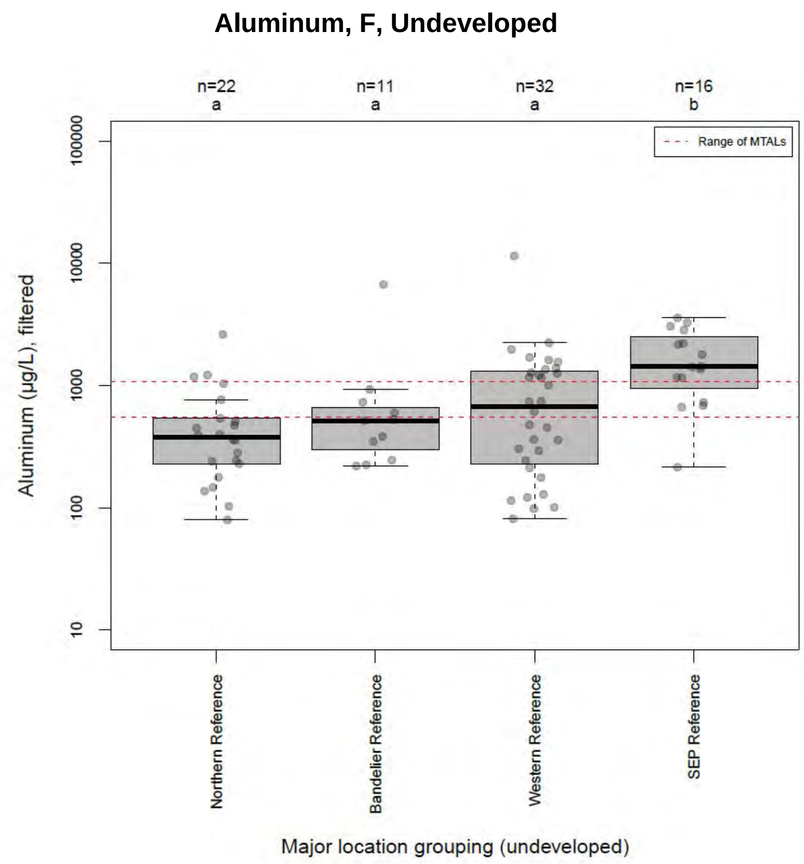


Figure 1e: SSC-normalized aluminum boxplots by major watershed





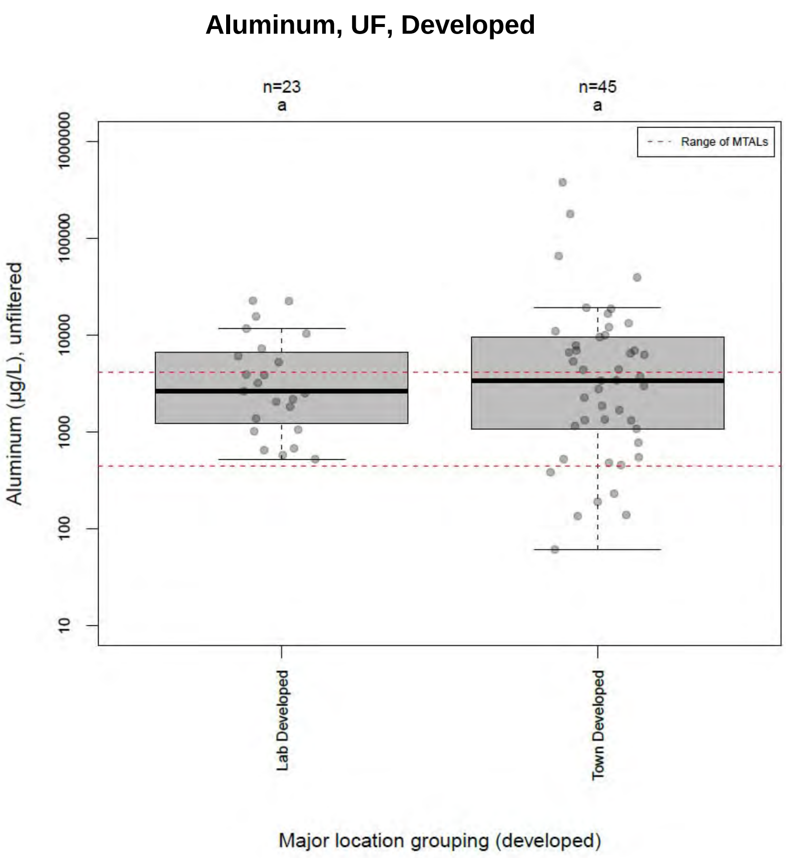


Figure 1g: Aluminum raw data boxplots by major location grouping

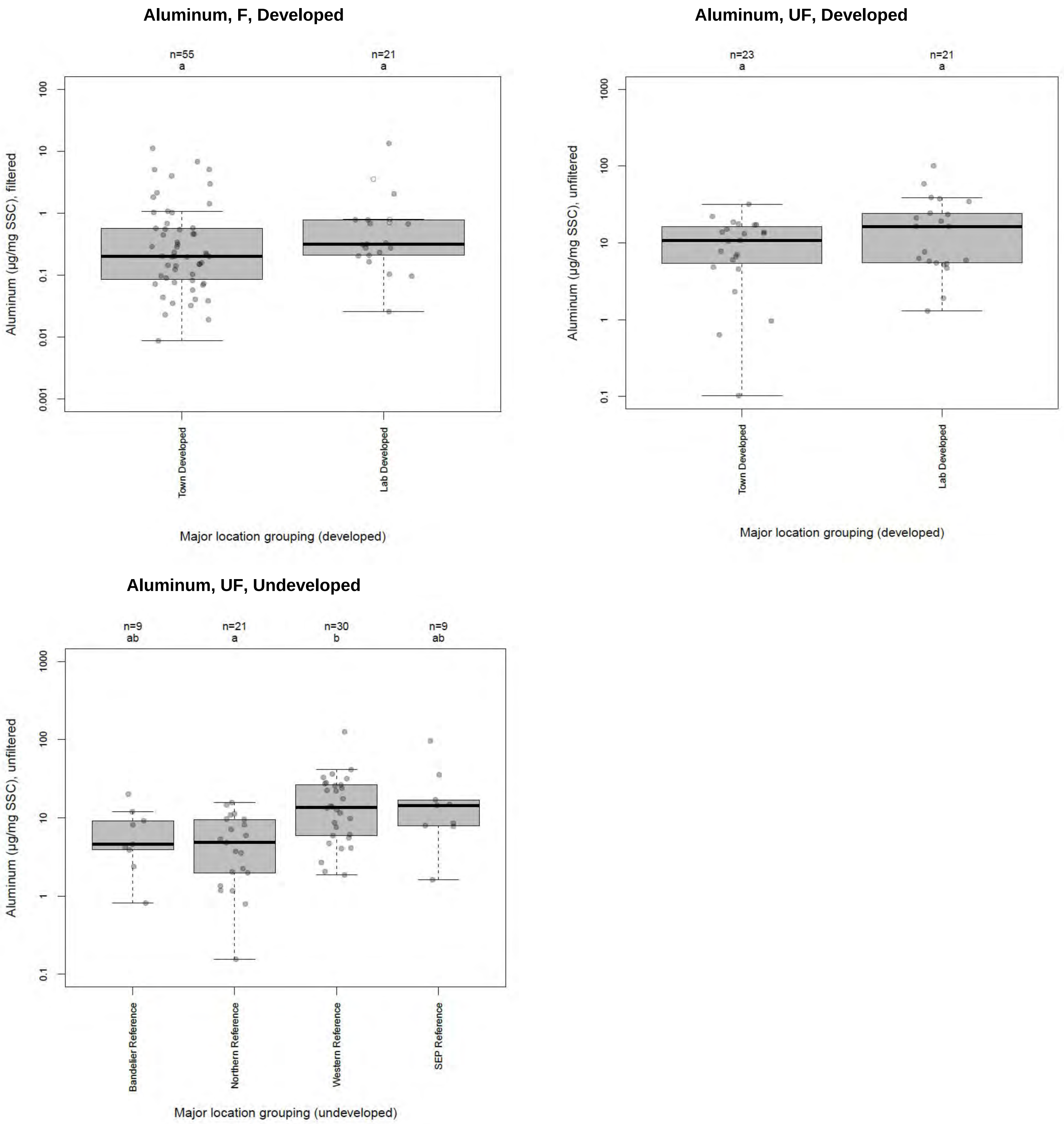
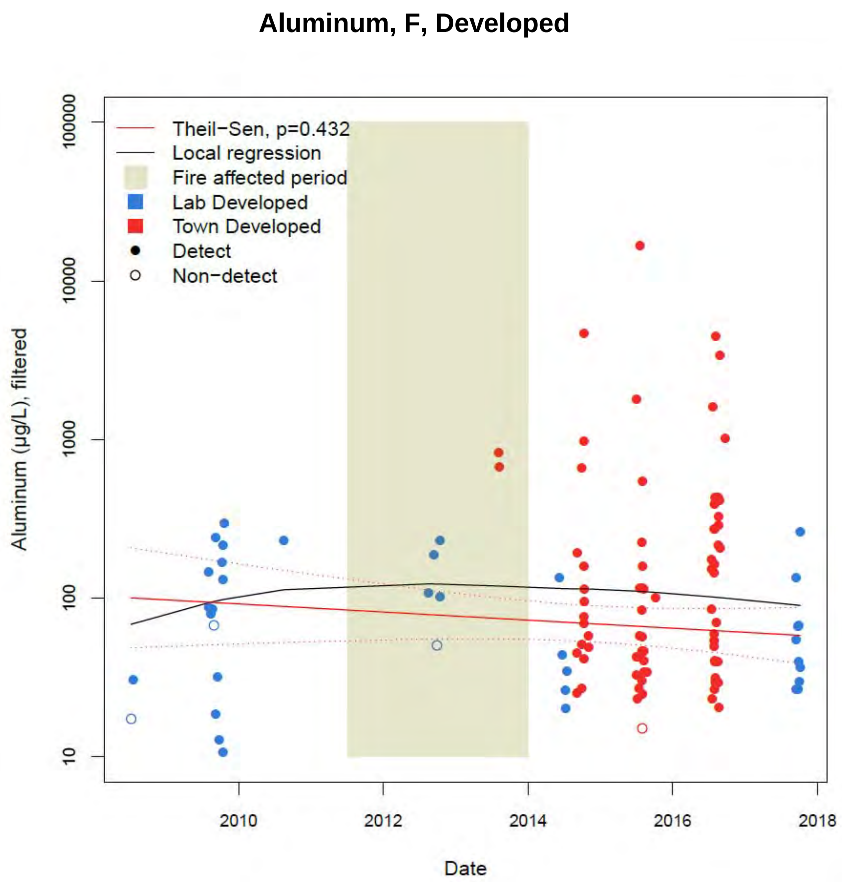
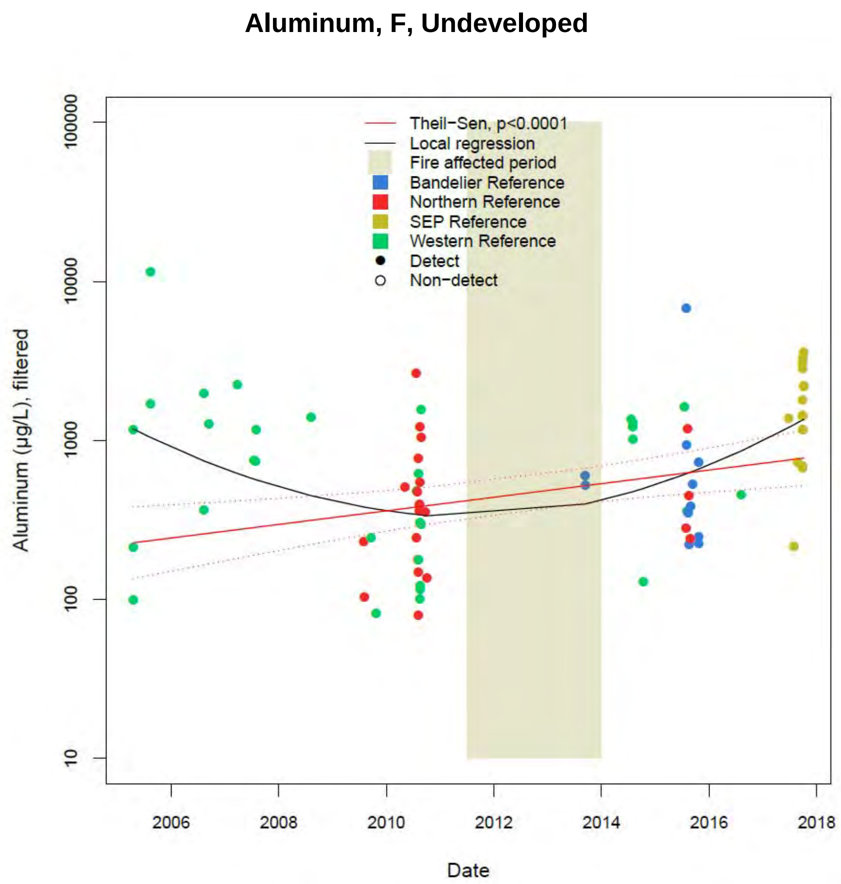


Figure 1h: SSC-normalized aluminum boxplots by major location grouping





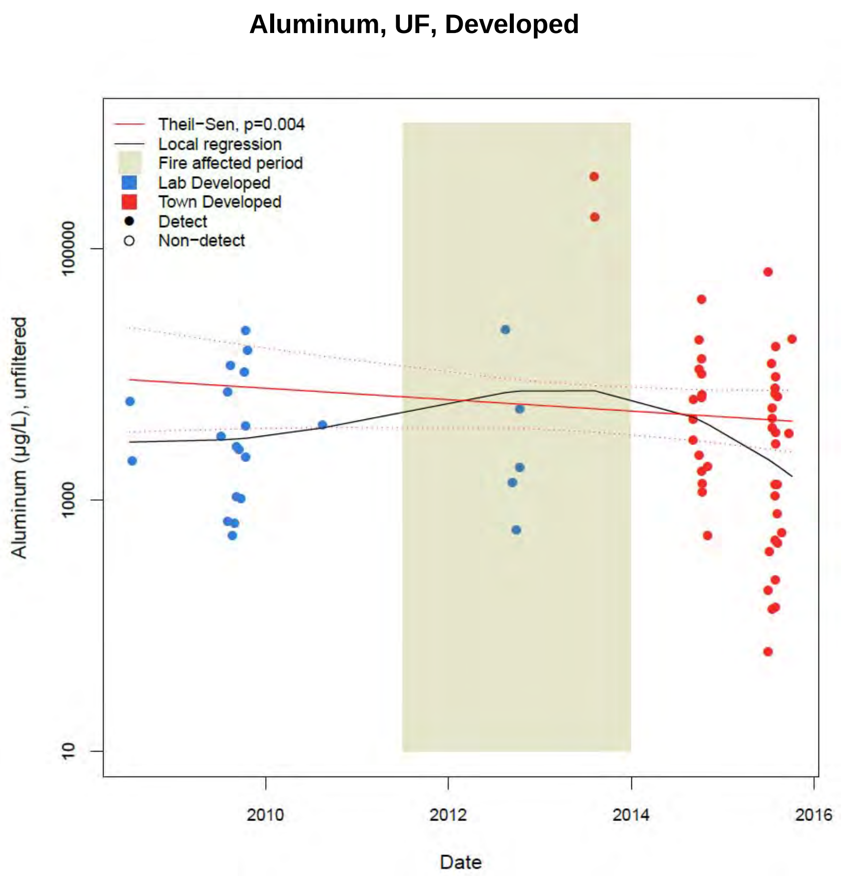


Figure 1j: Aluminum temporal trend, raw data

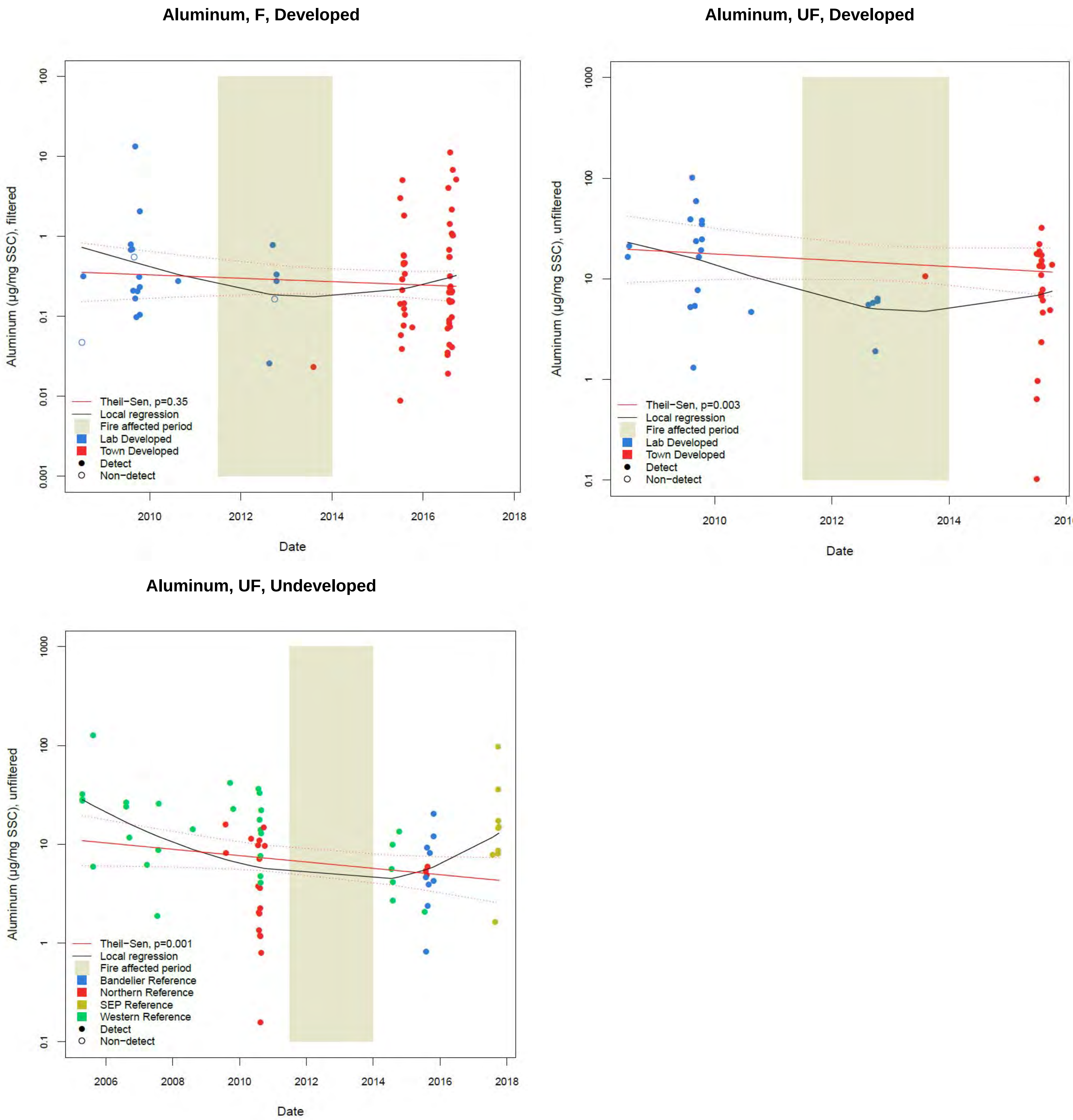


Figure 1k: SSC-normalized aluminum temporal trend

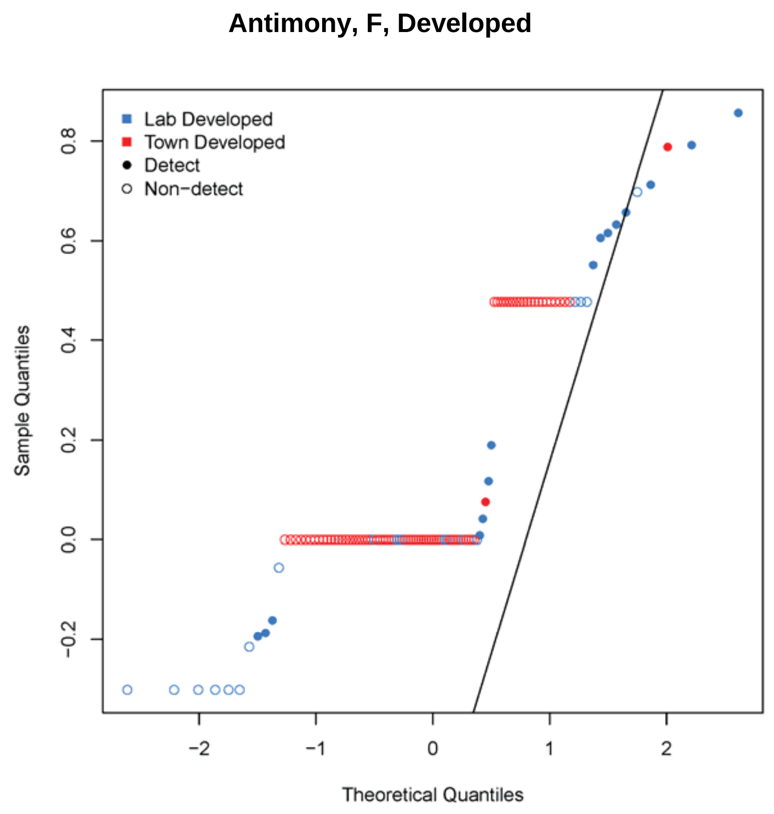


Figure 2a: Antimony raw Q-Q plot

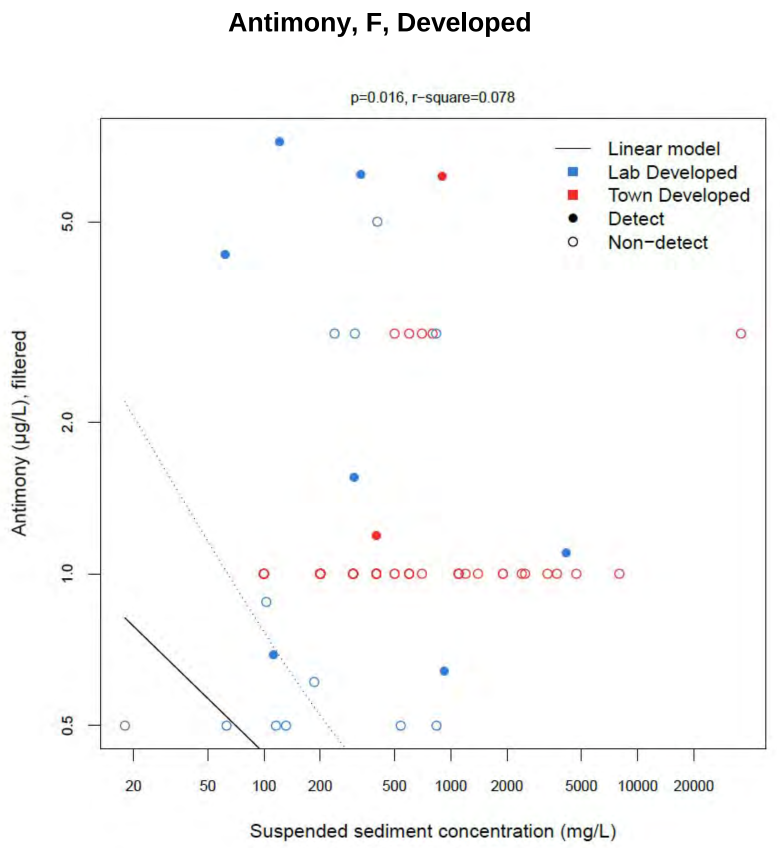


Figure 2b: Antimony-SSC scatterplot

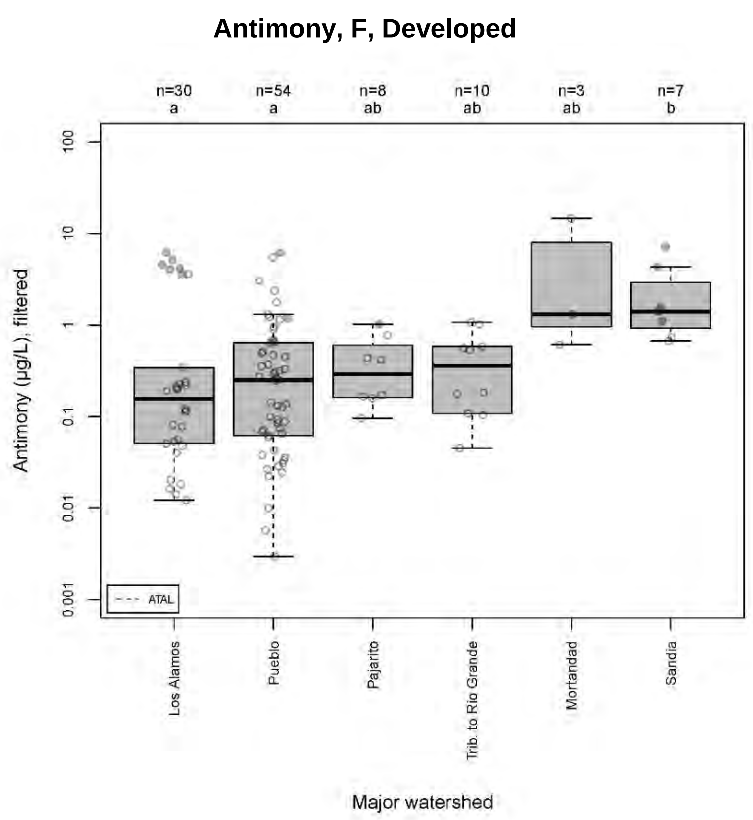


Figure 2d: Antimony raw data boxplot by major watershed

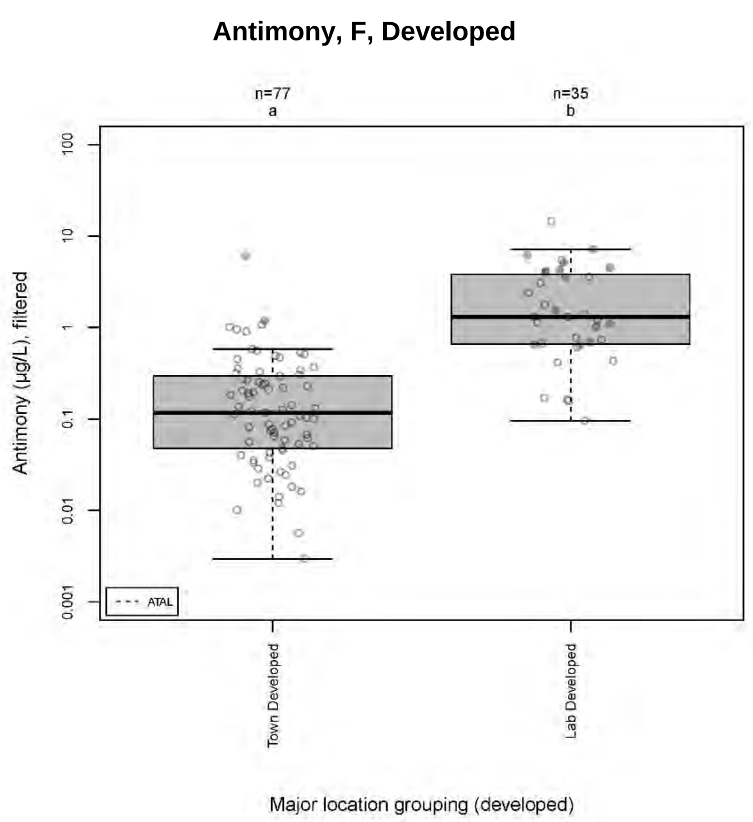


Figure 2g: Antimony raw data boxplot by major location group

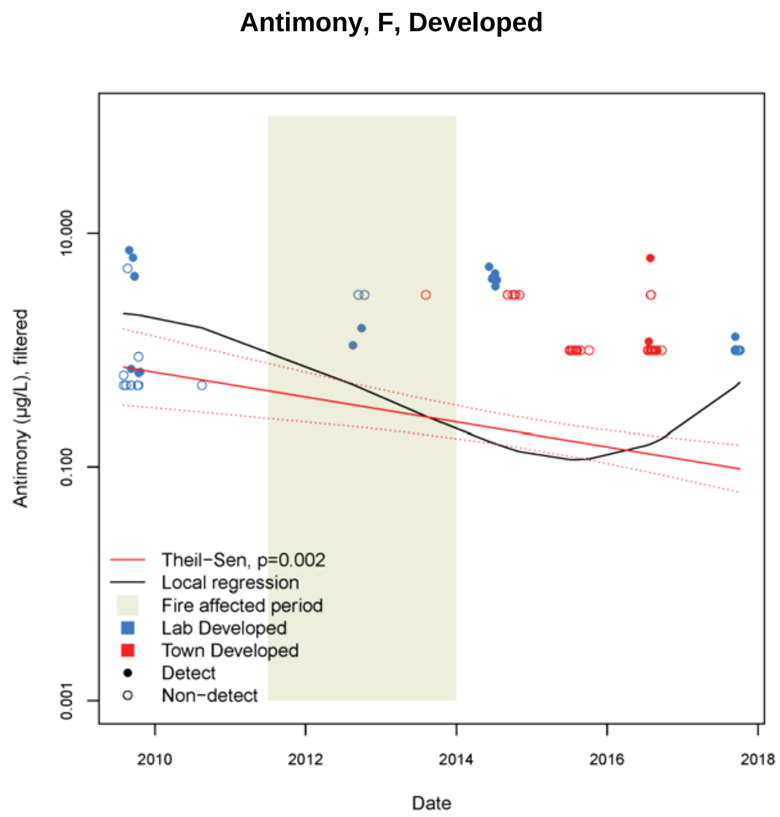
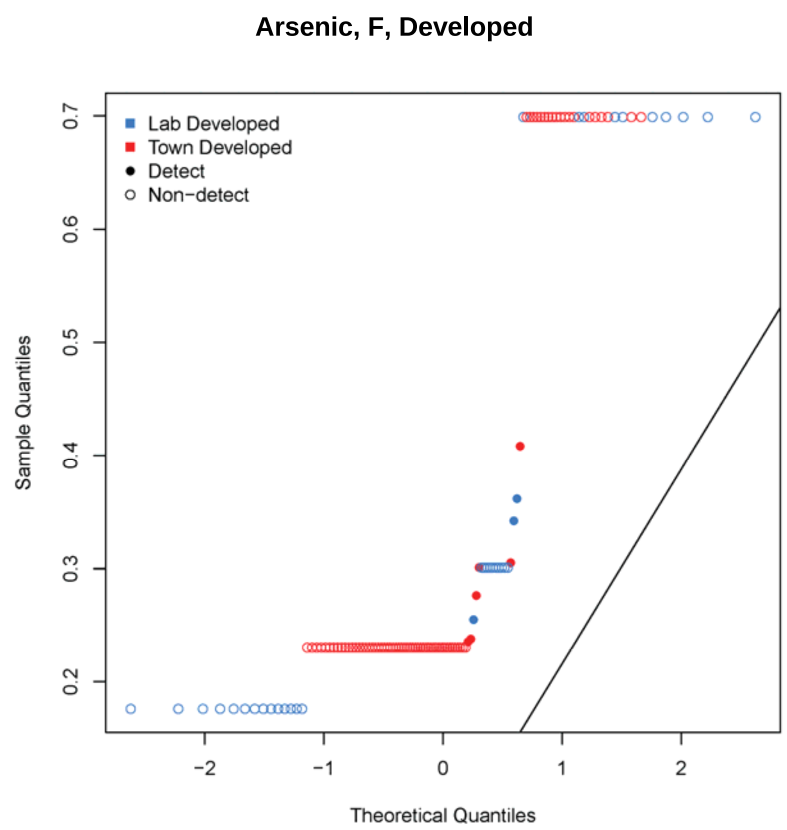


Figure 2j: Antimony temporal trend, raw data



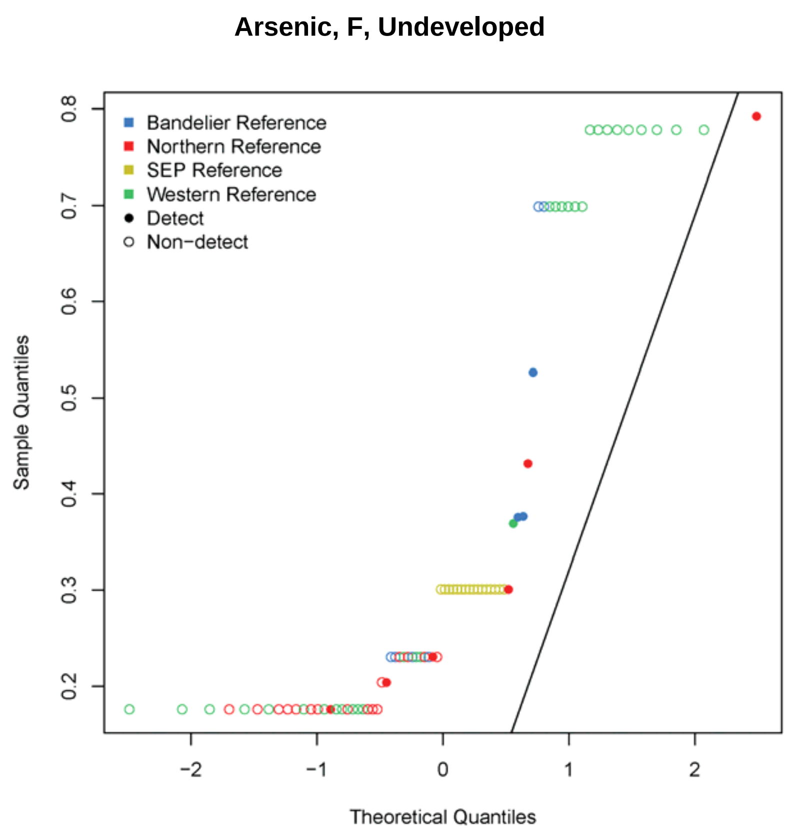


Figure 3a: Arsenic raw Q-Q plots

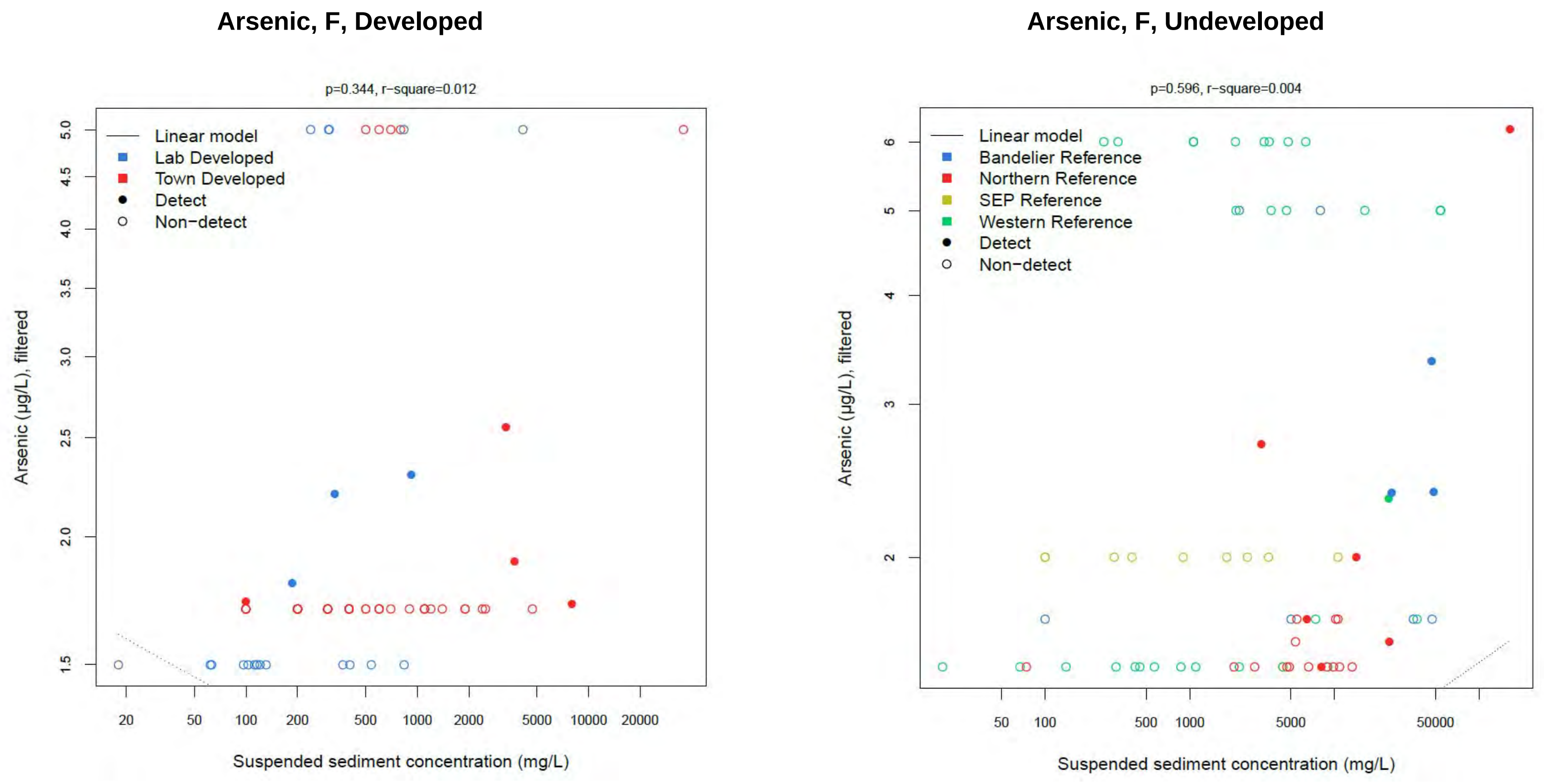


Figure 3b: Arsenic-SSC scatterplots

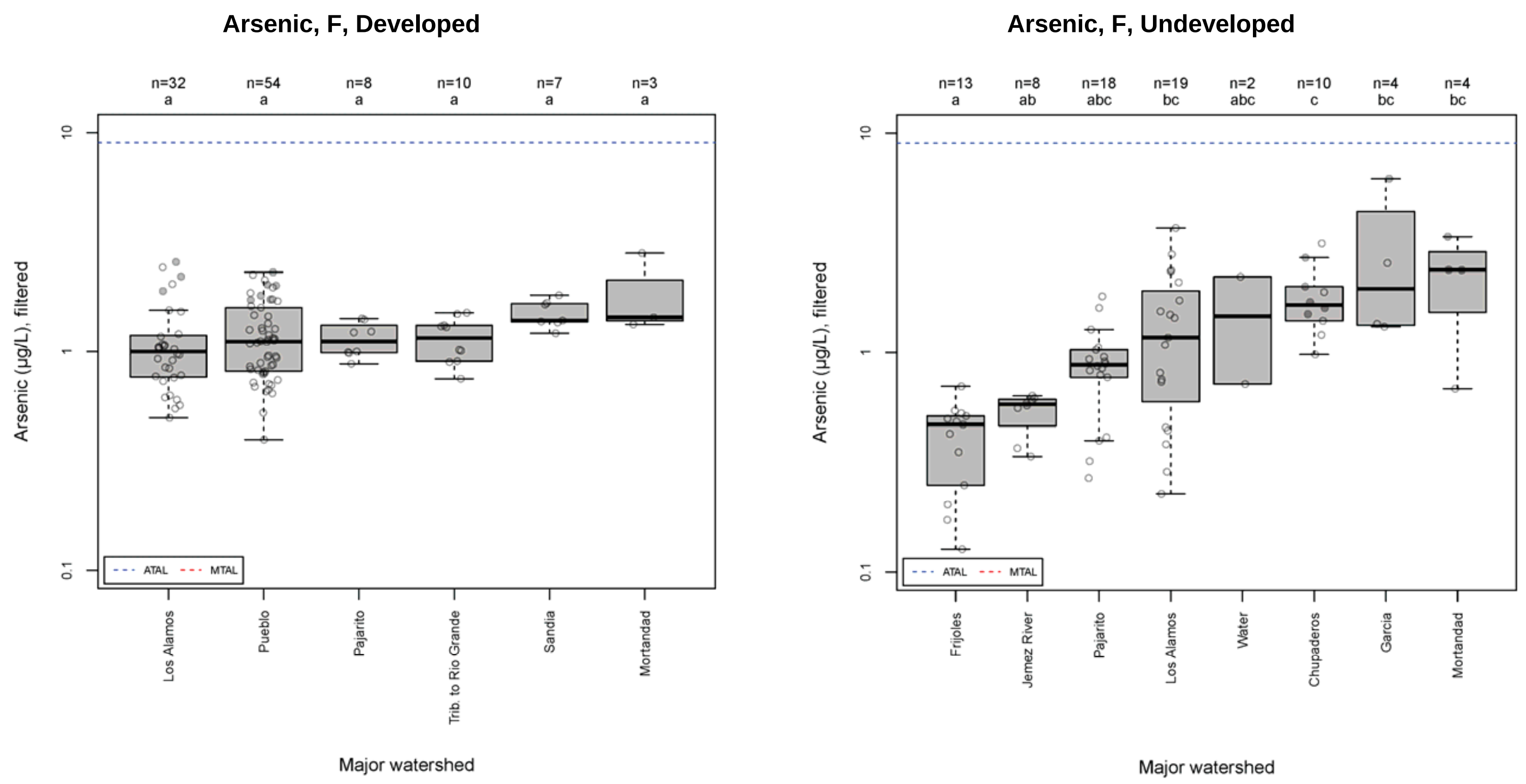


Figure 3d: Arsenic raw data boxplots by major watershed

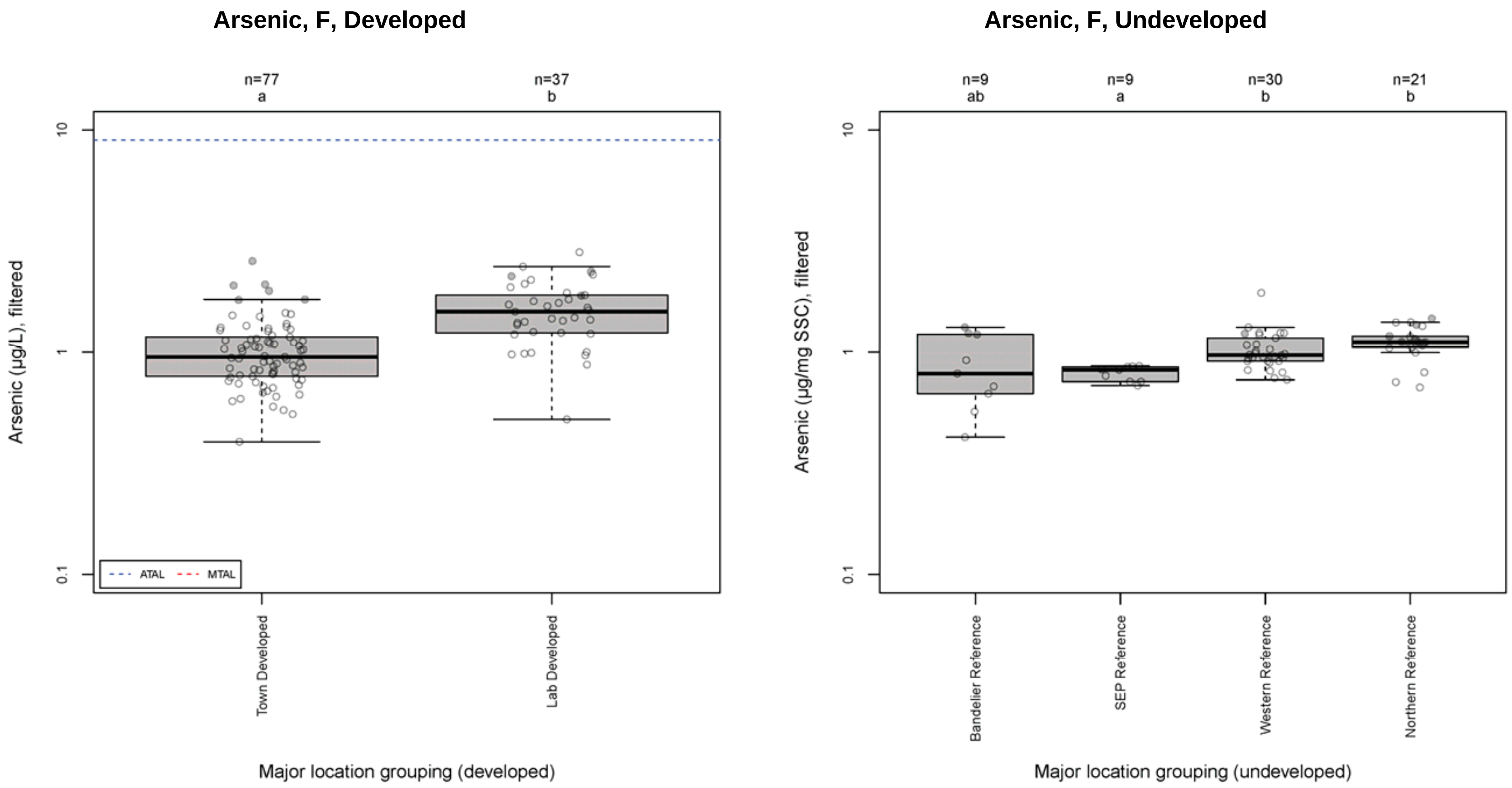


Figure 3g: Arsenic raw data boxplots by major location group

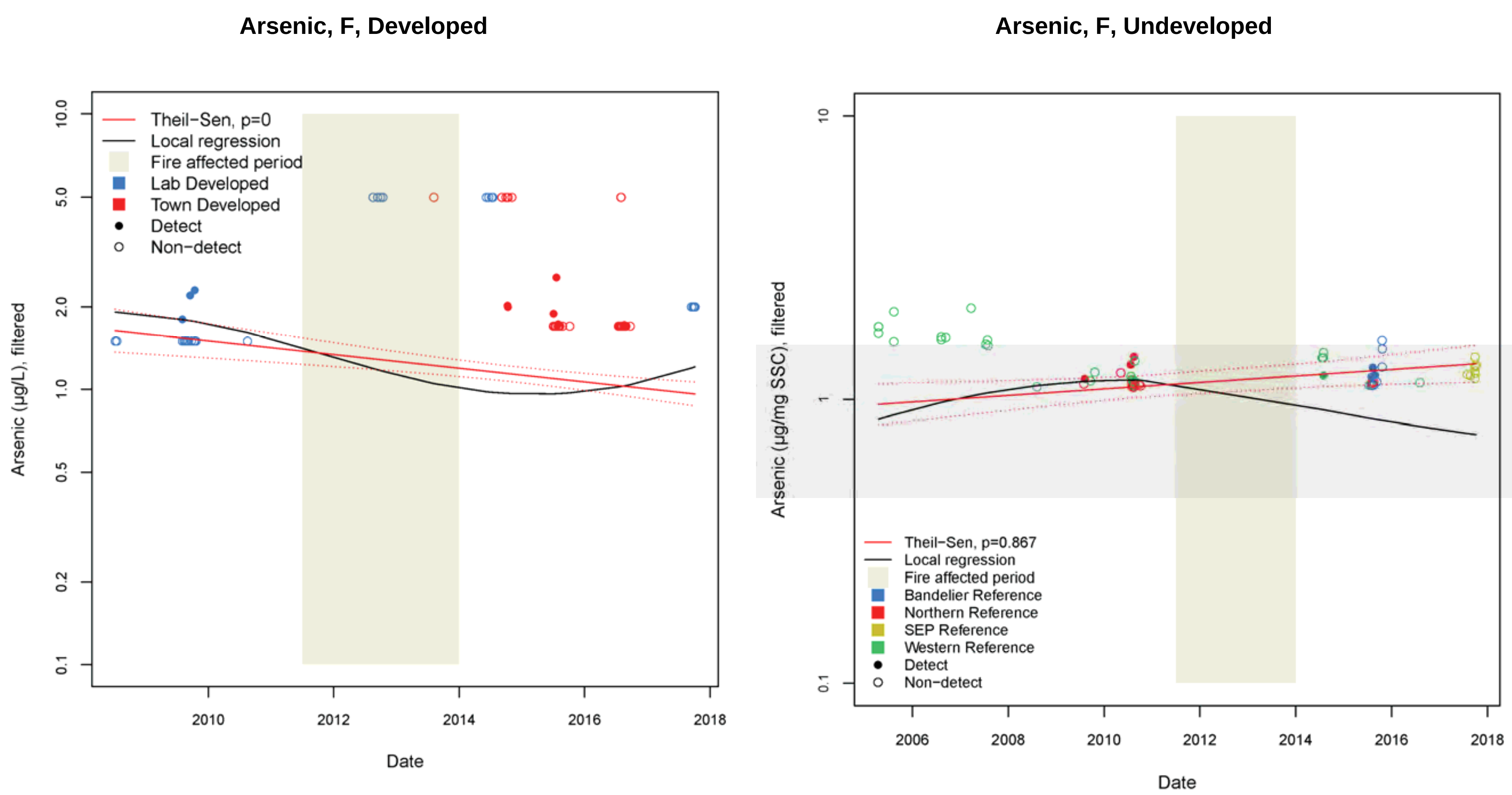


Figure 3j: Arsenic temporal trend, of raw data

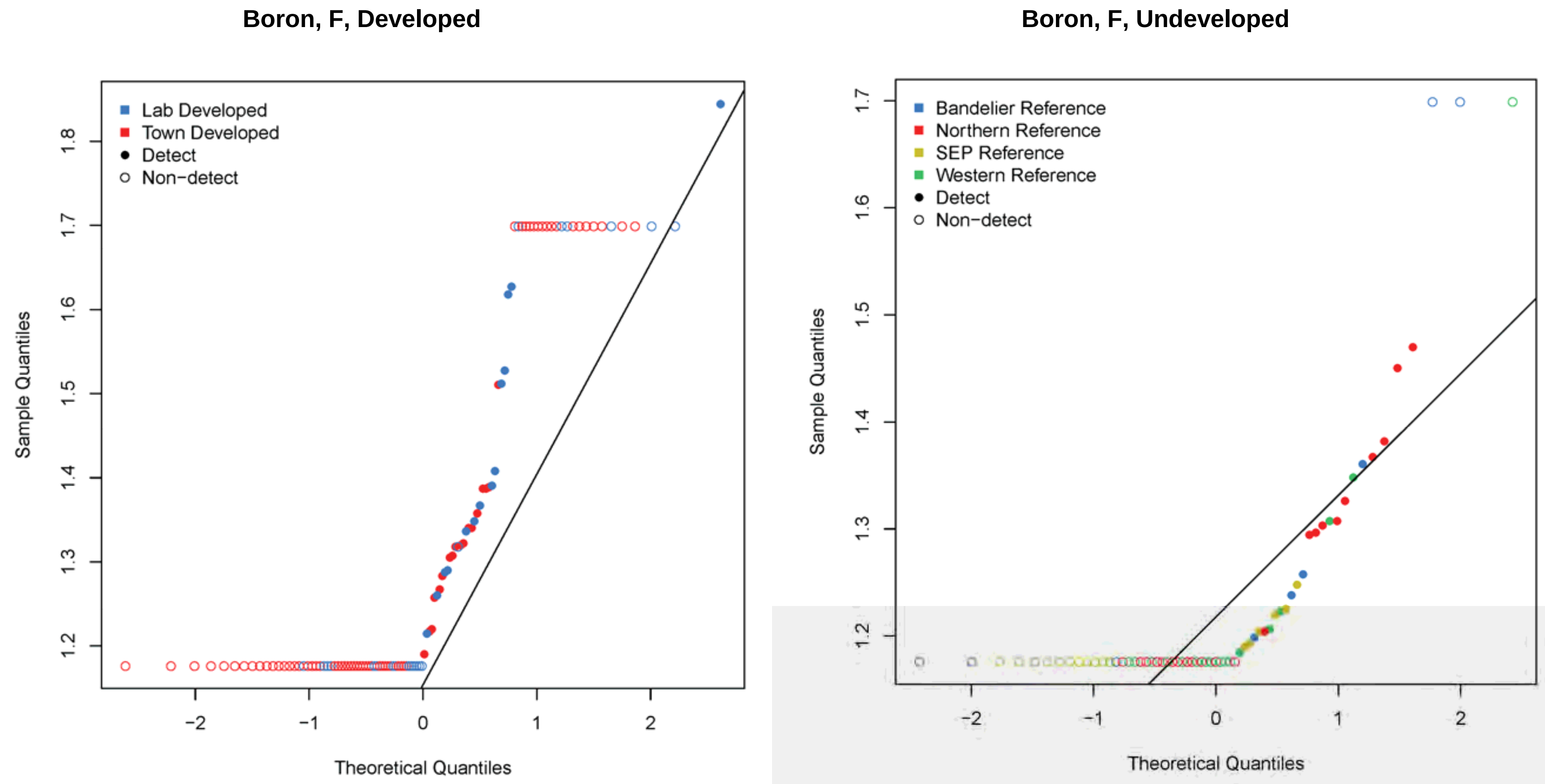


Figure 4a: Boron raw data Q-Q plots

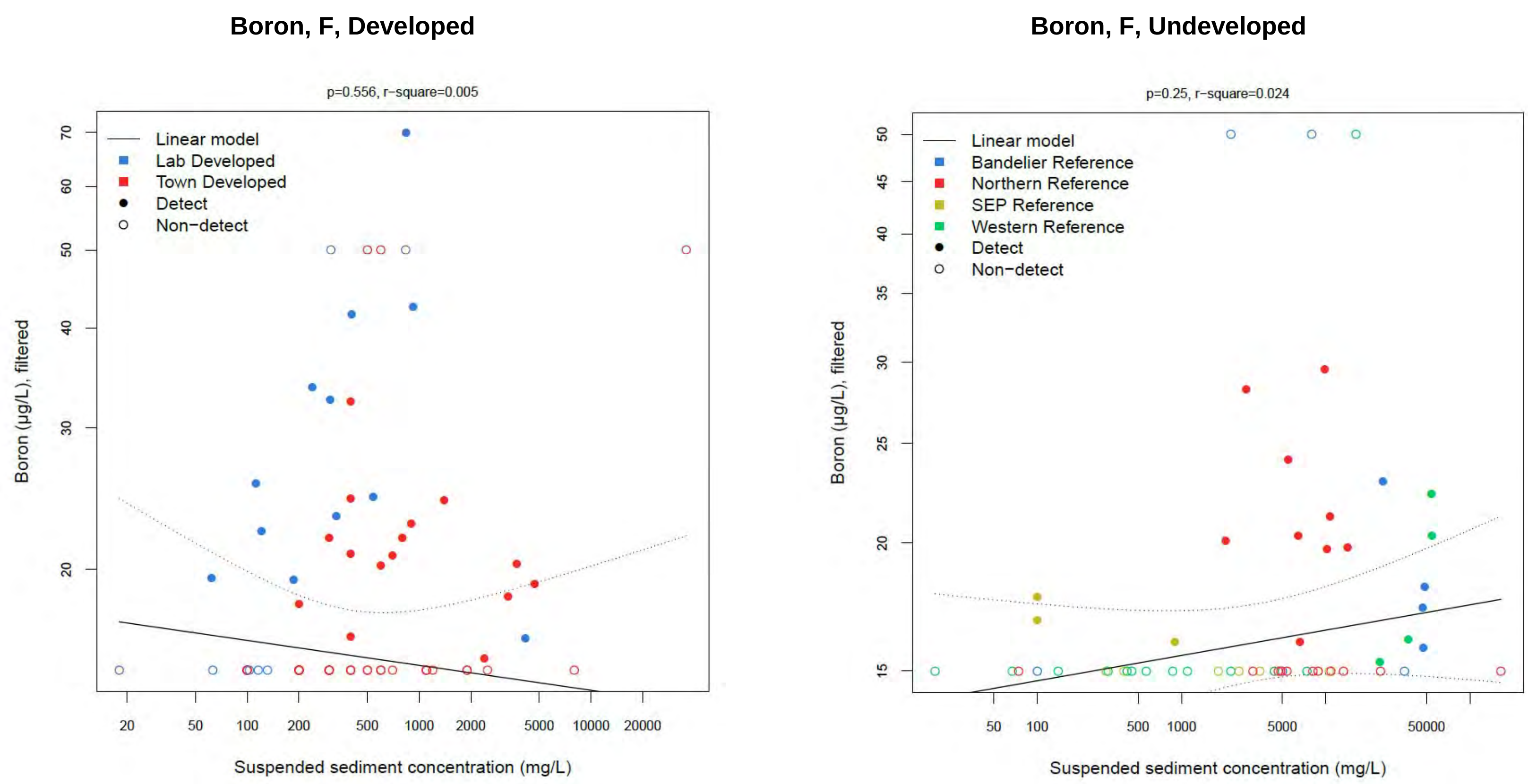
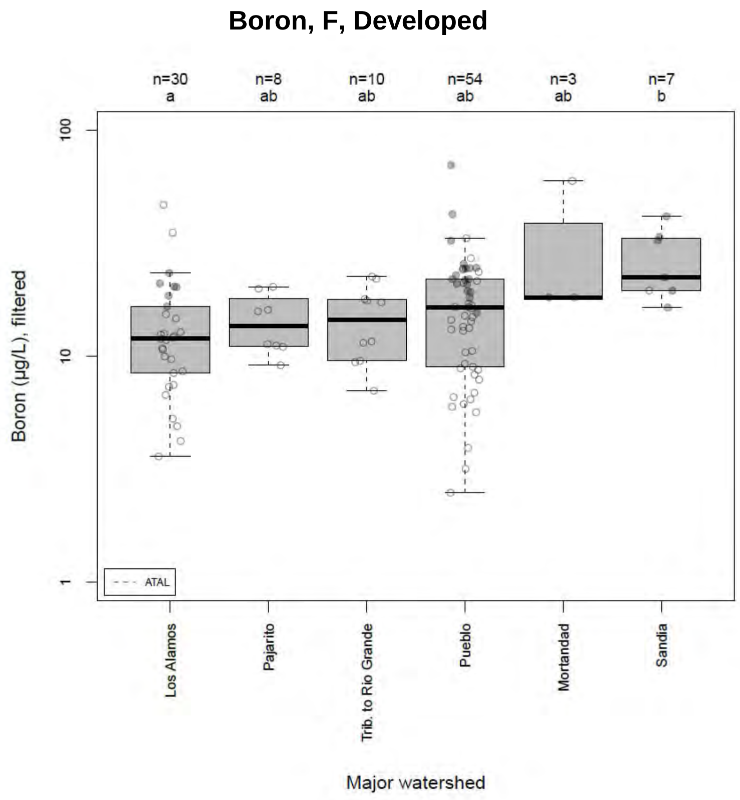


Figure 4b: Boron-SSC scatterplots



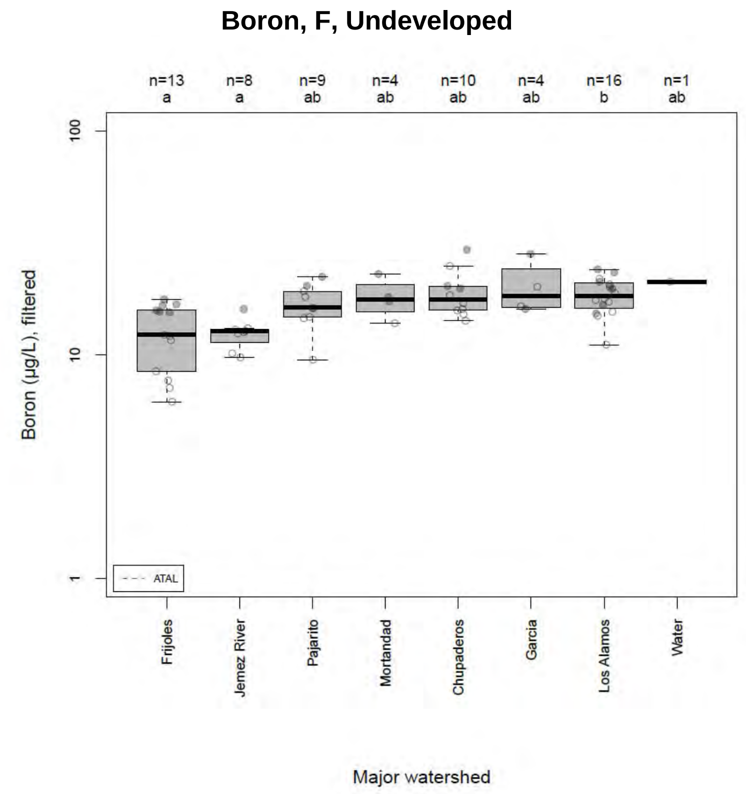
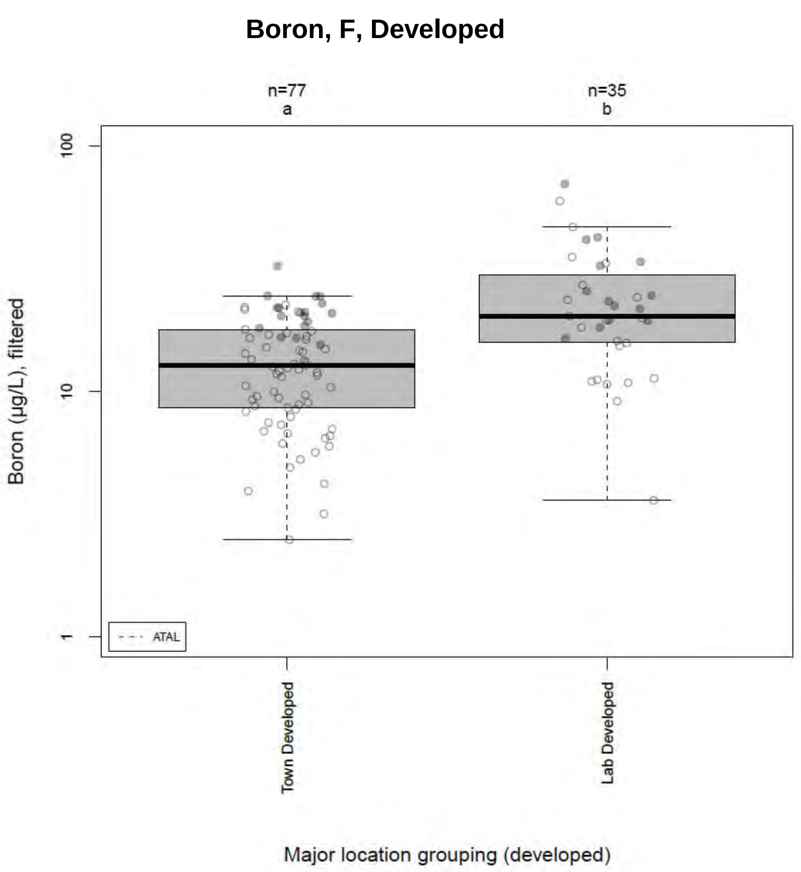


Figure 4d: Boron raw data boxplots by major watershed



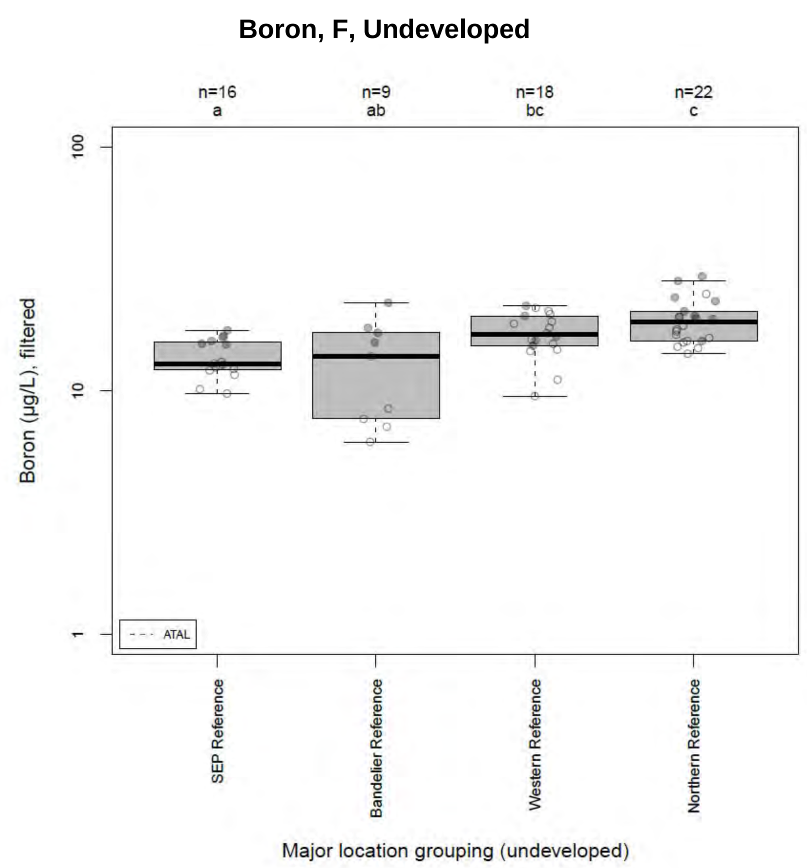


Figure 4g: Boron raw data boxplots by major location group

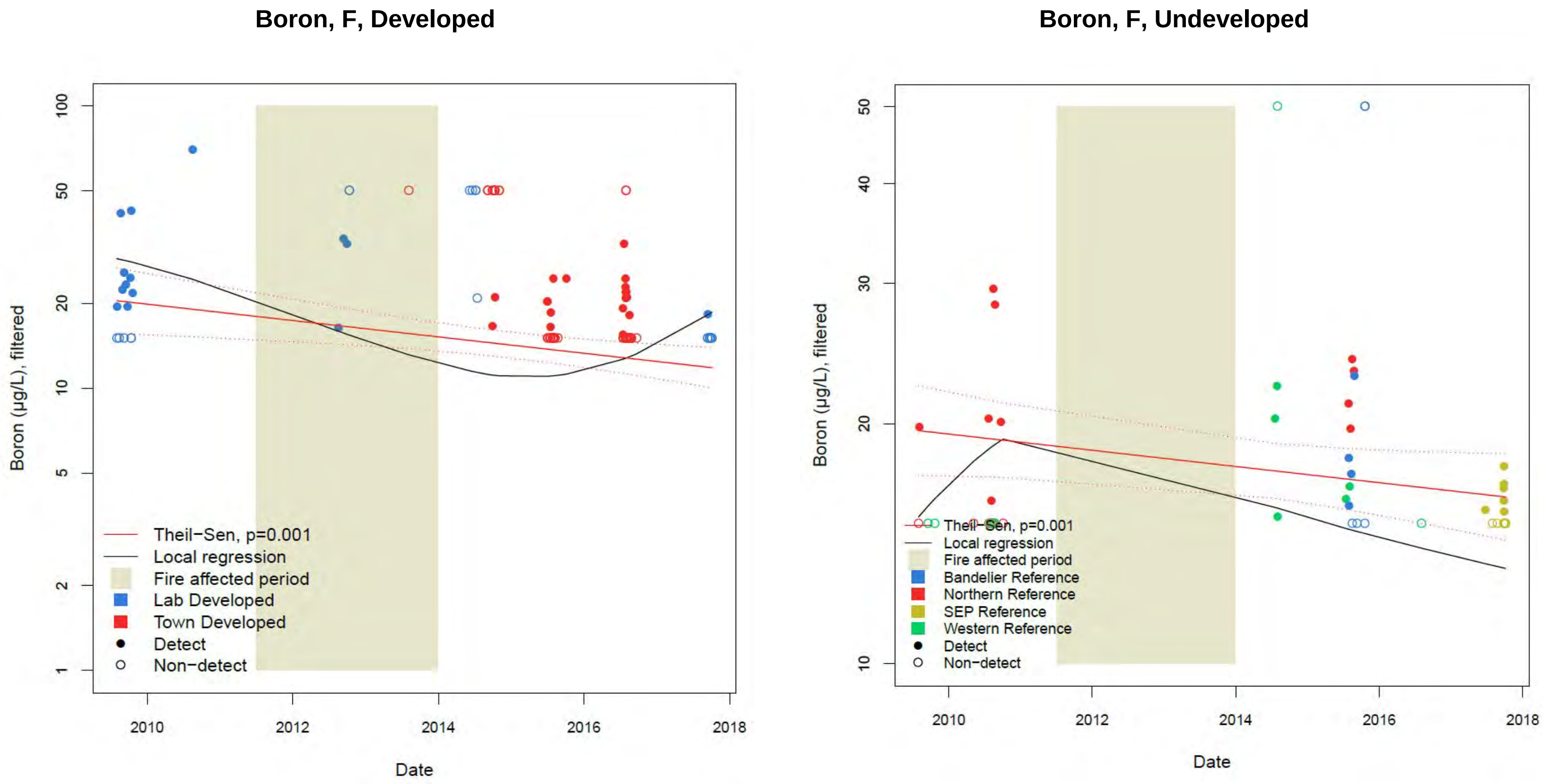


Figure 4j: Temporal trends for raw boron data

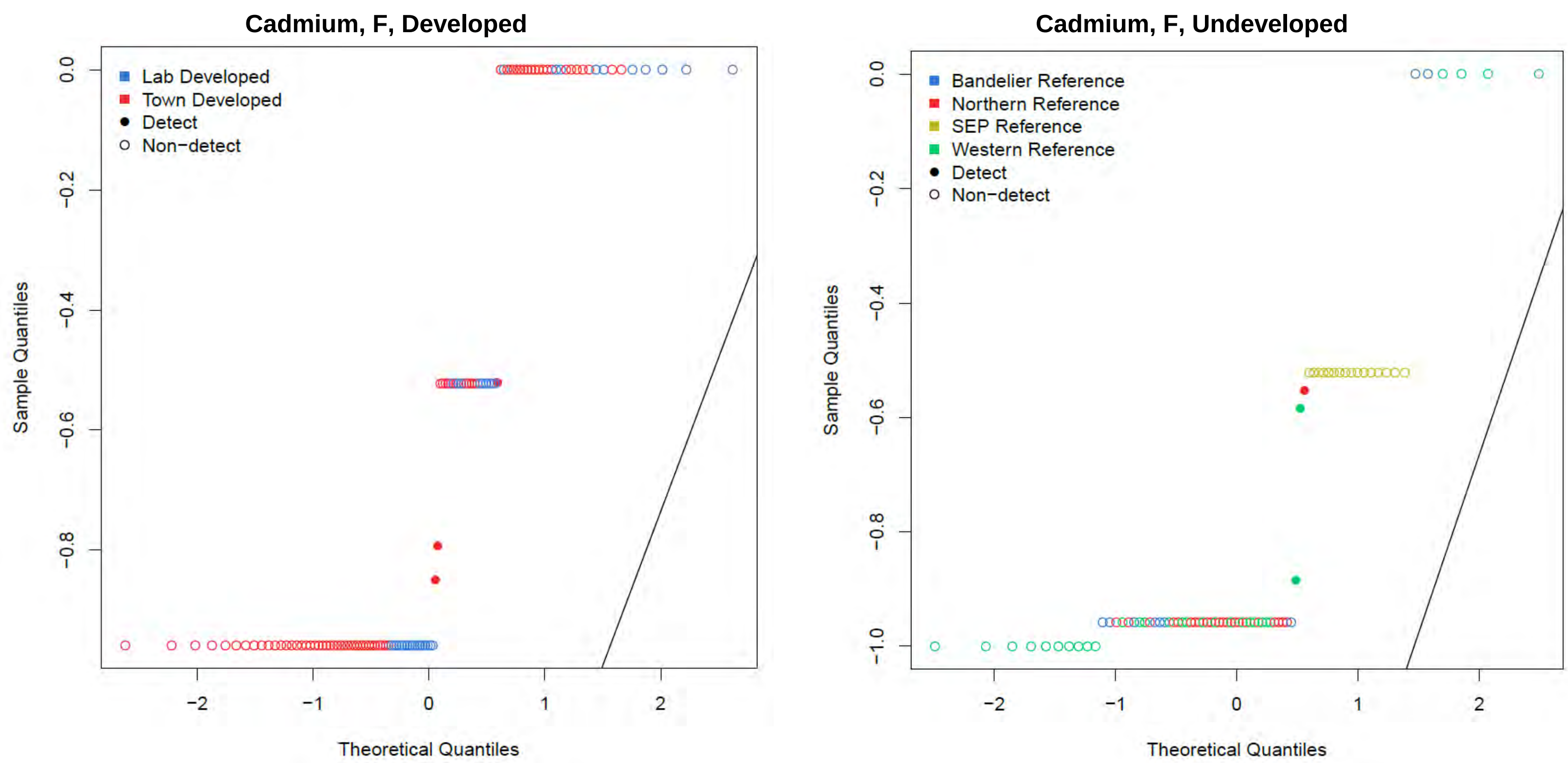


Figure 5a: Cadmium raw Q-Q Plots

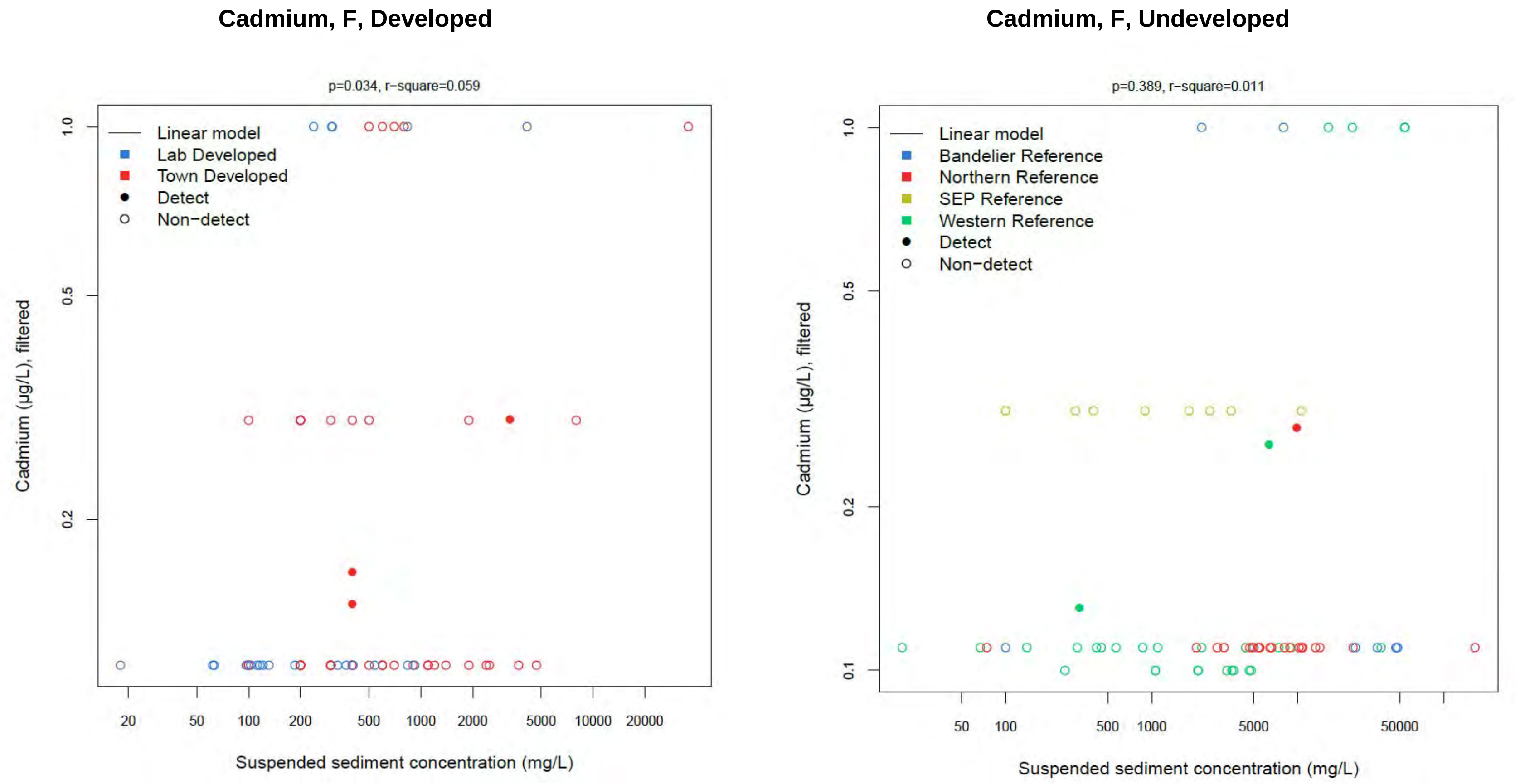


Figure 5b: Cadmium-SSC scatterplots

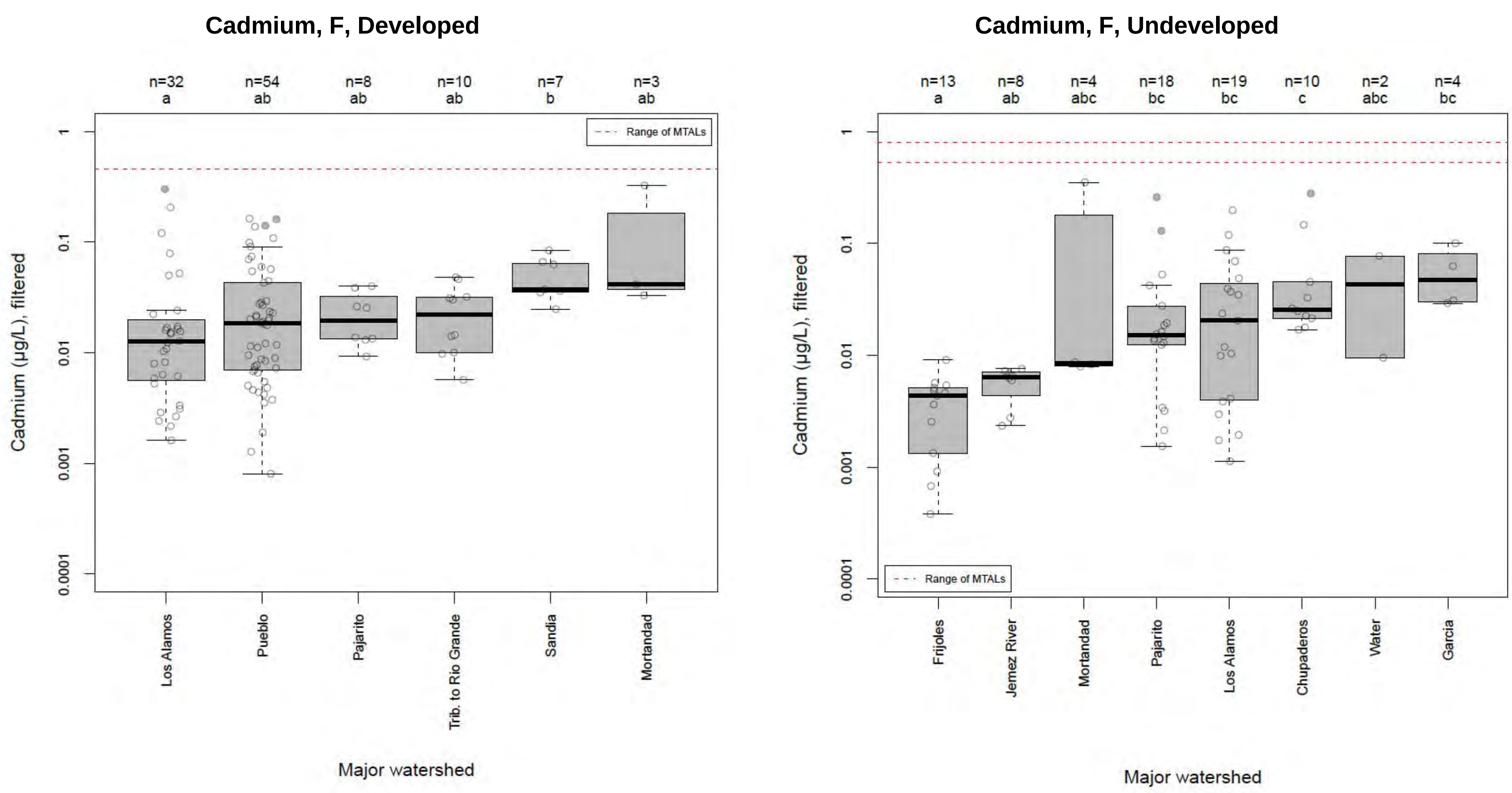


Figure 5d: Cadmium raw data boxplots by major watershed

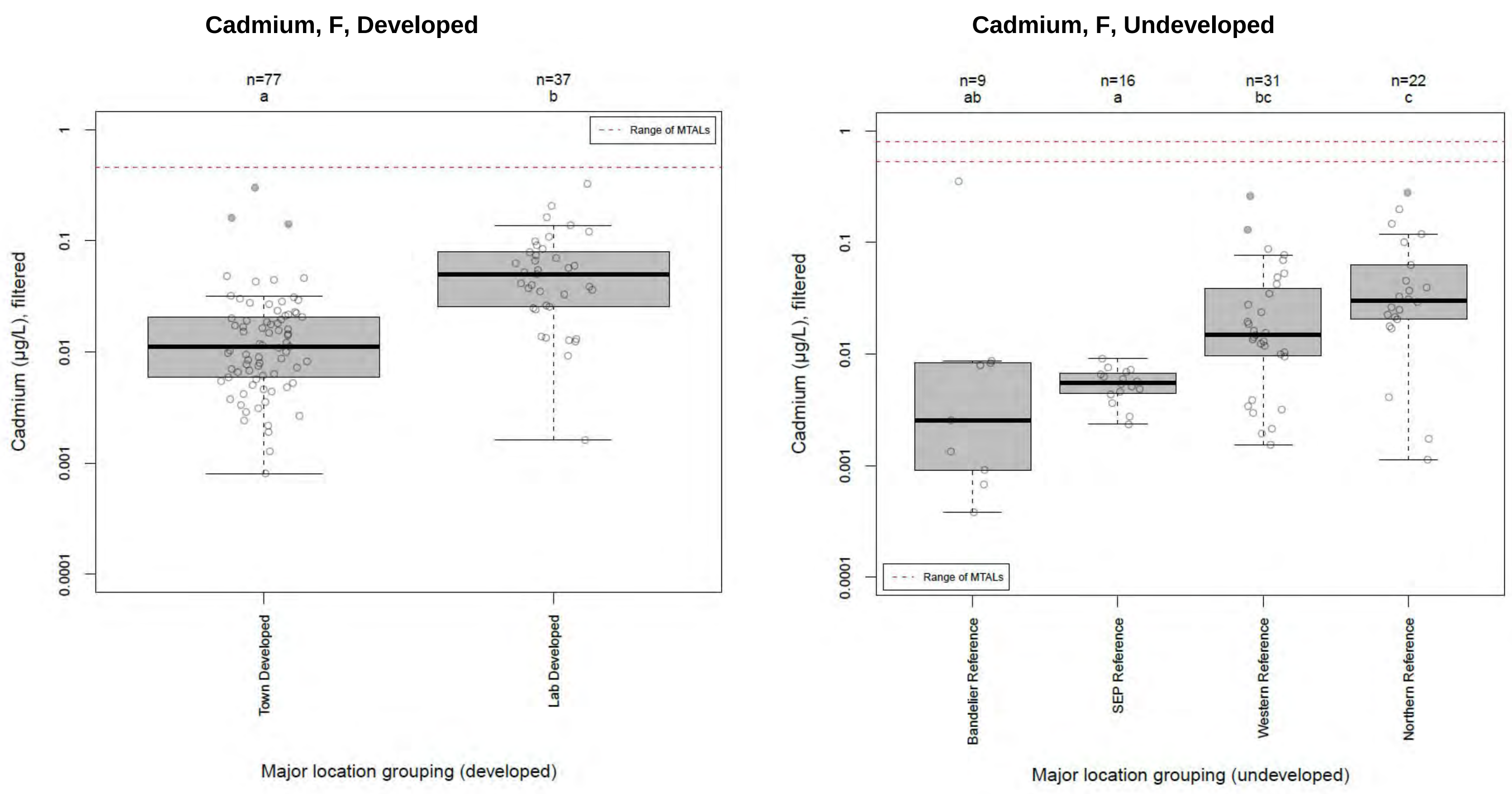


Figure 5g: Cadmium raw data boxplots by major location

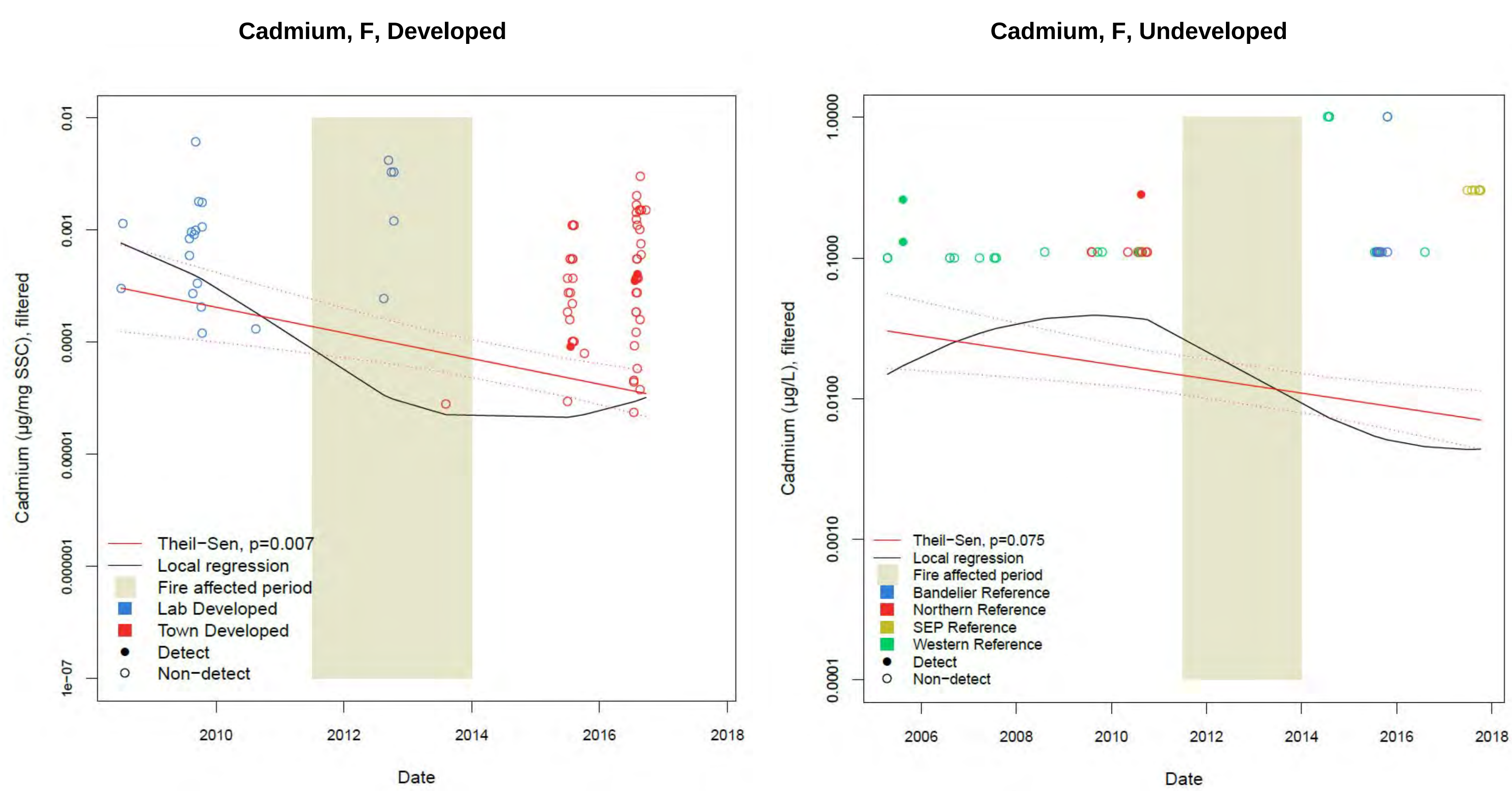


Figure 5j: Temporal trend for raw cadmium data

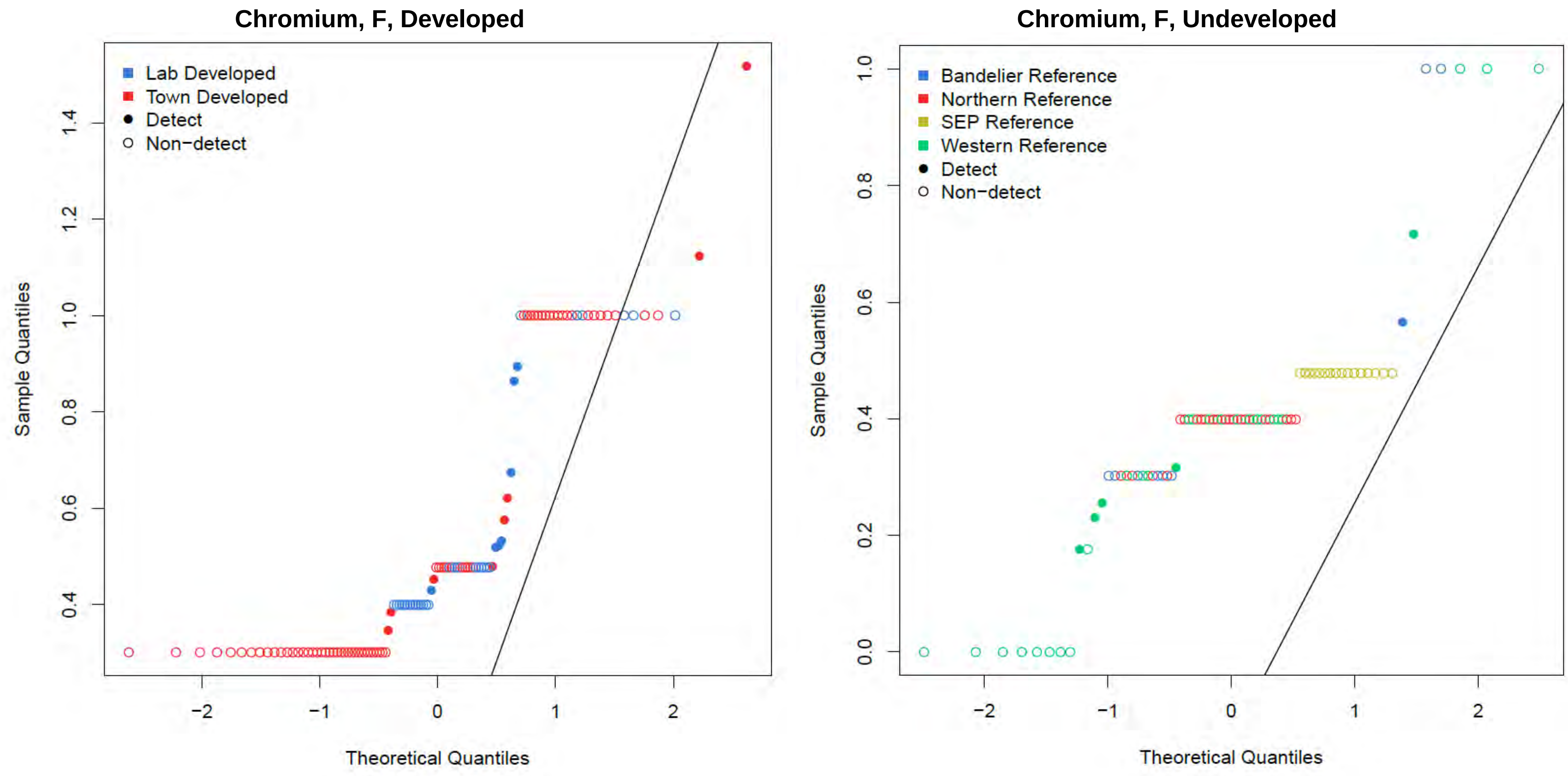


Figure 6a: Chromium raw data Q-Q plots

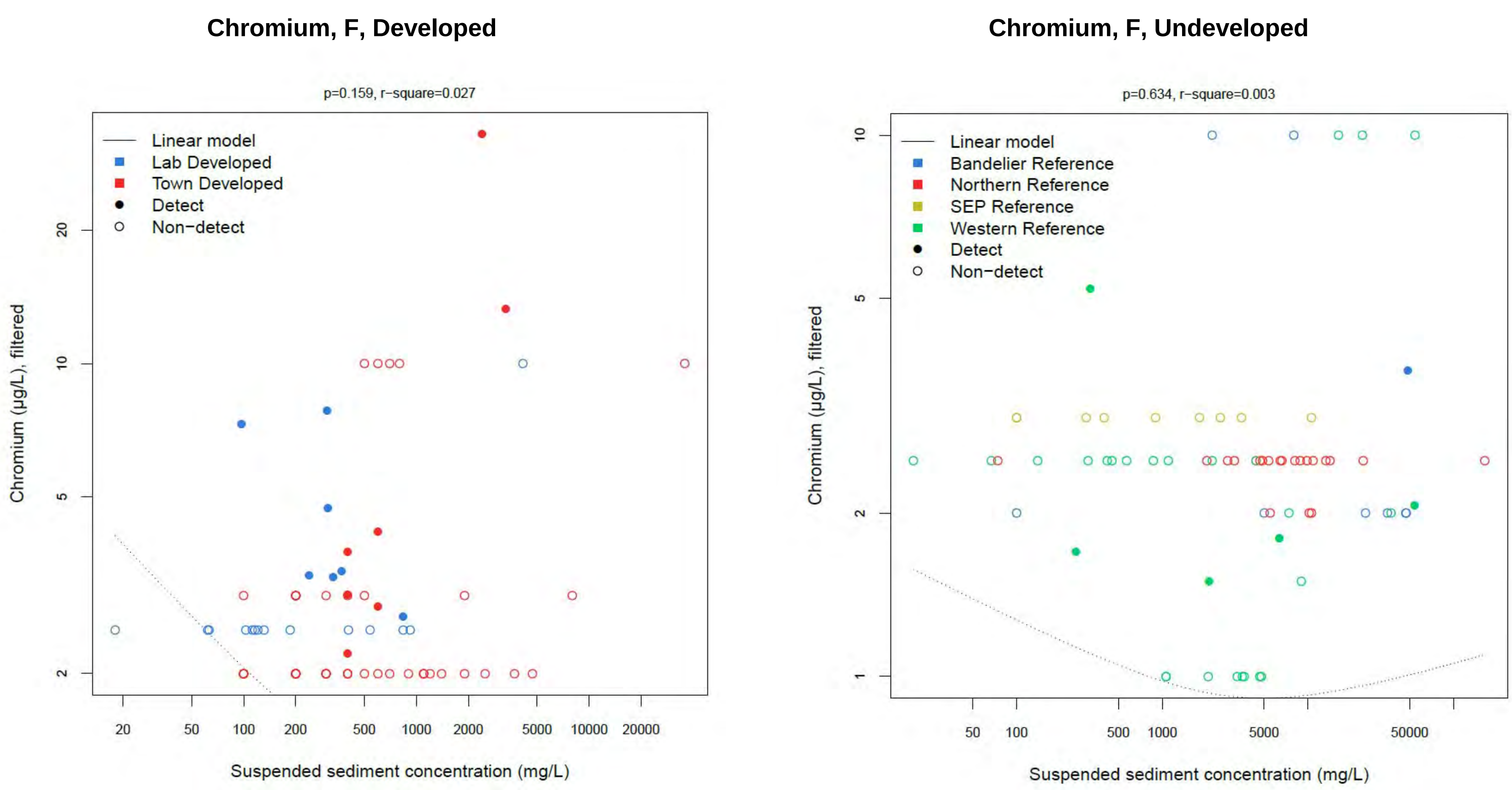
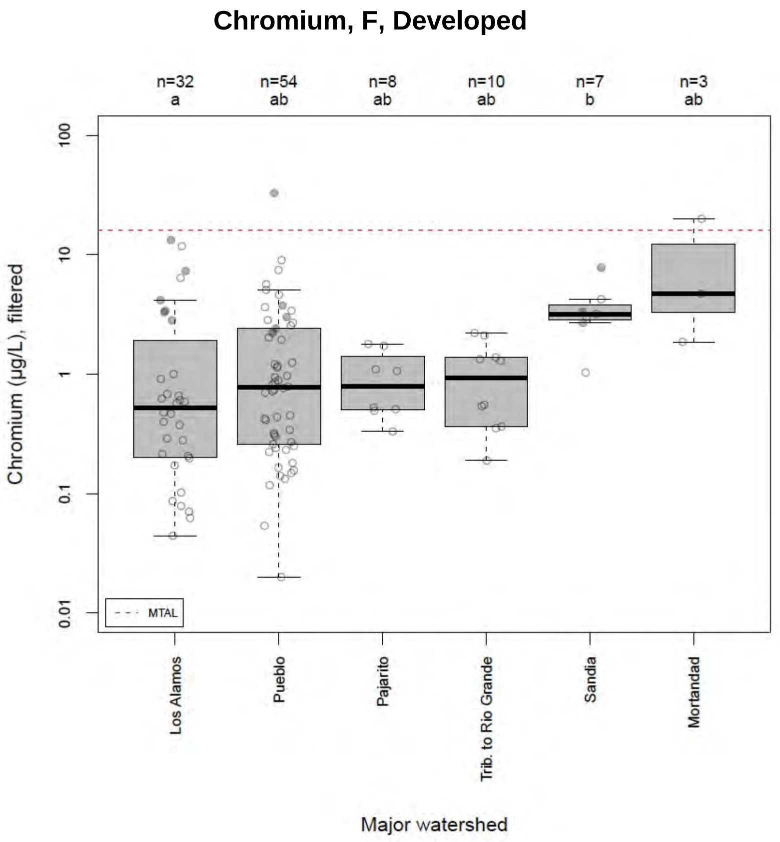


Figure 6b: Chromium-SSC scatterplots



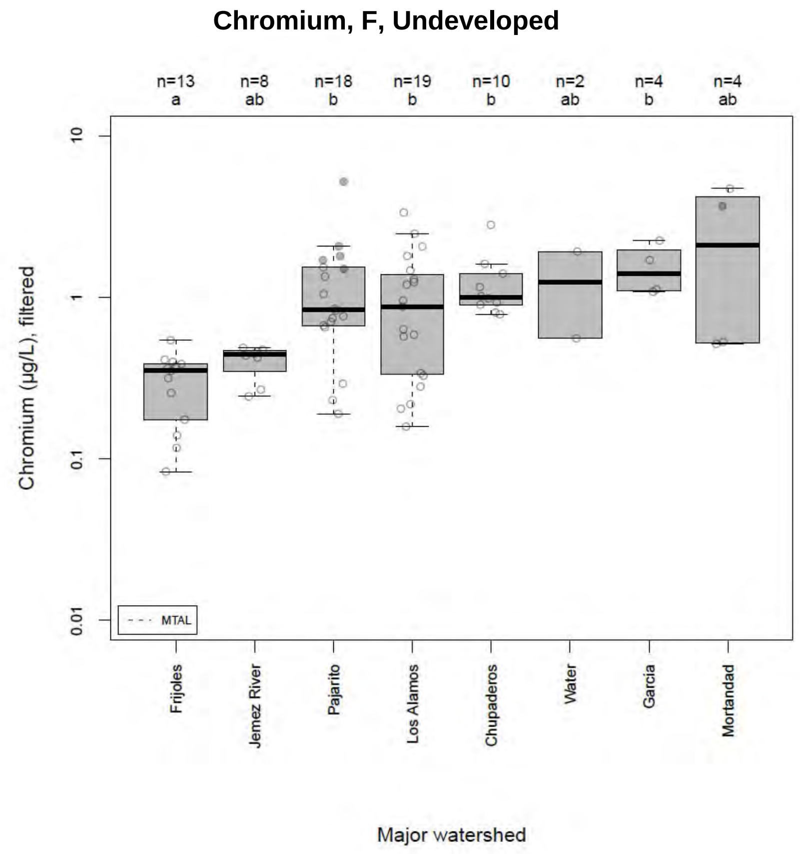
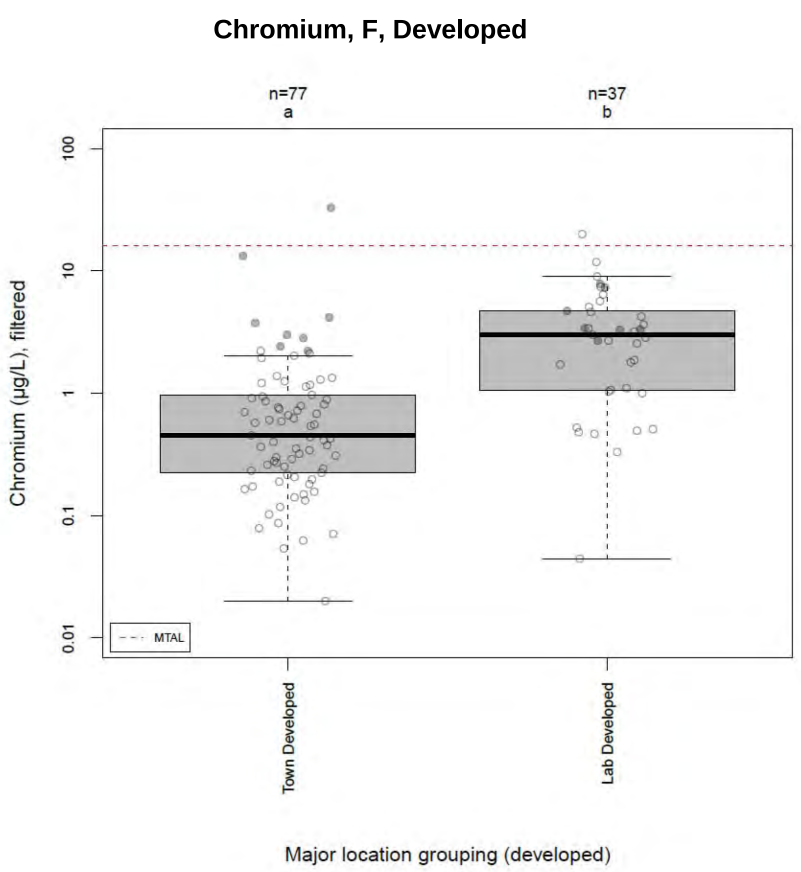


Figure 6d: Chromium raw data boxplots by major watershed



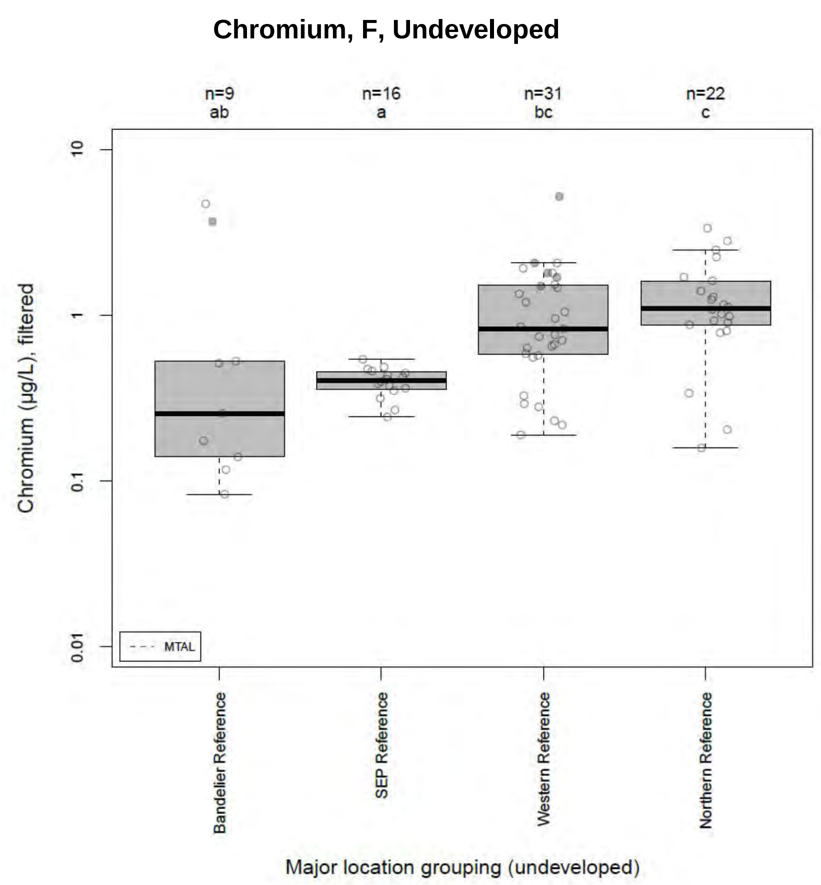


Figure 6g: Chromium raw data boxplots by major location

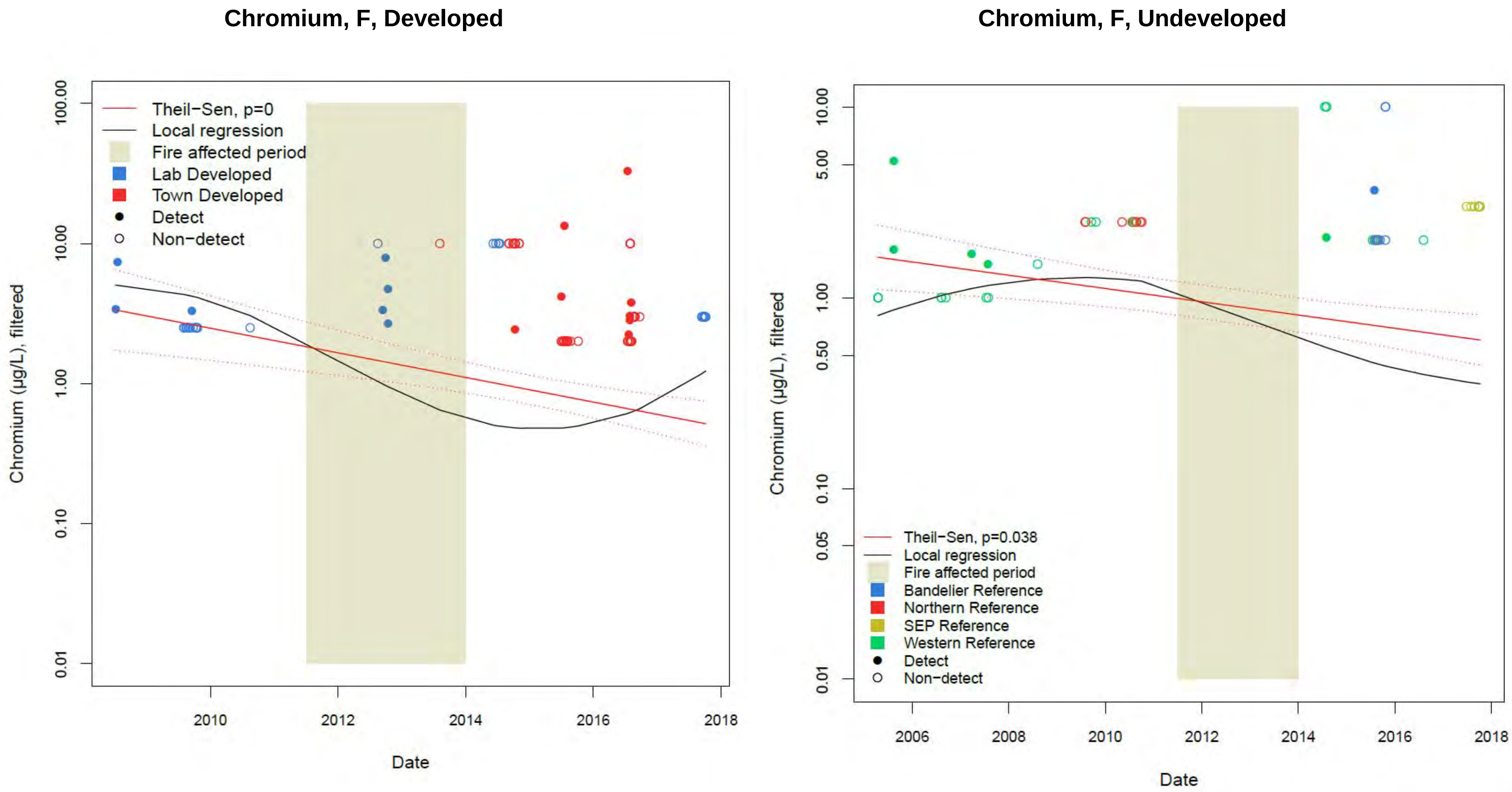


Figure 6j: Temporal trend for raw chromium data

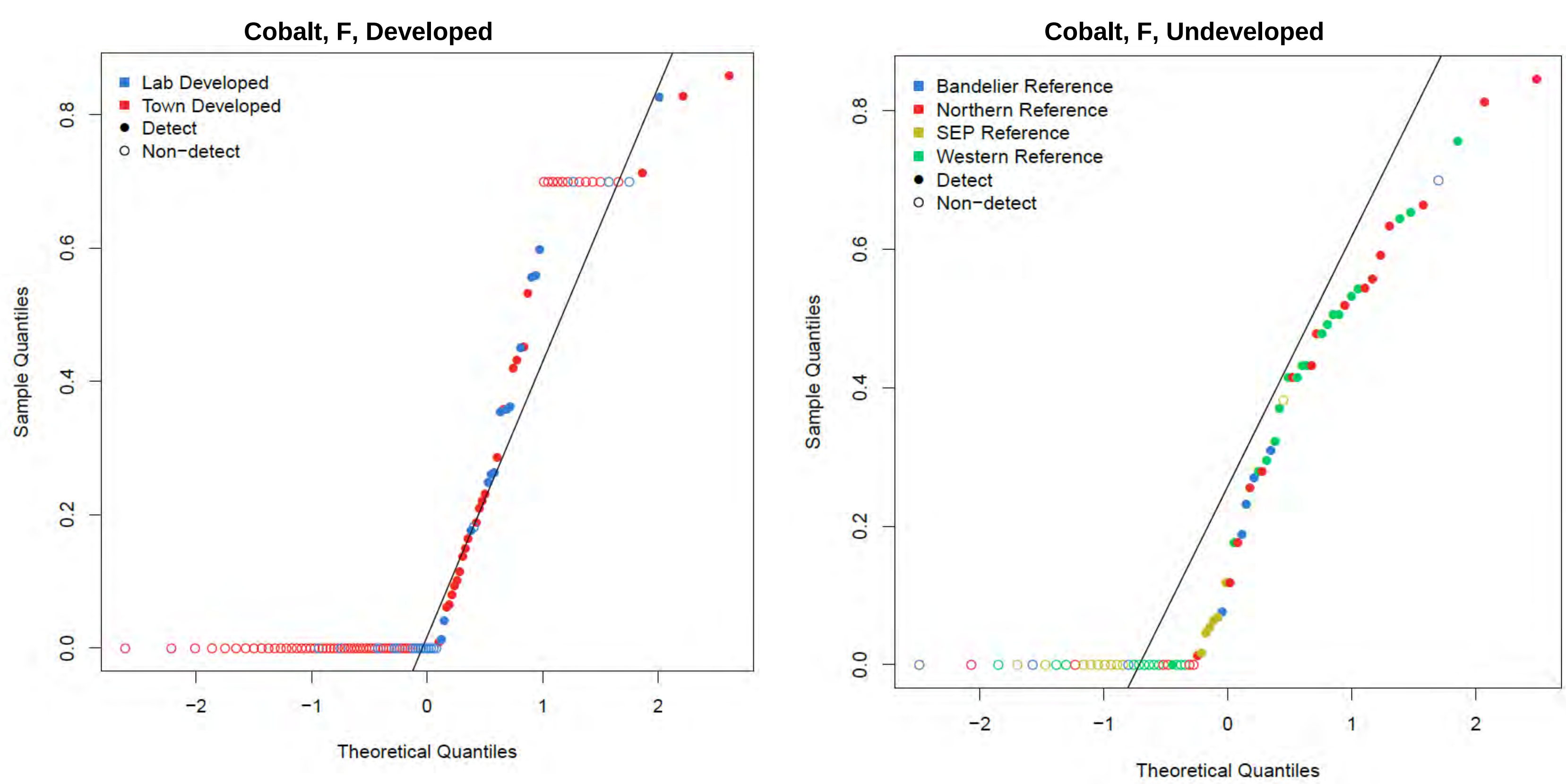


Figure 7a: Cobalt raw data Q-Q Plots

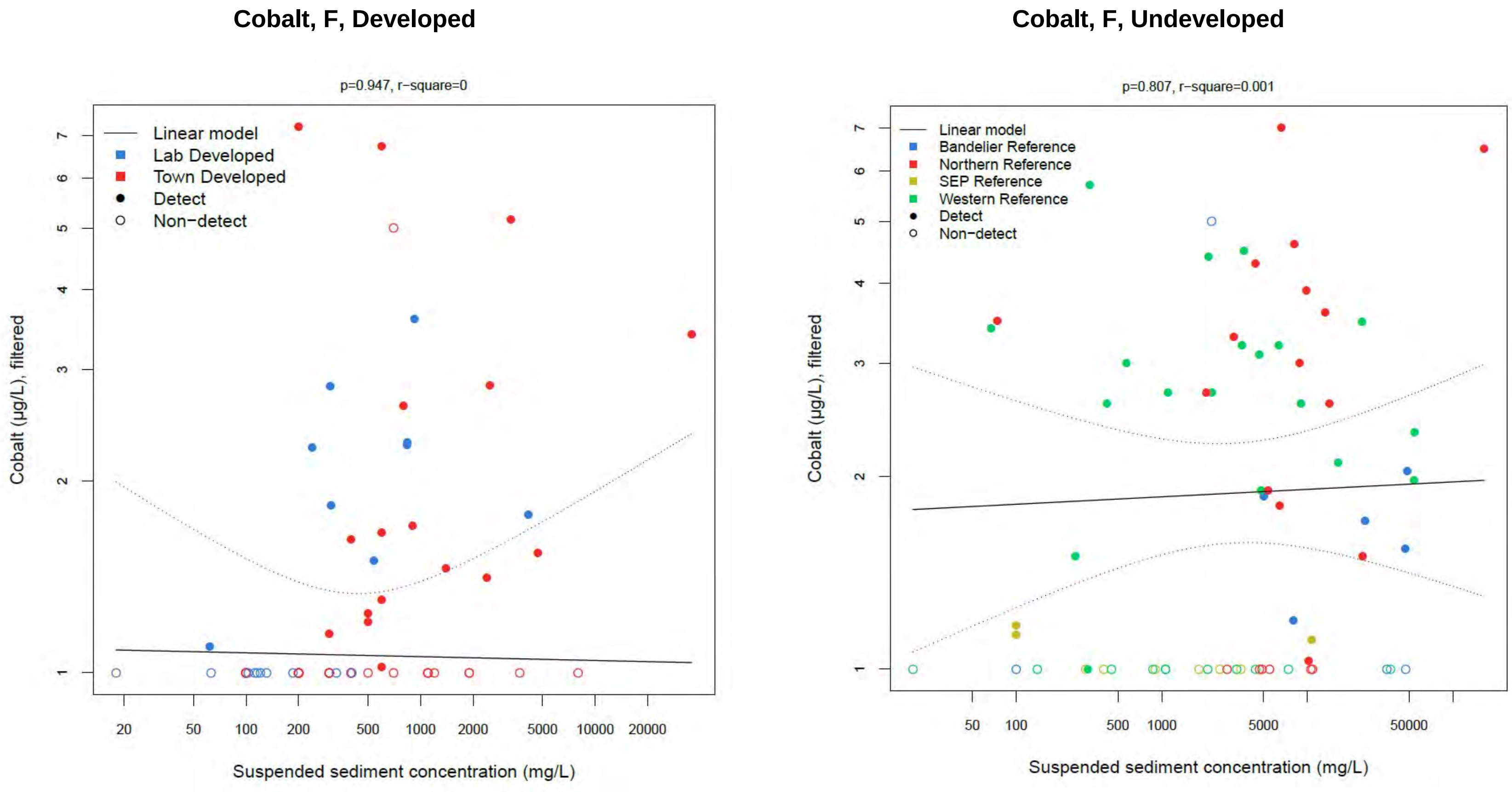


Figure 7b: Cobalt-SSC scatterplots

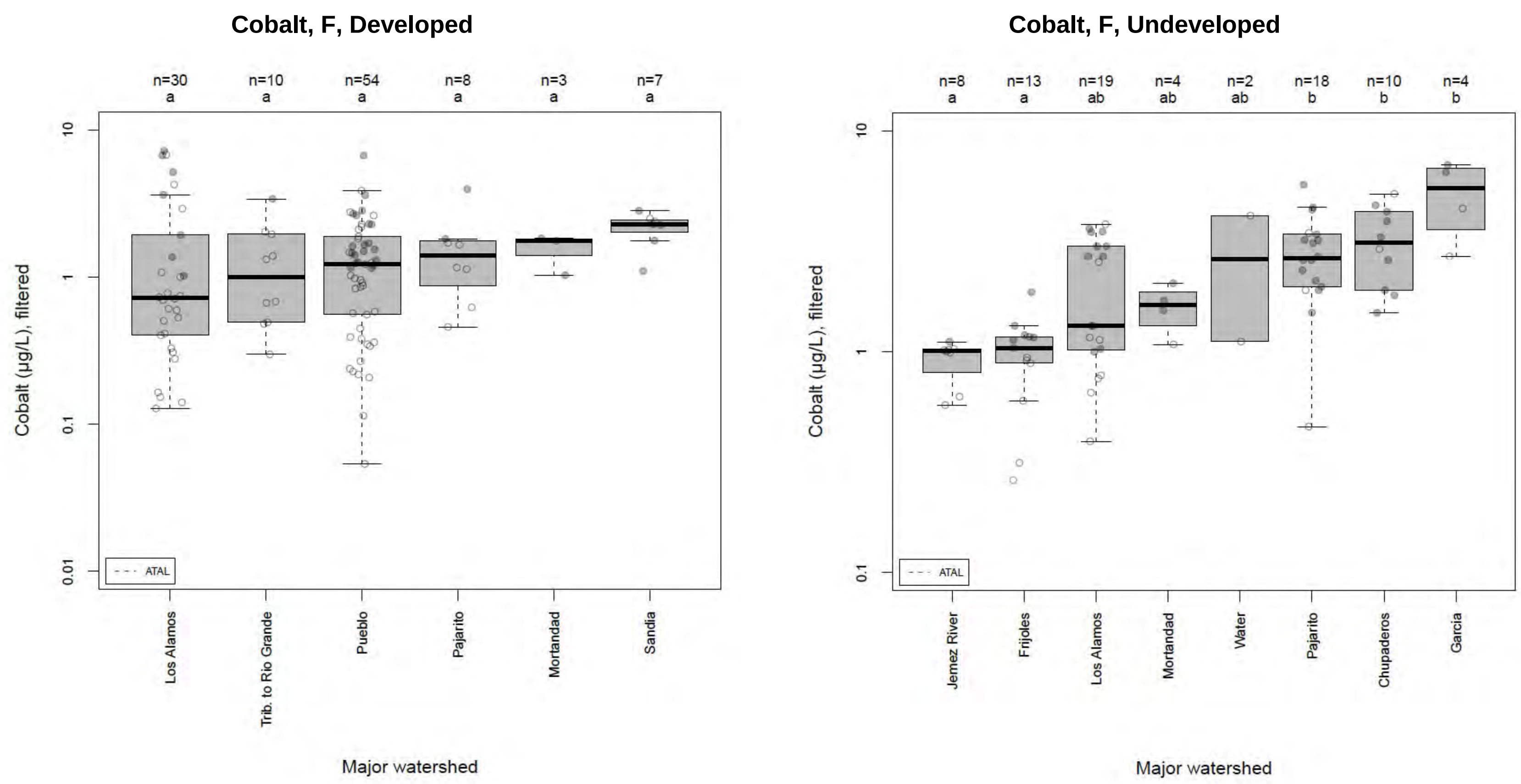


Figure 7d: Cobalt raw data boxplots by major watershed

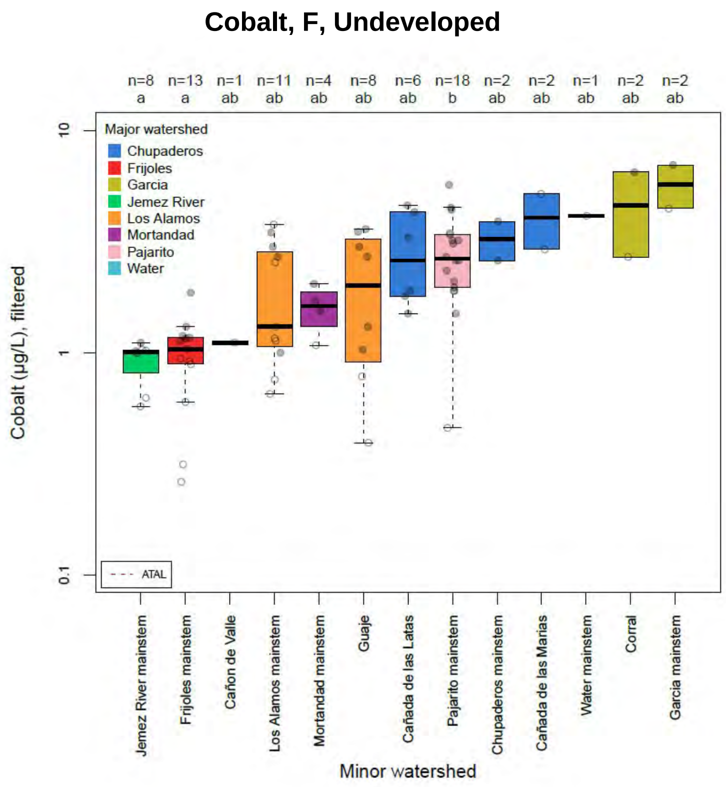


Figure 7f: Cobalt raw data boxplots by minor watershed

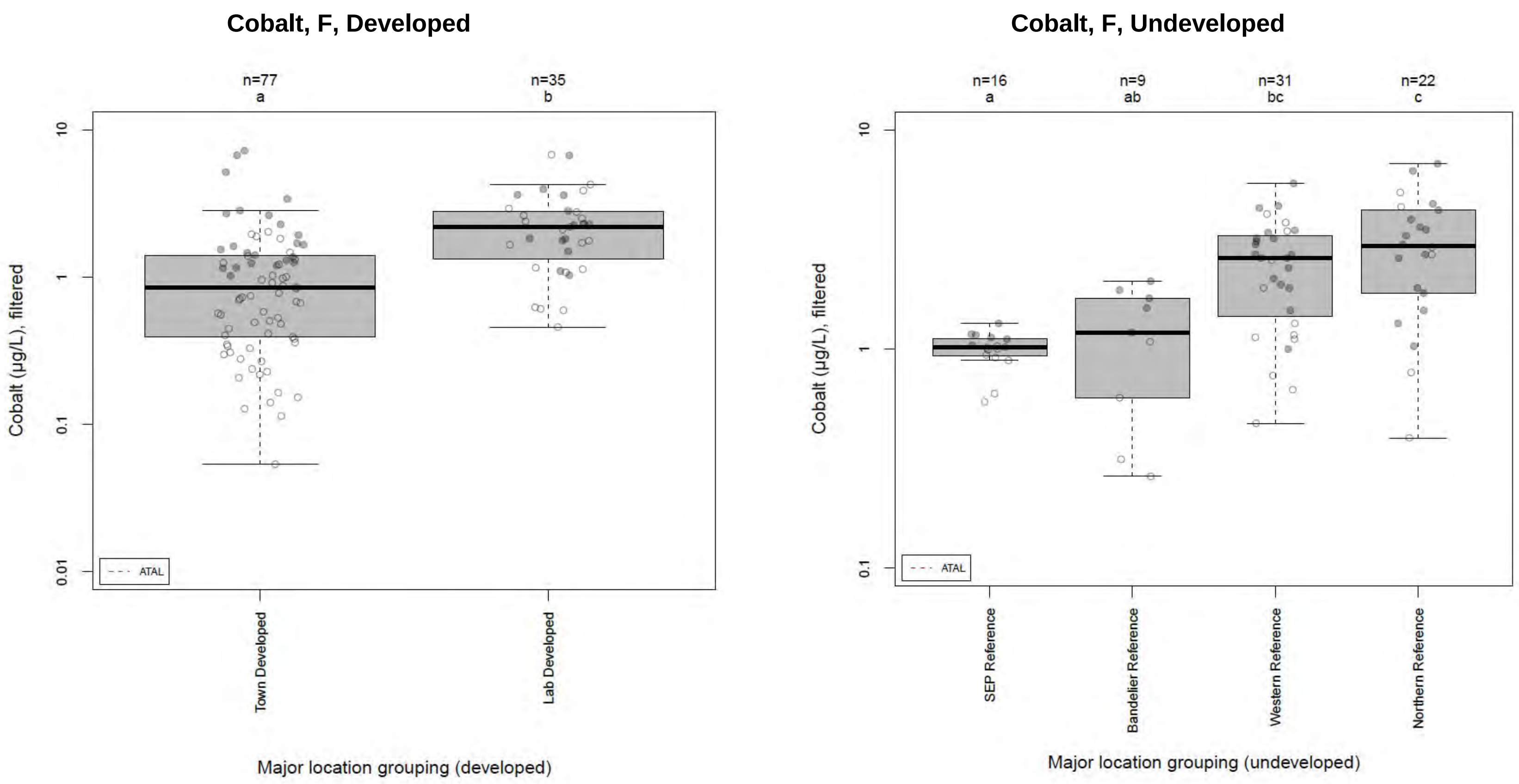
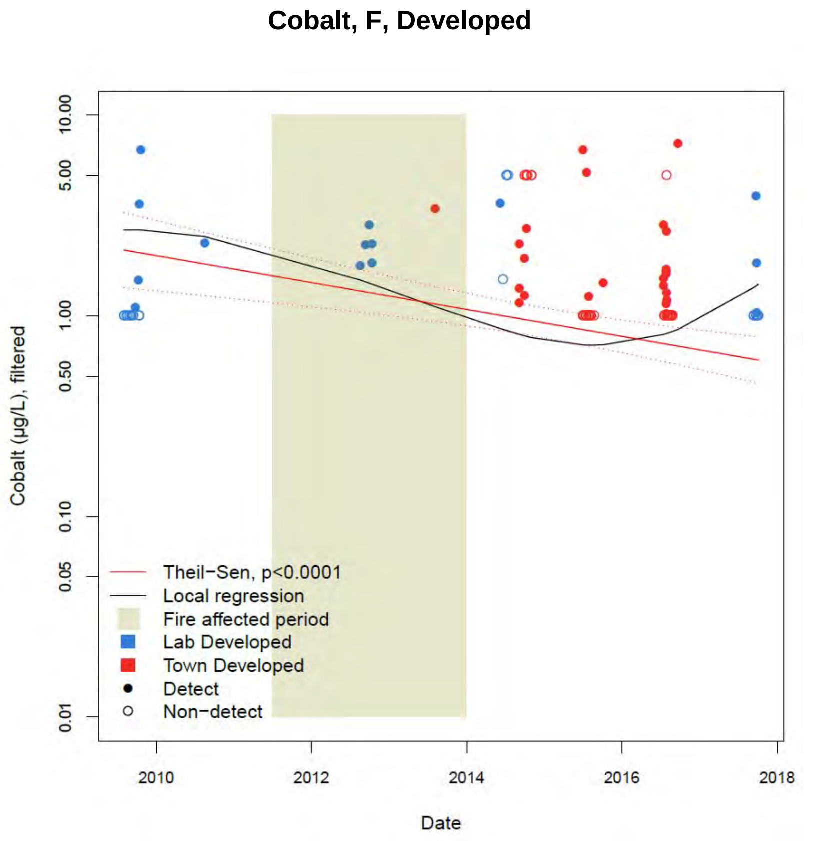


Figure 7g: Cobalt raw data boxplots by major location group



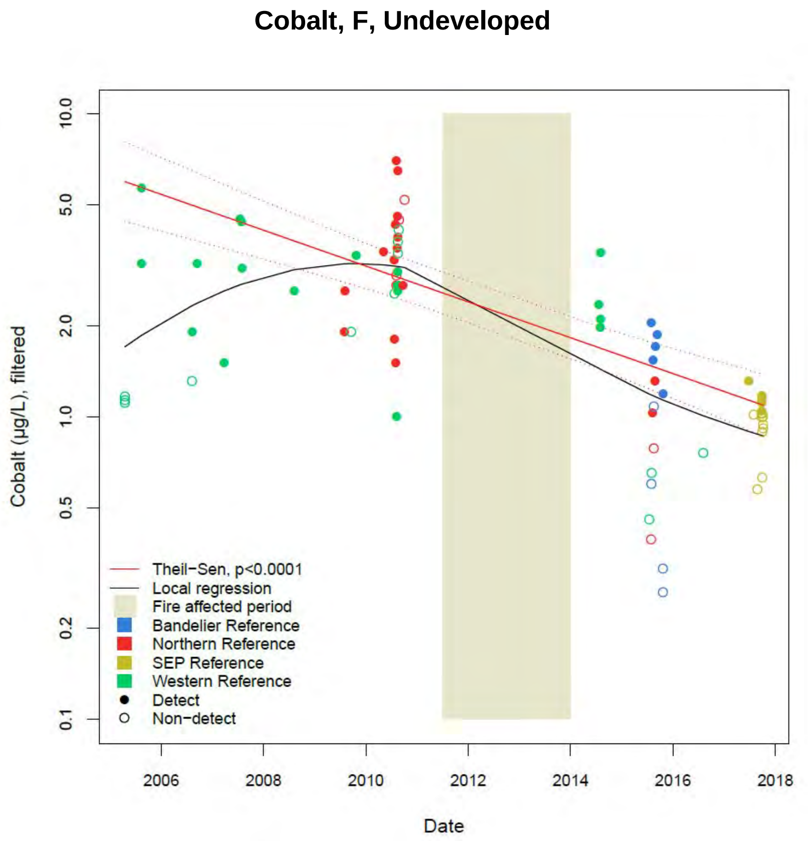
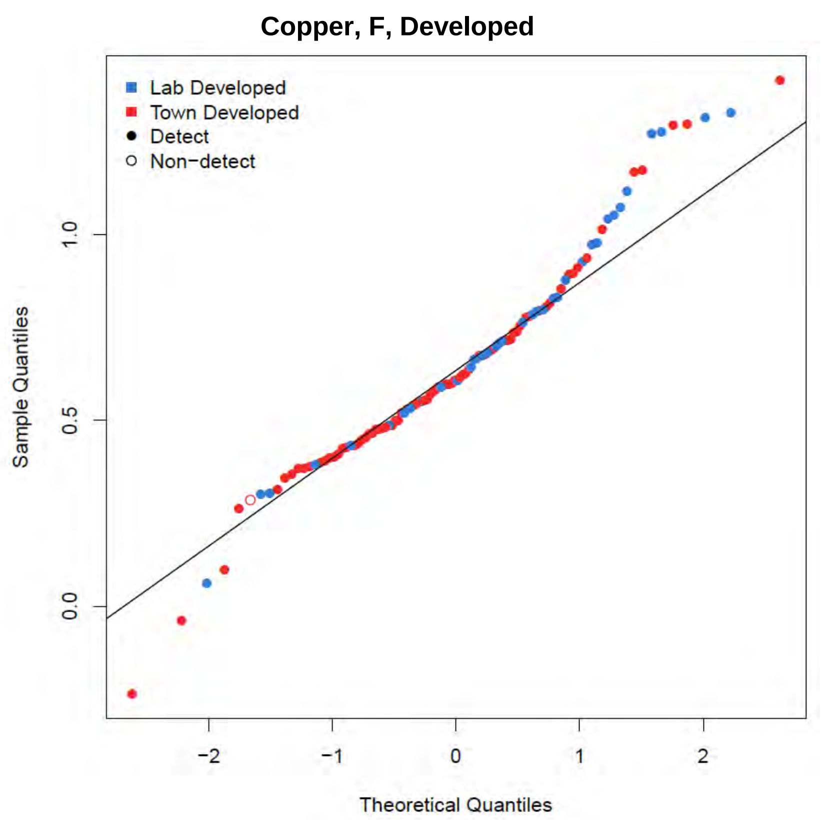


Figure 7j: Temporal trend for raw cobalt data



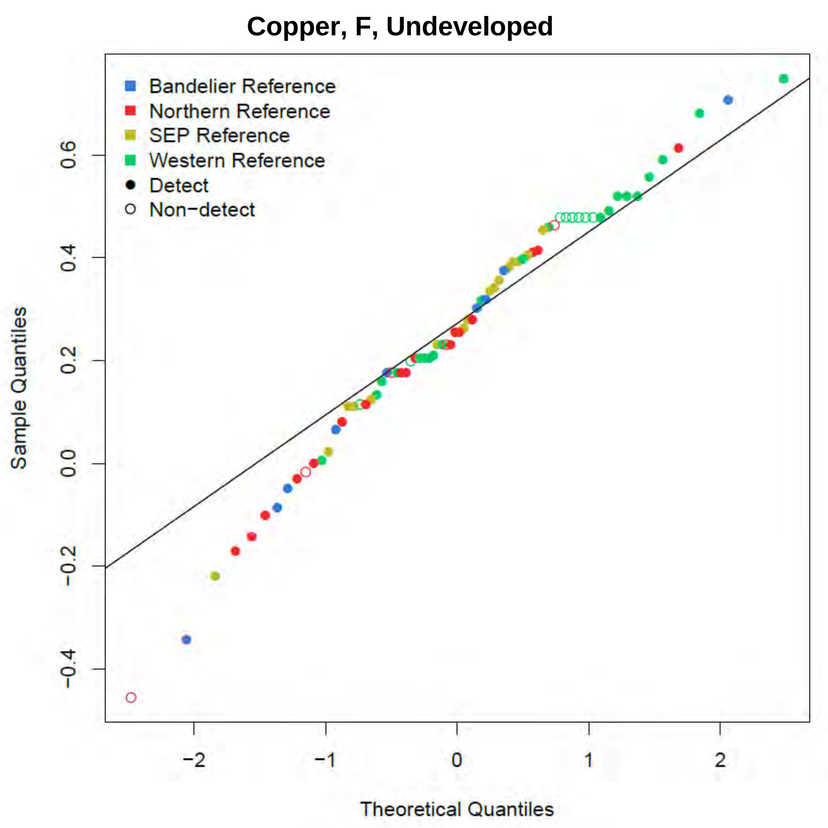


Figure 8a: Copper raw data Q-Q plots

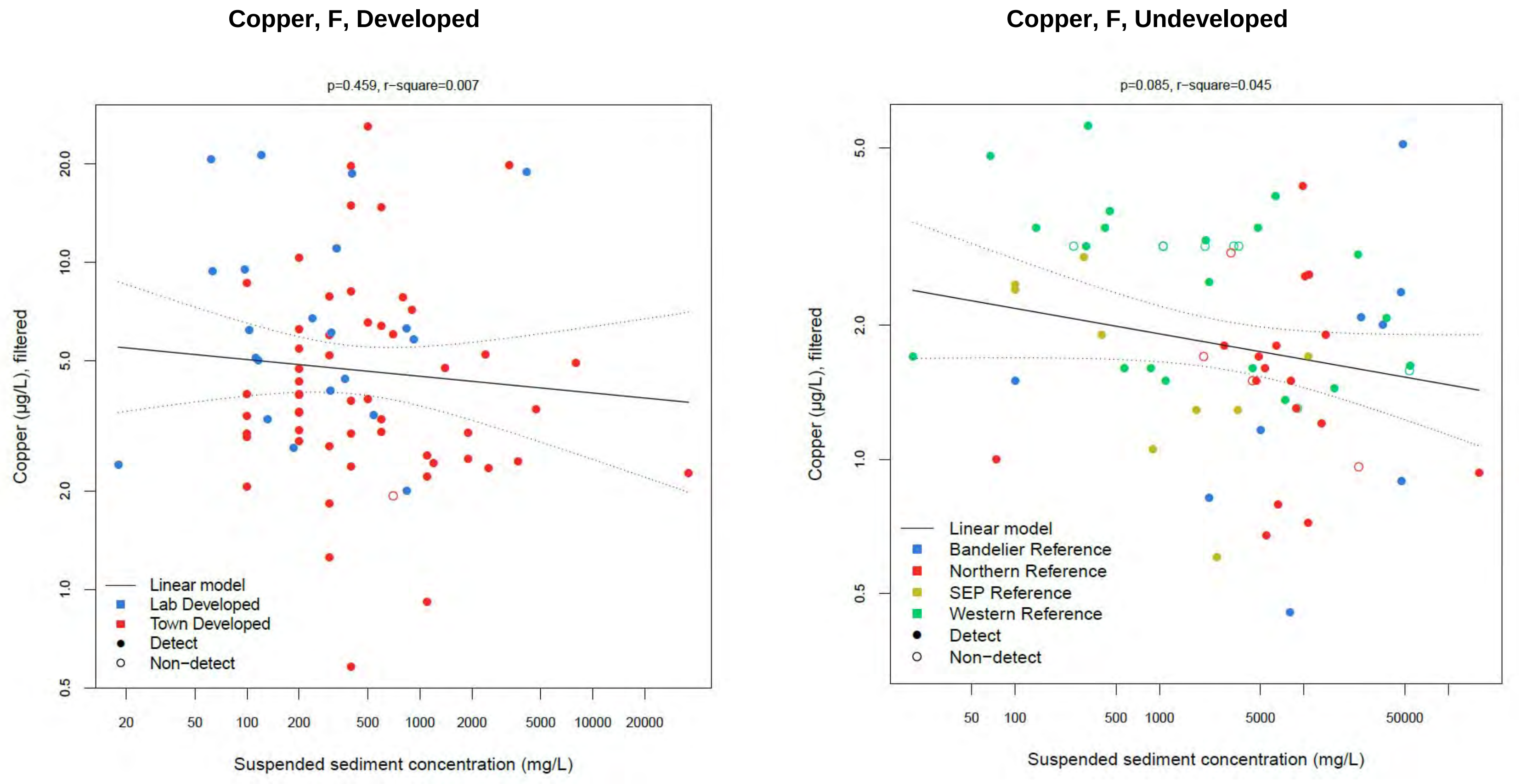


Figure 8b: Copper-SSC scatterplots

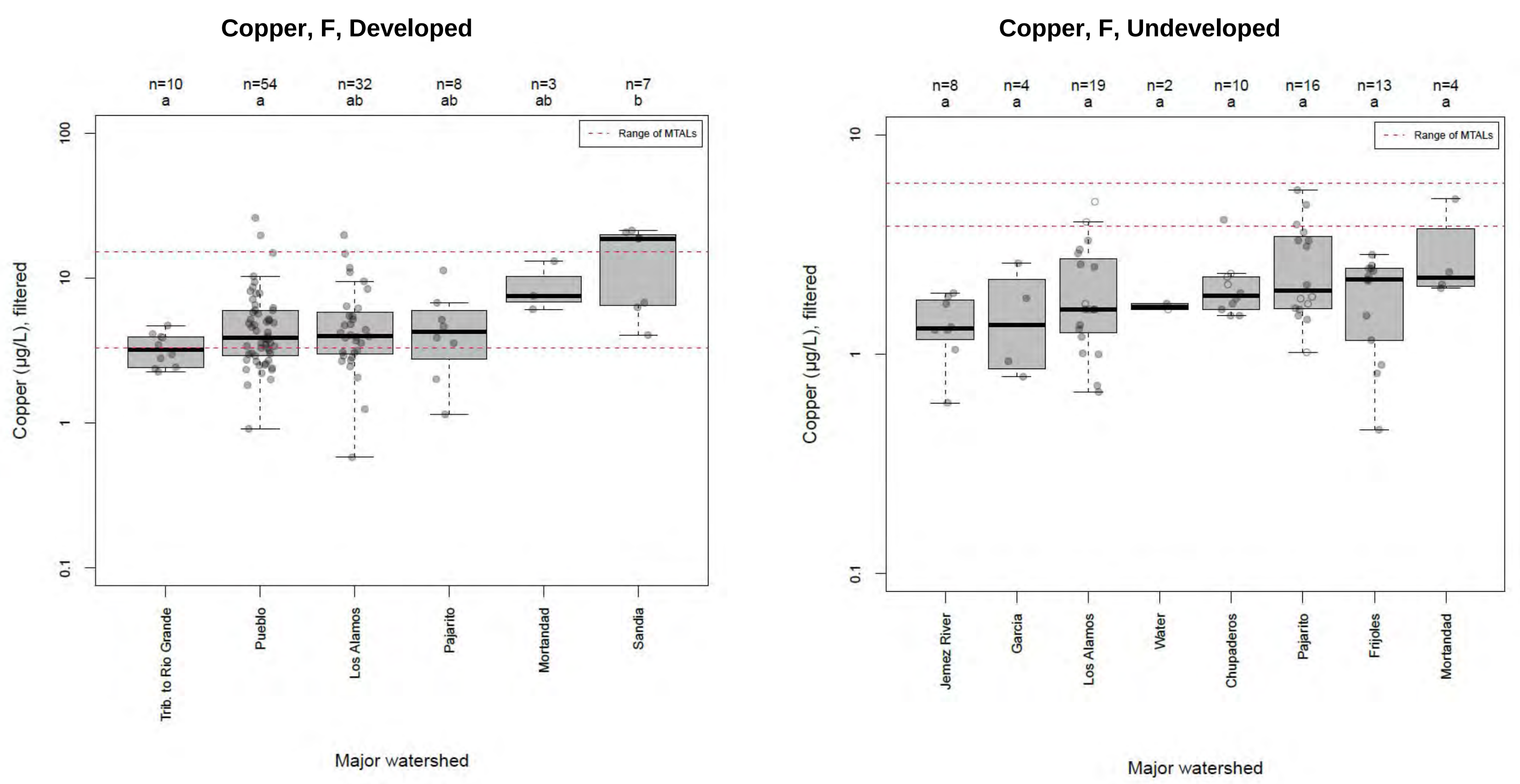


Figure 8d: Copper raw data boxplots by major watershed

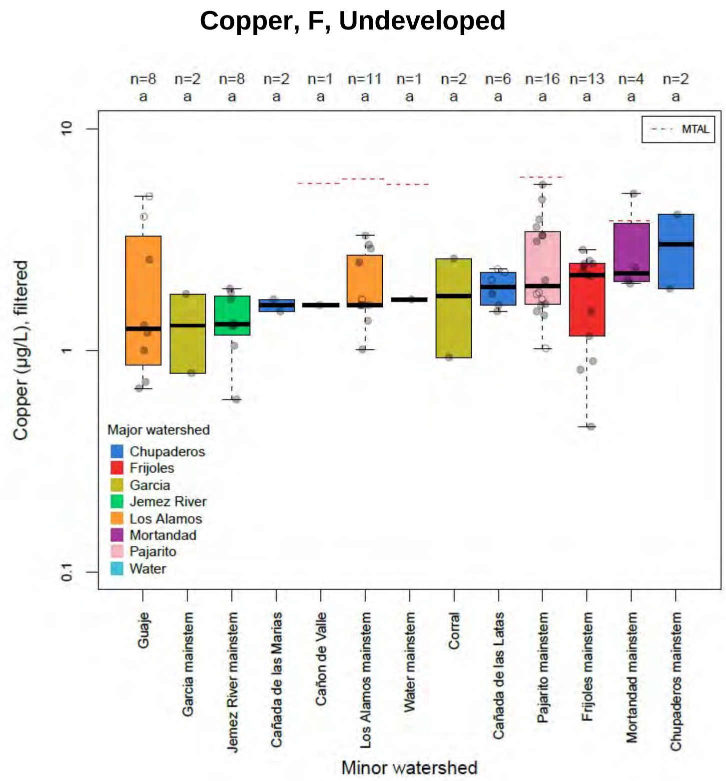
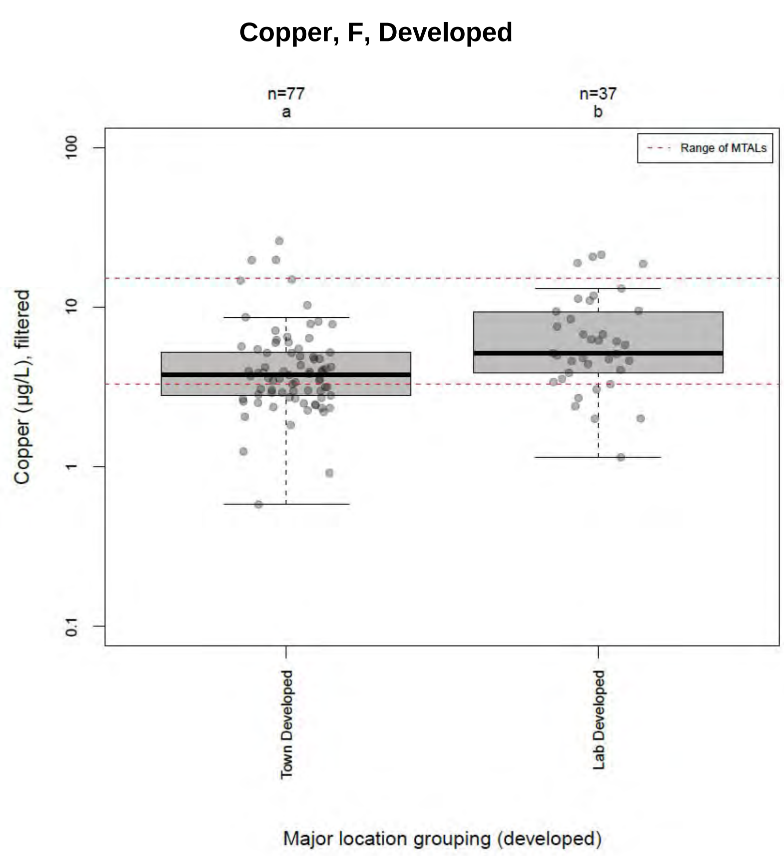


Figure 8f: Copper raw data boxplots by minor watershed



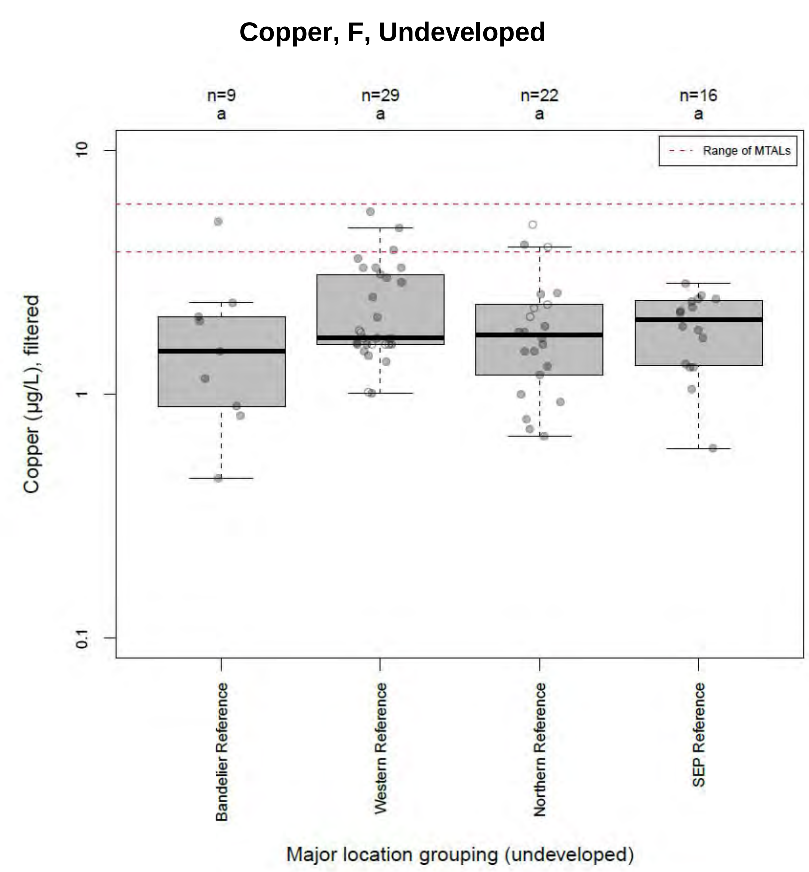


Figure 8g: Copper raw data boxplots by major location group

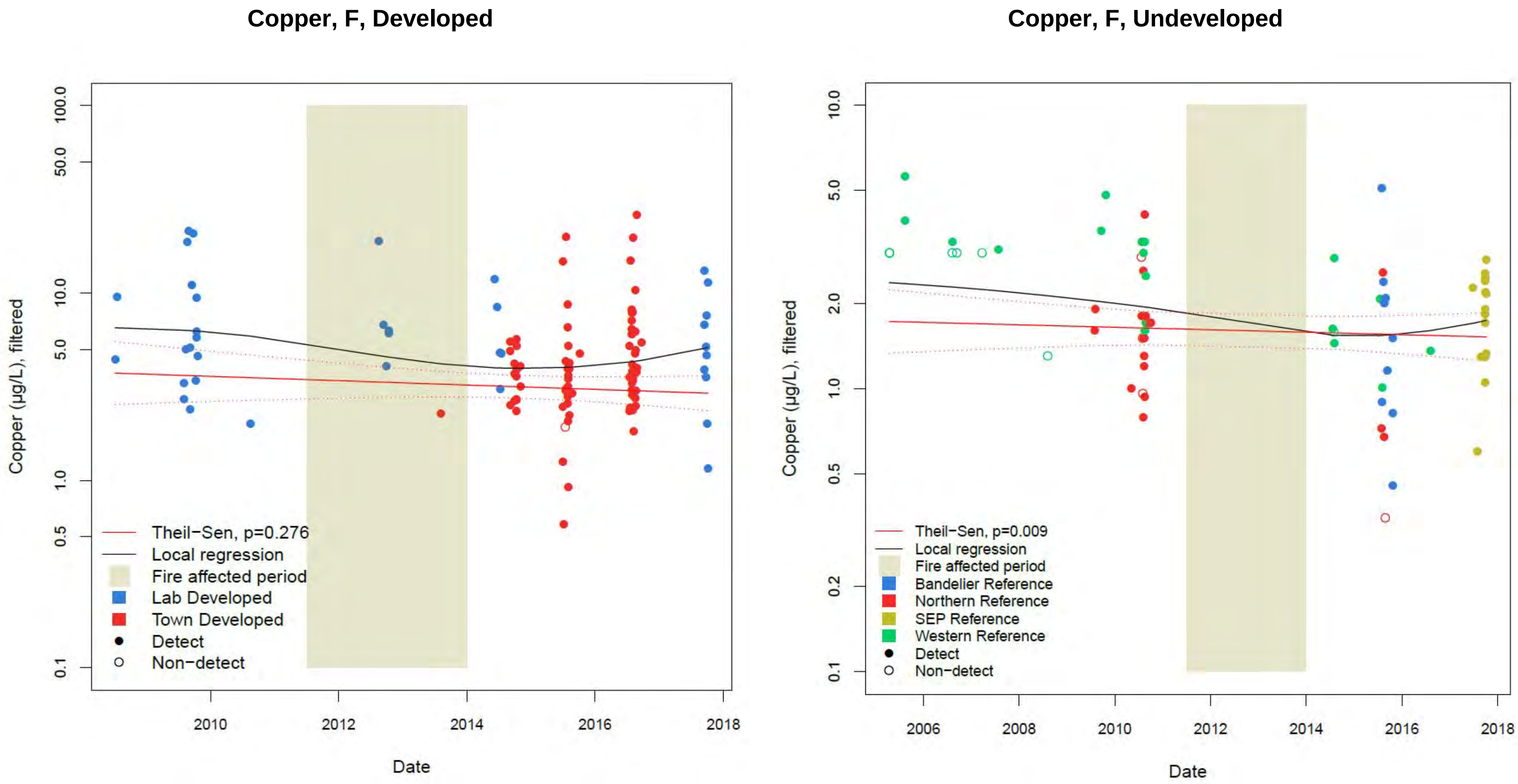


Figure 8j: Temporal trend for raw copper data

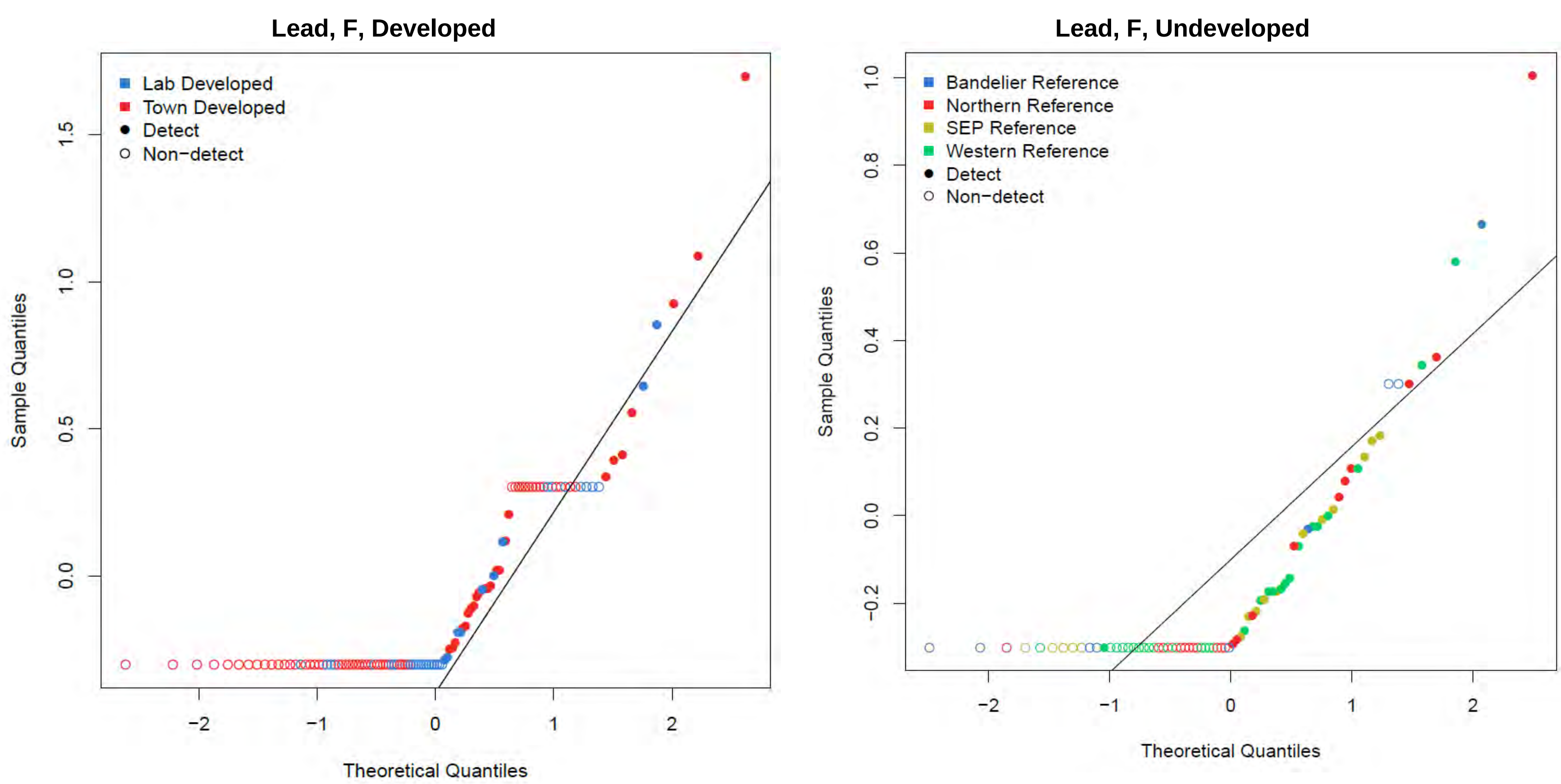


Figure 9a: Lead raw Q-Q plots

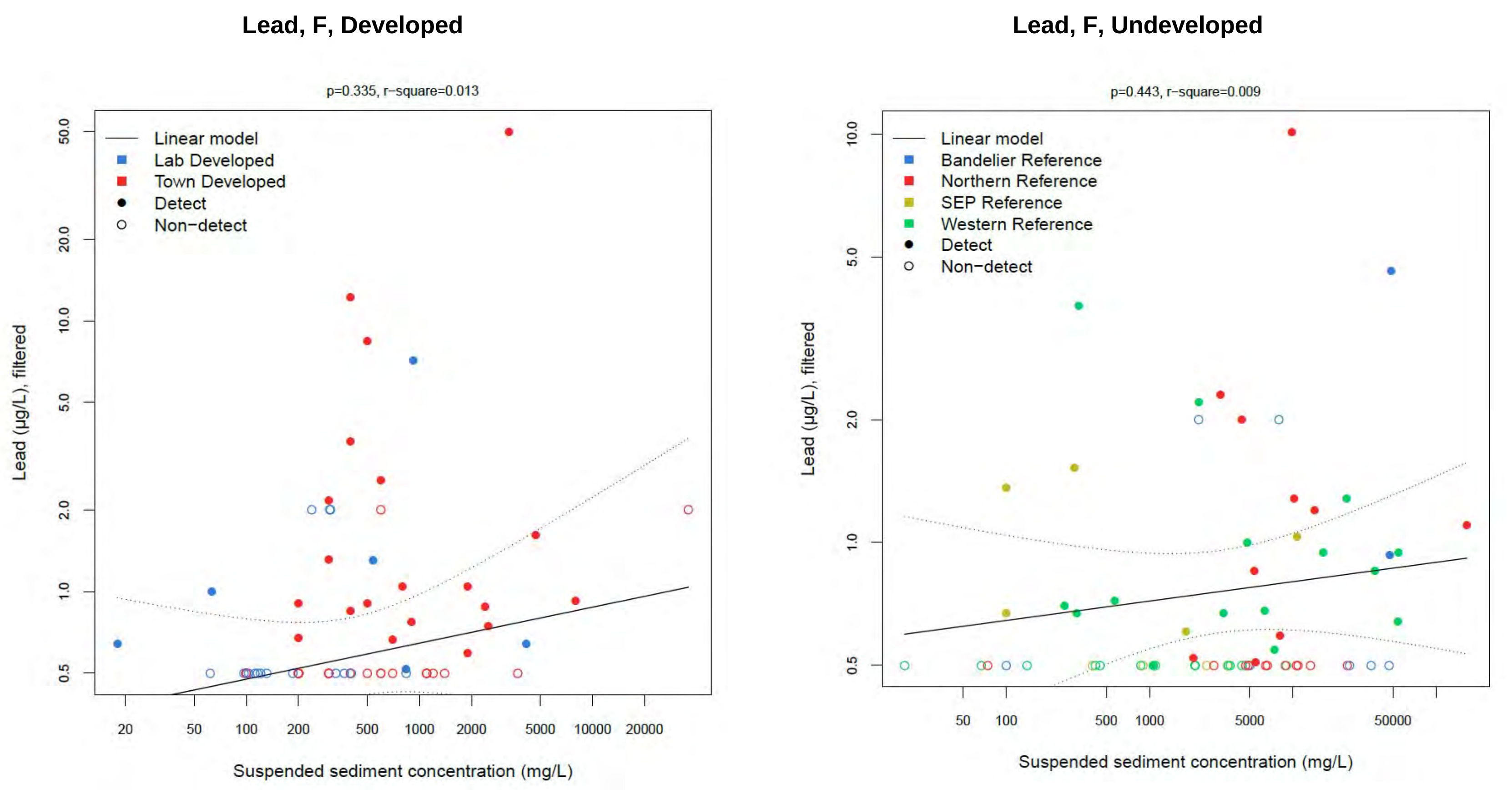


Figure 9b: Lead-SSC scatterplots

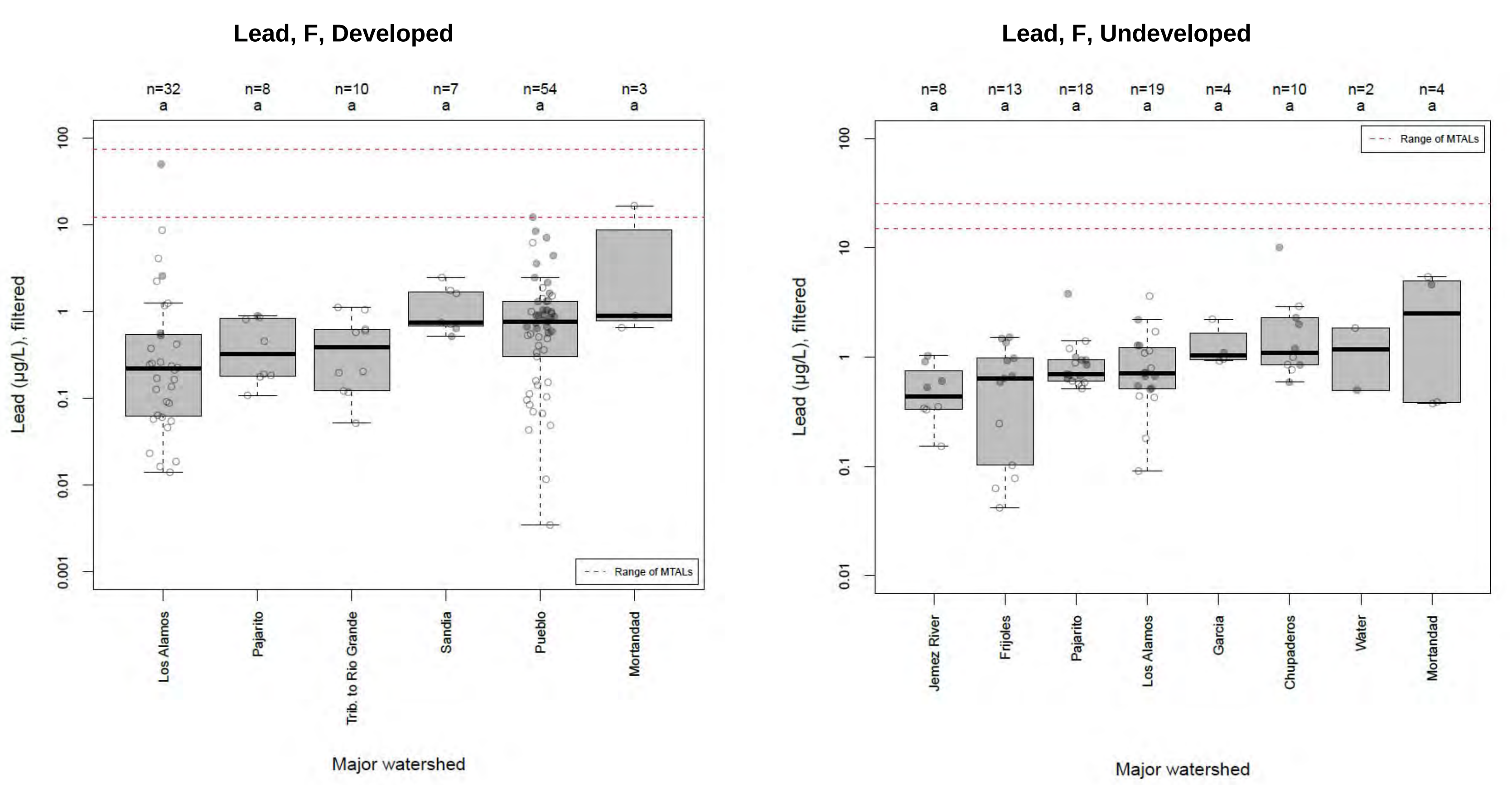


Figure 9d: Lead raw data boxplots by major watershed

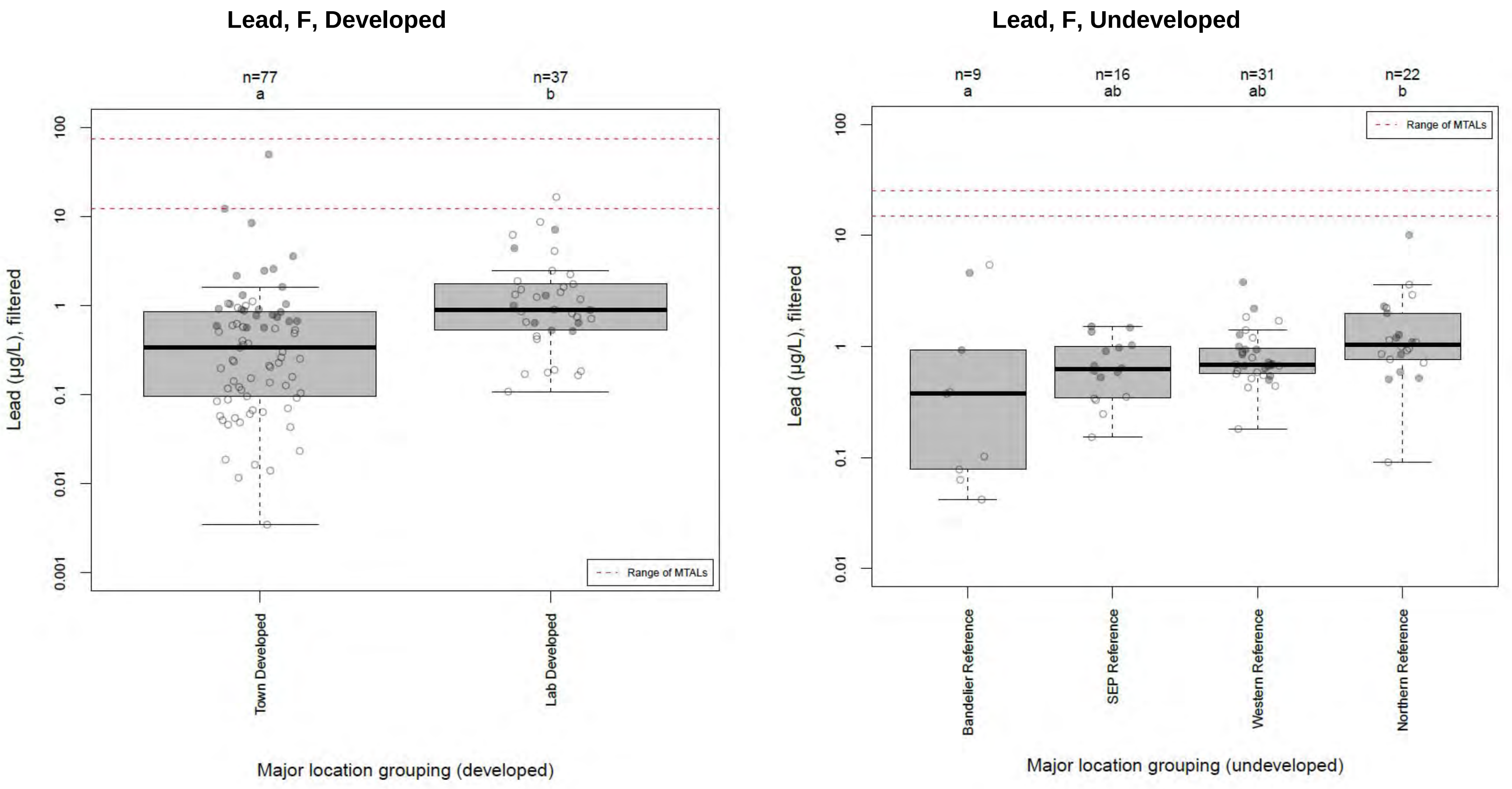


Figure 9g: Lead raw data boxplots by major location group

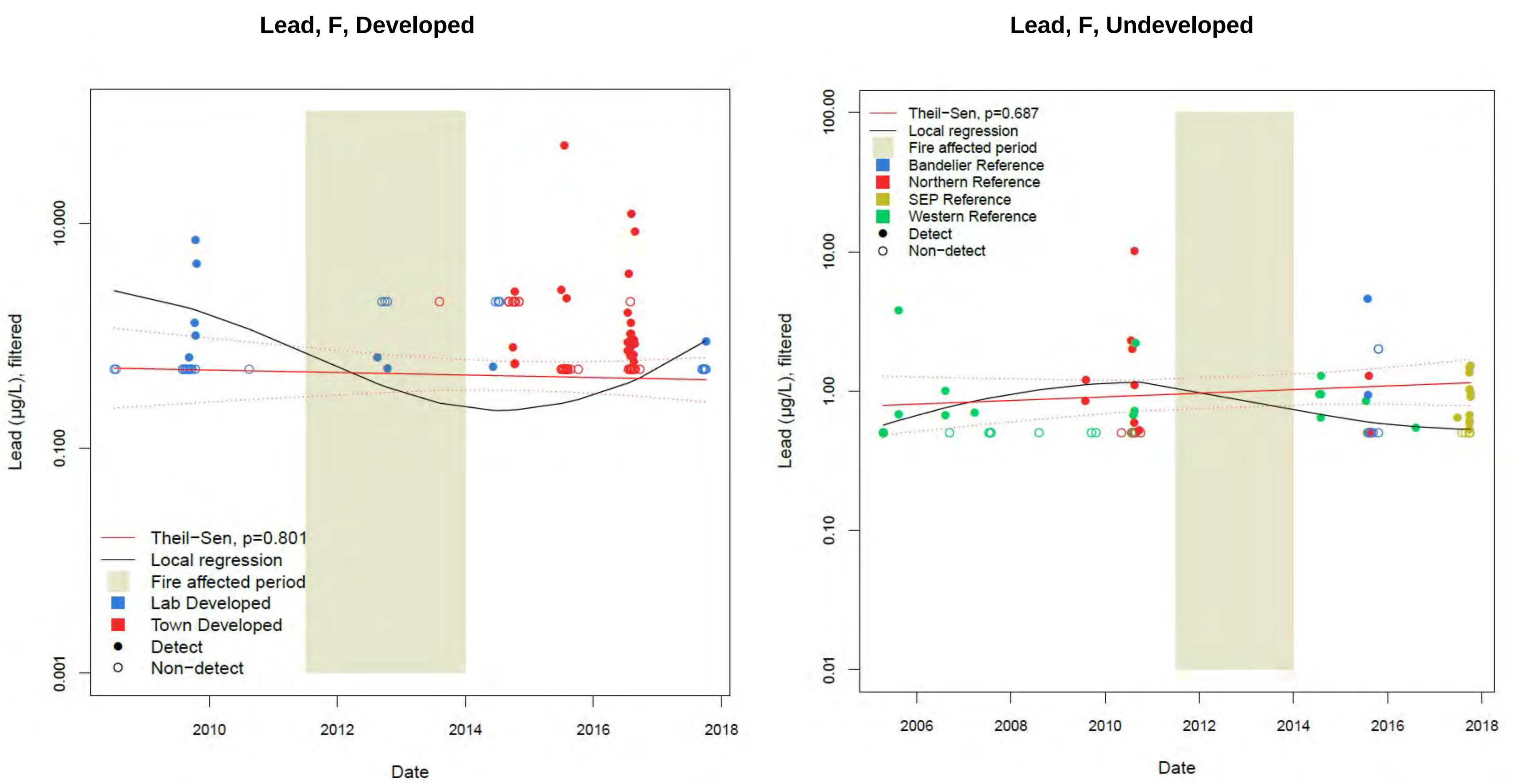


Figure 9j: Temporal trend for raw lead data

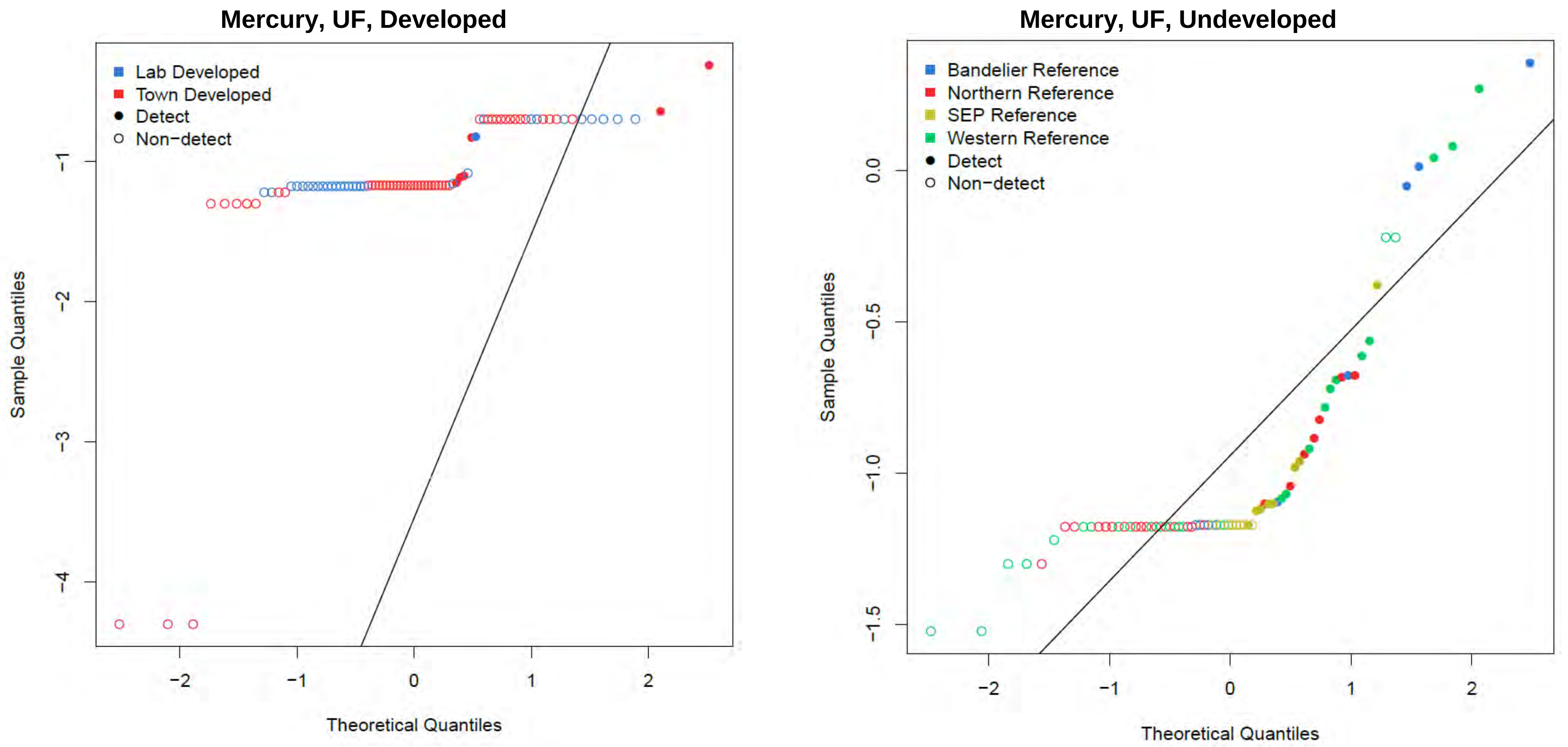


Figure 10a: Mercury raw Q-Q plots

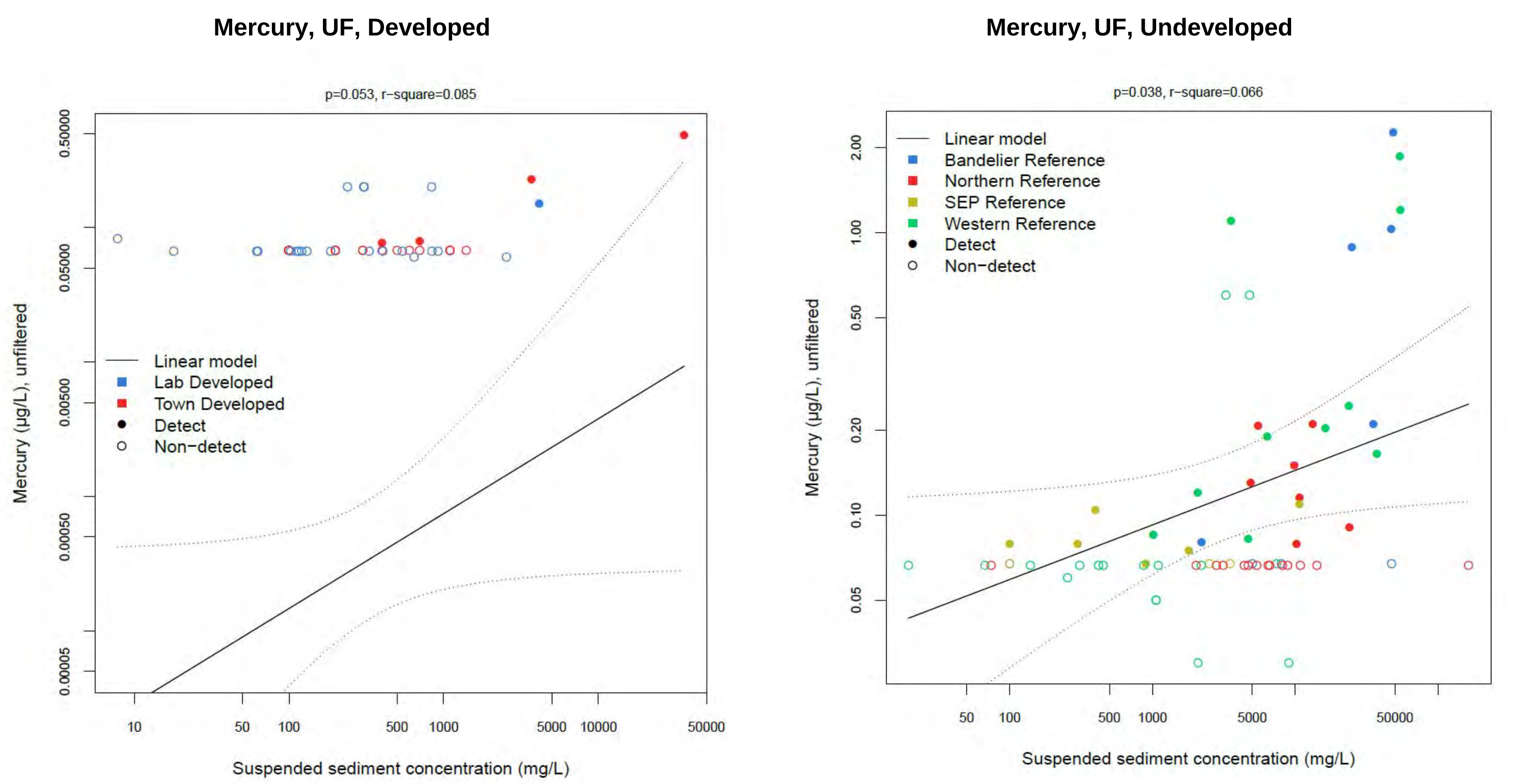


Figure 10b: Mercury-SSC scatterplot

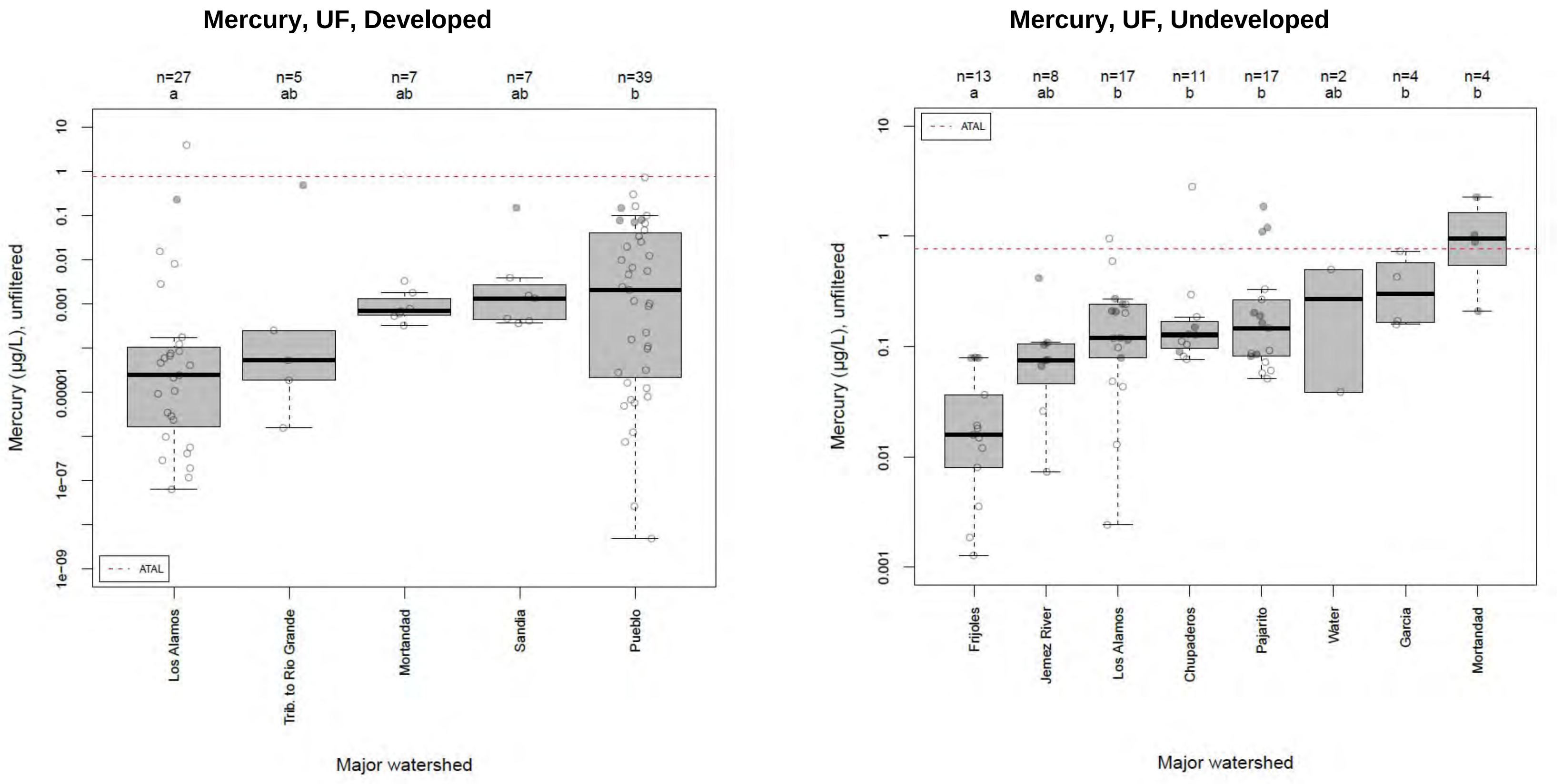


Figure 10d: Mercury raw data boxplots by major watershed

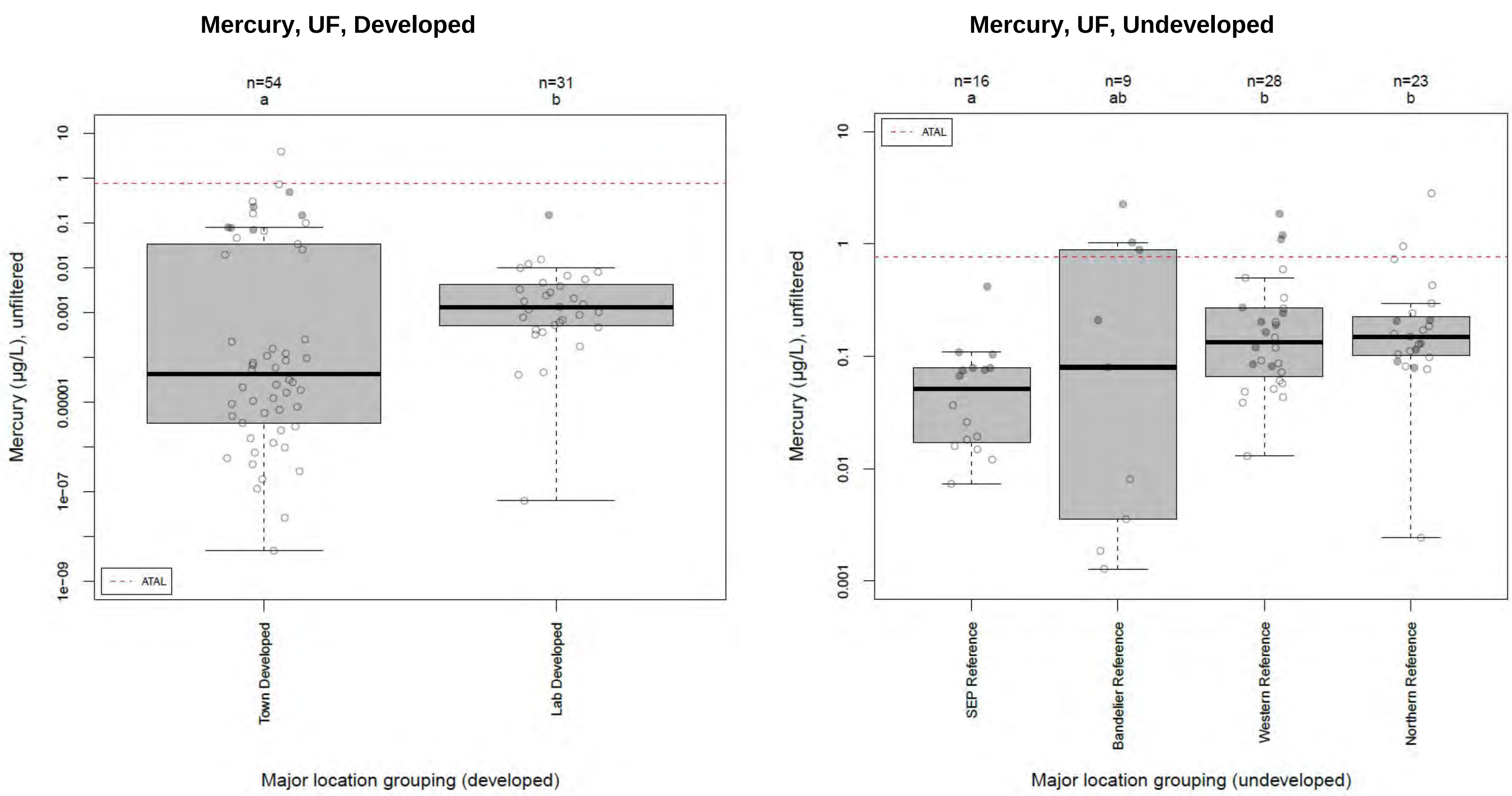


Figure 10g: Mercury raw data boxplots by major location group

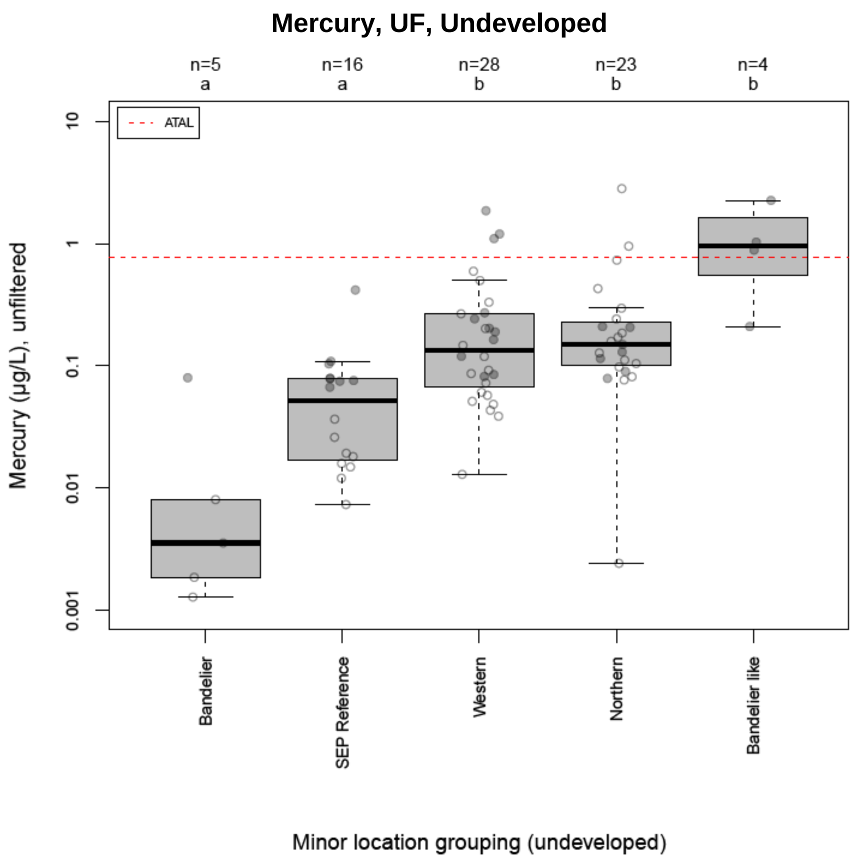
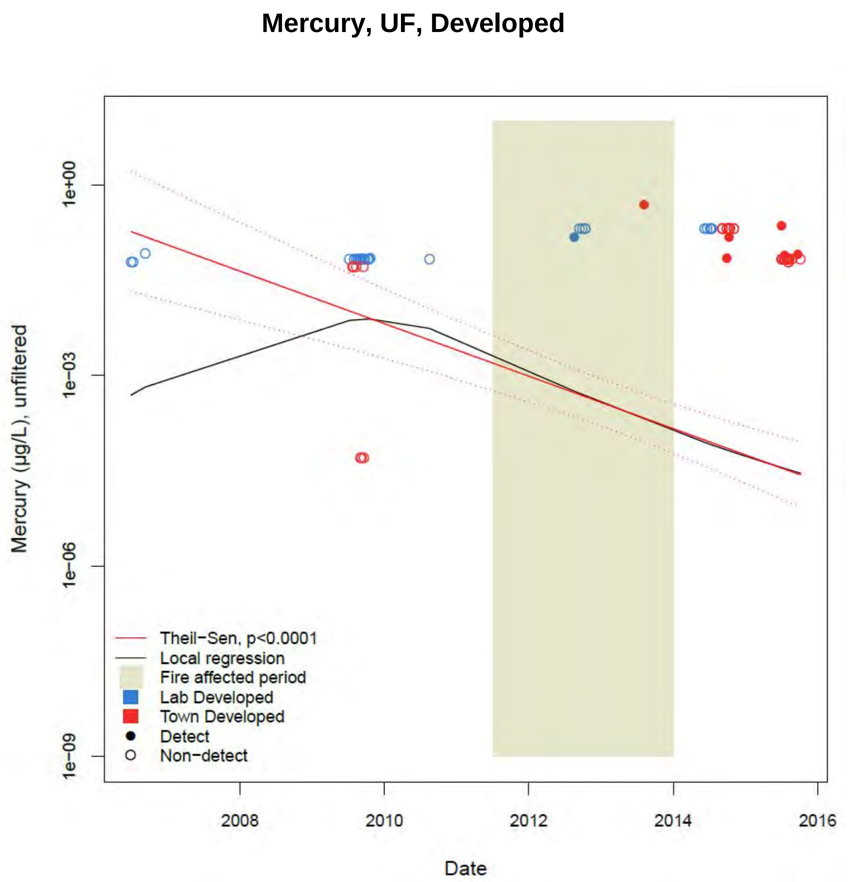


Figure 10i: Mercury raw data boxplot by minor location group



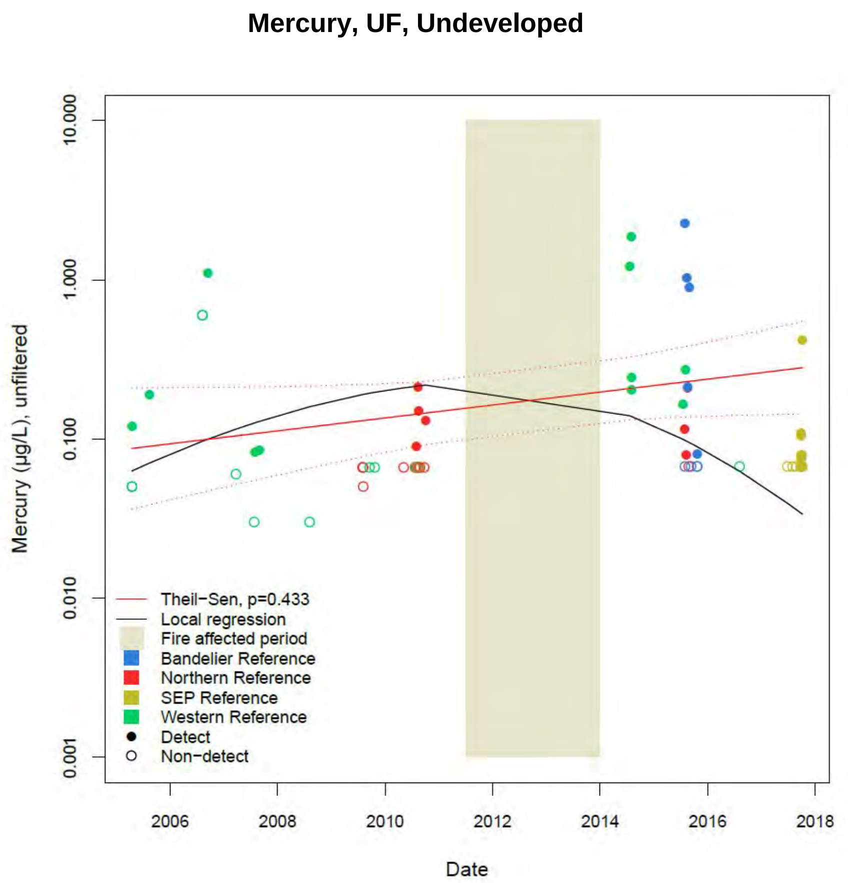
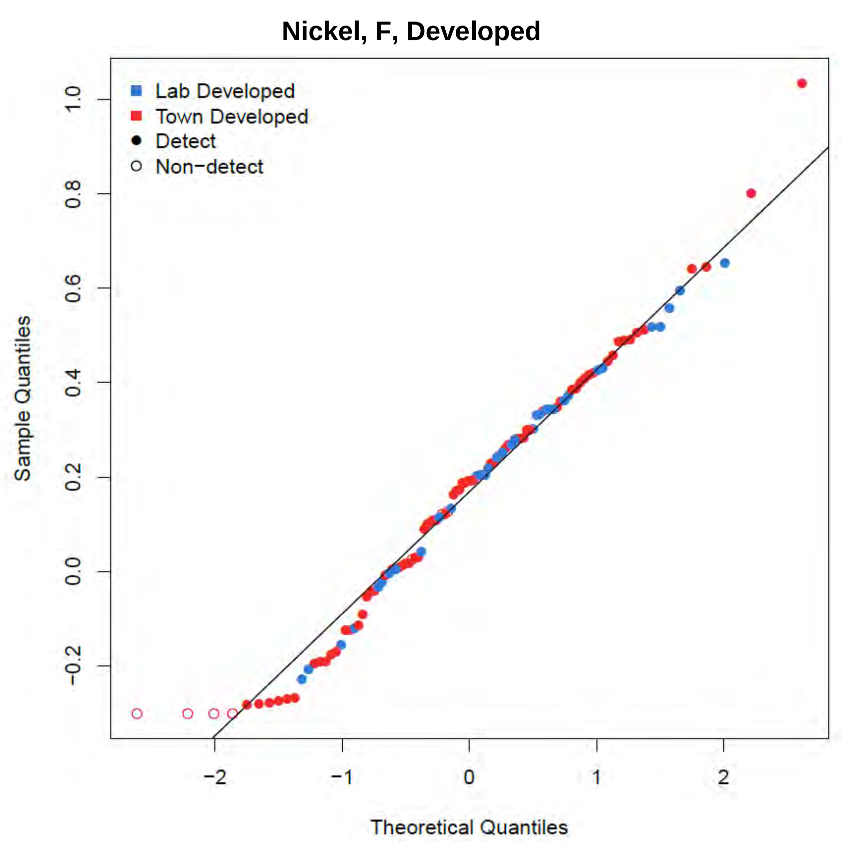


Figure 10j: Temporal trend for raw mercury data



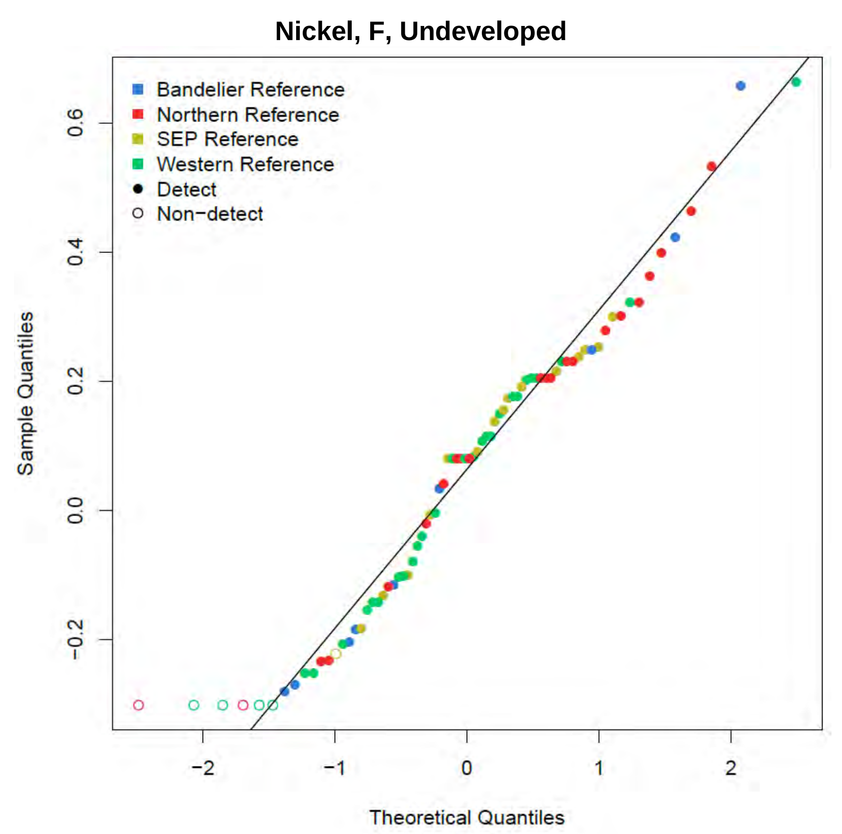


Figure 11a: Nickel raw data Q-Q plots

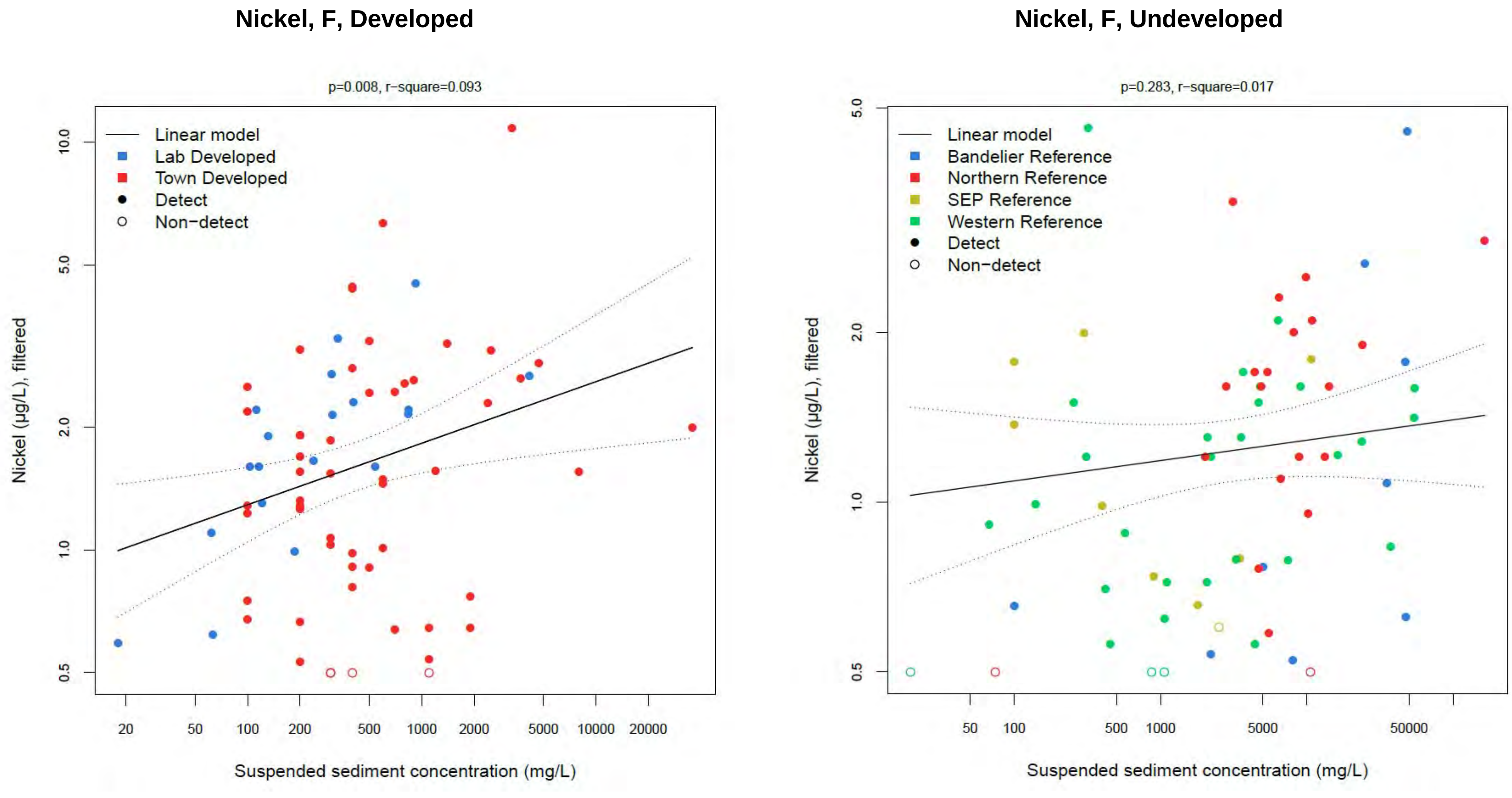


Figure 11b: Nickel-SSC scatterplot

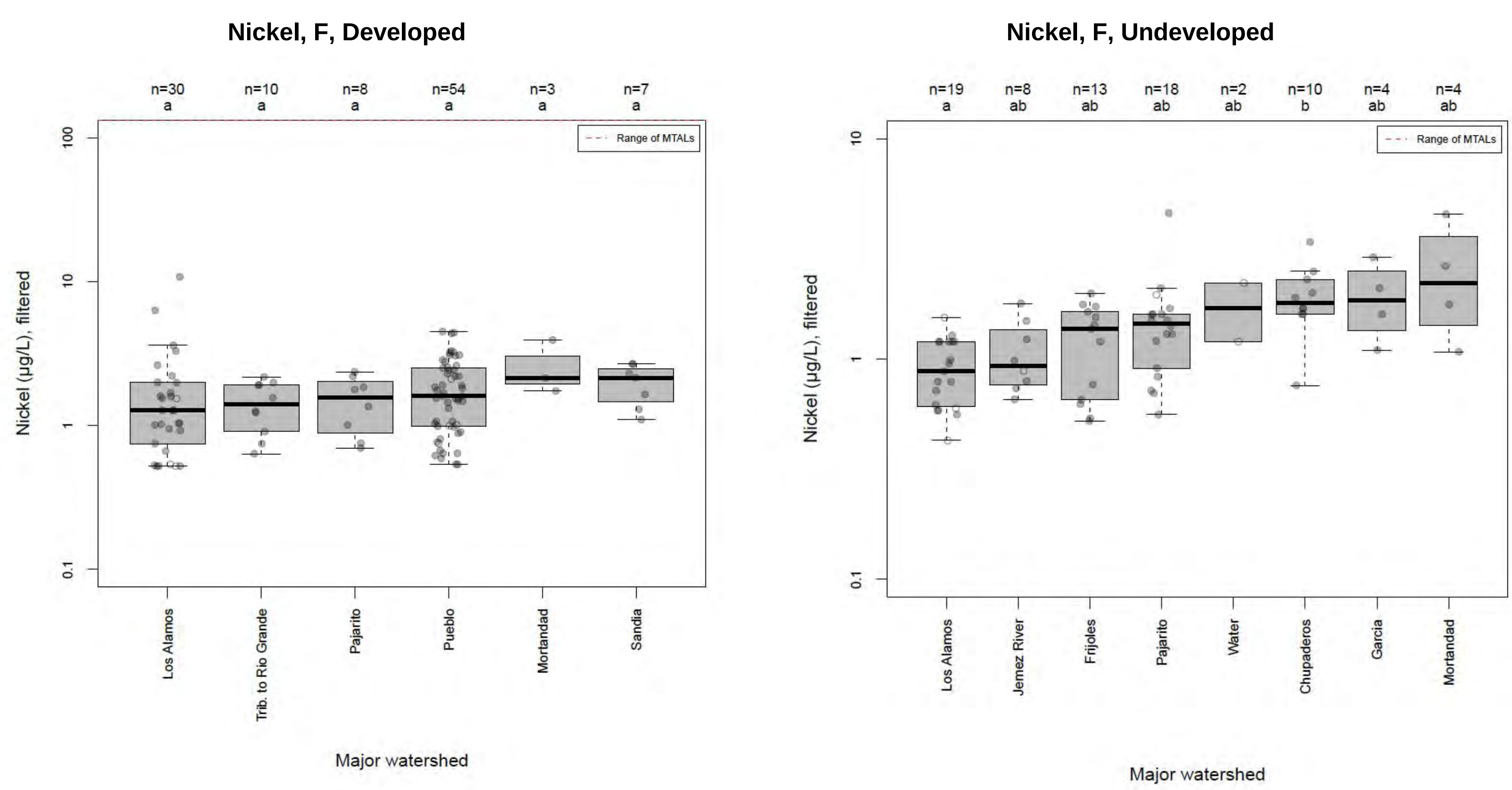


Figure 11d: Nickel raw data boxplots by major watershed

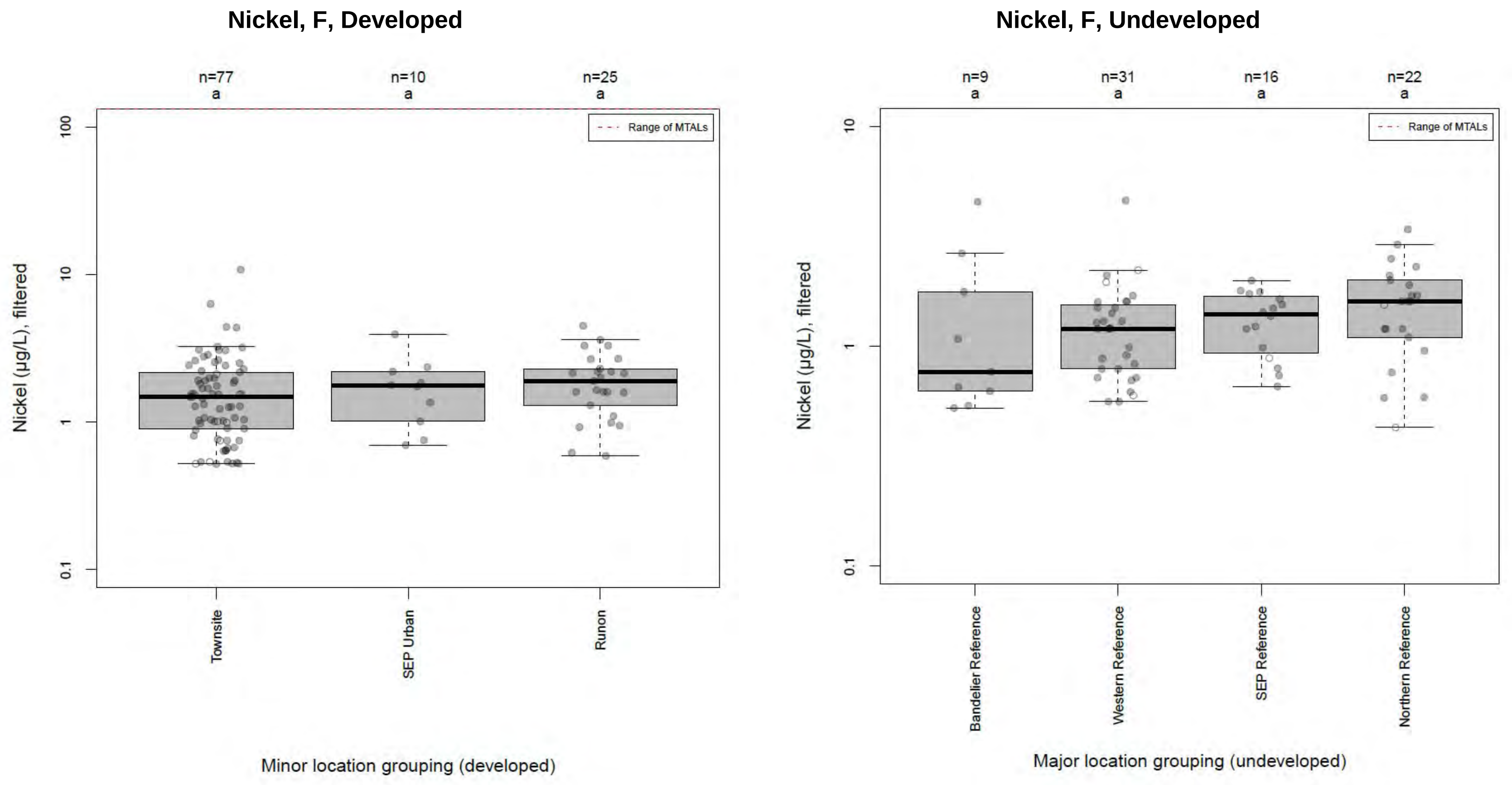


Figure 11g: Nickel raw data boxplots by major location group

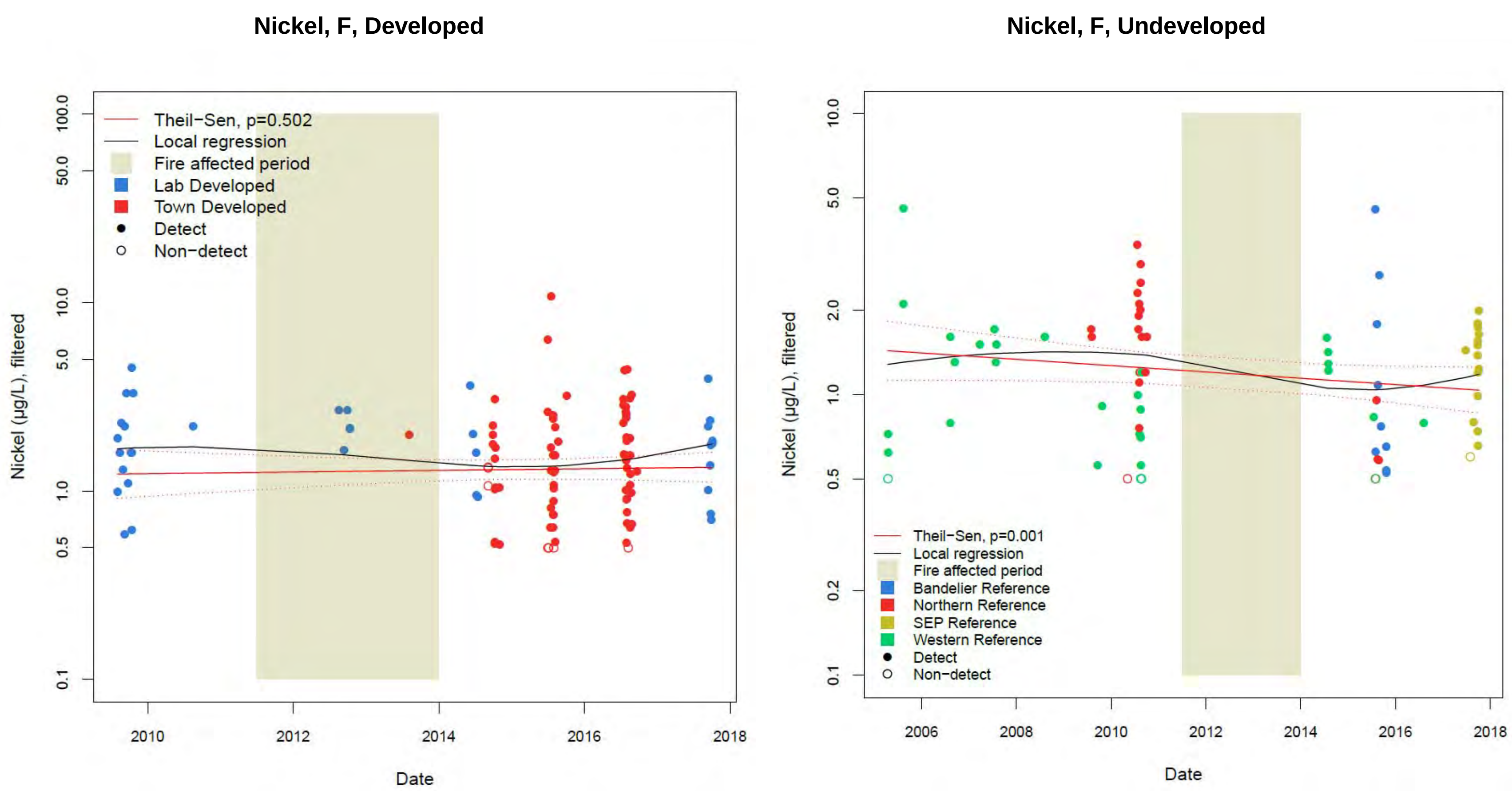


Figure 11j: Temporal trends for raw nickel data

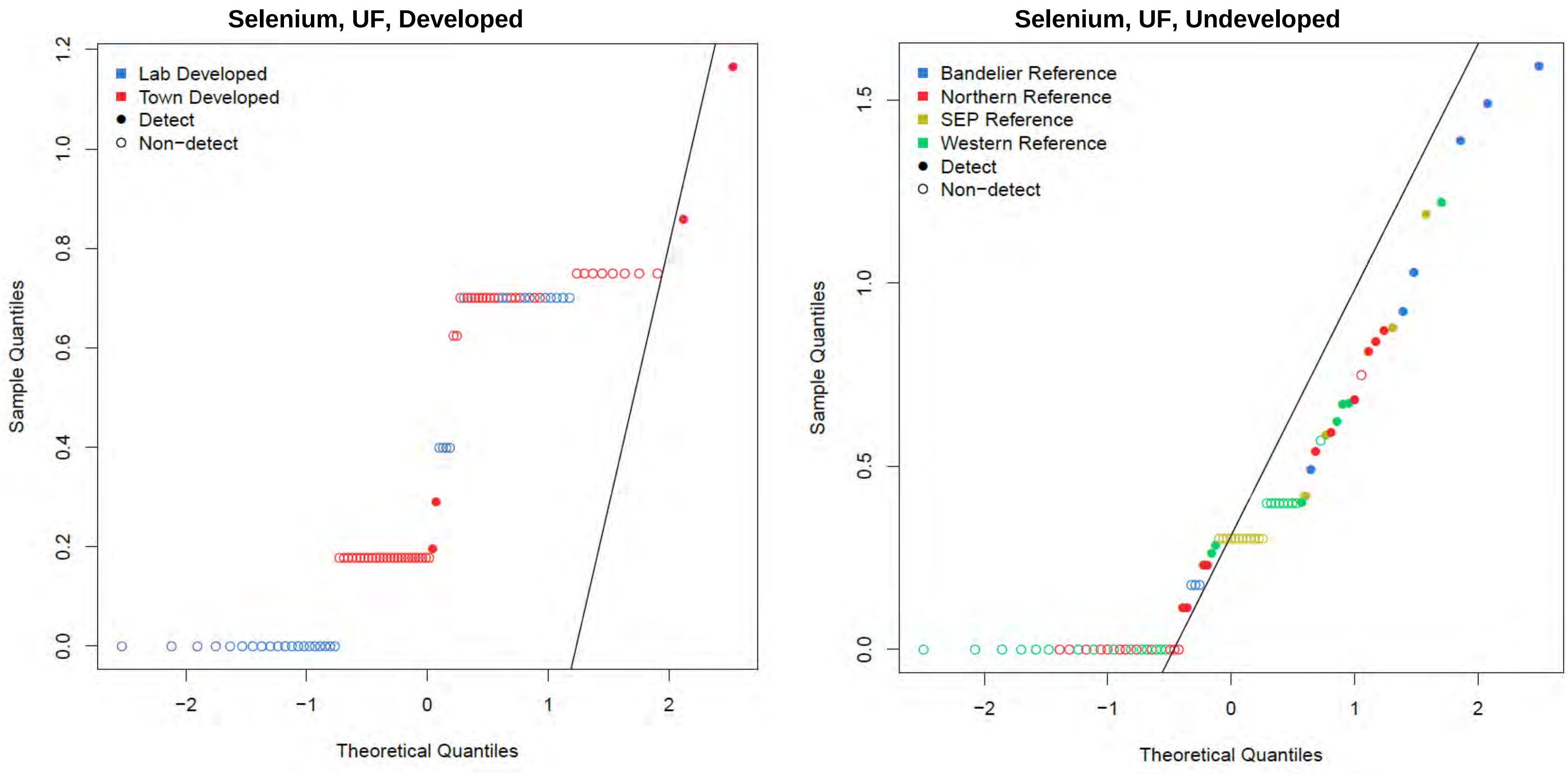


Figure 12a: Selenium raw data Q-Q plots

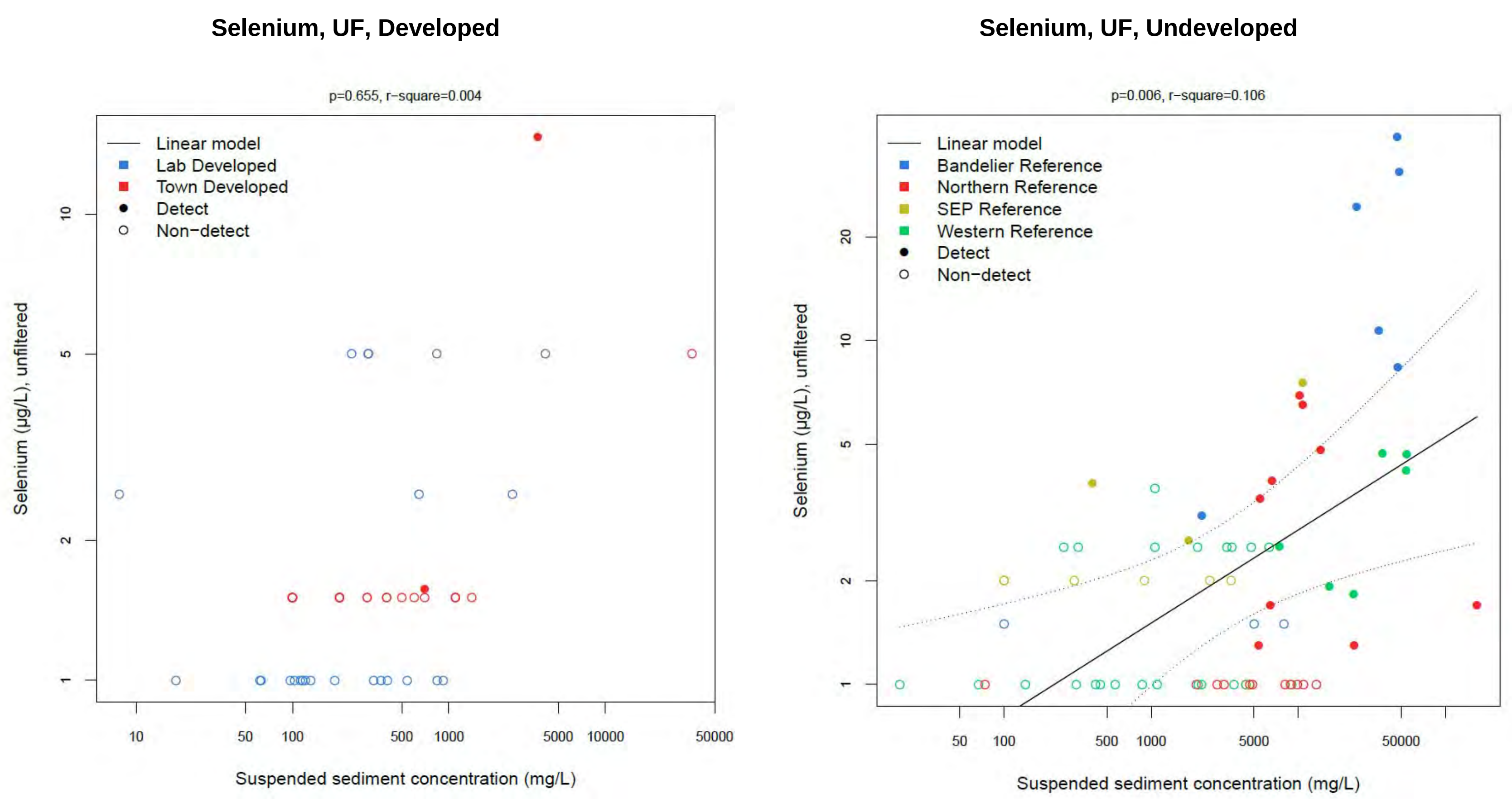


Figure 12b: Selenium-SSC scatterplots

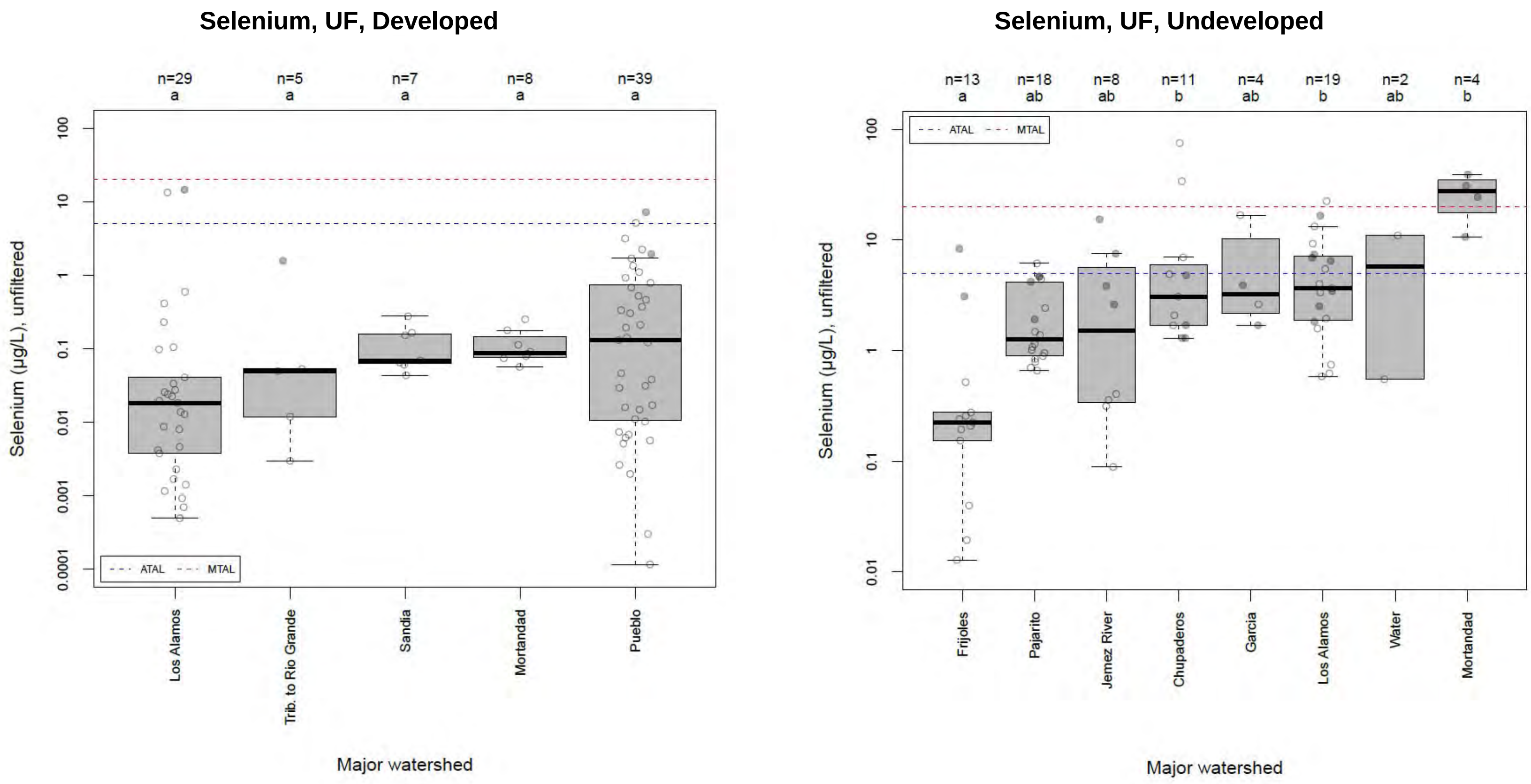


Figure 12d: Selenium raw data boxplots by major watershed

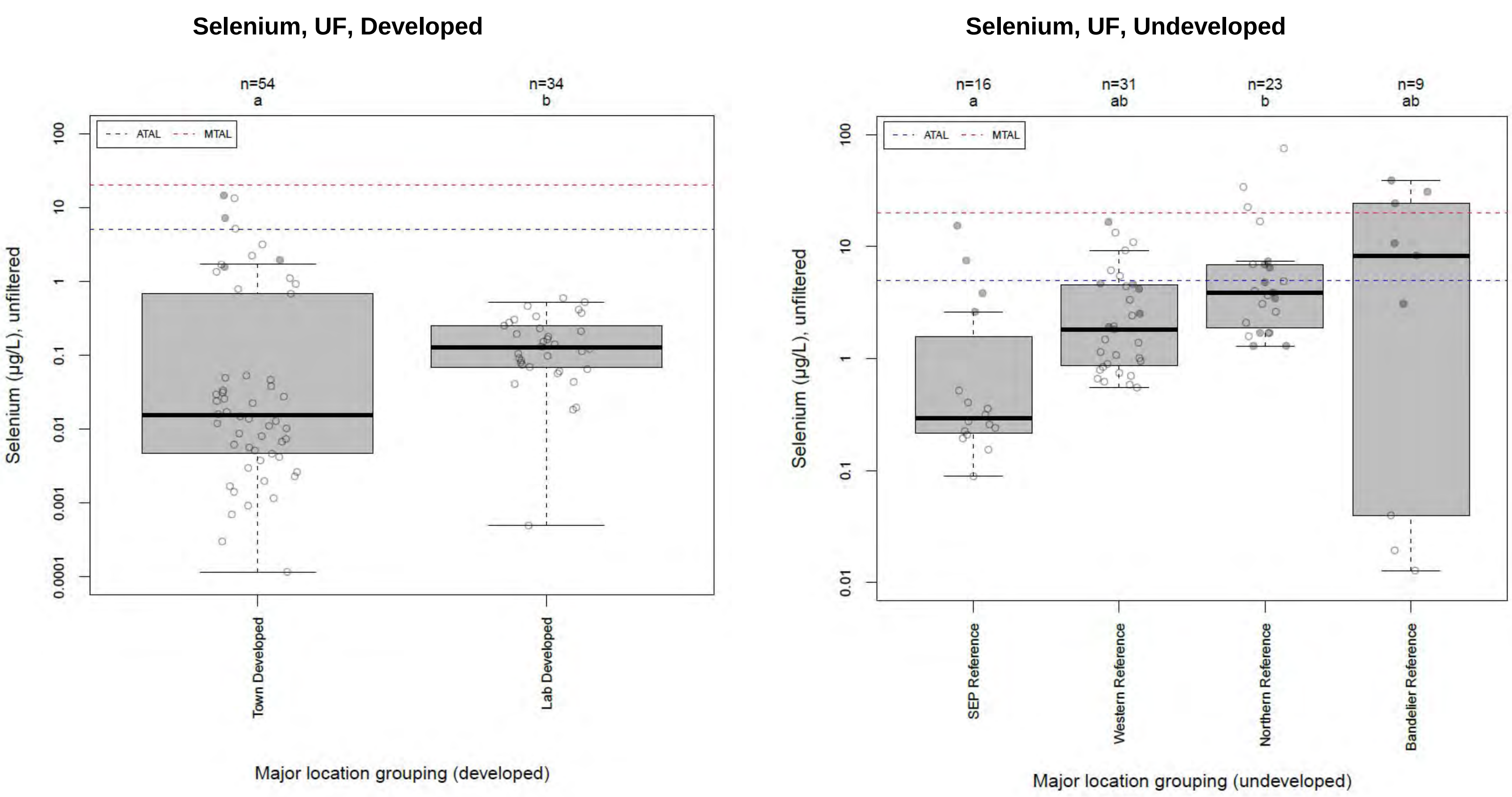


Figure 12g: Selenium raw data boxplots by major location group

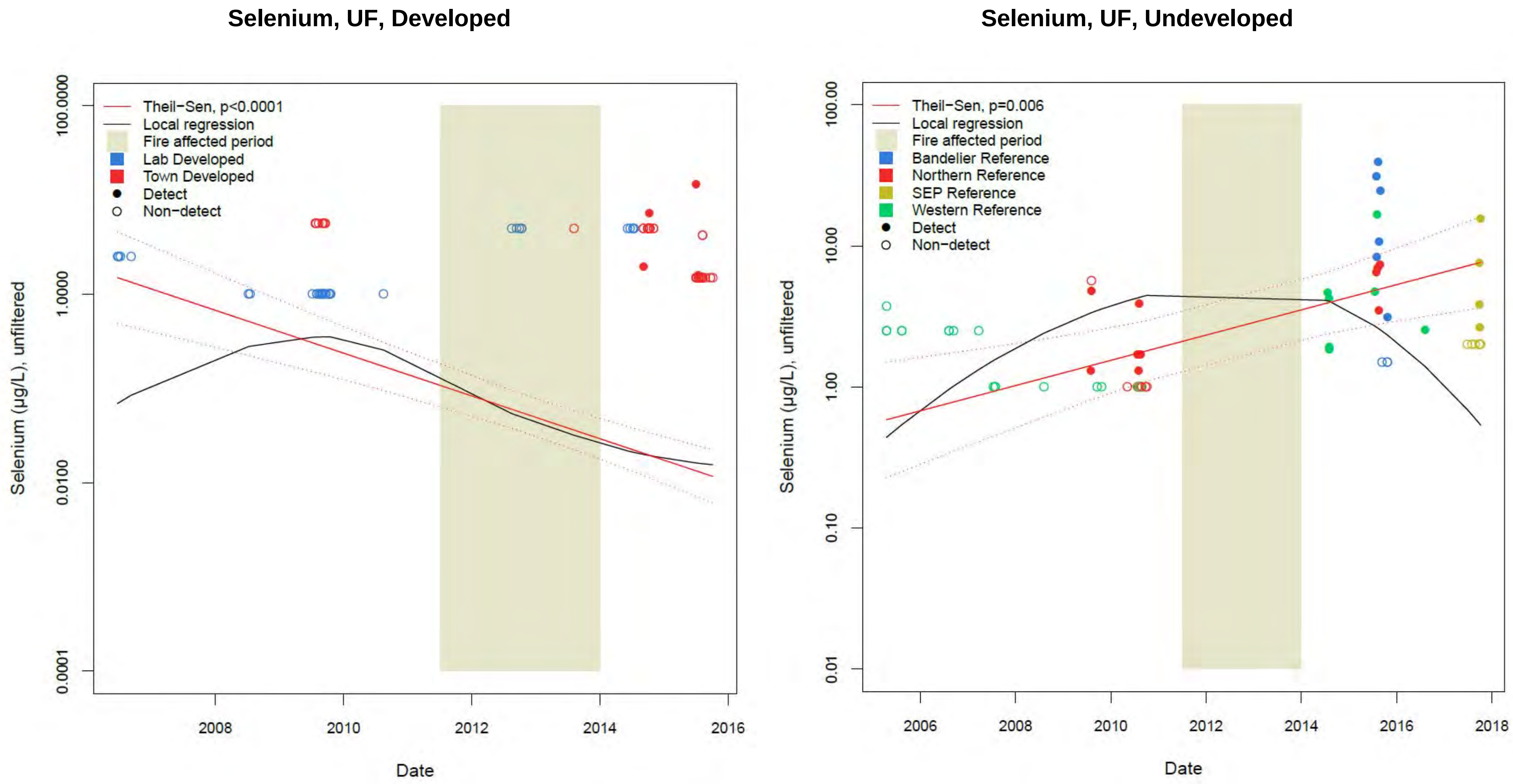


Figure 12j: Temporal trends for raw selenium data

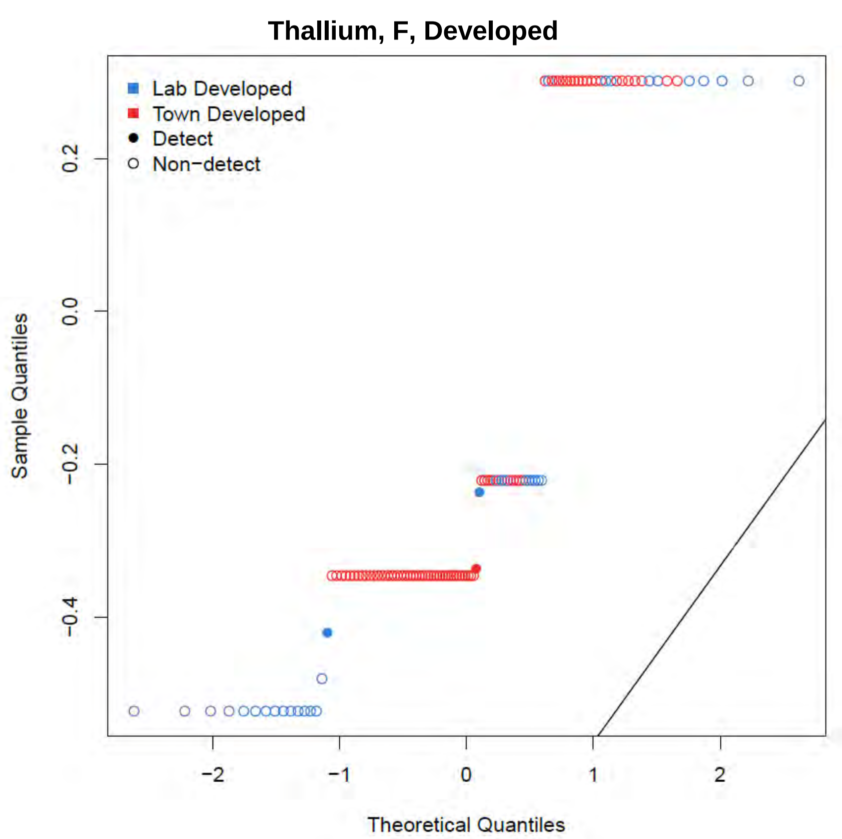


Figure 13a: Thallium raw data Q-Q plot

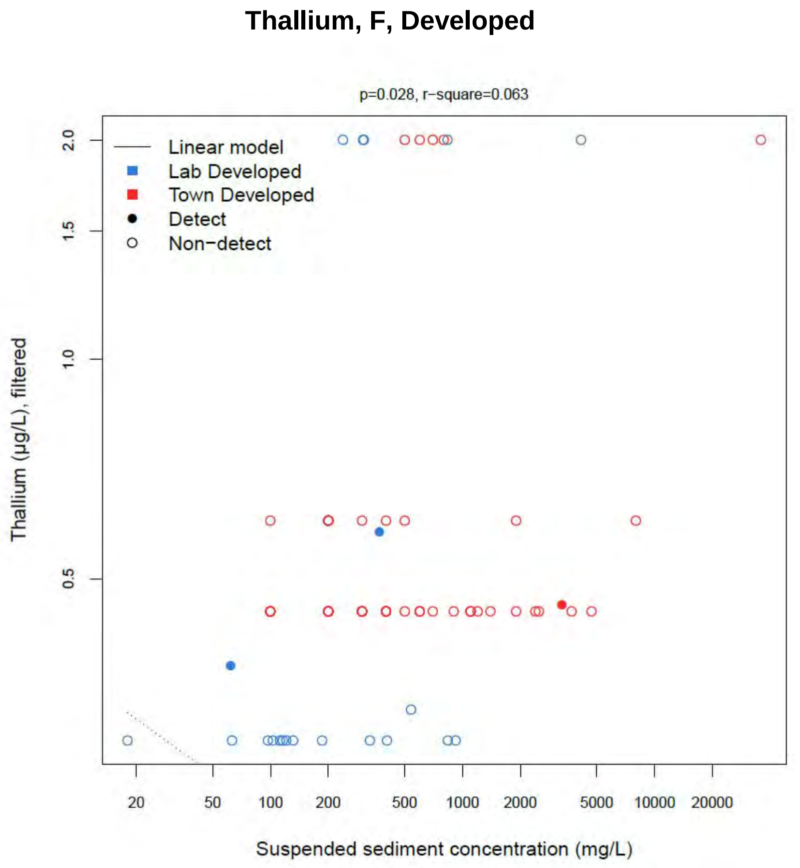


Figure 13b: Thallium-SSC scatterplot

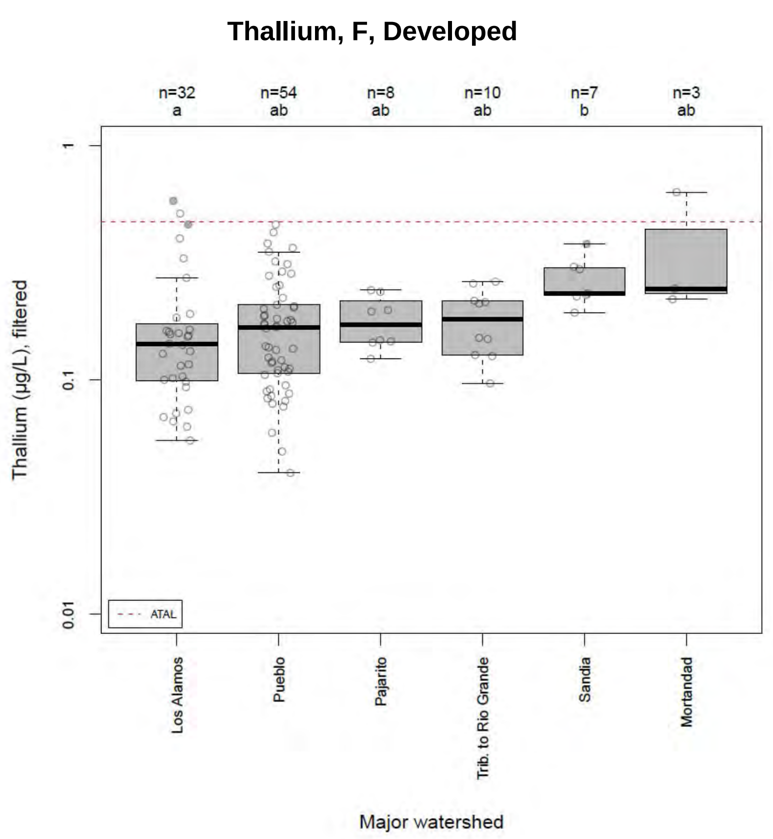


Figure 13d: Thallium raw data boxplots by major watershed

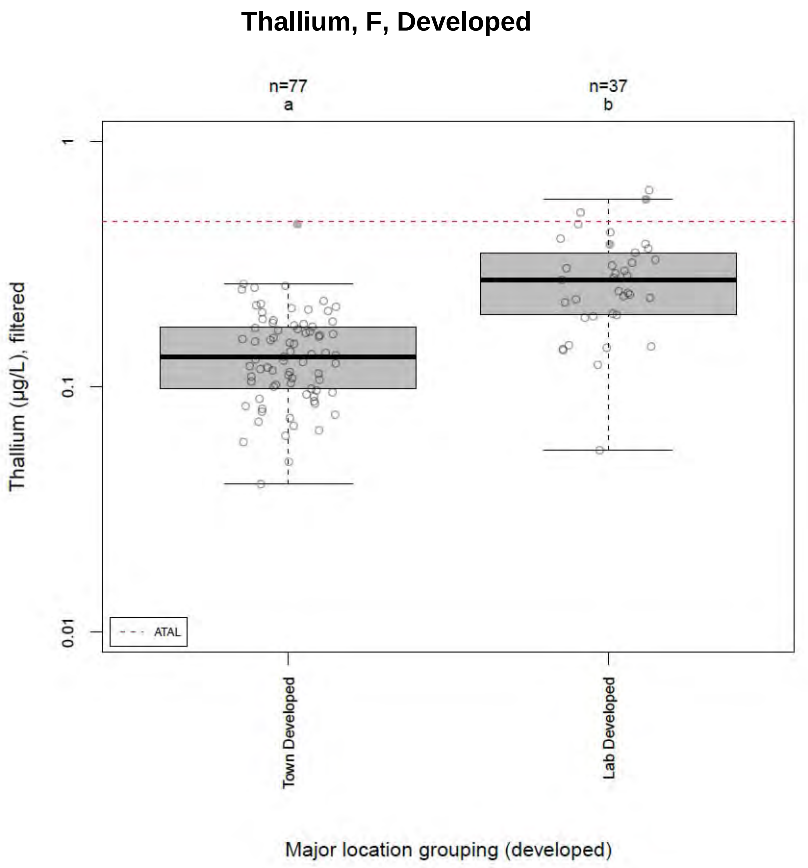


Figure 13g: Thallium raw data boxplots by major location group

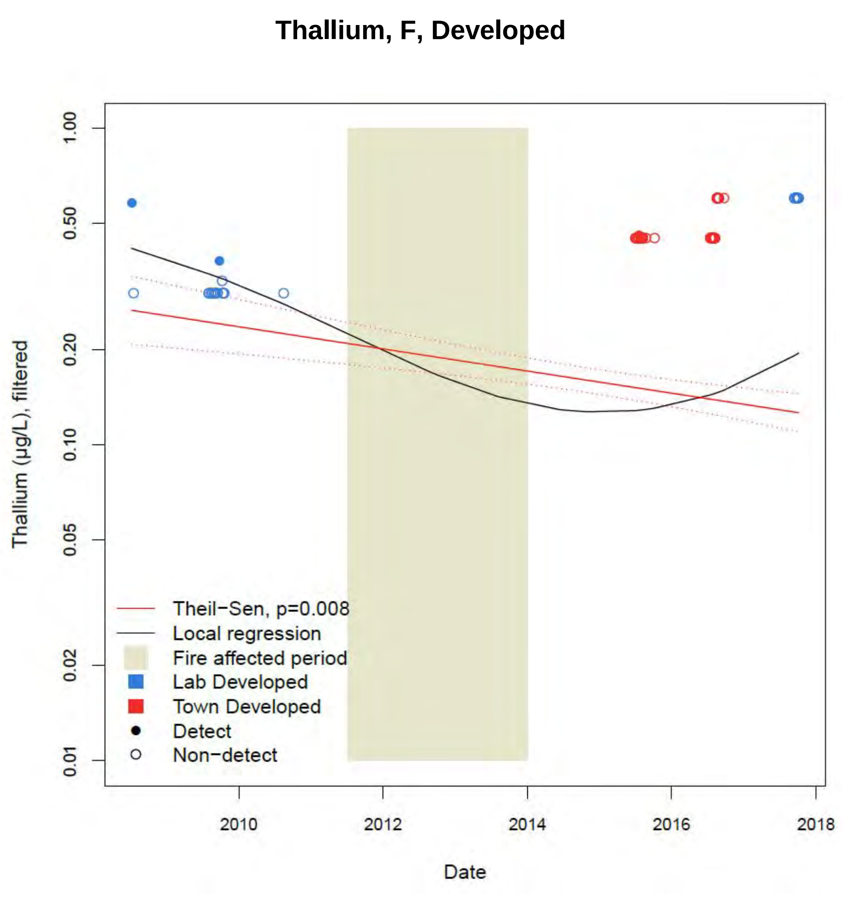


Figure 13j: Temporal trend for raw thallium data

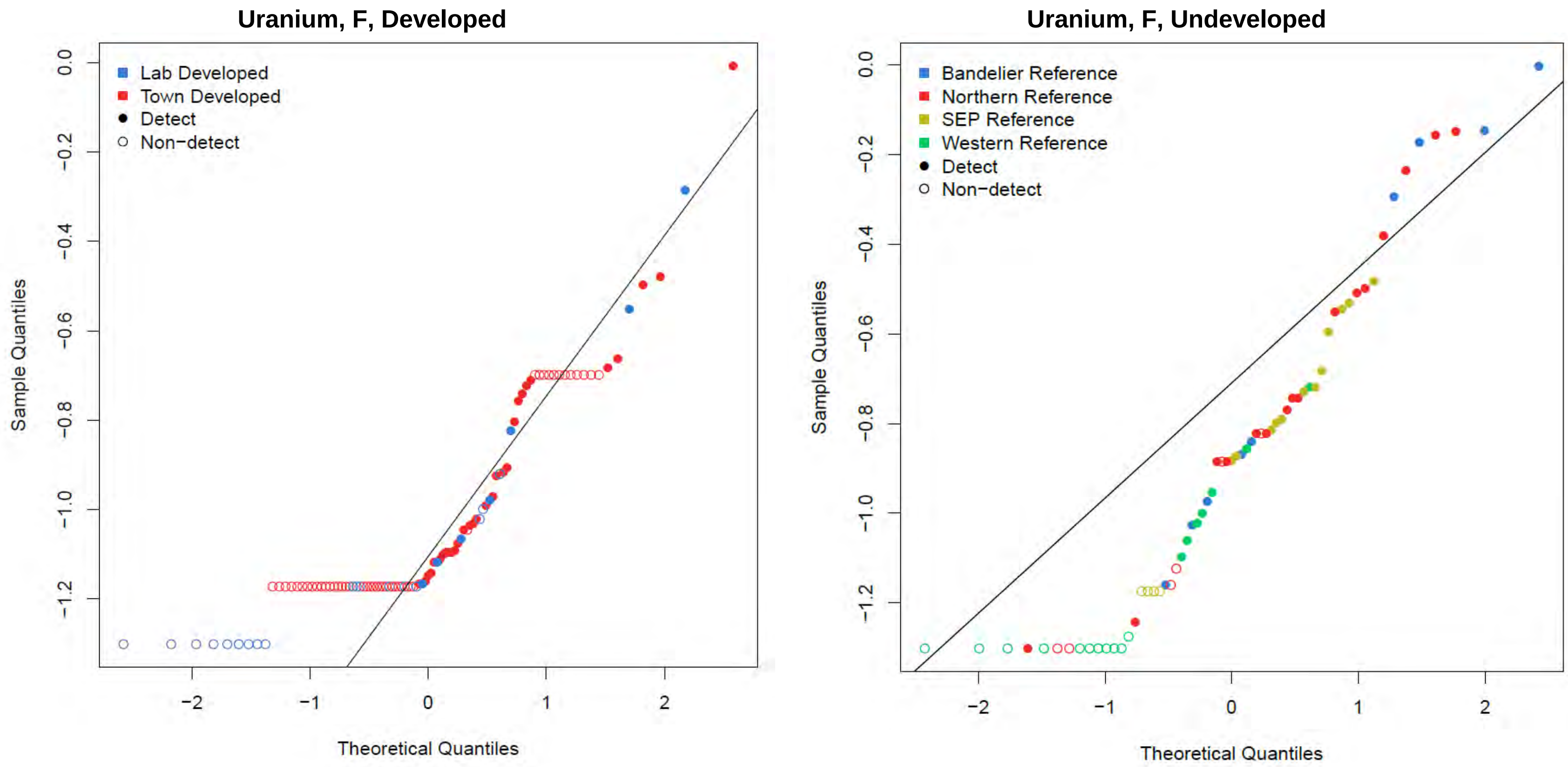


Figure 14a: Uranium raw data Q-Q plots

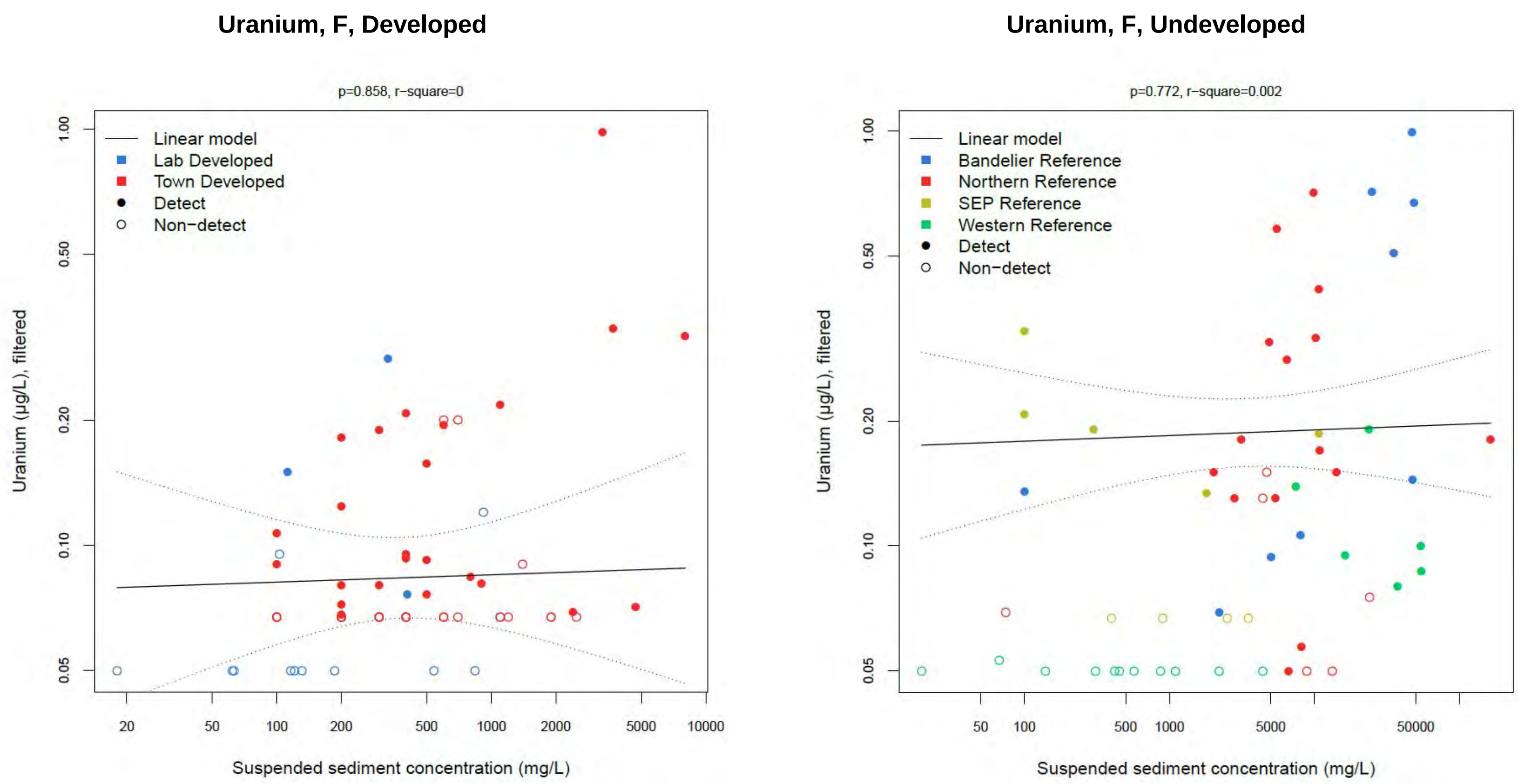


Figure 14b: Uranium-SSC scatterplots

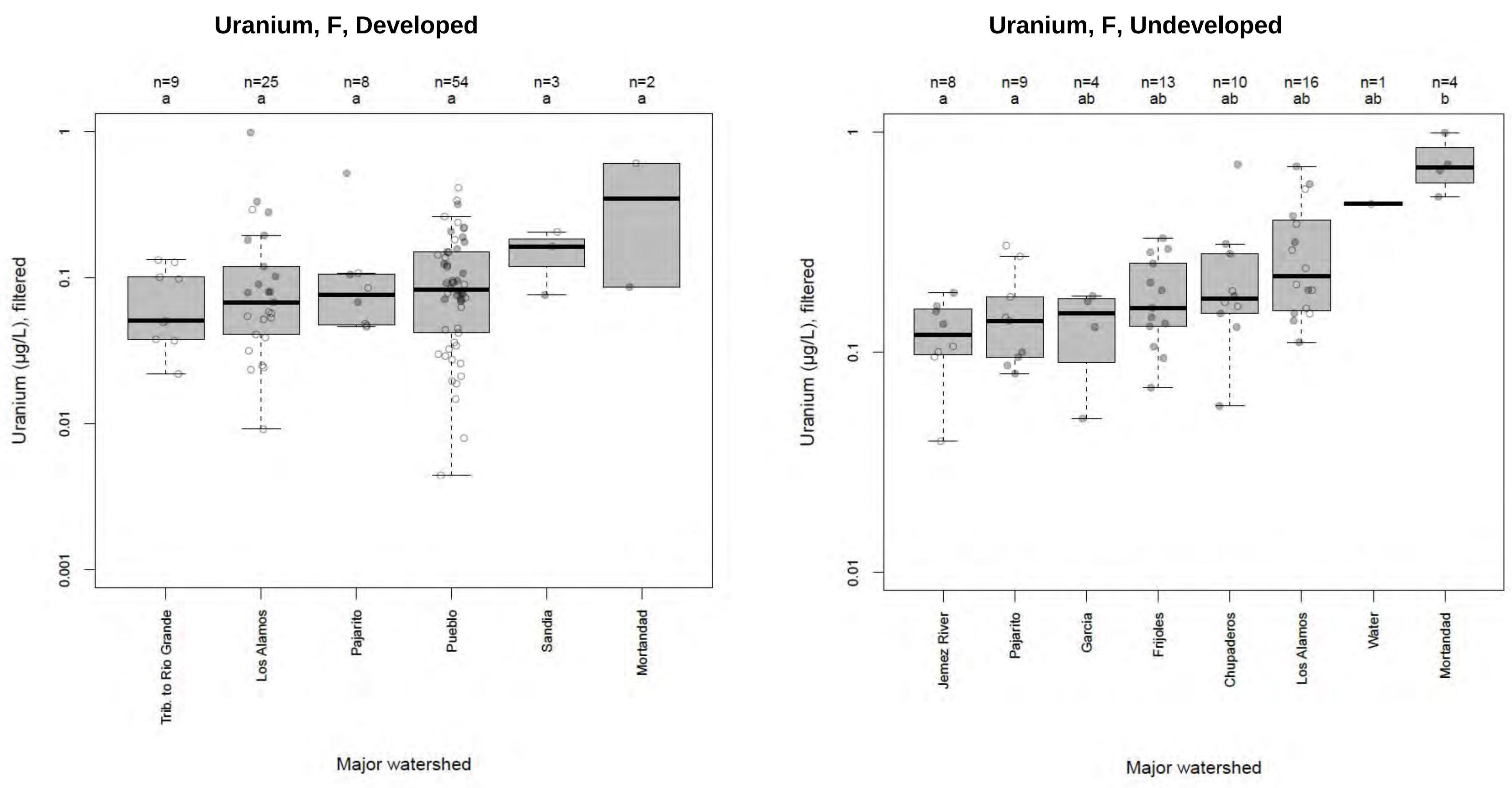


Figure 14d: Uranium raw data boxplots by major watershed

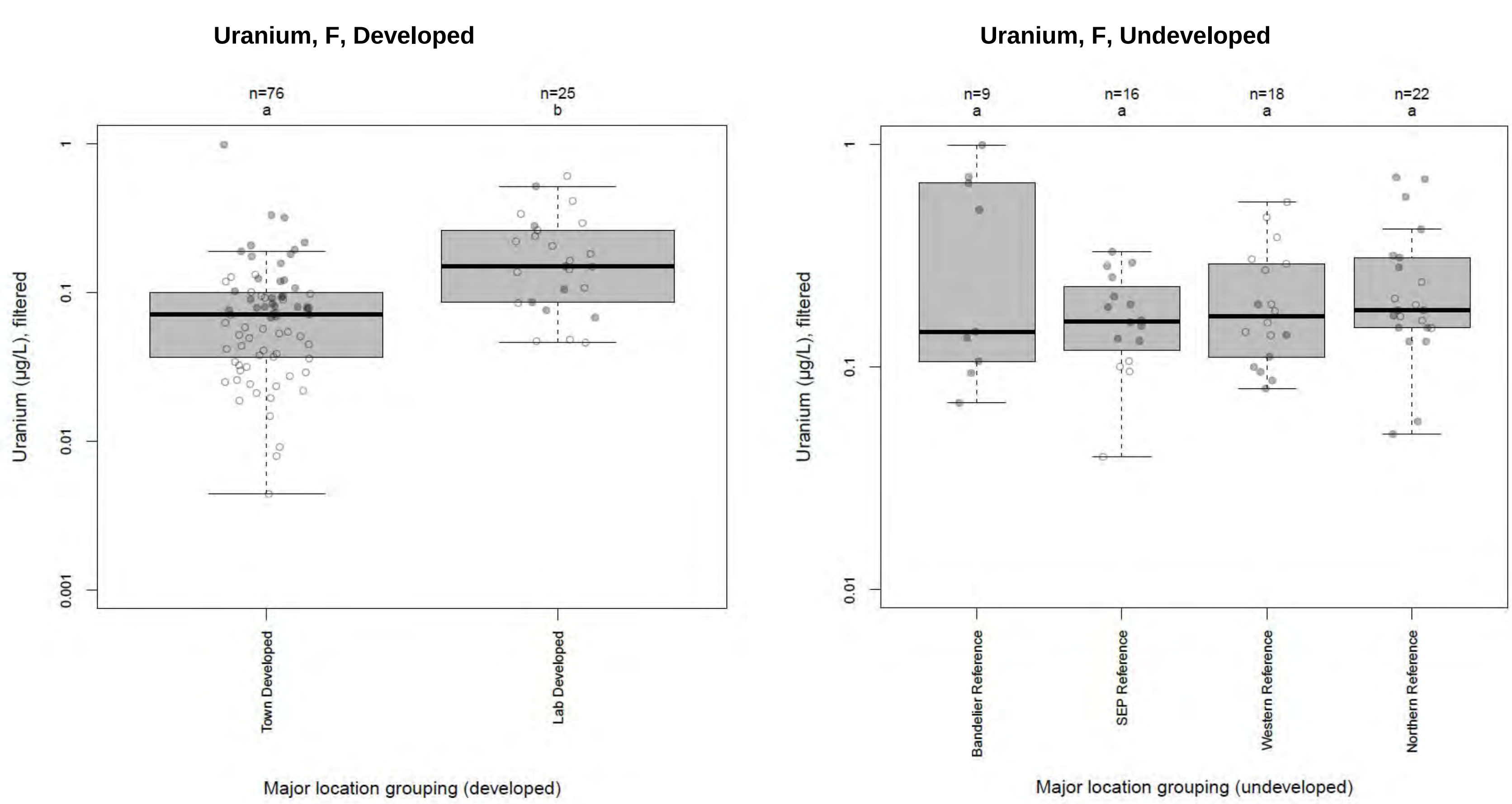


Figure 14g: Uranium raw data boxplots by major location group

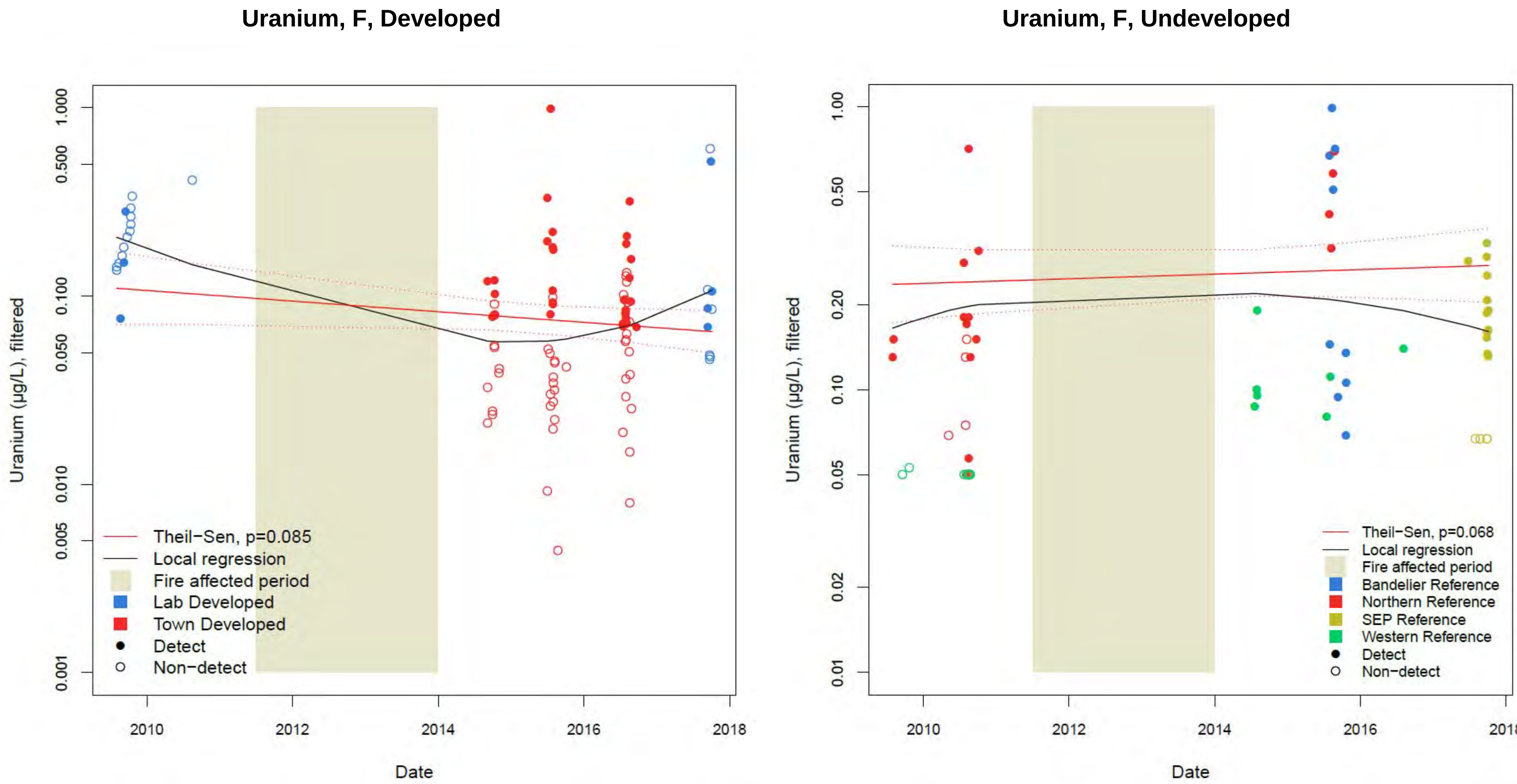


Figure 14j: Temporal trend for raw uranium data

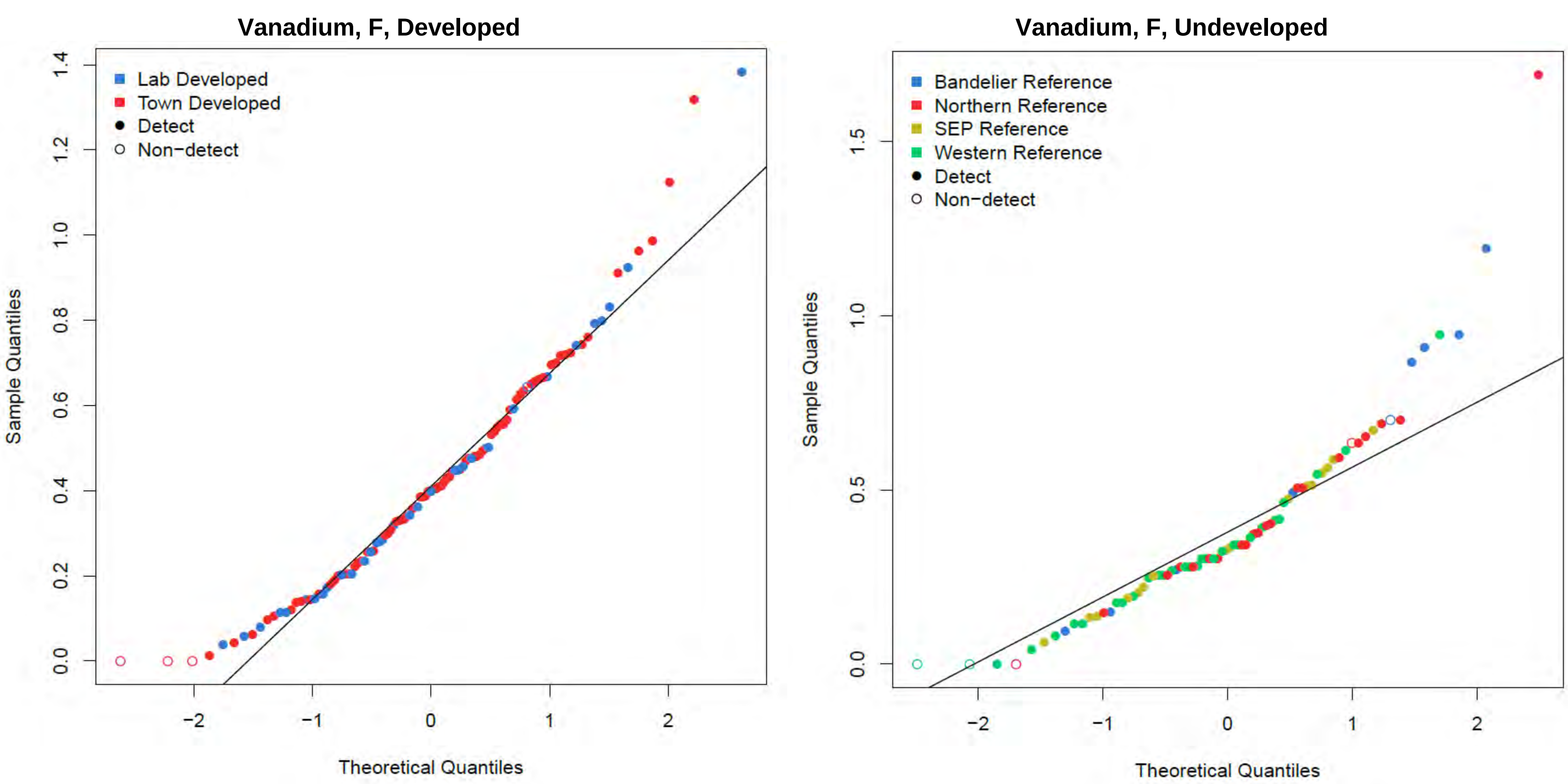


Figure 15a: Vanadium raw data Q-Q plots

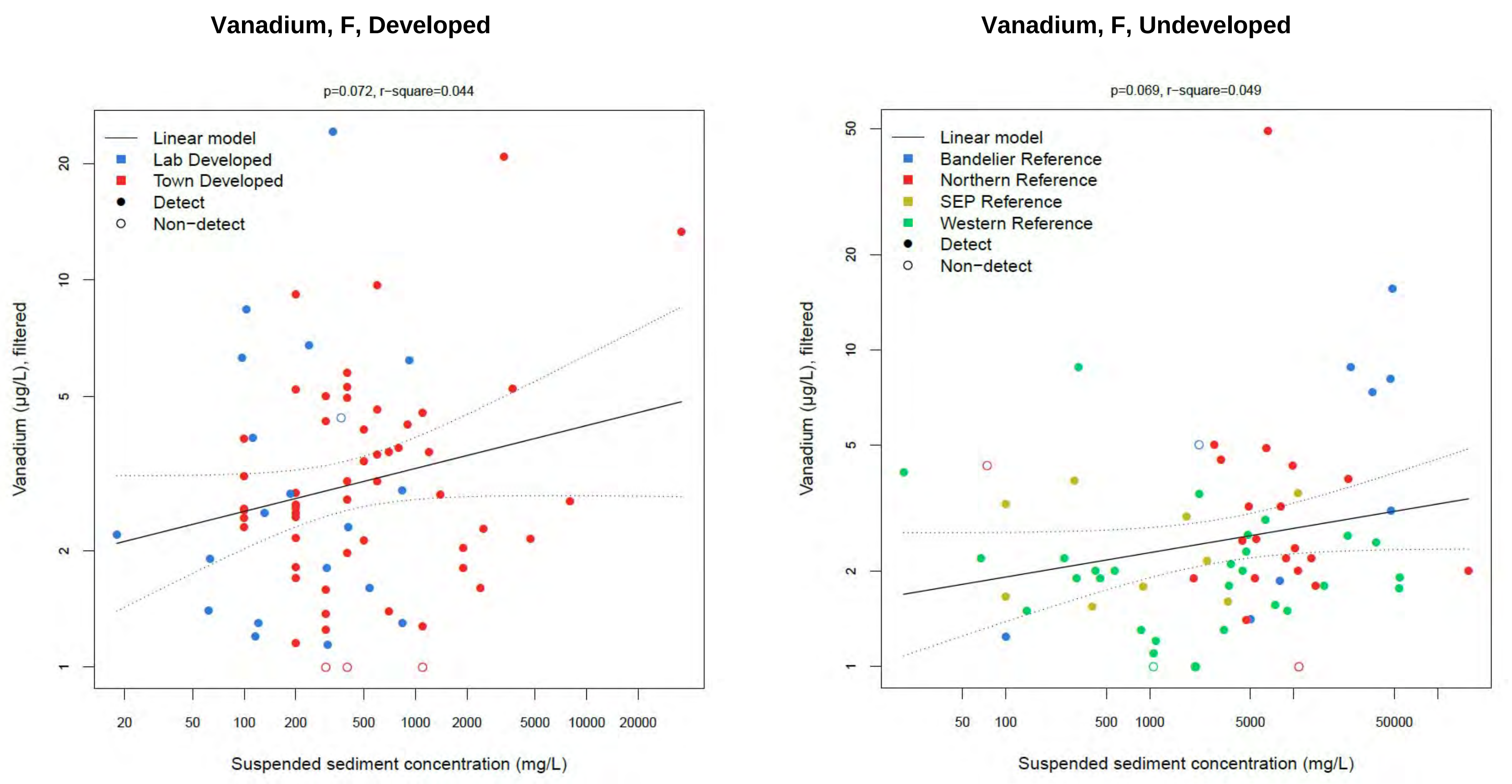


Figure 15b: Vanadium-SSC scatterplots

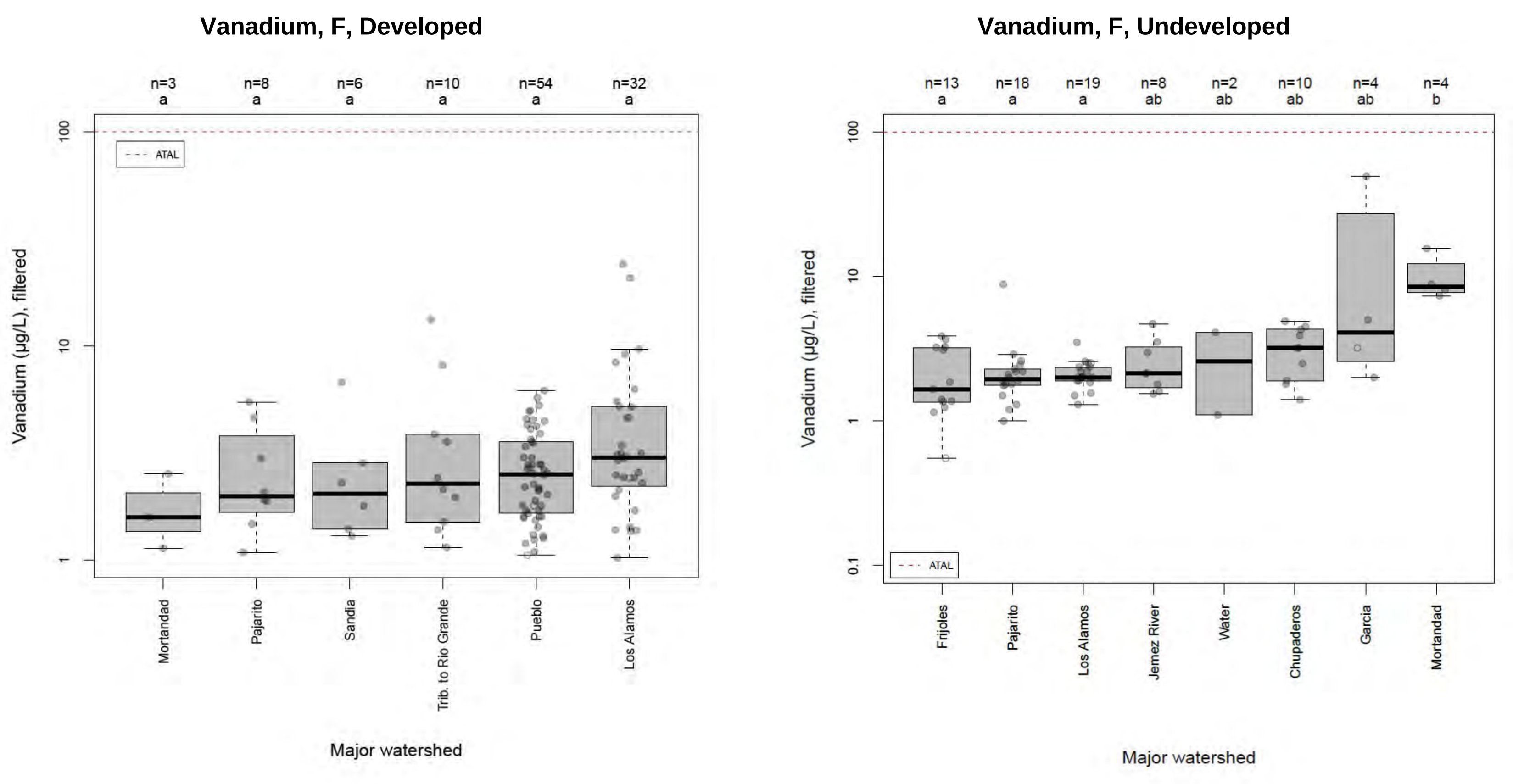


Figure 15d: Vanadium raw data box plots by major watershed

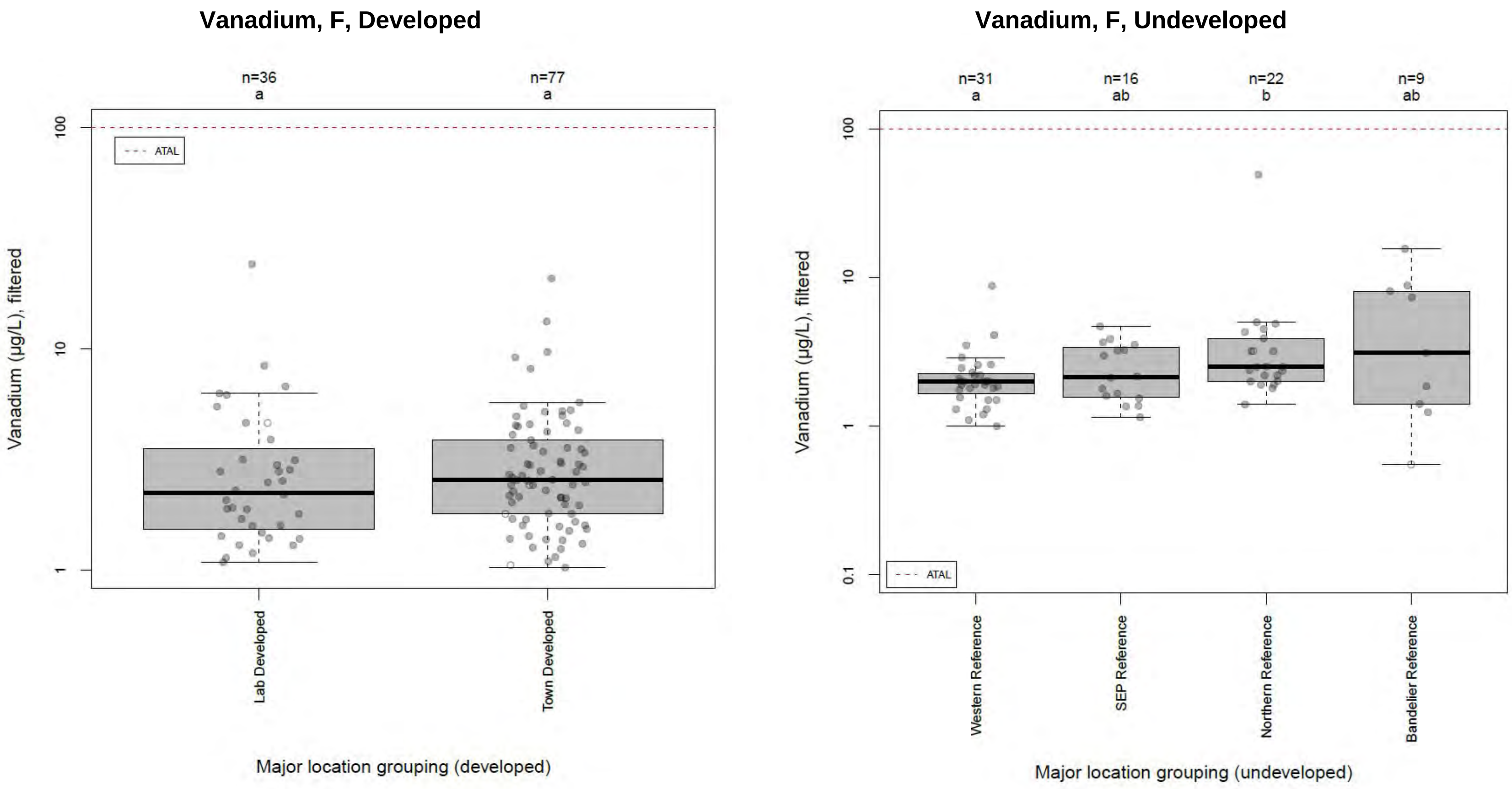


Figure 15g: Vanadium raw data box plots by major location group

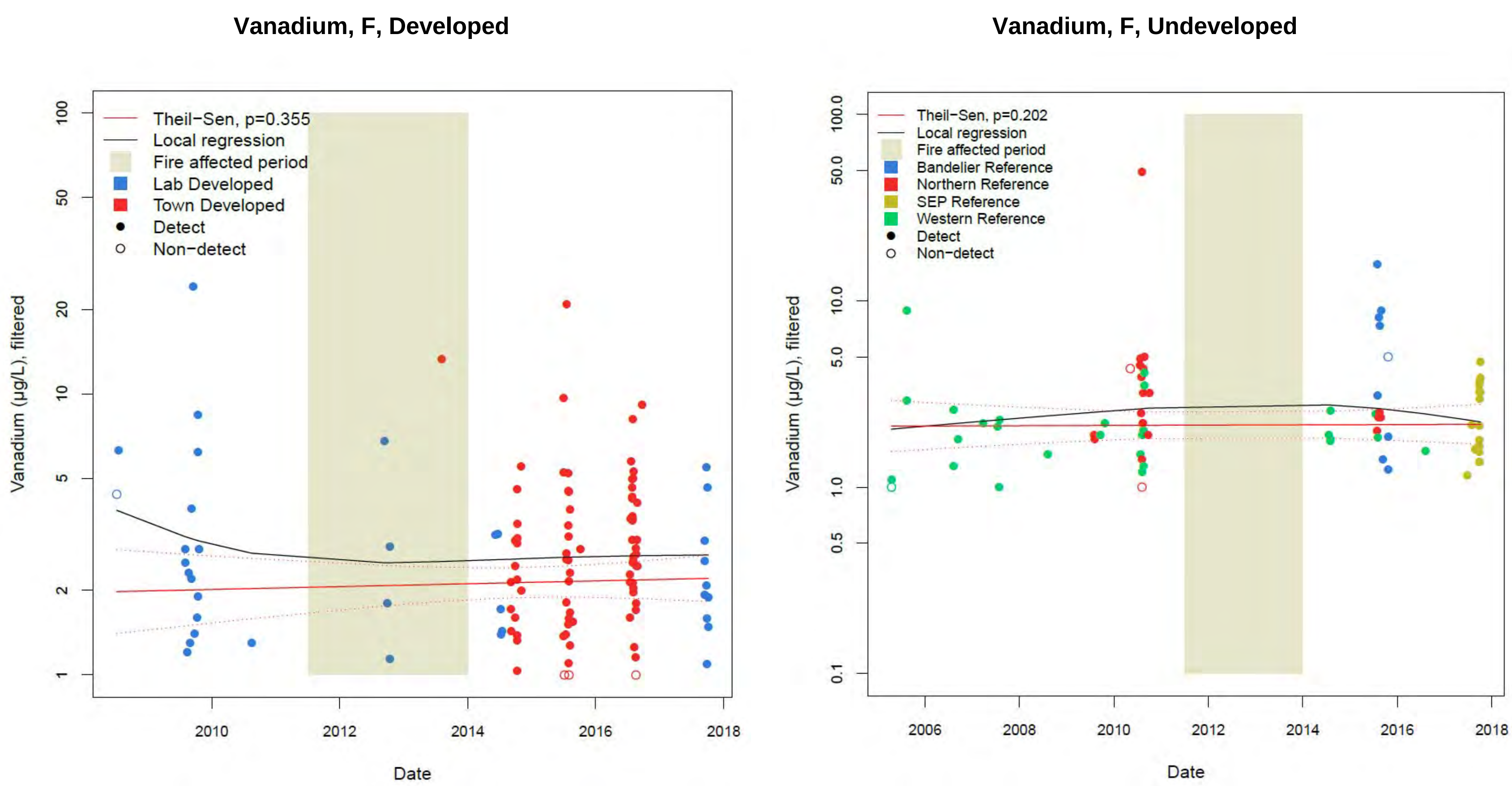


Figure 15j: Temporal trend for raw vanadium data

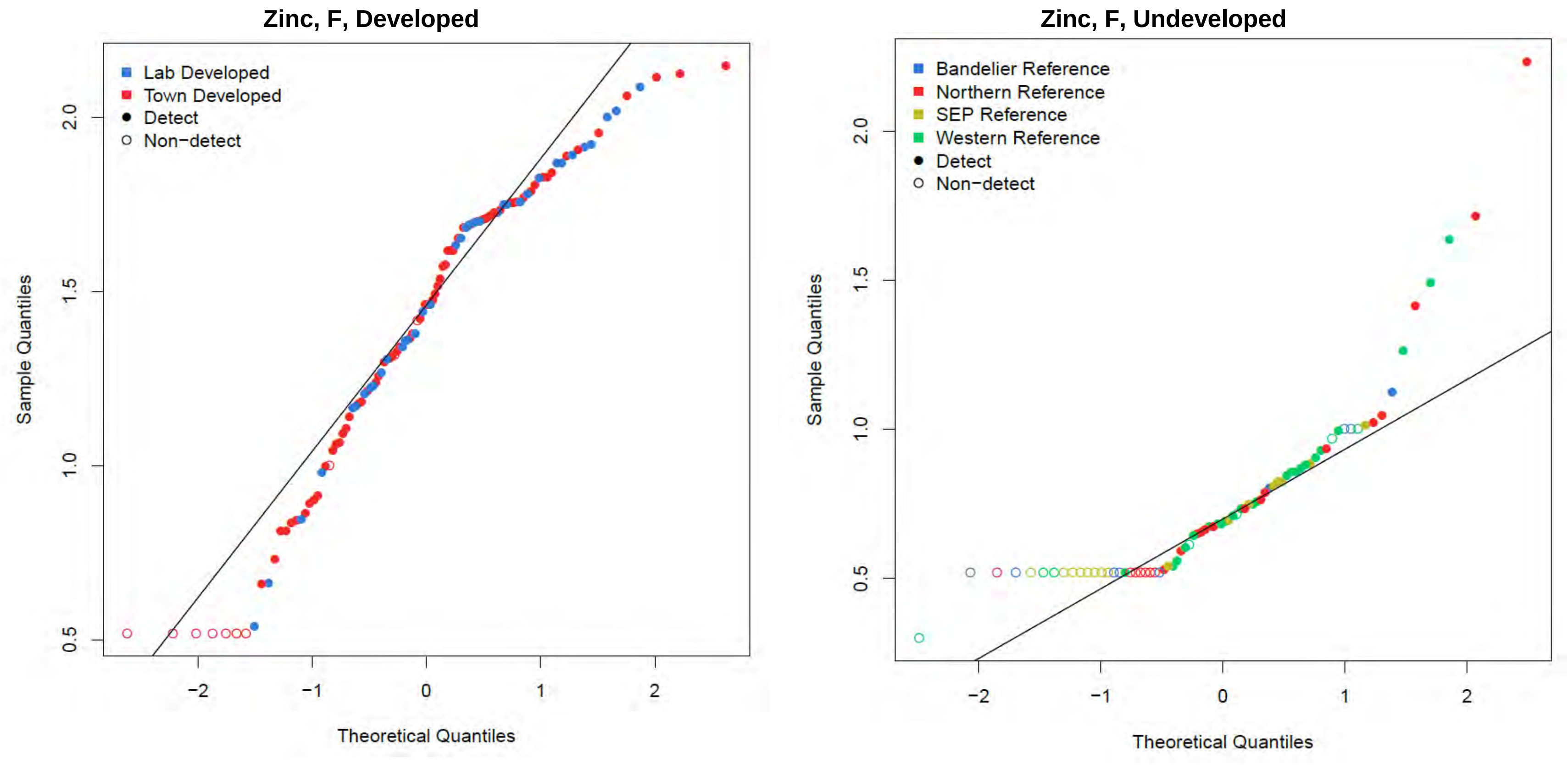


Figure 16a: Zinc raw data Q-Q plots

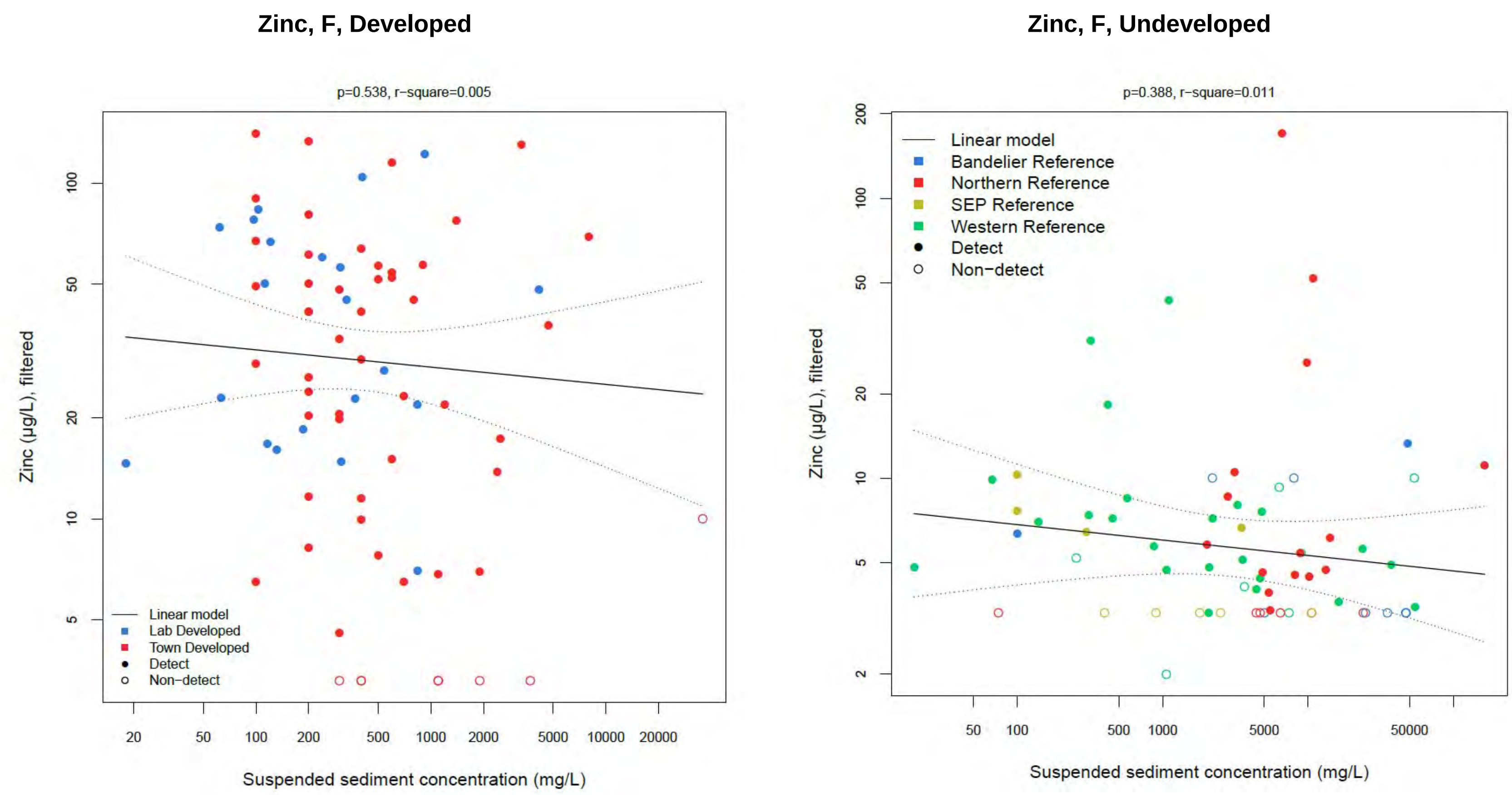


Figure 16b: Zinc-SSC scatterplot

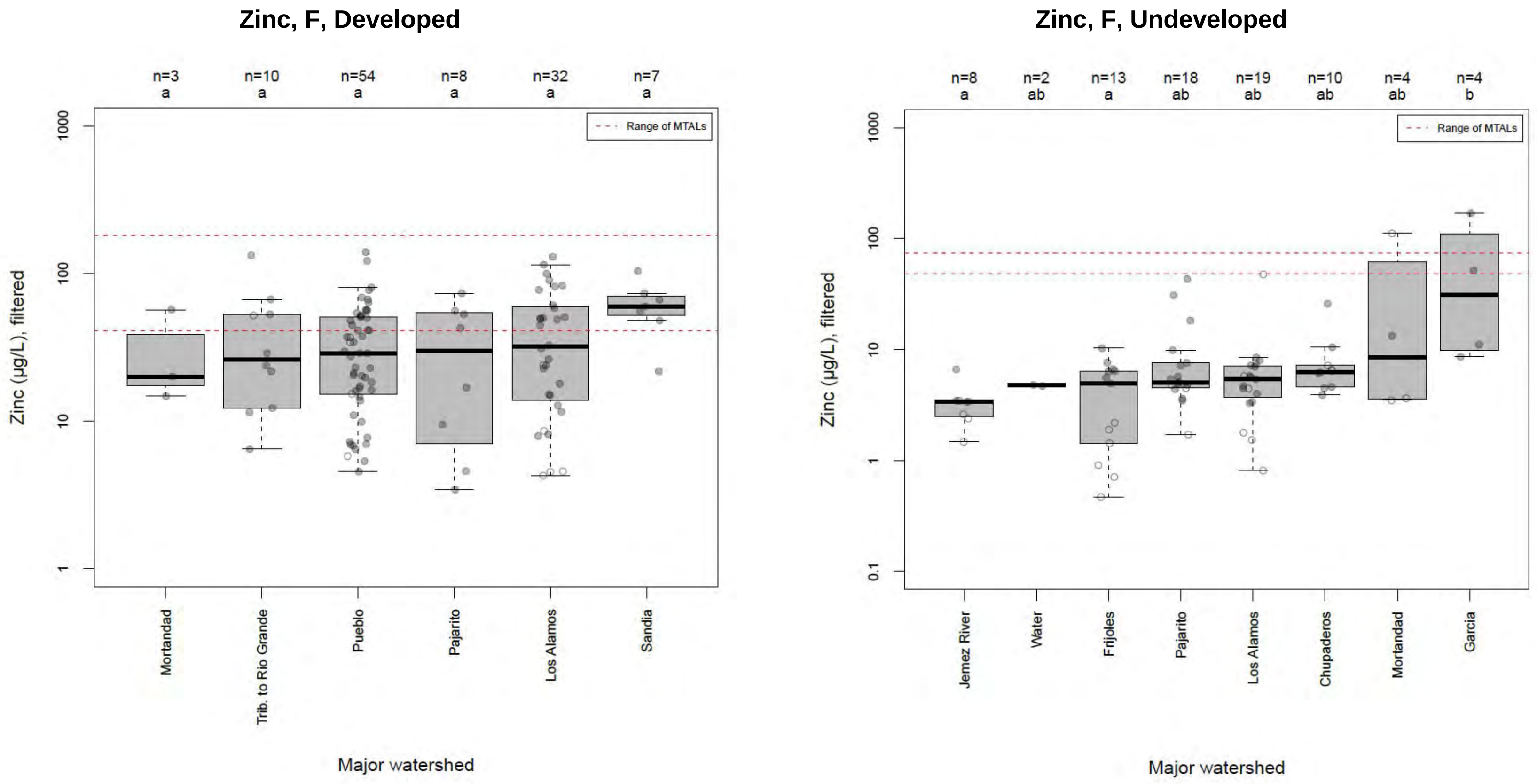


Figure 16d: Zinc raw data boxplots by major watershed

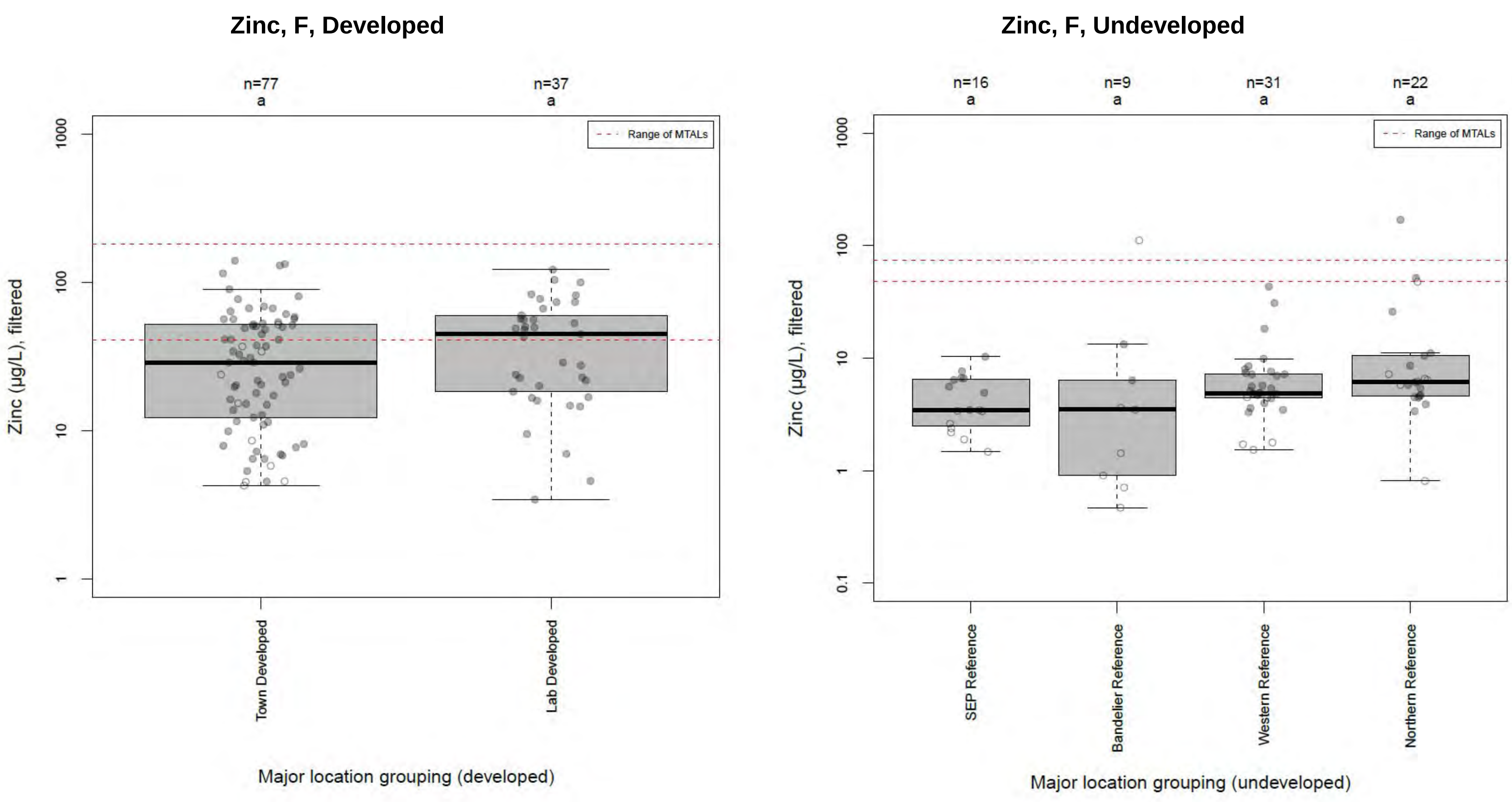


Figure 16g: Zinc raw data boxplots by major location group

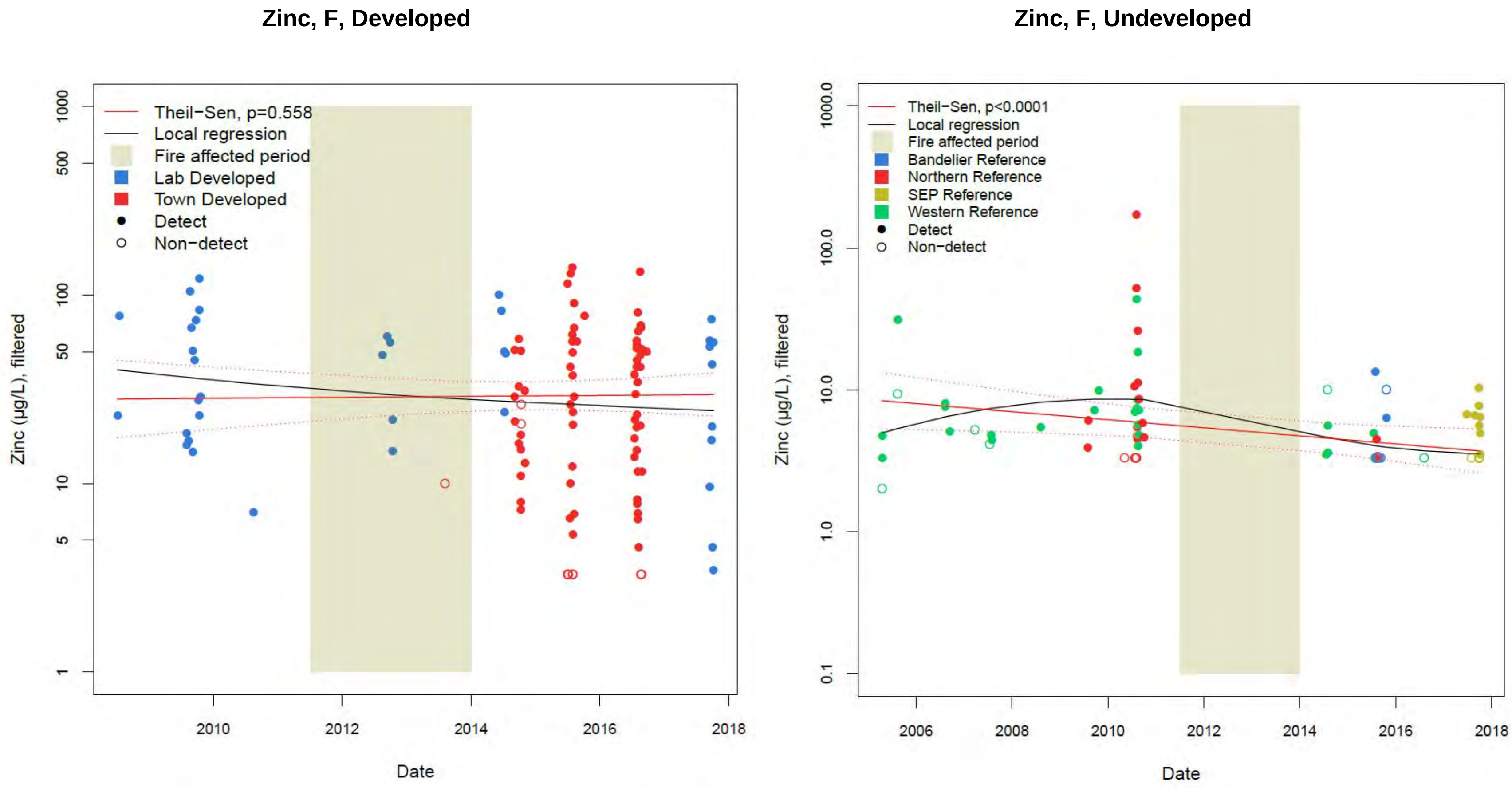


Figure 16j: Temporal trend for raw zinc data

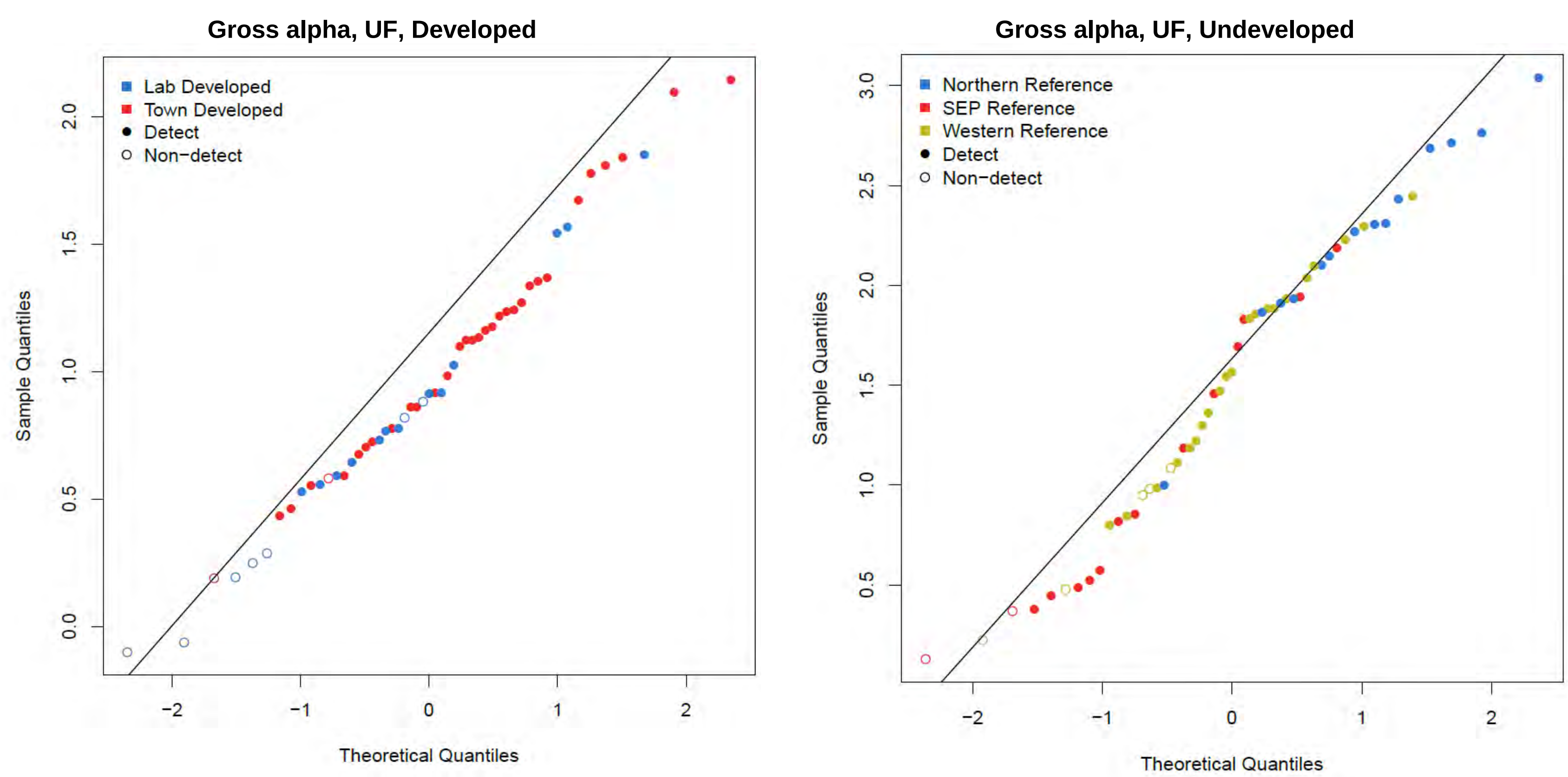


Figure 17a: Gross alpha raw Q-Q plots

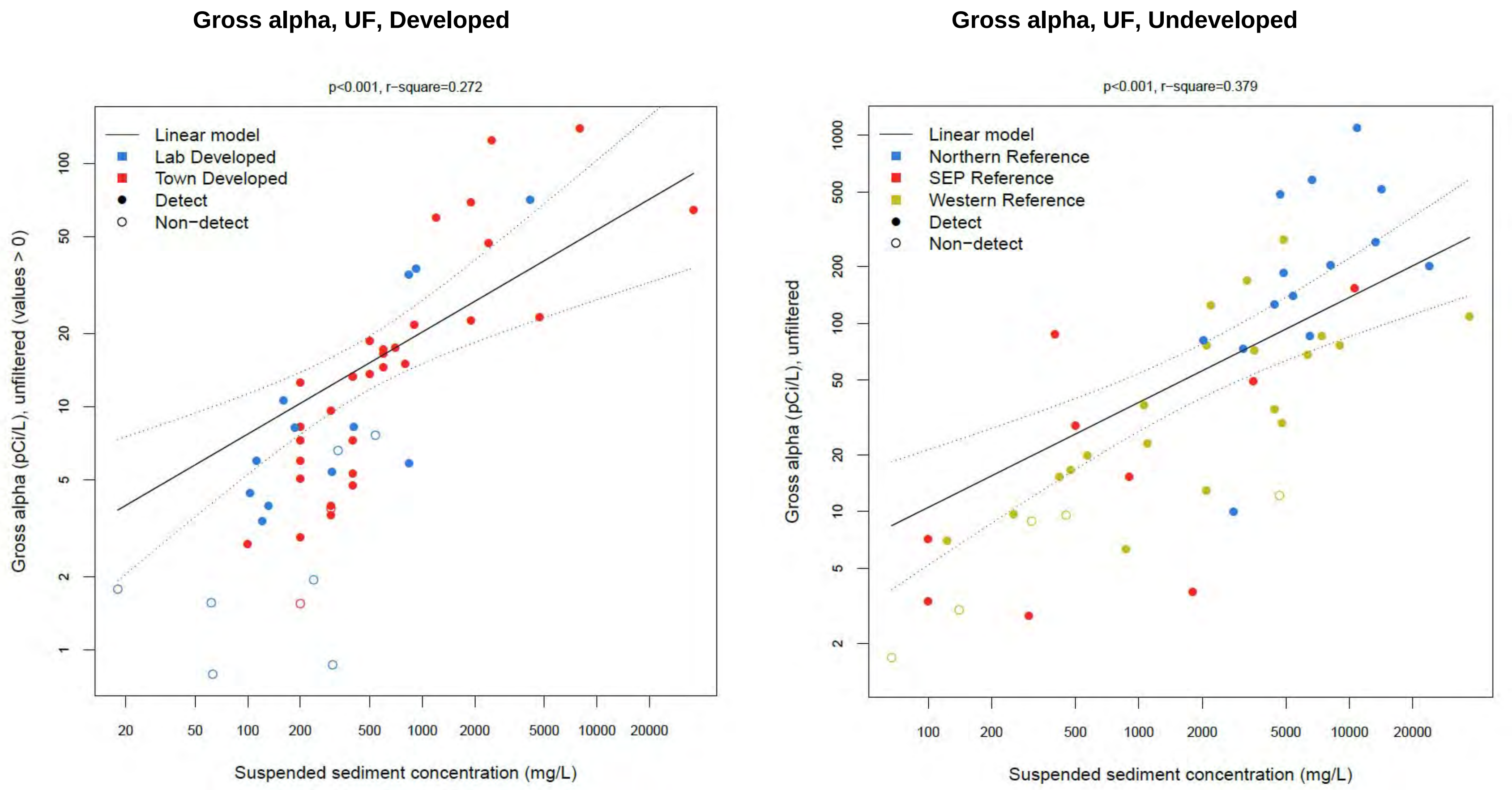


Figure 17b: Gross alpha-SSC scatterplots

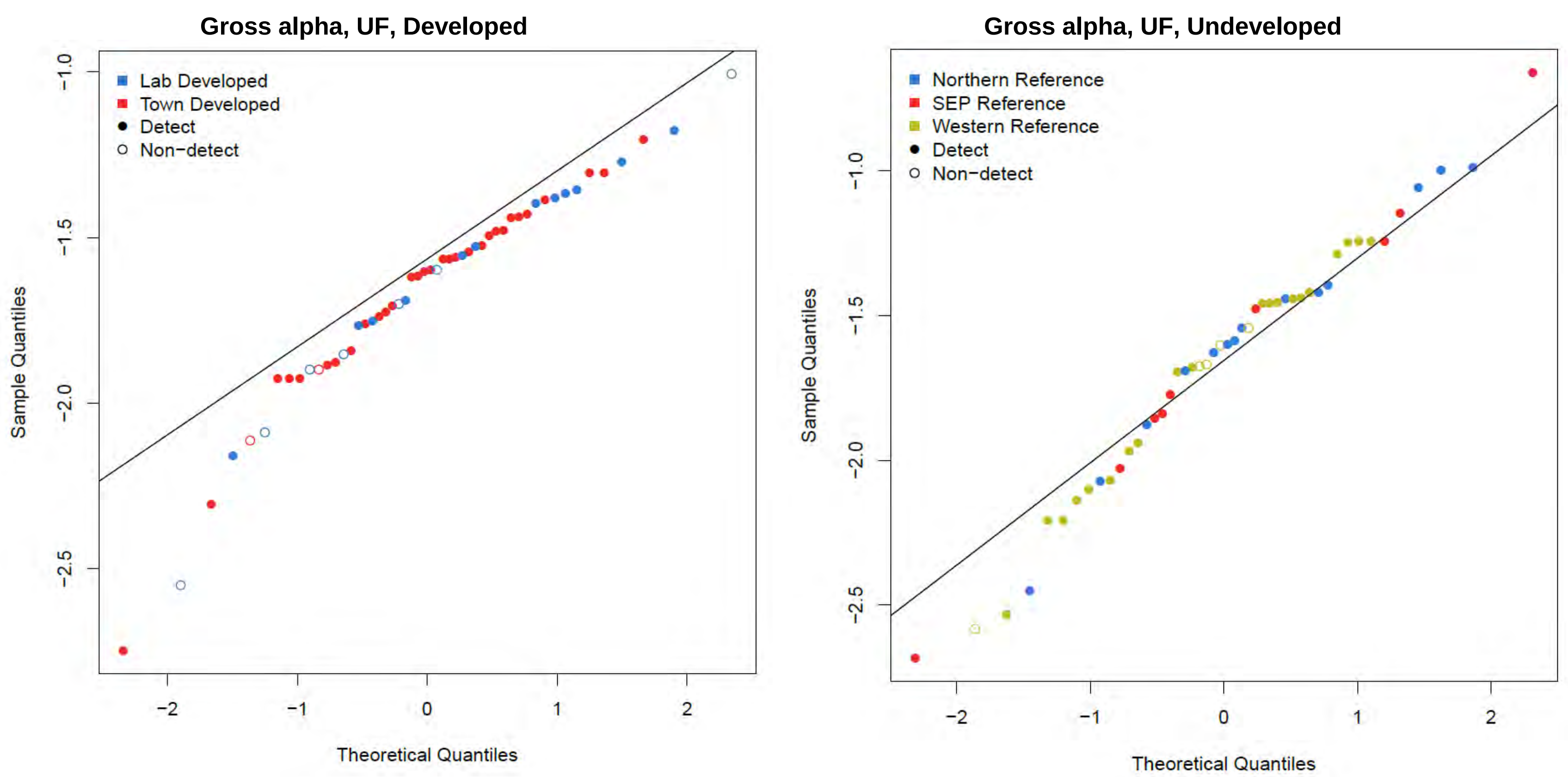


Figure 17c: SSC-normalized gross alpha Q-Q plots

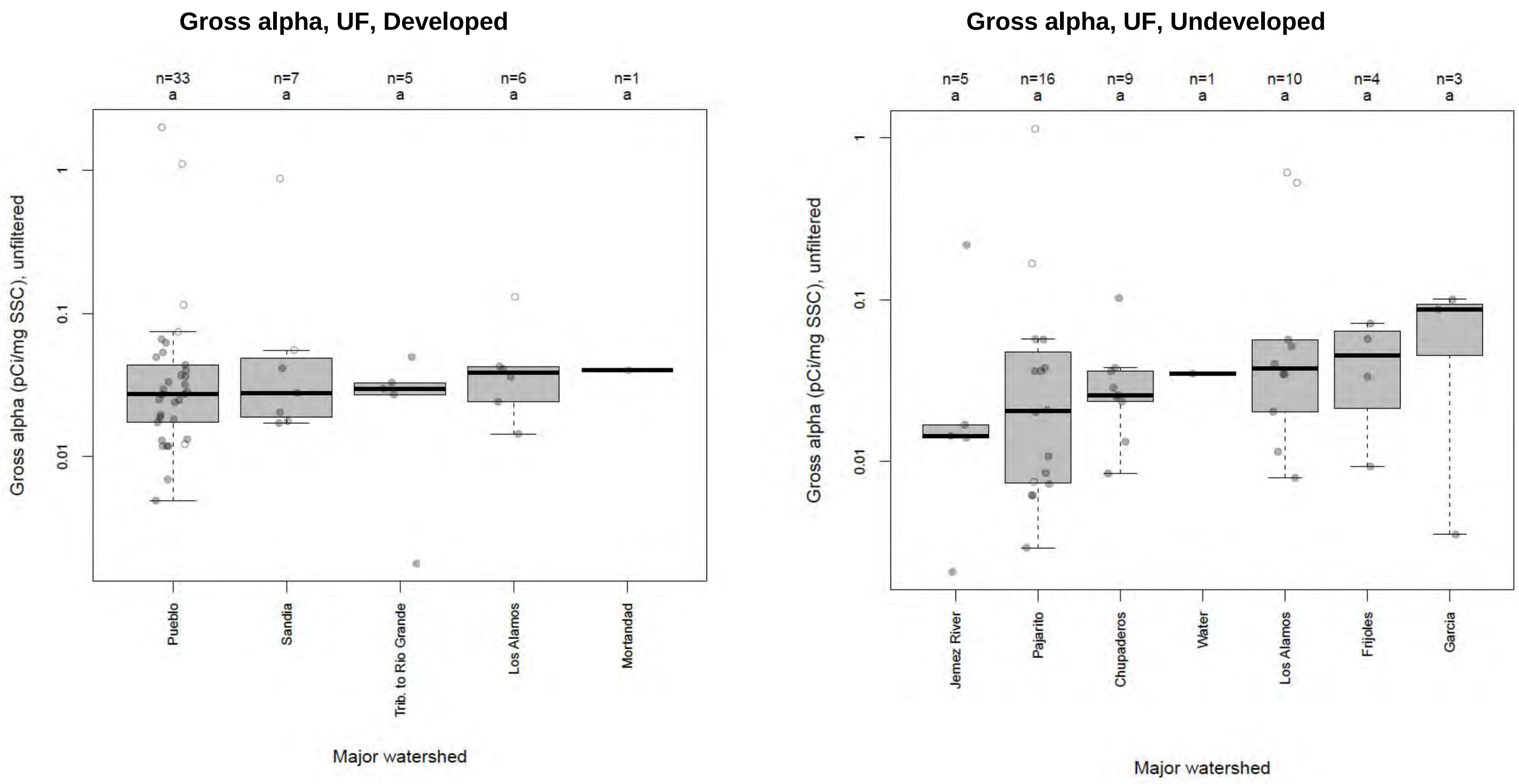


Figure 17e: SSC-normalized gross alpha boxplots by major watershed

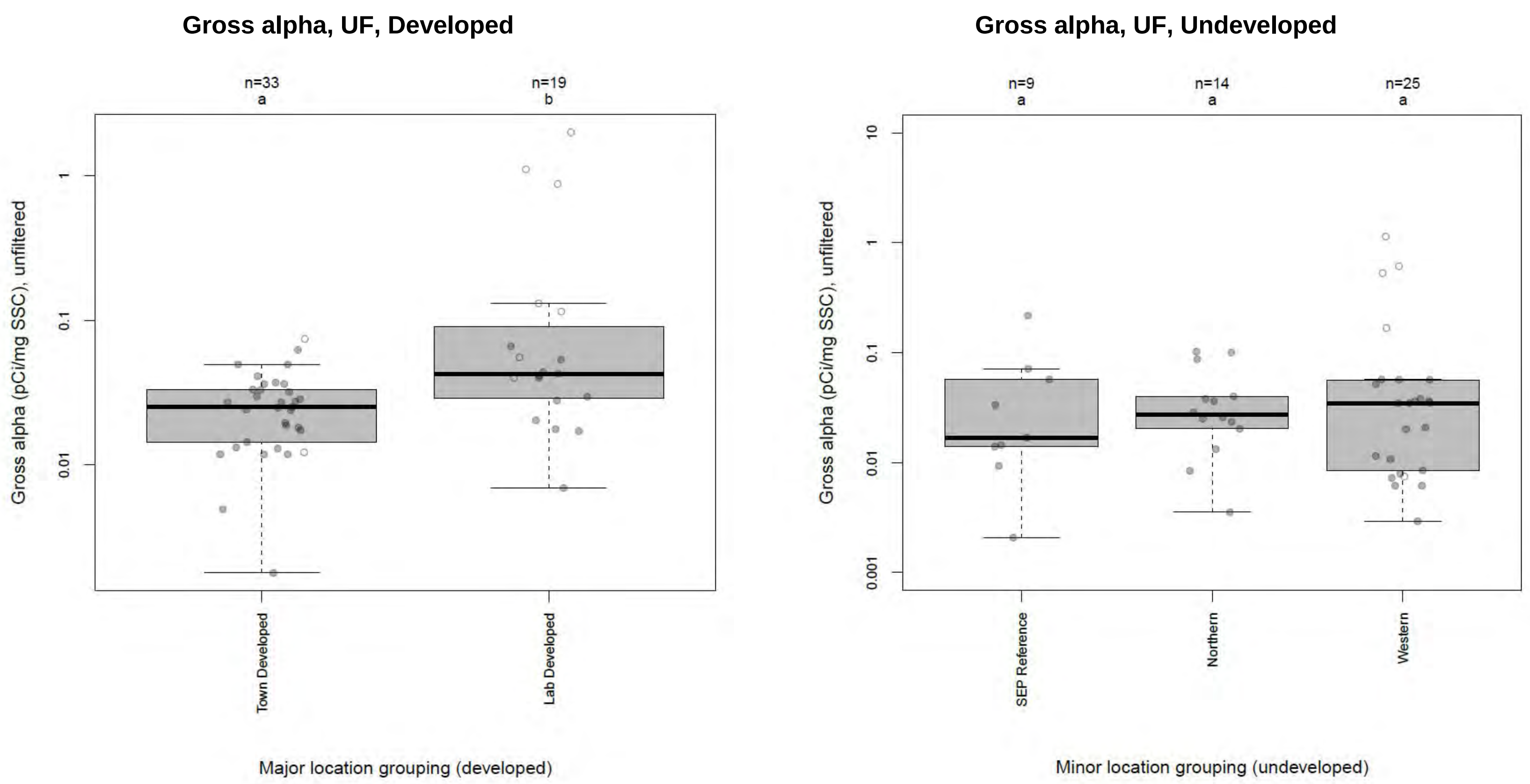


Figure 17h: SSC-normalized gross alpha boxplots by major location group

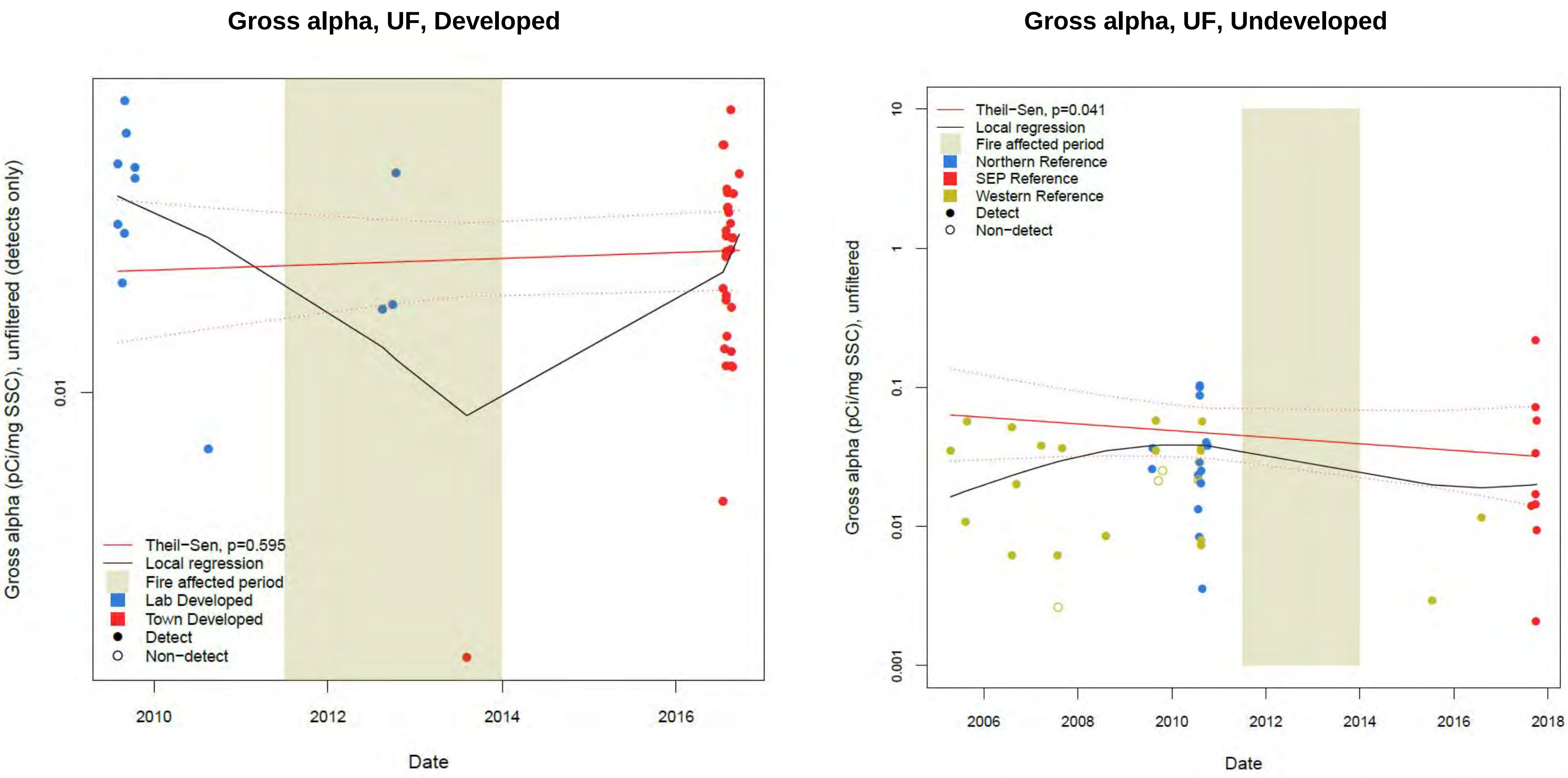


Figure 17k: Temporal trend for SSC-normalized gross alpha

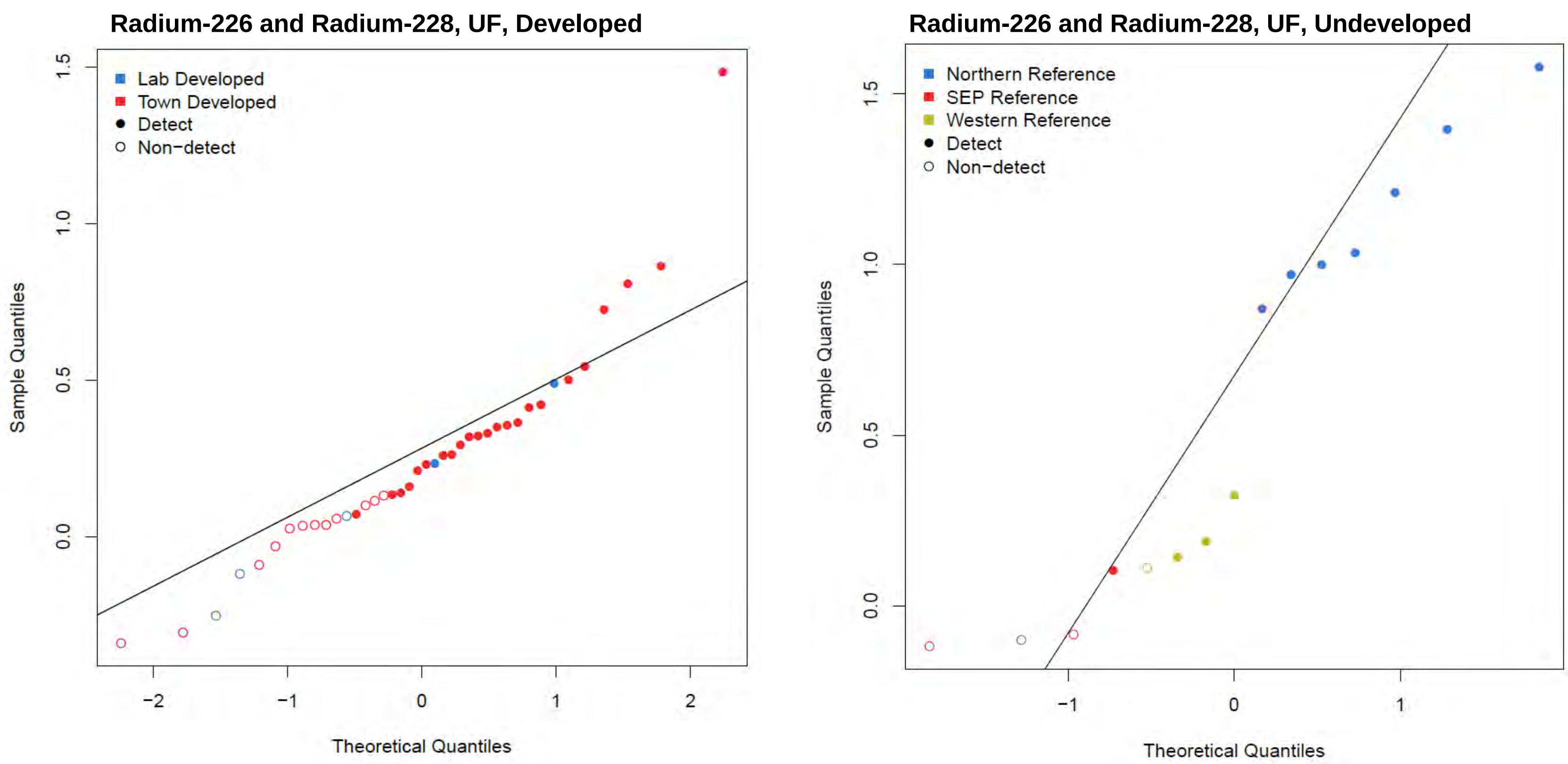


Figure 18a: Radium-226 and radium-228 raw data Q-Q plots

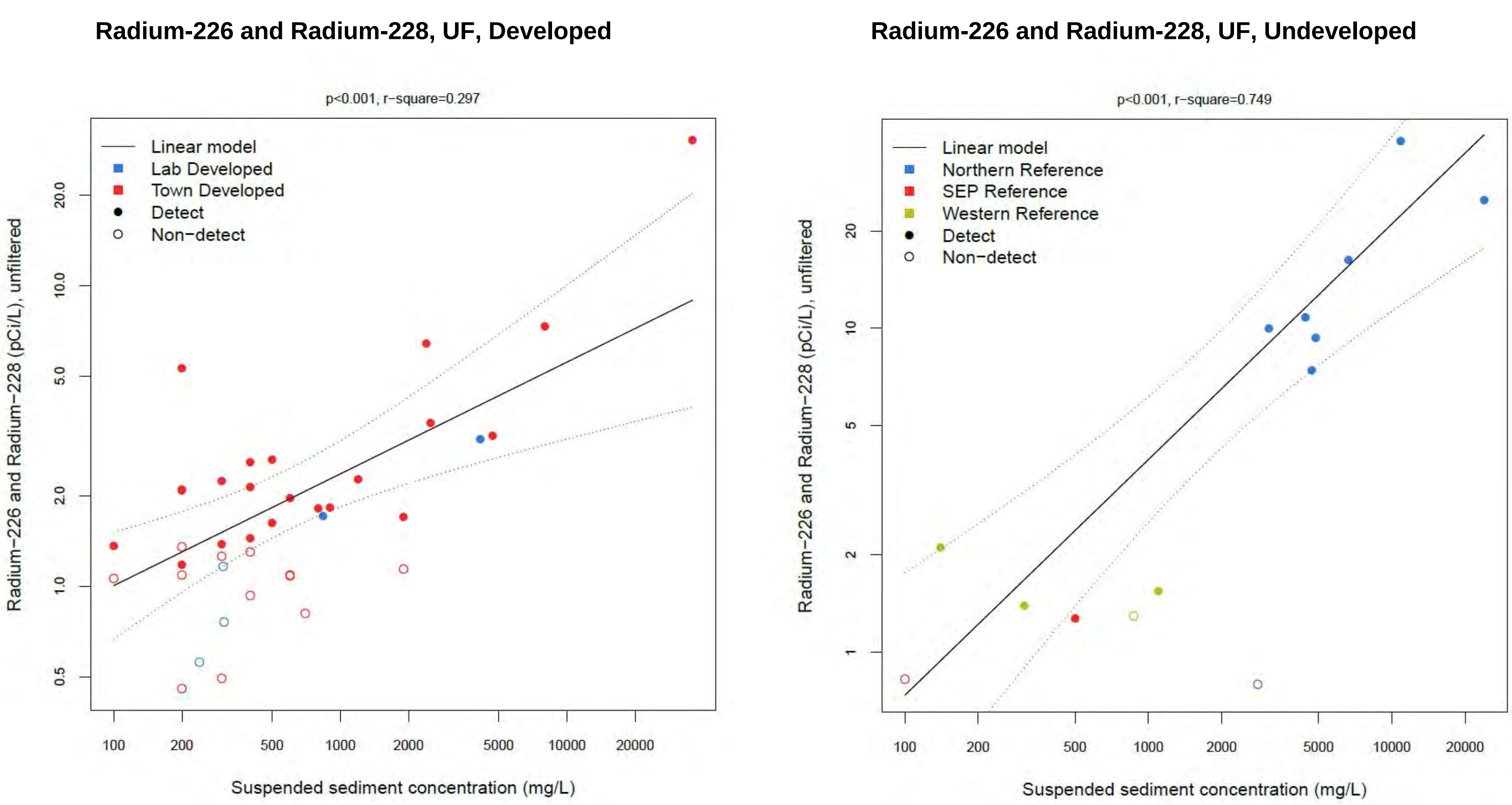


Figure 18b: Radium-226 and radium-228-SSC scatterplots

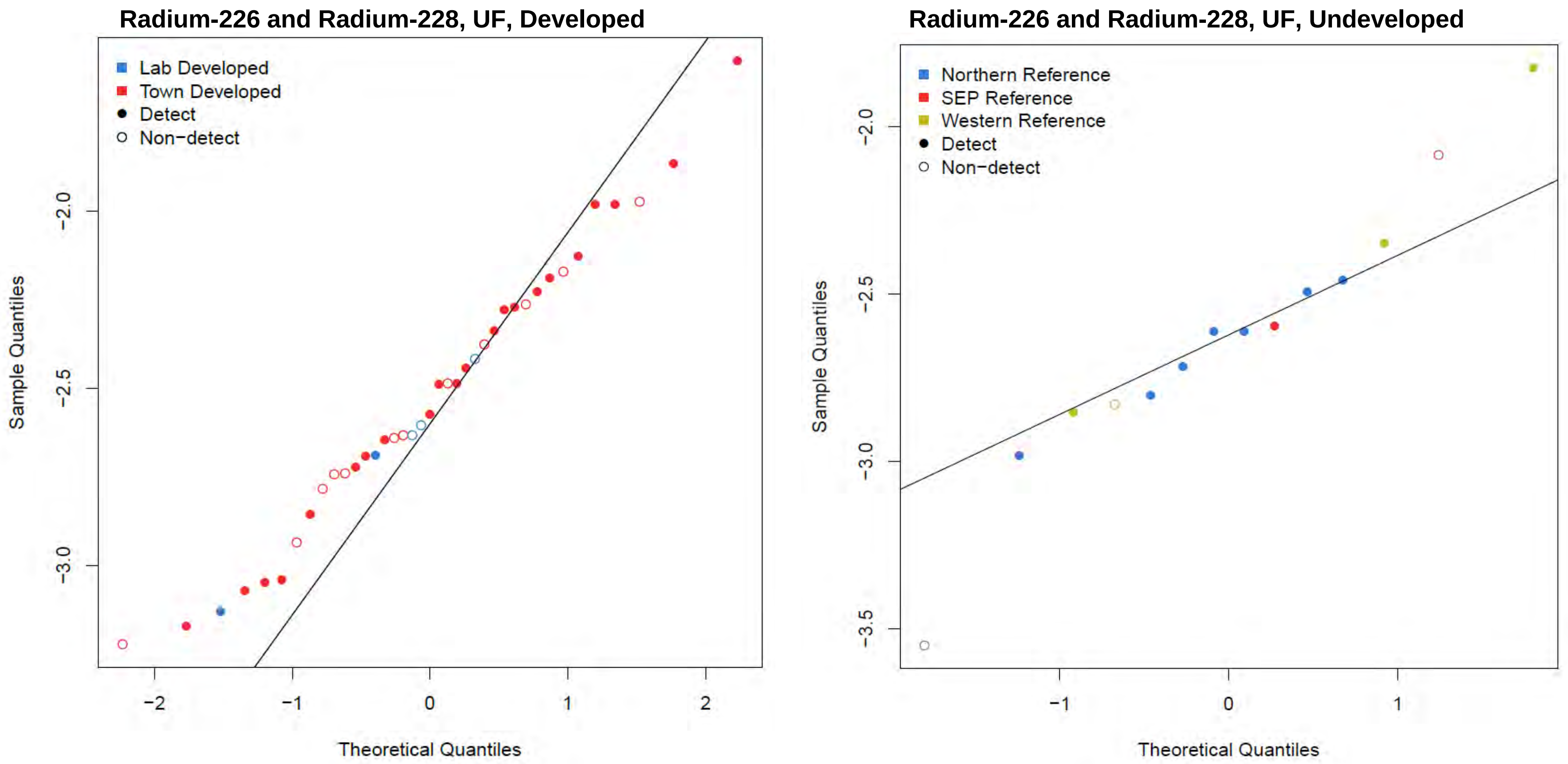


Figure 18c: SSC-normalized radium-226 and radium-228 Q-Q plots

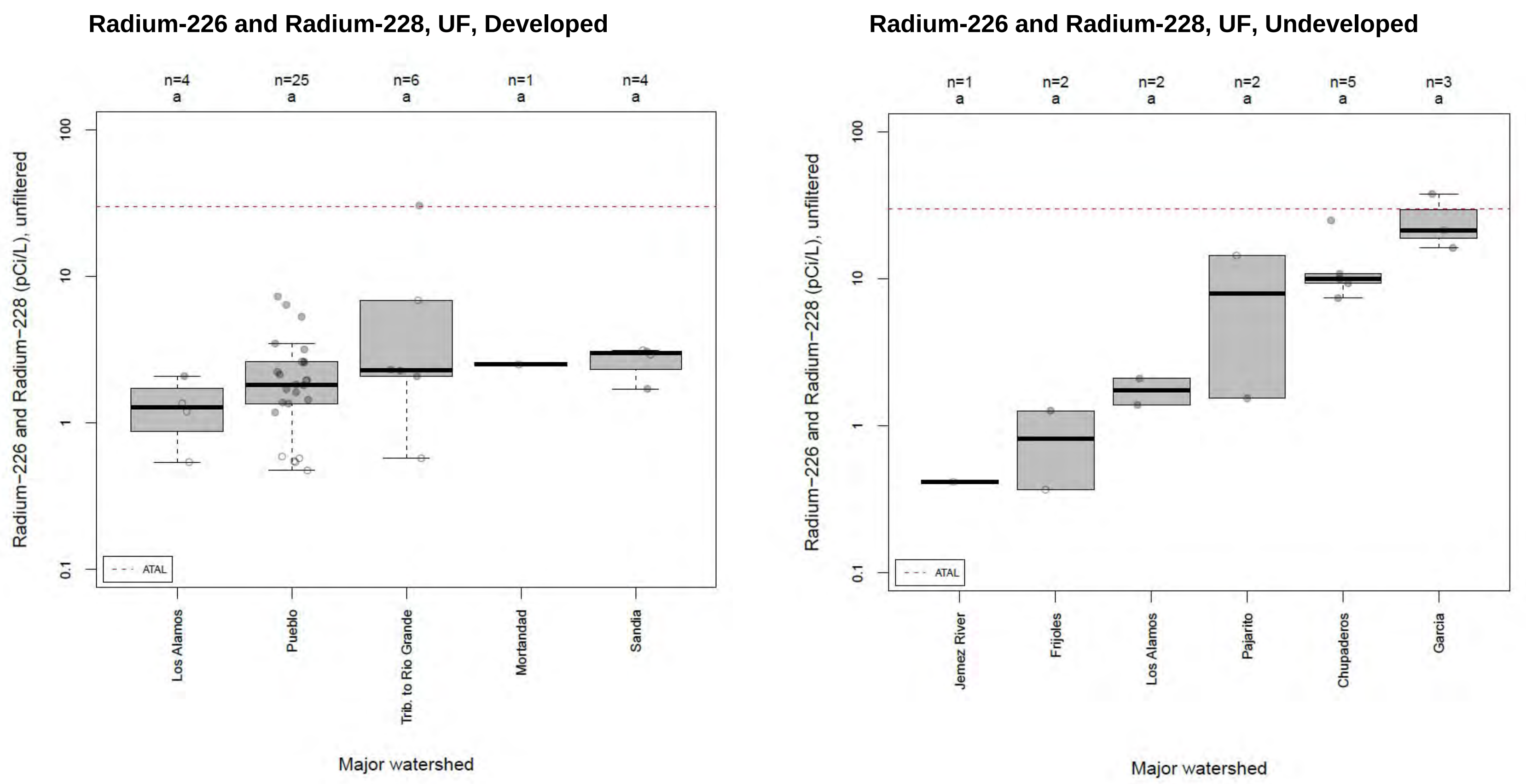


Figure 18d: Radium-226 and radium-228 raw data boxplots by major watershed

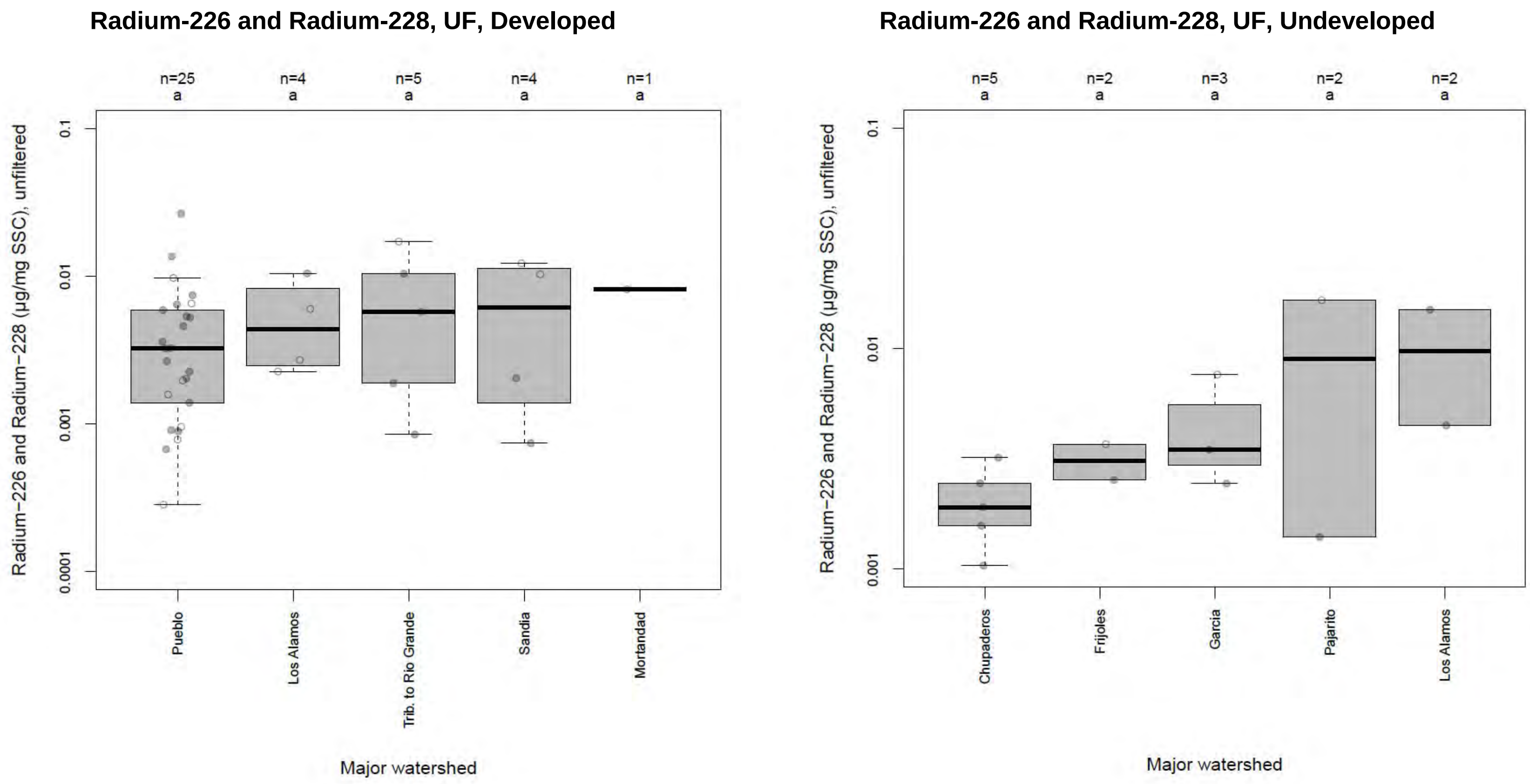


Figure 18e: SSC-normalized radium-226 and radium-228 boxplots by major watershed

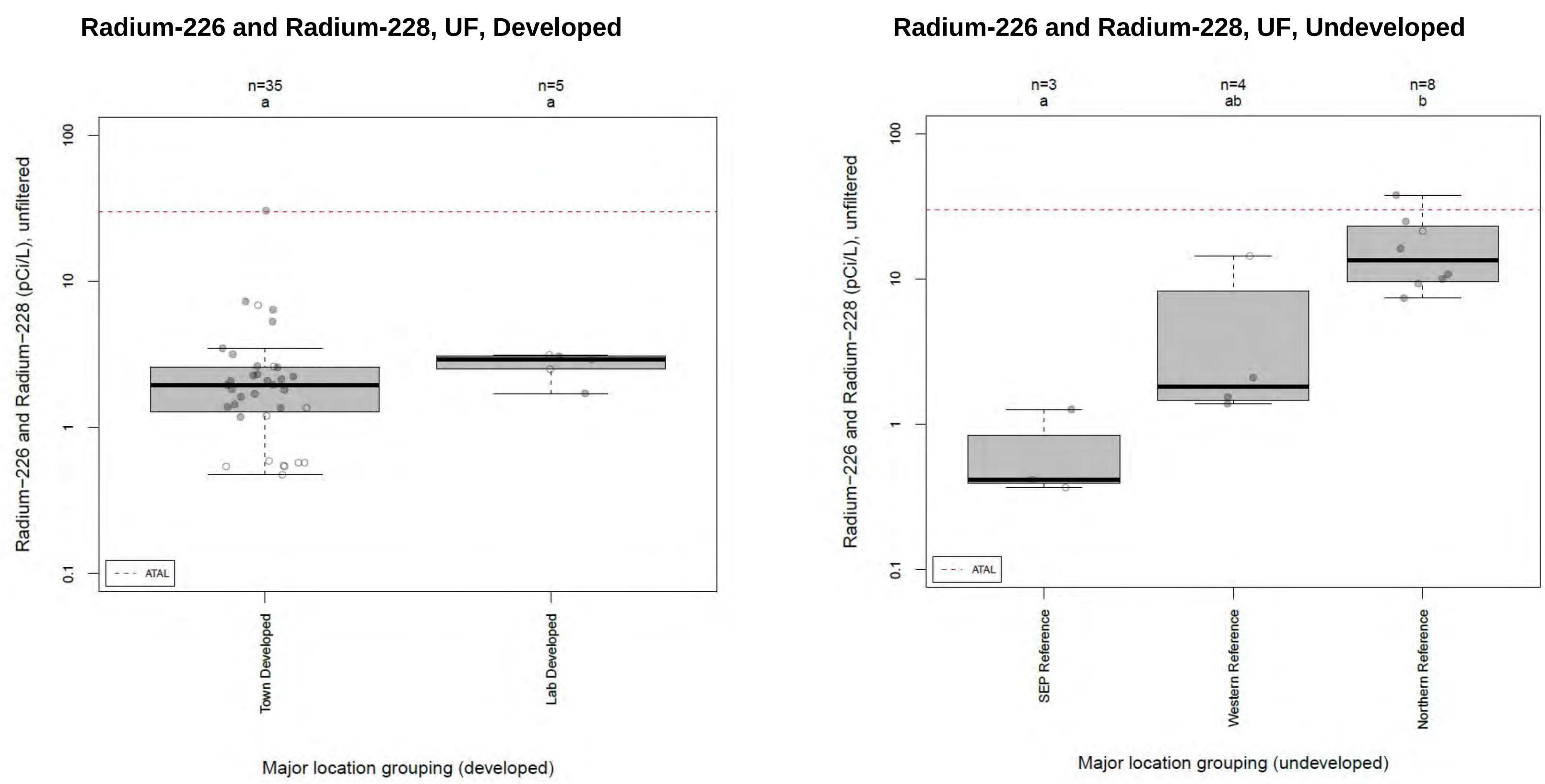


Figure 18g: Radium-226 and radium-228 raw data boxplots by major location group

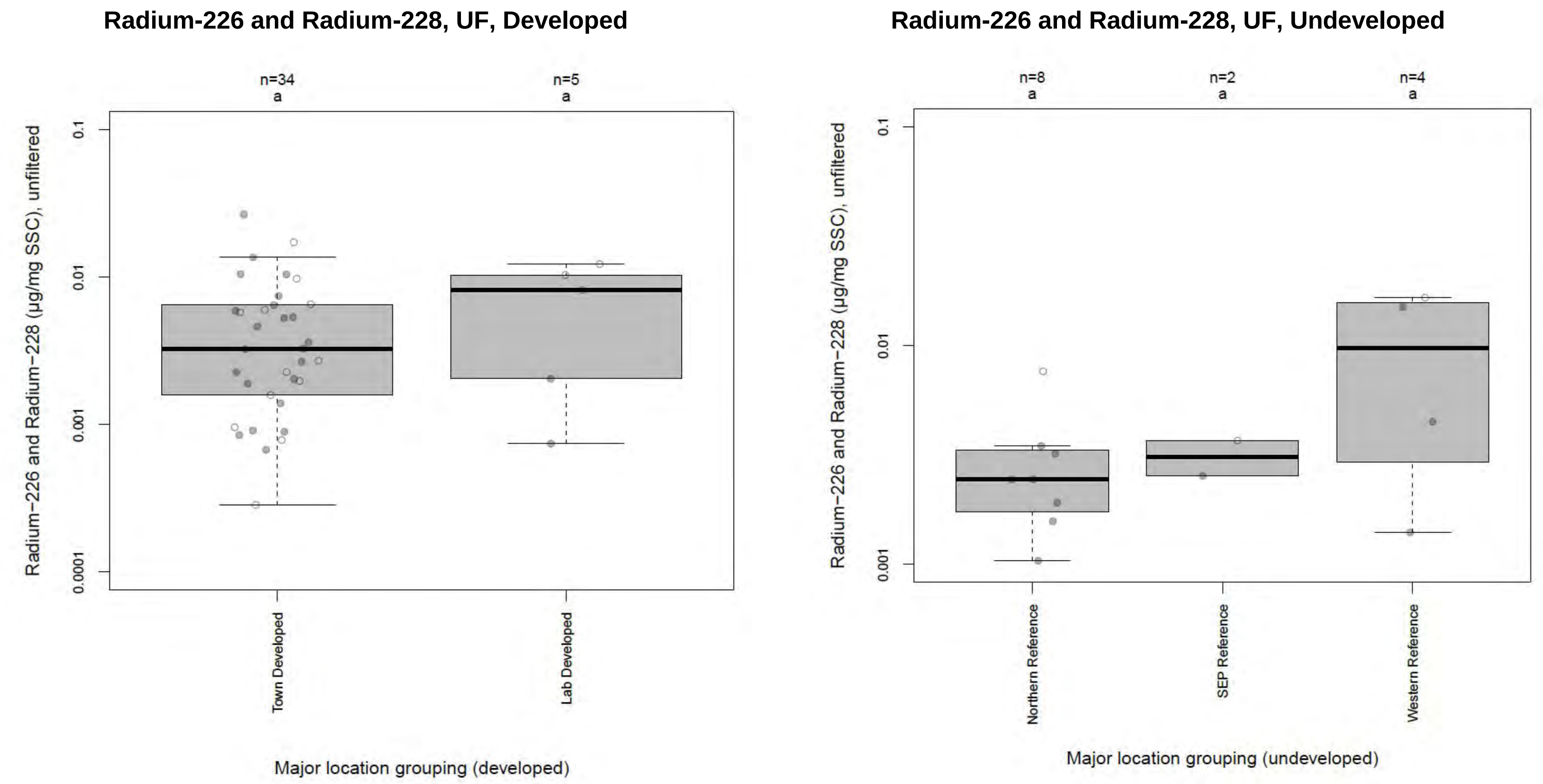


Figure 18h: SSC-normalized radium-226 and radium-228 boxplots by major location group

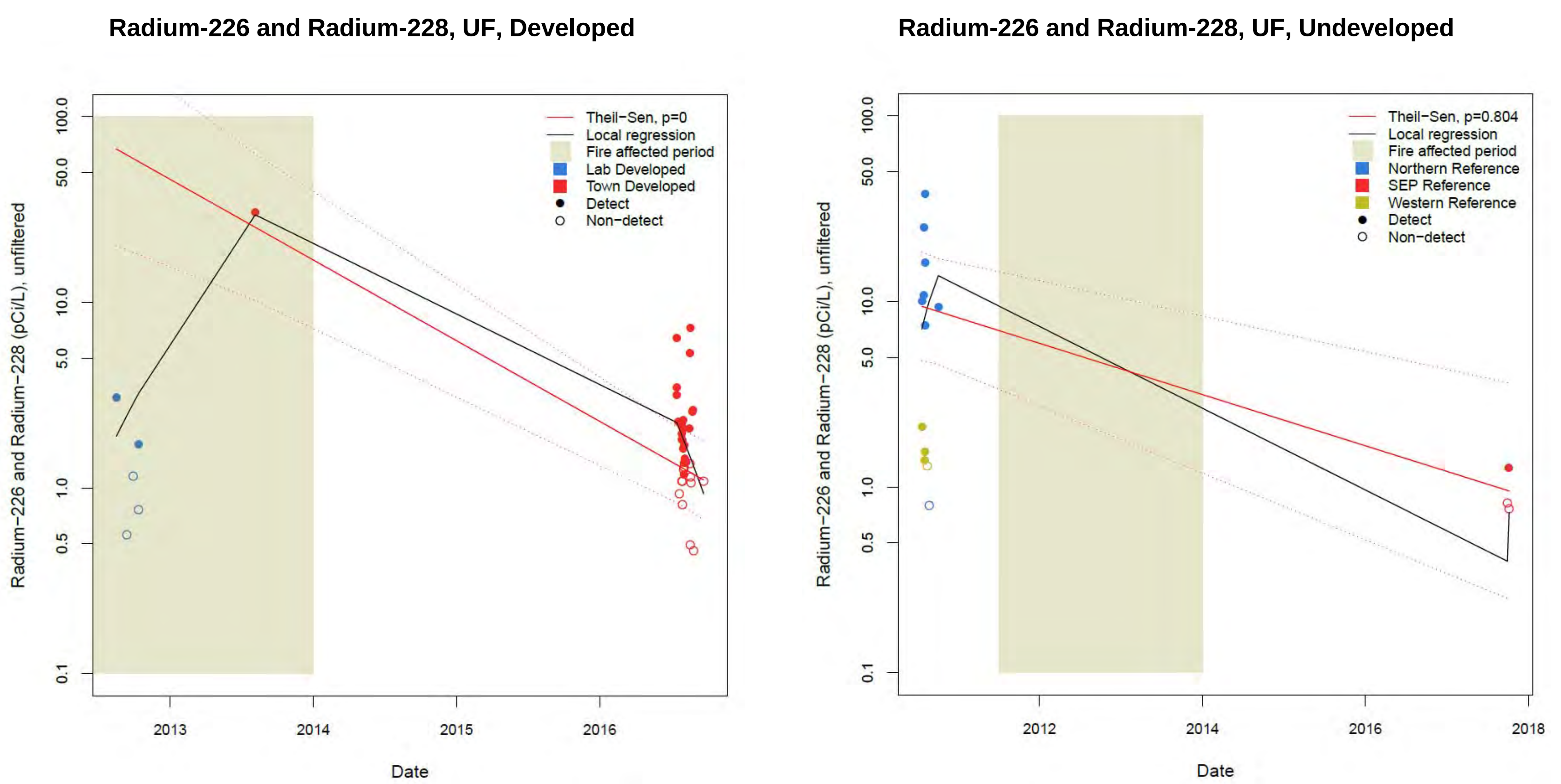


Figure 18j: Temporal trend for raw radium-226 and radium-228 data

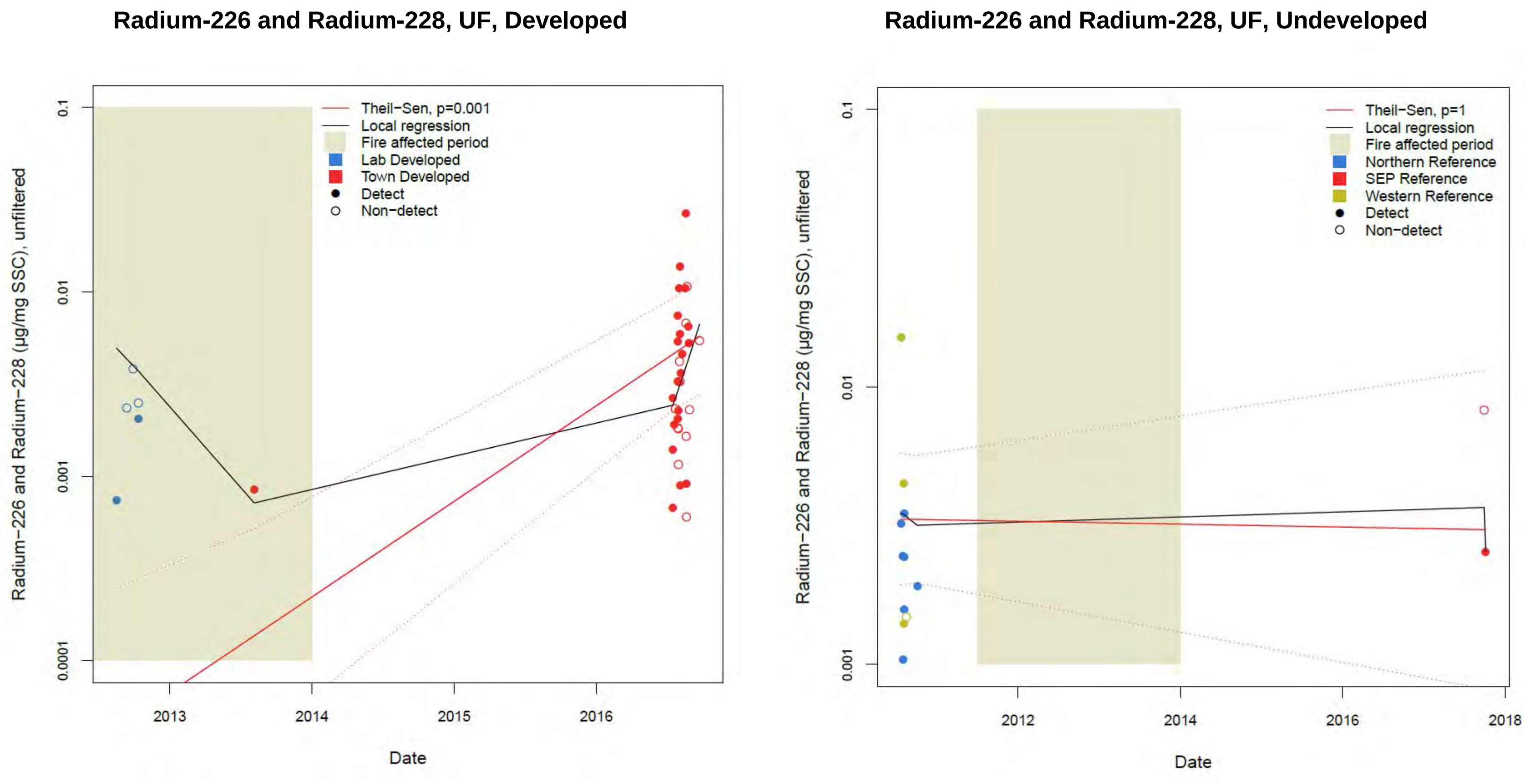


Figure 18k: Temporal trend for SSC-normalized radium-226 and radium-228 data

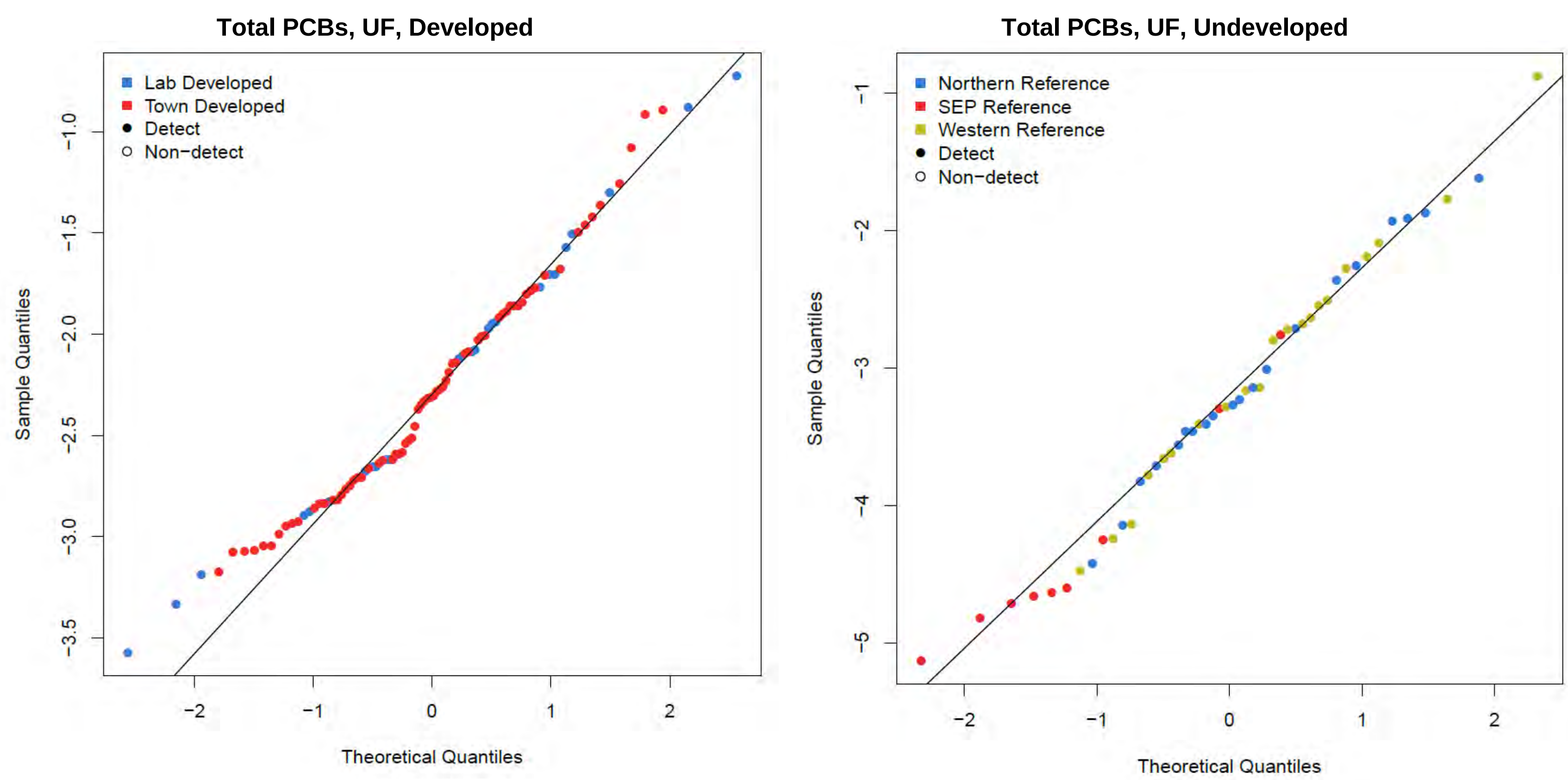


Figure 19a: Total PCBs raw data Q-Q plots

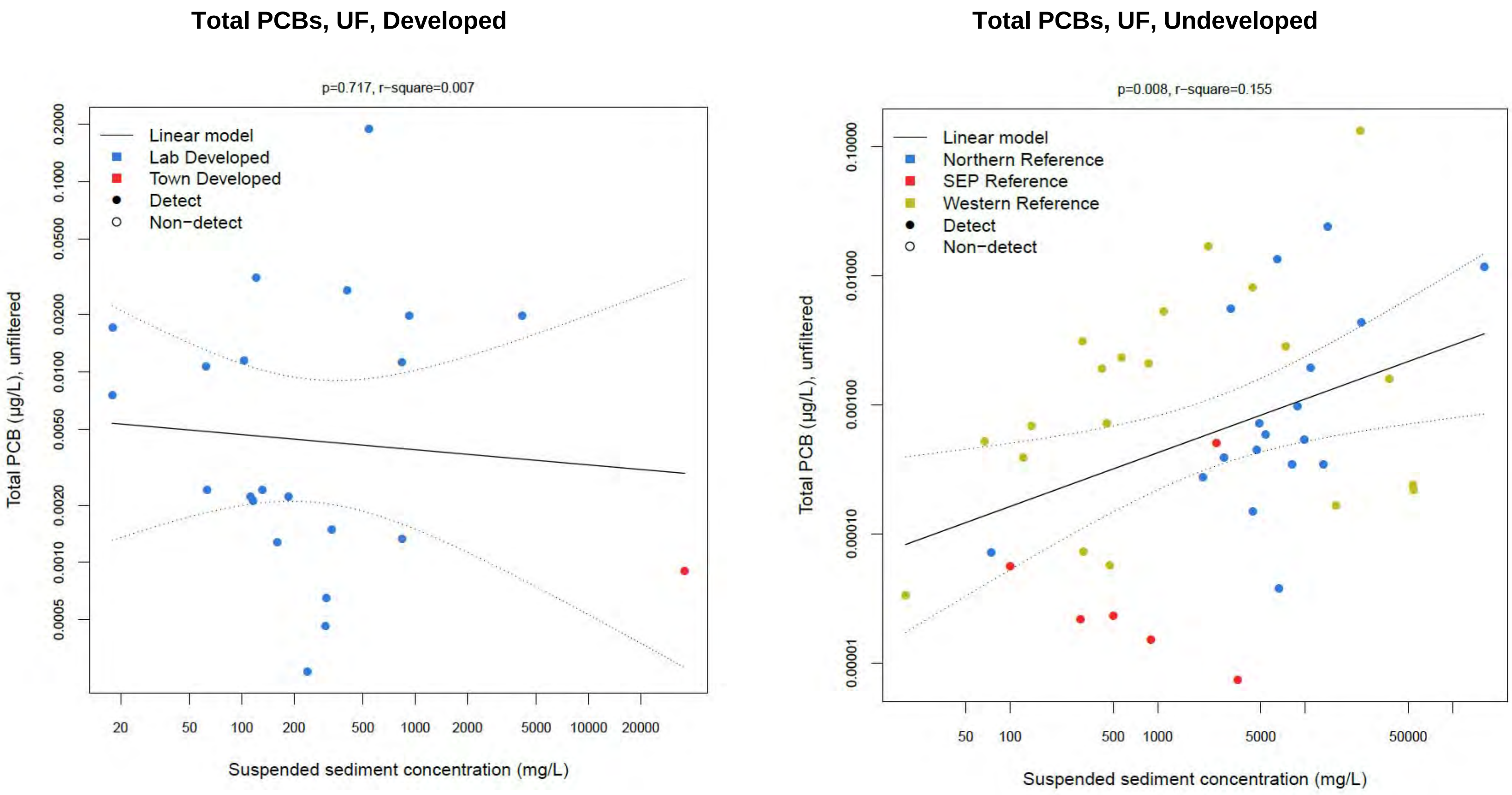


Figure 19b: Total PCBs-SSC scatterplots

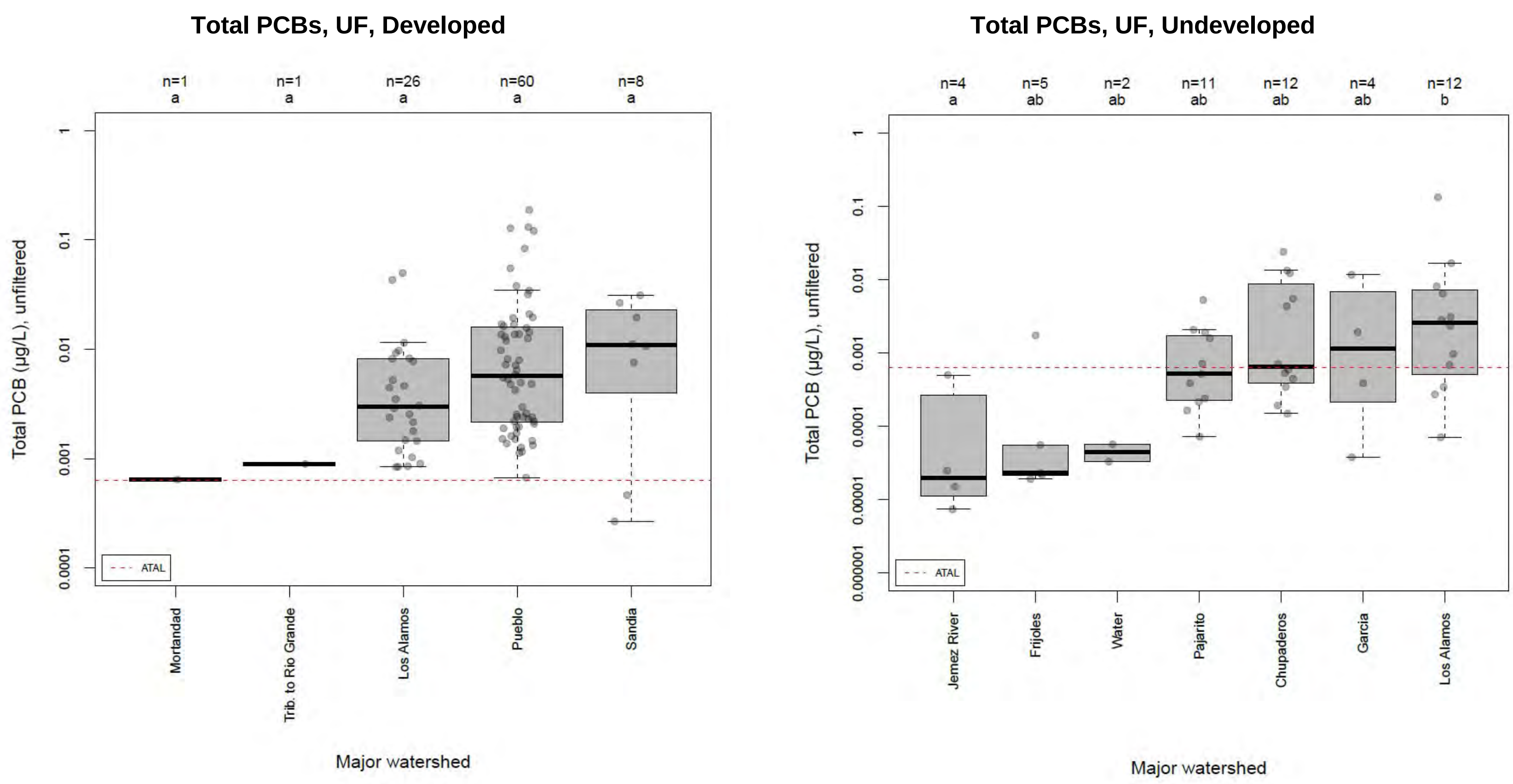


Figure 19d: Total PCBs raw data boxplots by major watershed

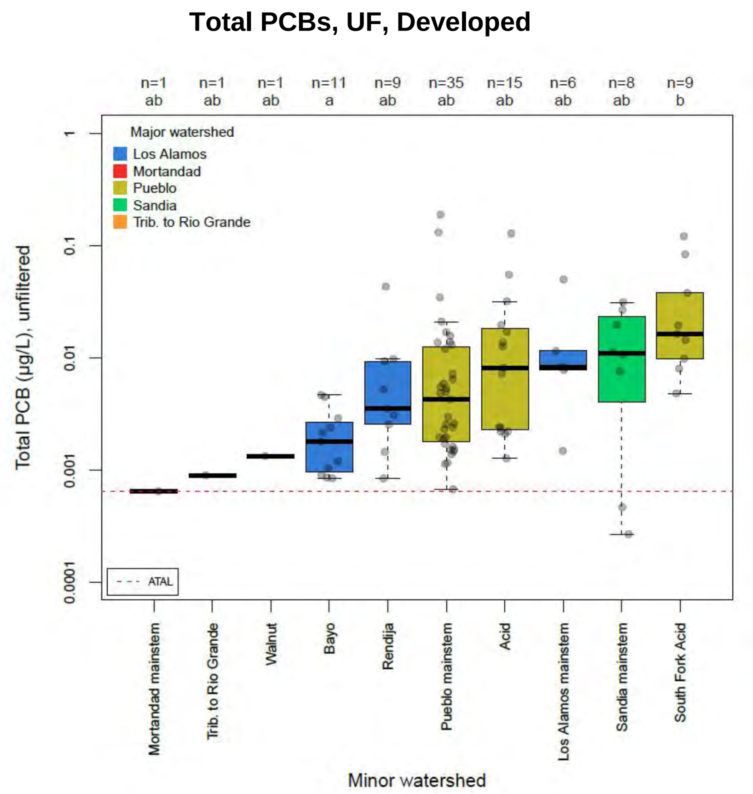


Figure 19f: Total PCBs raw data boxplots by minor watershed

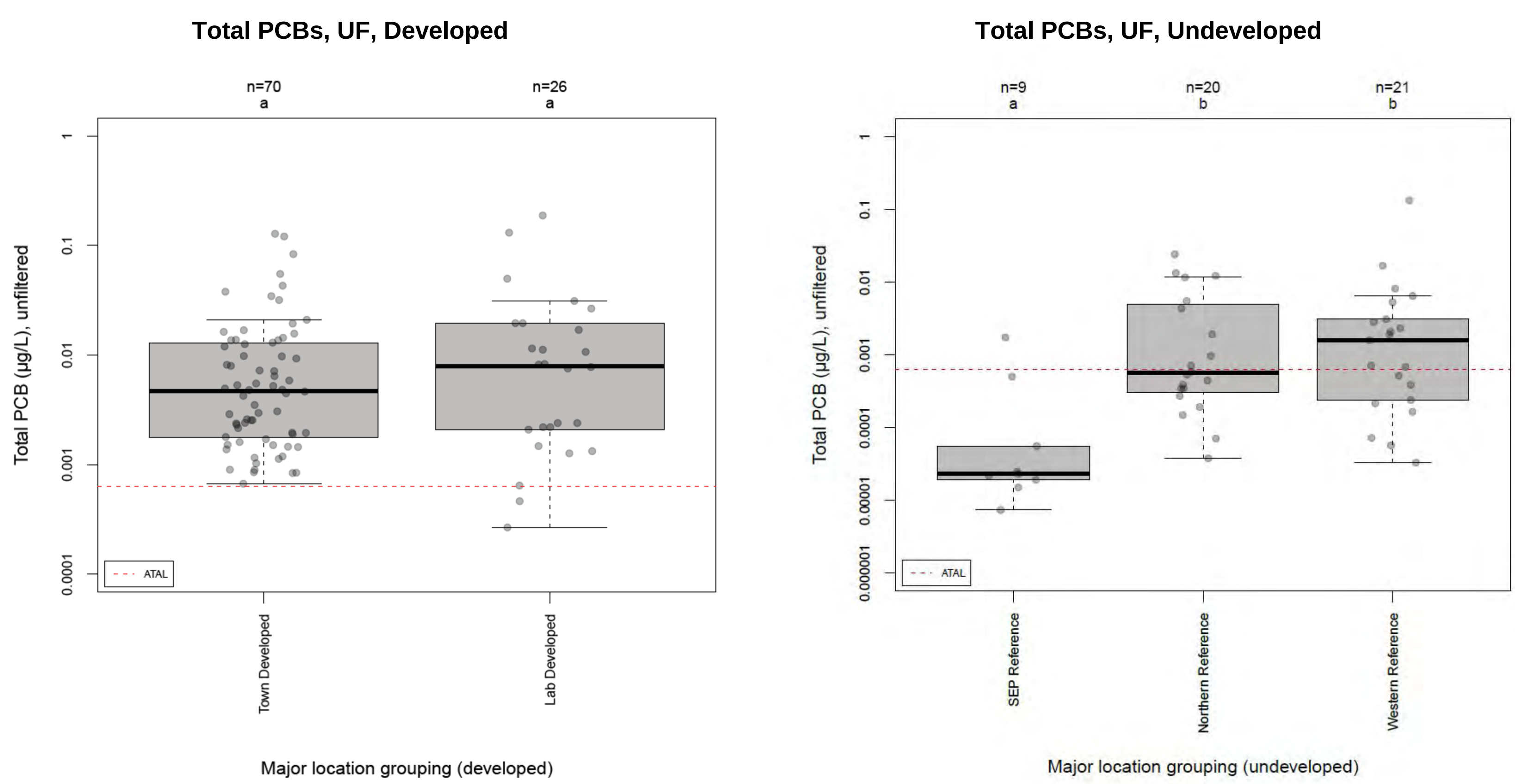


Figure 19g: Total PCBs raw data boxplots by major location group

Total PCBs, UF, Developed **Total PCBs, UF, Undeveloped**

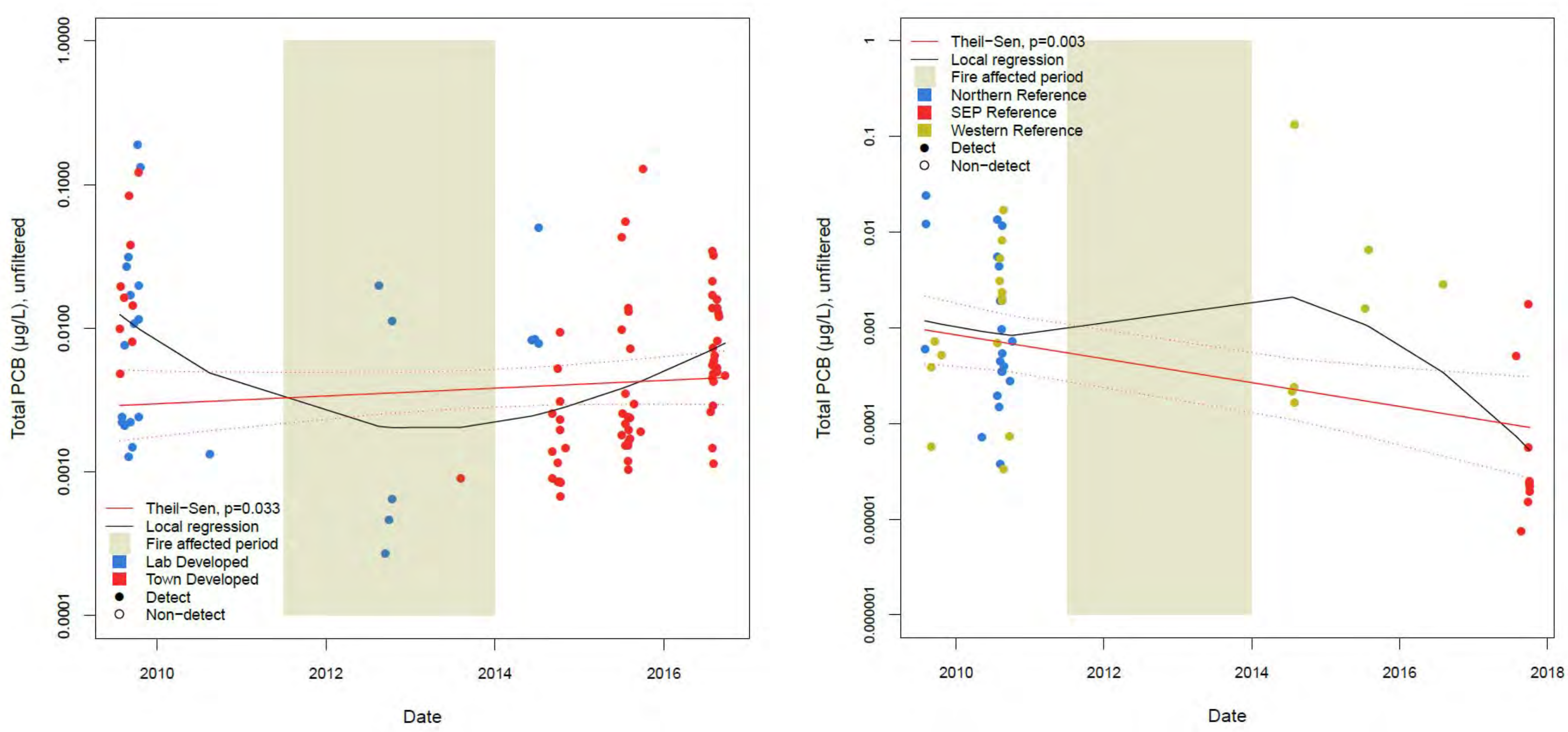


Figure 19j: Temporal trend for raw total PCBs data

Benzo(a)pyrene, UF, Developed

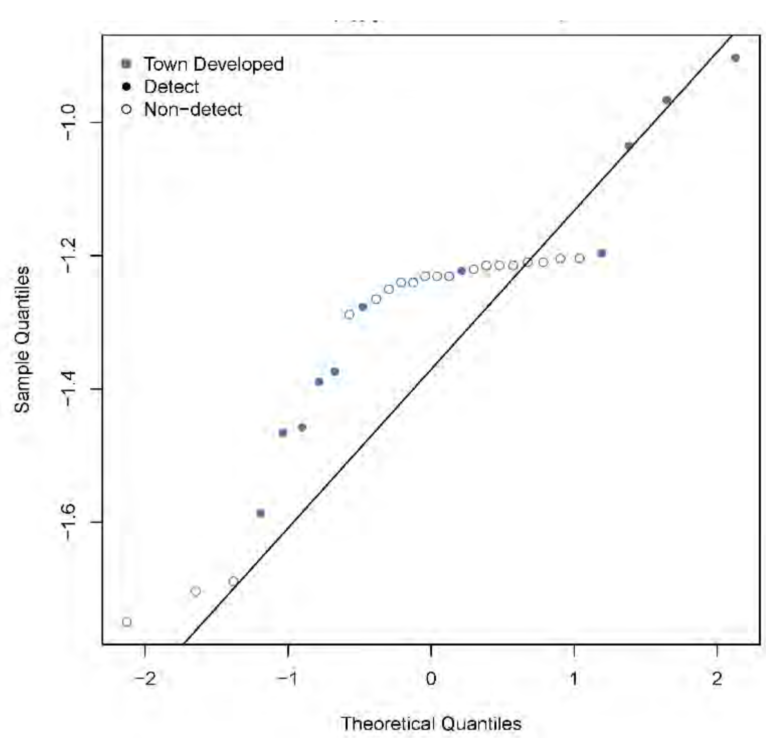


Figure 20a: Benzo(a)pyrene raw Q-Q plot

Benzo(a)pyrene, UF, Developed

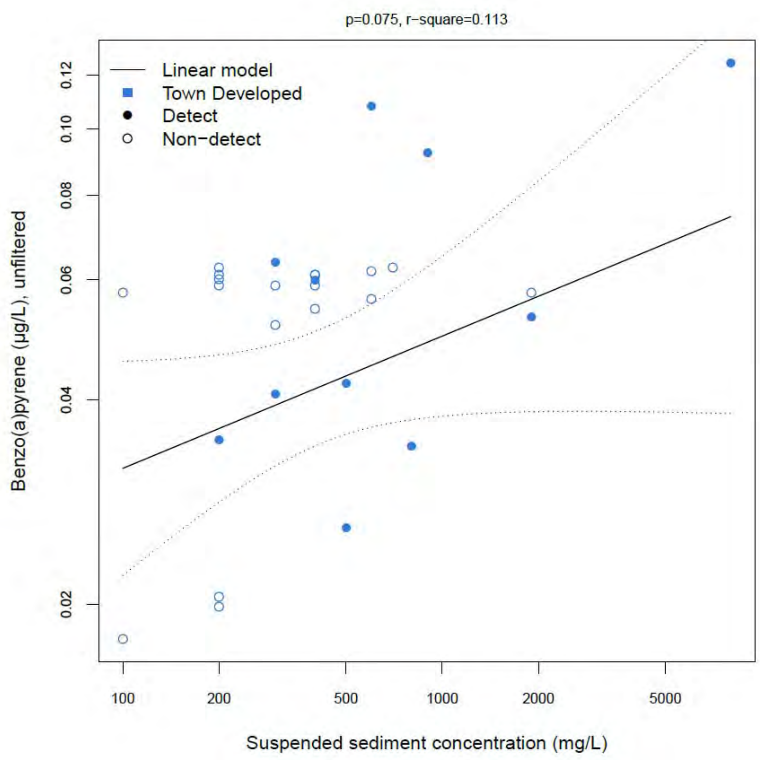


Figure 20b: Benzo(a)pyrene-SSC scatterplot

Benzo(a)pyrene, UF, Developed

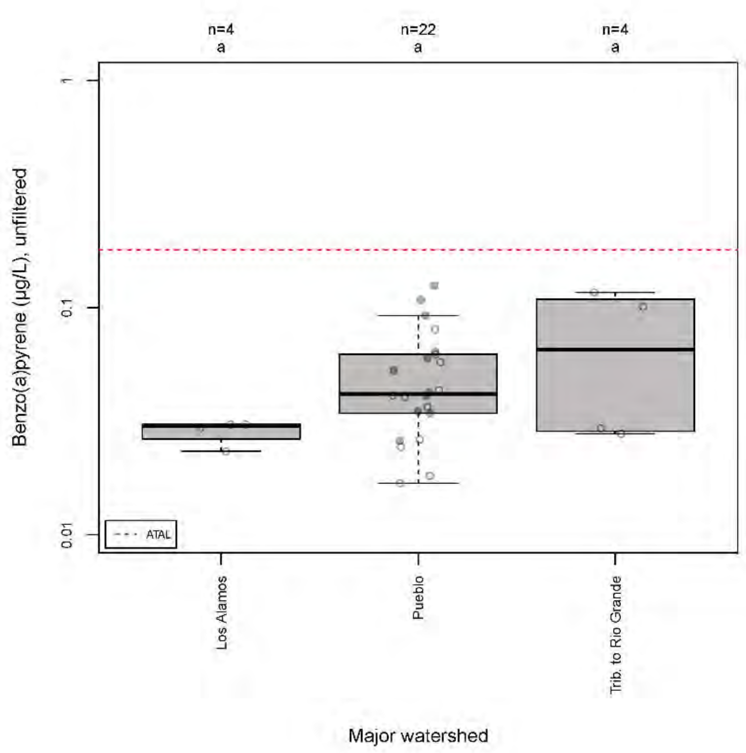


Figure 20d: Benzo(a)pyrene raw data boxplot by major watershed

Appendix A. Dataset Acquisition and Preparation

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Tables

1 Dataset Acquisition

This appendix to the document *Development of Background Threshold Values for Storm Water Runoff on the Pajarito Plateau, New Mexico* describes how the Los Alamos National Laboratory (LANL) dataset provided to Windward Environmental LLC (Windward) was prepared and reduced prior to assessing background concentration datasets. Figure 1-1 of the main text presents a map of the spatial locations and regional context for the background water quality samples collected by LANL and NMED. Location-specific metadata (including the spatial categories used to conduct the background characterization framework) are provided in Appendix C.

A background water quality dataset was provided to Windward by Los Alamos National Security (LANS) (now N3B) using the LANL Environmental Information Management (EIM) database. This dataset included water quality samples collected by LANL and the New Mexico Environment Department's (NMED) Department of Energy Oversight Bureau at locations around the Pajarito Plateau in the vicinity of LANL. The sampling efforts were largely intended to characterize natural background (NBG) concentrations in ambient surface waters during wet weather "stormflow" at locations representing relatively large, undeveloped watersheds, as well as developed background (DBG) concentrations in storm water discharged from a number of developed areas with representative types of impervious urban surfaces (e.g., parking lots, buildings, and roads). LANS prescreened the dataset to exclude sampling locations determined to be affected by Sites (defined as solid waste management units [SWMUs] and areas of concern [AOCs] regulated under the Consent Order and National Pollution Discharge and Elimination System [NPDES] Individual Permit [IP]).

The vast majority of data in this dataset recently underwent a data quality assessment (DQA) conducted as part of sampling and monitoring for the Supplemental Environmental Program (SEP) (LANL 2018). The dataset also includes water quality data collected by LANL in 2017 following quality assurance guidelines in the SEP data quality objective (DQO) report and related plans. Thus, the quality of the background water quality dataset used in the assessments herein has already been established. Similar SEP data collected during 2018 have also been provided to Windward by N3B, and those data will be incorporated into the background dataset and evaluated using the BCF for a supplement to this report.

2 Dataset Preparation

For the purposes of the assessments herein, the background dataset was reviewed by Windward and further refined in collaboration with LANS staff to account for the following:

- Data collected prior to the year 2005 were excluded. This eliminated 812 dataset entries for NMED samples, or 5% of the 16,511 entries for NMED samples.
- Duplicate data entries were excluded (including duplicate EIM database entries and field duplicate results). This eliminated 1,433 dataset entries, or 3% of the 49,917 total entries for LANL samples.
- If multiple samples were collected over a short time period (e.g., within a matter of minutes or hours), only the first sample was retained. According to LANS, the first sample in such a series occurs at peak flow, which represents the "first flush" of storm water. Measured constituent concentrations are expected to be highest in a first sample, thereby providing a conservative estimate of water quality during the event. This step affected 358 entries, or 0.7% of the 49,917 total entries for LANL samples.
- When EIM provided multiple results for the same sample, the reported concentrations were averaged for that sample if each concentration was detected. If only a subset of the reported concentrations were detected, then the average of only the detected concentrations was retained. If none of the reported concentrations were above detection limits, then the highest reported concentration was retained. This step affected 184 entries, or 0.4% of the 49,917 total entries for LANL samples.

After reducing dataset entries as described above, the background dataset comprised 60 LANL sampling locations and 25 NMED sampling locations, each characterized by basic attributes provided by EIM (e.g., location identification [ID], location alias, and spatial coordinates) (Appendix C).

The EIM sample types were limited to "WT", a code which LANL uses to designate a "storm water" sample, irrespective of whether the sample was collected from ambient surface waters during stormflow conditions or from a specific storm water discharge source (e.g., an SMA, urban runoff, DBG). Consequently, Windward worked with LANS/N3B to assign a new characteristic called "water type" for each sampling location (i.e., "surface water" or "storm water discharge").

LANS/N3B staff provided additional attributes for the sampling locations so that subgroups of background data across various "site classes" could be evaluated. These location attributes included major and minor watershed names, watershed landscape type (i.e., developed or undeveloped), and several regional groupings of developed and undeveloped locations.

The LANL dataset also indicated which watersheds were affected by the 2011 Las Conchas fire, so that data from those watersheds could be excluded. Based on LANS/N3B guidance, data were excluded for sample collection dates between July 4, 2011, and December 31, 2013 to account for the potentially lingering effects of the Las Conchas fire (e.g., on sediment runoff and associated constituent concentrations).

Although the NMED data were discussed in LANL's 2018 SEP DQA document (LANL 2018), there was some uncertainty at that time about the methods and quality control used for NMED water quality data. It was assumed, for the purpose of this analysis, that the quality of NMED water quality data was comparable to that of LANL datasets.[1]

Per discussions and agreement with LANL, the DQA-based landscape category assignment of "developed" was changed to "undeveloped" for the seven locations listed in Table A1. Despite the possibility of runoff from impervious surfaces (primarily roads) near the sampling locations, each of these locations represents storm flows accumulating in and flowing out of relatively large watersheds, where NBG conditions are expected to predominate. Furthermore, except for gage location E350, these locations have been used by LANL in the past to represent NBG conditions (LANL 2007, 2012, 2013, 2014).

Data for an additional 10 locations were included by LANS/N3B to supplement the 2018 SEP DQA-based locations, as listed in Table A2. These locations mainly represent new data collected during 2017, one year after the DQA dataset used in the 2018 SEP DQA was pulled from EIM, as well as one location that had inadvertently been left out of the DQA (Cañon de Valle above SR-501).

Table A1. Locations for which landscape category was reassigned since the 2018 SEP DQA

Location ID	Location Alias	Landscape Category	Minor Watershed	Major Location Grouping
Rio de los Frijoles at Band	E350	undeveloped	Frijoles	Bandelier reference
Los Alamos below Ice Rink	E026	undeveloped	Los Alamos	western reference
Pajarito below SR-501	E240	undeveloped	Pajarito	western reference
Water above SR-501	E252	undeveloped	Water	western reference
RA110402	E252	undeveloped	Water	western reference
Canon de Valle above SR-501	E253	undeveloped	Cañon de Valle	western reference
RA113902	E253	undeveloped	Cañon de Valle	western reference

DQA – data quality assessment
ID – identification

[1] Based on comments received from NMED on October 16, 2018, there are differences between the sampling methods used by NMED and LANL to collect surface waters that are worth investigating. In particular, NMED expects that suspended sediment concentrations to be higher in LANL samples than in NMED samples. Such a difference may be investigated in a supplement to this report expected to be finalized in 2019.

Table A2. Locations with new data added since the 2018 SEP DQA

Location ID	Landscape Category	Minor Watershed	Major Location Grouping
SEP-URBAN-PL1 at URBAN173227	developed	Twomile	lab developed
SEP-URBAN-PL2 at URBAN173228	developed	Twomile	lab developed
SEP-URBAN-PL3 at URBAN173229	developed	Twomile	lab developed
SEP-URBAN-PL4 at URBAN171246	developed	Tensite	lab developed
SEP-URBAN-PL5 at URBAN173230	developed	Twomile	lab developed
Canon de Valle above SR-501[a]	undeveloped	Cañon de Valle	western reference
SEP-REF-BM1 at RF17BM01	undeveloped	Frijoles	SEP reference
SEP-REF-P1 at RF17P01	undeveloped	Frijoles	SEP reference
SEP-REF-SJM1 at RF17SJM01	undeveloped	Jemez River	SEP reference
SEP-REF-SJM4 at RF17SJM04	undeveloped	Jemez River	SEP reference

[a] The location alias for the gage identified as “Canon de Valle above SR-501” is “E253.”

DQA – data quality assessment

ID – identification

SEP – Supplemental Environmental Program

Suspended sediment concentration (SSC) was identified as an important, potentially independent water quality variable affecting concentrations for certain analytes found in ambient surface waters during storm flows, or in storm water discharges. To maximize the availability of SSC data in the dataset, SSC concentrations were estimated from samples for which total suspended sediment (TSS) concentrations were available. SSC and TSS are very similar measurements of suspended sediment, although SSC is generally considered to be the more accurate parameter. A log-log linear regression of SSC and TSS resulted in a significant slope ($p < 0.05$) and an r^2 of 0.71; this regression was used to estimate SSC when only TSS data were available.[2]

Prior to conducting the background characterization framework (BCF) assessment, negative or zero values for non-detect concentrations were removed. For unfiltered total polychlorinated biphenyls (PCBs), values reported in the LANL dataset as 0 µg/L were excluded. Similarly, total gross alpha data were prescreened to remove negative or zero values. Such values are unusable for calculation purposes. Storm water concentration data are generally log distributed (or similarly skewed), and the logarithm of zero (infinite) or negative values (non-real number) cannot be used for the purposes of graphing, modeling, or calculating reasonable background threshold values (BTVs).

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[2] Two outliers were removed from the TSS-SSC dataset to improve the model fit (by reducing the influence of extreme points). The two points were associated with location IDs RF09LL02 (Cañada de las Latas) and RF09CO01 (Corral Canyon), both sampled in July/August 2010. These points had extreme residuals in an initial model (including all data points) as well as high leverage (determined by Cook’s distance statistic) (Chatterjee and Hadi 1986). The final regression equation was as follows: $\log_{10}(SSC) = 1.122 + 0.689*\log_{10}(TSS)$.

Finally, the background dataset was split into separate datasets according to the landscape category (DBG or NBG/baseline) and relevant sample preparation method (filtered or unfiltered). The relevant sample preparation method for each constituent was identified according to the matrix shown in Table 3-1 of the main text; that matrix corresponds to the dissolved (filtered) and total (unfiltered) basis for parameters regulated under LANL's 2010 or 2015 draft IP.

The approach described herein yielded 28 constituent-sample preparation combinations to consider and a total of 58 possible datasets (after designating the 28 datasets as either "developed" or "undeveloped") for evaluation using the BCF assessment.

3 Differences Between 2018 BTV Development and Historical LANL BTVs

The datasets and methods used by LANL to generate historical BTVs for storm water constituents (Los Alamos 2012; LANL 2013) are known to have differed from those used to generate BTVs in 2018 (Sections 3 and 4 of the main text). A list of known or potential differences are provided here:

- The DBG datasets used by LANL in 2012 and 2013 included data from several sampling locations that LANL excluded from the current LANL database (described in previous sections above) due to potential Site influence.
- The current LANL database includes more recent and more widespread Pajarito Plateau background data collected through 2017 and excludes data from before 2005 that were included when calculating 2012 and 2013 BTVs.
- Dataset stability was not considered as extensively by LANL in 2012 and 2013 reports as it was for the current effort.
- The dataset preparation steps may have differed between the current effort and the LANL 2012 and 2013 reports.
- Distribution assumptions for calculation of BTVs (Appendix D) may have differed from those made in 2012 and 2013 due to the inclusion of new data, exclusion of pre-2005 data, or exclusion of data from Site-affected locations.
- Outliers were handled in different ways, such that extreme points were not excluded from the datasets evaluated herein if there was no clear reason to exclude those points. In 2012 and 2013, possible outliers were identified using a formal statistical test (which pre-supposes a distribution type) and quantile-quantile plots (Los Alamos 2012; LANL 2013). Outliers were then excluded from the 2012 and 2013 datasets.

The differences noted above likely contribute to observed differences between new BTVs and previous LANL BTVs.

4 References

Chatterjee S, Hadi AS. 1986. Influential observations, high leverage points, and outliers in linear regression. Statist Sci 1(3):379-416.

LANL. 2007. Los Alamos National Laboratory NPDES permit application number NM0030759. Preliminary comments regarding use of statistical methods to evaluate background surface water quality and identify laboratory impacts. LA-UR-07-8120. Los Alamos National Laboratory, Los Alamos, NM.

LANL. 2012. Polychlorinated biphenyls in precipitation and stormwater within the Upper Rio Grande Watershed. Los Alamos National Laboratory, Los Alamos, NM.

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APPENDIX B. RESULTS, DISCUSSION, AND FIGURES OF BACKGROUND CHARACTERIZATION FRAMEWORK ASSESSMENTS, STEPS 1 TO 3

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1 Results of Background Characterization Framework Assessments

This appendix to the document *Development of Background Threshold Values for Storm Water Runoff on the Pajarito Plateau, New Mexico* presents the detailed results of the background characterization framework (BCF) assessments of storm water datasets based on the methods described in the main text (Sections 3 and 4) and the datasets described in Appendix A.[1] Results are grouped alphabetically by parameter name and analytical preparation (i.e., filtered or unfiltered). Within each parameter group, the results for natural background (NBG)/baseline datasets are described first, followed by the results for developed background (DBG) datasets.[2]

Figures cited in this appendix are provided in a separate document that is being delivered with this appendix.[3] The types of figures presented in that separate document are described by Figures 3-3, 3-4, 3-6, and 3-7 of the main text.

1.1 Aluminum, Filtered, Undeveloped Landscape

The NBG filtered aluminum dataset is robust, with 81 samples and a detection frequency of 100%. Figure B-1-1 shows the distribution, which appears to be somewhat stable with some moderate deviations from the lognormal expectation. Multiple populations are possible, but the differences among subpopulations may not be large. Figure B-1-2 clearly shows that filtered aluminum is not related to suspended sediment concentration (SSC) ($p = 0.75$, $r^2=0.001$), so normalization to SSC was not conducted.

Figure B-1-8 shows that at supplemental environmental program (SEP) reference locations (major location grouping), filtered aluminum concentrations are generally higher than those at the three other NBG background location groups. However, Figure B-1-12 shows that this pattern corresponds with a potentially artificial, yet significant, time trend in filtered aluminum; the trend increases over time, which is due in large part to SEP reference locations (which were all sampled in 2017) having greater filtered aluminum concentrations than the three other groups.

[1] The term "storm water" is used in this appendix to refer to the samples evaluated using the BCF. This is based on the initial classification and definition of samples obtained through the Environmental Information Management database (described in Appendix A). In reality, the samples described in the database are both storm water (i.e., runoff) and storm flow (i.e., surface water).

[2] The term "baseline" refers to concentrations of man-made storm water constituents such as polychlorinated biphenyls, whereas "NBG" refers to naturally occurring constituents. Both baseline and NBG are terms related to storm water that has run off of the undeveloped landscape.

[3] The separate document (saved in portable document format [pdf]) is called "TO-6.1 Appendix B – Figures."

After splitting the dataset into two subsets (i.e., SEP reference data and all other samples), the distributions of each subset appeared to be more stable. However, the SEP reference dataset (n = 16) clearly deviates from lognormality, and some extreme points remain in the larger, non-SEP reference dataset. These extreme concentrations were measured in samples collected at gaging station E240 (location ID "Pajarito below SR-501"). Data from this location ID (n = 14) were separated into a third dataset, although other E240 data (classified under a different location ID) were retained in the larger non-SEP dataset (n = 51). As noted, the detection frequency of the final data subsets was 100%. The distributions for the three subsets are shown in Figures B-1-14, B-1-15, and B-1-16.

1.2 ALUMINUM, FILTERED, DEVELOPED LANDSCAPE

The DBG filtered aluminum dataset is also robust, with 115 samples and 97% detection frequency. Figure B-2-1 suggests that there are not large subpopulations of data to consider; small subsets may exist at the extreme ends of the distribution. Figure B-2-2 shows a significant ($p = 0.003$) but very weak ($r^2 = 0.112$) relationship with SSC; as a result, normalized and raw datasets were both evaluated to determine if normalization substantially improved overall stability. Figure B-2-3 suggests that normalizing filtered aluminum to SSC does not substantially improve dataset stability; the same potential data subsets (i.e., at low and high concentrations) are still present in the normalized data. However, because normalization reduces significant differences between spatial groups (Figures B-2-4 through B-2-11), normalization was ultimately used to stabilize datasets over space.

Spatially, raw aluminum concentrations differed only between Pueblo and the Tributary to the Rio Grande watersheds (location IDs "WR-REF-1" and "WR-REF-6"). This subset was not apparent after SSC normalization. No dependency on location grouping was found (Figures B-2-9 and B-2-11). Thus, SSC-normalized aluminum concentrations were considered spatially stable.

There was not a significant trend in aluminum over time (Theil-Sen $p = 0.35$), so the dataset was considered stable (Figure B-2-13).

The final SSC-normalized DBG filtered aluminum dataset consists of 76 samples (with paired SSC and aluminum concentrations), with 73 detects. Thus, the dataset is fairly robust.

1.3 ALUMINUM, UNFILTERED, UNDEVELOPED LANDSCAPE

The Q-Q plot of NBG unfiltered aluminum (Figure B-3-1) suggests that multiple populations of aluminum concentrations exist. SSC and unfiltered aluminum have a strong relationship ($p < 0.001$, $r^2 = 0.62$), so aluminum concentrations were normalized to SSC (Figure B-3-2). After SSC normalization, small subpopulations may still exist (e.g., extreme high values and lower values) (Figure B-3-3).

Samples from the Northern and Bandelier reference groupings (particularly the Bandelier-like minor grouping) tend to have higher SSC-normalized aluminum concentrations than do Western Reference or SEP Reference samples (Figures B-3-9 and B-3-11); only Western Reference samples have significantly higher aluminum concentrations than do Northern Reference samples.

A significant time trend exists in the SSC-normalized unfiltered aluminum concentrations (Theil-Sen $p = 0.001$), which is likely driven by spatial differences in sampling (Figure B-3-13). As noted, the Western reference dataset tends to have higher concentrations of aluminum than do the Northern or Bandelier reference samples, and Western reference samples are often older than Northern or Bandelier Reference samples. The local regression (LOESS) line shows a different trend: a decrease in aluminum concentrations followed by an increase in 2017, which reflects the higher concentrations of aluminum in SEP reference samples (as noted above). Overall, aluminum concentrations appear to be fairly consistent over time, with increases or decreases associated with sampling events in specific areas (Figure B-3-13). Thus, the significant trend over time is considered a minor point of uncertainty.

To account for spatial instability in aluminum concentrations, the dataset was split into two subsets by location grouping. The resulting Northern and Bandelier reference subset has 46 samples, and the Western and SEP reference subset has 33 samples. All samples had detected concentrations of aluminum. The distribution of final aluminum subsets still contains extreme values, which appear to be reasonable based on the available location data (Figures B-3-14 and B-3-15). These subpopulations are not related to major or minor watersheds, major or minor location groupings, analytical laboratory, sampling location, sampling event, or sampling method. SSC also does not appear to drive these subpopulations of extreme values. This is a minor point of potential instability for the BCF assessment of NBG unfiltered aluminum. This instability can be addressed by using a different distribution assumption when calculating background threshold values (BTVs) (i.e., lognormal; see Appendix E Figure E-3).

1.4 ALUMINUM, UNFILTERED, DEVELOPED LANDSCAPE

Like NBG unfiltered aluminum (Section 3), the DBG unfiltered aluminum distribution was fairly stable prior to normalization (Figure B-4-1), but SSC was significantly ($p < 0.001$) and somewhat strongly ($r^2 = 0.43$) related to aluminum (Figure B-4-2). Based on variability in the SSC-aluminum relationship, both SSC-normalized and non-normalized data were evaluated using the BCF. Spatial comparison boxplots and statistical tests indicate that SSC-normalization stabilizes the aluminum dataset. For example, significant differences in raw aluminum concentrations observed among major watersheds were no longer significant after normalization (Figures B-4-4 and B-4-5). This change is due, in part, to a reduction in the total sample sizes for comparisons among watersheds.

After normalization, a significant time trend in unfiltered aluminum was detected (Theil-Sen, $p = 0.003$). The estimated median decrease from the earliest (7/7/2008) to the most recent sample (10/5/2015) was 20 to 12 µg/mg SSC. The temporal trend may be driven by spatial differences in aluminum concentrations, in that some Town Developed samples collected in 2015 had relatively very low aluminum concentrations, whereas a portion of earlier Lab Developed samples (2009 to 2010) had higher concentrations of aluminum (Figure B-4-13). Figure B-4-13 shows that sampling over time was almost entirely separated into Lab or Town Developed areas, and those two groups are not significantly different. This suggests that, overall, the trend in aluminum over time is not a substantial concern for stability and BTV calculations.

The final dataset of SSC-normalized aluminum concentrations comprises 68 samples with zero non-detect values. The dataset appears to be reasonably stable with minor deviation from lognormality toward the tails of the dataset. The degree of deviation from lognormality observed in Figure B-4-3 is typical of environmental datasets.

1.5 Antimony, Filtered, Developed Landscape

Filtered antimony concentrations from the DBG landscapes are dominated by non-detected concentrations (97 of 112), so the estimation of non-detect values will be inaccurate and uncertain (Figure B-5-1). Similarly, the evaluation of spatial and temporal dependencies is uncertain and unreliable for decision making. As a result, any BTV estimated for the DBG filtered antimony dataset will be very highly uncertain. The data suggest that significant sources of filtered antimony are limited in DBG landscapes on or around the Pajarito Plateau.

Filtered antimony was detected most frequently in the mainstem of Los Alamos watershed (location ID “LA-ROM-2-PCB”) ($n = 6$), with detections also occurring in the Sandia mainstem ($n = 4$), Pueblo mainstem ($n = 3$), Acid (Pueblo) ($n = 2$), Mortandad mainstem ($n = 1$), and Twomile (Pajarito) ($n = 1$) watersheds. Measured concentrations ranged from 0.64 to 7.2 µg/L, all well below the average target action level (ATAL) for filtered antimony of 640 µg/L.

1.6 Arsenic, Filtered, Undeveloped Landscape

Arsenic samples from the NBG dataset were limited in terms of detection frequency, although the numbers of detected concentrations (10 of 78) met the requirement for data sufficiency of the BCF. Due to the low detection frequency, the NBG arsenic concentration data suggest that significant sources of filtered arsenic are limited in undeveloped areas on or around the Pajarito Plateau.

Filtered arsenic was primarily detected in Chupaderos ($n = 5$) and Mortandad ($n = 3$), and one sample each was detected in Garcia (Corral) and Los Alamos (mainstem). Detected concentrations ranged from 1.5 to 6.2 µg/L, all below the ATAL of 9 µg/L (and well below the maximum target action level [MTAL] of 340 µg/L). After estimating non-detect concentrations, the highest concentration in the dataset was still

6.2 µg/L; thus, no exceedances of individual permit (IP) target action levels (TALs) were observed in samples from undeveloped locations.

1.7 Arsenic, Filtered, Developed Landscape

Arsenic samples from the DBG dataset were limited in terms of detection frequency, although the numbers of detected concentrations (9 of 114 in the DBG) met the requirement for data sufficiency of the BCF. The distribution of DBG arsenic is dominated by non-detect concentrations, suggesting that significant sources of filtered arsenic are limited in developed areas on or around the Pajarito Plateau.

Filtered arsenic was only detected in Pueblo (n = 6) and Los Alamos (n = 3) watersheds. Concentrations ranged from 1.72 to 2.56 µg/L, all below the ATAL of 9 µg/L (and well below the MTAL of 340 µg/L). Many samples had an analytical detection limit of 5 µg/L, which exceeded all detected concentrations. The highest estimated non-detect value was 2.8 µg/L. Thus, there were no exceedances of IP TALs among samples from the developed landscape.

1.8 Boron, Filtered, Undeveloped Landscape

The NBG filtered boron dataset includes 112 samples but only 32 detects (29% detection frequency). Thus, the dataset is heavily influenced by non-detects and the estimation of those values (see the Q-Q line in Figure B-8-1). Filtered boron and SSC are not related ($p = 0.25$), so SSC normalization was not needed to stabilize the dataset (Figure B-8-2).

Spatial differences were observed for major and minor watersheds as well as major and minor location groupings (Figures B-8-4, B-8-6, B-8-8, and B-8-10). Filtered boron in Los Alamos watershed samples (and Guaje minor watershed in particular) was higher than in Frijoles or Jemez River samples. The Northern reference location grouping was higher than either the SEP or Bandelier reference groups, and the Western reference grouping was higher than the SEP reference group.

There is a significant change in filtered boron over time (Theil-Sen $p = 0.001$), but the trend appears to be due in part to estimated non-detect values. For example, the LOESS line in Figure B-8-12 does not pass through many of the raw values from recent samples. Also, detected concentrations appear to be fairly consistent over time. Spatial bias in sampling may also contribute to the significant time trend, in that SEP reference samples are more recent than Northern or Western reference samples, and boron measured in the SEP reference samples was generally lower than boron measured in other location groupings. Overall, the estimated median change in filtered boron over time (from 2009 to 2017) was from 20 to 16 µg/L. This potential instability is a minor point of uncertainty for calculating BTVs.

Based on the spatial differences, the dataset was split into two subsets: the first includes Western and Northern reference samples (n = 40, with 15 detects) (Figure B-8-14), and the second includes SEP and Bandelier reference samples (n = 25 with 10 detects)

(Figure B-8-15). The resulting datasets appear to be fairly stable, with visible subpopulations being driven, in part, by analytical artifacts (i.e., estimated non-detect values appear as a separate subpopulation from detect values) (Figure B-8-15). BTVs based on the final data subsets will be fairly uncertain due to low detection frequencies. Uncertainties associated with distribution assumptions are evaluated in Appendix E (Figure E-; a normal distribution is more reasonable for the final data subsets.

1.9 Boron, Filtered, Developed Landscape

The DBG filtered boron dataset consists of 65 samples and 25 detects (38% detection frequency). As a result, the dataset is influenced by non-detect values and the estimate of non-detects. Many non-detect values had a relatively high detection limit of 50 µg/L, and only a single detected value was above that detection limit (Figure B-9-1). Boron is not related to SSC ($p = 0.56$), so SSC normalization was not needed to stabilize the dataset (Figure B-9-2).

There are marked spatial differences among watersheds: Sandia (mainstem) and Acid (in Pueblo) tend to have samples with higher filtered boron concentrations than do samples from other watersheds, particularly Bayo (in Los Alamos) (Figure B-9-6). Walnut (in Pueblo) ($n = 1$) also had a single high boron concentration. Elevated concentrations in Mortandad were due to the high estimate of a non-detect value at location “SEP-URBAN-PL4” (sampled in September 2017). In general, Lab Developed samples had higher filtered boron concentrations than did Town Developed samples (Figure B-9-8). Boron concentrations measured in samples from the SEP Urban minor location group tended to be similar to boron measured in samples from the Town Developed minor location group (Figure B-9-10).

There is a significant change in filtered boron over time (Theil-Sen $p = 0.001$), but the trend appears to be due, in large part, to estimated non-detect values (Figure B-9-12). Detected concentrations appear to be fairly consistent over time. Also, spatial bias may contribute to this significant trend, such that Town Developed data are generally newer (e.g., from 2014 to 2016) than Lab Developed data.

Based on spatial differences, the DBG filtered boron dataset was split into two subsets by minor watershed: Sandia mainstem, Mortandad mainstem, Acid, and Walnut watersheds were grouped into one subset ($n = 27$, with 15 detects), and all other watersheds were grouped into the other subset. After splitting the data, the second subset was influenced by two high non-detect estimates in Los Alamos mainstem, so those two samples were excluded (location alias “LA-ROM-2-PCB,” sampled in July 2014 and October 2009). The final dataset, after removing potential outlier samples, included 83 samples with 17 detects. Detected samples in the second subset were primarily observed in Pueblo mainstem (11 of 17 detects). As noted, the BTVs based on these datasets will be heavily influenced by non-detect estimates, resulting in a high degree of uncertainty. However, based on the available data, the two datasets appear to be fairly stable (Figures B-9-14 and B-9-15).

1.10 Cadmium, Filtered, Undeveloped Landscape

Cadmium samples from the NBG dataset were limited in terms of detection frequency, although the number of detected concentrations (3 of 78 samples) just met the requirement for data sufficiency of the BCF. The data suggest that significant sources of filtered cadmium are limited in undeveloped landscapes on or around the Pajarito Plateau.

Detected concentrations were observed in samples from Pajarito mainstem (n = 2) at the E240 gage location and from Chupaderos at the CHUP-REF-1 location. Measured cadmium ranged from 0.13 to 0.28 µg/L. The concentrations from Pajarito were below their watershed-specific MTAL of 0.8 µg/L, and the detected concentration from Chupaderos (0.28 µg/L) was below the minimum MTAL across all watersheds of 0.34 µg/L. Thus, there were no exceedances of cadmium MTALs in samples from the undeveloped landscape.

1.11 Cadmium, Filtered, Developed Landscape

Cadmium samples from the DBG datasets were limited in terms of detection frequency, although the number of detected concentrations (3 of 114) just met the requirement for data sufficiency of the BCF. The DBG cadmium distribution is dominated by non-detected concentrations, suggesting that significant sources of filtered cadmium are limited in developed landscapes on or around the Pajarito Plateau.

Detected concentrations were observed in samples from Pueblo mainstem (n = 2) and at BM-REF-2 from Rendija (Los Alamos) watershed. Measured cadmium ranged from 0.141 to 0.301 µg/L. The concentrations from Pueblo were below their watershed-specific MTAL of 0.76 µg/L, and the detected concentration from Rendija (0.301 µg/L) was below the watershed-specific MTAL of 1.86 µg/L. Thus, there were no exceedances of cadmium MTALs in samples from the developed landscape.

1.12 Chromium, Filtered, Undeveloped Landscape

Chromium samples from the NBG dataset were limited in terms of detection frequency, although the number of detected concentrations (6 of 78 samples) met the requirement for data sufficiency of the BCF. The high degree of non-detection in the NBG chromium concentration data suggests that significant sources of filtered chromium are limited in undeveloped landscapes on or around the Pajarito Plateau.

Filtered chromium was detected primarily in Pajarito (n = 5); only one sample was detected in Mortandad. The detected chromium concentrations ranged from 1.5 to 5.2 µg/L, all well below the MTAL of 16 µg/L.

1.13 Chromium, Filtered, Developed Landscape

Chromium samples from the DBG datasets were limited in terms of detection frequency, although the number of detected concentrations (15 of 114 samples) met the requirement for data sufficiency of the BCF. The high degree of non-detection in the DBG chromium concentration data suggests that significant sources of filtered chromium are limited in developed landscapes on or around the Pajarito Plateau.

Filtered chromium was predominately detected in Los Alamos (n = 6) and Pueblo (n = 5) watersheds, with some other detects in Sandia (n = 3) and Mortandad (n = 1). The detected chromium concentrations ranged from 2.22 to 32.9 µg/L, with only the highest detected concentration exceeding the MTAL of 16 µg/L (Figure B-13-4)

1.14 Cobalt, Filtered, Undeveloped Landscape

The NBG filtered cobalt dataset comprises 78 samples, with 46 detects (59% detection). The distribution appears to be somewhat stable, with a clear subpopulation of non-detect values (equal to a low detection limit) and small subpopulations of higher concentrations (Figure B-14-1). There is no relationship between SSC and cobalt (p = 0.81), so normalization was not needed to stabilize the dataset (Figure B-14-2).

There were significant spatial differences in cobalt concentrations among watersheds and location groupings (Figures B-14-4, B-14-6, B-14-8, and B-14-10). Samples collected in Pajarito, Chupaderos, and Garcia watersheds had higher cobalt concentrations than did samples from Jemez River and Frijoles watersheds (Figure B-14-4). Filtered cobalt in samples collected at Northern and Western reference locations was higher than in SEP Reference samples, and cobalt concentrations in Northern reference samples were higher than cobalt in Bandelier reference samples (Figure B-14-10).

There appears to be a fairly steep trend in filtered cobalt over time (p < 0.001), however, the trend is related to spatial differences in sampling over time (Figure B-14-12). SEP and Bandelier reference data are more recent (2015 to 2017), whereas Northern and Western reference data are older (2005 to 2016). Splitting datasets by spatial groupings will reduce uncertainty associated with decreasing cobalt over time. Non-detect estimates also appear to drive the estimated trend over time; older samples tend to have higher estimated non-detect values (100% above the detection limit) than do newer samples (39% above the detection limit), resulting in an artificially exaggerated time trend. Overall, temporal instability is expected to have a negligible influence on the interpretation of the cobalt dataset (and future BTV calculations).

Based on the spatial differences noted, the cobalt dataset was divided into two subsets: one with the Western and Northern reference samples (n = 57, with 38 detects), and the other with the SEP and Bandelier reference samples (n = 21, with 8 detects). These distributions appear to be fairly stable (Figures B-14-14 and B-14-15), with subpopulations likely being due to estimated non-detect concentrations. This type of uncertainty can be resolved by using either a different distribution assumption or a nonparametric method when estimating non-detect values and developing BTVs.

1.15 COBALT, FILTERED, DEVELOPED LANDSCAPE

The DBG filtered cobalt dataset comprises 112 samples, with 37 detects (33% detection). The majority of non-detect values are at a low detection limit (1 µg/L), but several (n = 14) are at a higher detection limit (5 µg/L). Only four detected concentrations exceed this higher detection limit (Figure B-15-1). SSC and filtered cobalt are not related ($p = 0.95$), so normalization was not needed to stabilize the dataset (Figure B-15-2).

There appear to be spatial differences between Sandia mainstem and Rendija (in Los Alamos) watersheds, with Sandia having higher cobalt concentrations. Concentrations in Lab Developed samples also are higher than those in Town Developed samples. These differences are likely artificial and driven by non-detect estimation (e.g., compare filled circles in Figure B-15-8). The distributions of detected Town and Lab Developed concentrations do not appear different from one another.

There is a significant trend in cobalt over time ($p < 0.001$), but the trend appears to be driven by estimated non-detect values as well; the time plot of cobalt data (Figure B-15-12) shows that detected values are consistent over time.

While differences among areas (and over time) were determined to be significant, these differences appear to be artificial. Therefore, the DBG filtered cobalt dataset is considered final. A small subset of higher values has been retained in the dataset and remains an additional point of uncertainty. These high points do not represent any specific watershed, location grouping, time period, sampling event, sampling method, analytical laboratory, or other factor available in the cobalt dataset that could differentiate a subpopulation. The final distribution (including estimated non-detect values) is shown in Figure B-15-14.

1.16 COPPER, FILTERED, UNDEVELOPED LANDSCAPE

The NBG filtered copper dataset includes 76 samples, with 63 detects. The lognormal Q-Q plot suggests that the distribution of concentrations is not lognormally distributed but is reasonably stable (due to curvature in distribution) (Figure B-16-1). SSC is not significantly related to filtered copper ($p = 0.085$), so normalization is not needed to stabilize the NBG copper dataset (Figure B-16-2).

Differences were not observed among major or minor watersheds or major location groupings (Figures B-16-4, B-16-6, and B-16-8), but differences were found between minor location groupings (Figure B-16-10). Filtered copper concentrations in Bandelier reference samples (n = 4) were significantly lower than those in either the Western reference or “Bandelier-like” subsets (location ID “WR-REF-3”).

A minor declining trend in filtered copper was identified using Theil-Sen regression ($p = 0.009$) (Figure B-16-12). However, the estimated median change between the first and last dates in the dataset is miniscule (from 1.7 µg/L to 1.5 µg/L). This degree of temporal instability is not considered a substantial point of uncertainty. The trend appears to be related to spatial sampling bias: Western reference locations, which tend to have higher copper concentrations than do other location groupings, were sampled more frequently between 2005 and 2010 than they were in later years.

In order to achieve a stable dataset, the Bandelier reference (minor location group) samples (n = 4) were excluded from the final subset. The final NBG filtered copper subset appears fairly stable (Figure B-16-14) and is robust (n = 71, with 58 detects).

1.17 COPPER, FILTERED, DEVELOPED LANDSCAPE

The DBG filtered copper dataset is suitable for BCF assessment, with 114 samples and 113 detects. A subgroup of seven high copper concentrations is visible in the Q-Q plot for this dataset (Figure B-17-1). Copper is not related to SSC (p = 0.46), so normalization is not needed to stabilize the DBG filtered copper dataset (Figure B-17-2).

Significant differences were observed among major watersheds (Figure B-17-4): Sandia samples had greater concentrations than those in Pueblo and the Tributary to the Rio Grande. While not significant, concentrations from Mortandad (n = 3) also appeared elevated. Within minor watersheds, differences appeared to be driven by samples from the mainstem of Sandia, which had filtered copper concentrations exceeding those in the Tributary to the Rio Grande and Rendija (within Los Alamos) (Figure B-17-6). After close review of the Sandia mainstem data, it appeared that a single aberrant location (location ID "S-ROM-2(a)") was driving differences among watersheds.

No time trend in filtered copper was apparent in the original DBG filtered copper dataset (Theil-Sen, p = 0.28). This lack of trend is shown in Figure B-17-12.

To obtain a more spatially stable distribution of DBG copper concentration data, S-ROM-2(a) location samples, all of which had high copper concentrations, were excluded. Lab Developed and Town Developed location groupings were significantly different as well, requiring these subsets to be split. The resulting Lab and Town data subsets included 33 and 77 samples, respectively, and filtered copper was detected in all samples, except 1 Town sample. The final subsets are shown in Figures B-17-14 and B-17-15.

1.18 LEAD, FILTERED, UNDEVELOPED LANDSCAPE

The NBG filtered lead dataset contains 78 samples, including 38 detects. The distribution of samples appears to be fairly stable (Figure B-18-1), although there are many non-detects at low concentrations. Filtered lead is not related to SSC (p = 0.44) (Figure B-18-2), so normalization of lead to SSC is not needed to stabilize the dataset.

There do not appear to be significant differences among watersheds (Figures B-18-4 and B-18-6), but there are differences among location groupings (Figures B-18-8, and B-18-10); Northern Reference samples appear to have higher lead concentrations in general than do other groupings. When comparing minor location groupings, it appears that concentrations in Bandelier samples are generally lower than in other groups (and Northern samples in particular).

There does not appear to be a trend in lead over time (Theil-Sen p = 0.69), so the distribution is assumed to be temporally stable (Figure B-18-12).

The NBG filtered lead dataset was stabilized by splitting it into two subsets according to minor location groupings: one subset of Bandelier samples (n = 5, with only 1 detect), and one subset of the remaining samples (n = 73, with 37 detects). Due to the small sample size and low detection frequency in samples from the Bandelier major location group, it will not be used to calculate BTVs specific to that location group. The final subset appears to be stable (Figure B-18-14), although a lognormal distribution may not be appropriate for BTV calculations (due to deviation from lognormality toward the tails of the distribution). Non-parametric statistics can be used to partly address this uncertainty.

1.19 Lead, Filtered, Developed Landscape

The DBG filtered lead dataset comprises 114 samples, including only 33 detects. The dataset is somewhat stable (Figure B-19-1), not considering non-detect values. Filtered lead is not related to SSC (p = 0.34) (Figure B-19-2), so normalization is not needed to stabilize the dataset.

Lead concentrations were not significantly different among watersheds (Figures B-19-4 and B-19-6), but concentrations did differ among location groupings; Lab Developed samples had higher lead concentrations than did Town Developed samples (Figure B-19-6). SEP Urban samples (minor location grouping) were more similar to townsite (minor location grouping) samples (Figure B-19-8). After further investigation of the differences among location groupings, it was determined that differences were likely artificial, resulting from the estimation of non-detect values. Before the estimation of non-detect values, lead concentrations in Lab Developed and Town Developed samples were quite similar (Figure B-19-1). Non-detect concentrations in the Town Developed dataset were more frequently estimated below detection limits than were those in the Lab Developed dataset (85 and 39% of samples, respectively), resulting in the observed trend.

There is not a significant time trend in filtered lead (Theil-Sen p=0.8) (Figure B-19-12), so the distribution is assumed to temporally stable.

Based on the evaluations described above, it was determined that the full DBG filtered lead dataset is stable. Any perceived instability is likely related to the estimation of non-detect values. The relatively low detection frequency of the final dataset (29%) will result in highly uncertain BTVs, which should be used with caution. The low frequency of detection of lead in DBG samples suggests that sources of lead are limited in the DBG landscape. No detected lead concentration exceeds the minor watershed-specific 2015 draft MTAL values shown in Figure B-19-6.

1.20 MERCURY, UNFILTERED, UNDEVELOPED LANDSCAPE

There are 76 samples from the NBG landscape with unfiltered mercury data, 31 of which have detected concentrations of mercury. The distribution of mercury appears to have several small subpopulations of concentration data (Figure B-20-1). SSC and mercury are significantly related ($p = 0.038$), but the relationship is very weak ($r^2 = 0.07$) (Figure B-20-2). Therefore, normalized results were considered when conducting the BCF assessment of unfiltered mercury (alongside results for raw concentrations). The distribution of SSC-normalized mercury concentrations also has subpopulations (Figure B-20-3).

There are clear spatial differences in unfiltered mercury concentrations among watersheds, with Mortandad, Garcia, Chupaderos, and Los Alamos having higher mercury concentrations than Frijoles (Figure B-20-4). When considering minor watersheds, Pajarito mainstem concentrations also appear to be higher than do those in Frijoles (Figure B-20-6). Moreover, mercury concentrations in Northern and Western reference samples appear to be higher than concentrations in SEP reference samples (Figures B-20-8 and B-20-10). The comparison of minor groupings shows a stark difference between mercury concentrations in Bandelier and Bandelier-like samples ("WR-REF-3" location, sampled in 2015). Normalization of mercury to SSC does not substantially increase spatial stability across watersheds or location groupings (Figures B-20-5, B-20-7, B-20-9, and B-20-11).

There is not a significant trend in unfiltered mercury over time (Theil-Sen $p=0.43$) (Figure B-20-12). Normalization of mercury data to SSC introduces a time trend ($p = 0.005$), which is likely artificial, driven by differences over time in SSC rather than mercury (Figure B-20-13). Because SSC normalization has a destabilizing effect on mercury time trends and an insubstantial effect on the stability of mercury concentrations over space, SSC normalization was not ultimately considered for the final dataset (to be used for BTV calculations).

Due to concentration differences among spatial groupings, the NBG dataset was split into two datasets using the minor location grouping parameter: one subset of SEP reference and Bandelier locations, and one subset of Western and Northern samples. The extreme Bandelier-like grouping ("WR-REF-3" samples) was excluded from further consideration. This location is developed to a degree and may have a local source of mercury. After splitting the data, it was noticed that the maximum value in the Western and Northern dataset (from Cañada de las Marias, August 2009) was a non-detect estimate; this sample was excluded to minimize bias in the BTV calculation resulting from non-detect estimates. Based on re-evaluation of the Q-Q plot (with estimated non-detect values), another subpopulation of three high mercury values (associated with the "Pajarito below SR-501" location [gage E240]) was identified in the Western and Northern subset. Like the location of the WR-REF-3 samples, this location may be influenced by a small degree of development (i.e., SR-501). These three samples were therefore also excluded from the dataset, resulting in a single, stable population. Lastly, after removing the E240 samples, the highest seven concentrations, which were all non-detect estimates, were also excluded from the final subset. All seven concentrations were from locations sampled during the 2010 Watershed Boundary Station Sampling event. The final Western and Northern subset, which is relatively stable and unbiased by non-detect estimates, includes 40 samples with 15 detects (Figure B-20-14).

The final SEP and Bandelier reference subset (n = 21, with 9 detects), while spatially stable after splitting the data and estimating non-detect values, appears to have two subpopulations and one extreme value. The subpopulations are clearly driven by analytical reporting artifacts, in that the single extreme value is the only detected concentration; the middle population comprises estimated detect concentrations (J-flagged values), and the lowest population comprises non-detect concentrations (U-flagged values) (Figure B-20-15). Thus, there remains substantial uncertainty associated with the SEP and Bandelier reference subset and any BTVs calculated using those data.

1.21 MERCURY, UNFILTERED, DEVELOPED LANDSCAPE

The DBG unfiltered mercury dataset consists of 85 samples, only 7 of which are detected (Figure B-21-1). The high degree of non-detection among DBG unfiltered mercury data suggest that significant sources of unfiltered mercury are limited in developed landscapes on or around the Pajarito Plateau.

After estimating non-detect concentrations of unfiltered mercury, the two highest concentrations were non-detects. These samples—NM-REF-2 (from Pueblo mainstem) and NM-REF-3 from Bayo (in Los Alamos), both sampled on 8/7/2015— were removed to reduce potential bias from estimating non-detects. Both samples were flagged “UH,” indicating that they were not detected and were analyzed past the established holding time for mercury. Thus, the final dataset, includes 83 samples and 7 detects.

Detected concentrations of unfiltered mercury were mostly observed in Pueblo (n = 4), but single detections were also observed in Los Alamos (Rendija), Sandia, and the tributary to the Rio Grande. Detected mercury concentrations ranged from 0.070 to 0.484 µg/L, all of which were below the ATAL of 0.77 µg/L. All concentrations (including estimated non-detect values) were between 4.9×10^{-9} and 3.89 µg/L, and only the highest (estimated) concentration exceeded the ATAL. This provides additional justification for the conclusion that there is not a significant source of unfiltered mercury in the DBG landscape on or around Pajarito Plateau.

1.22 NICKEL, FILTERED, UNDEVELOPED LANDSCAPE

The NBG filtered nickel dataset contains 78 samples with 71 detects. Nickel concentrations appear to have a reasonably lognormal distribution, although there appear to be small subpopulations (Figure B-22-1). SSC and filtered nickel are not related (p = 0.28), so normalization is not needed to stabilize the dataset (Figure B-22-2).

There are significant differences in filtered nickel concentrations among watersheds and minor location groupings (Figures B-22-4, B-22-6, and B-22-10). In general, nickel concentrations are higher in Chupaderos (i.e., Cañada de las Latas and Chupaderos mainstem) than in Los Alamos (i.e., mainstem and Guaje). Among minor location groupings, nickel concentrations are lower in Bandelier than in other groups.

There is a significant change in nickel over time (Theil-Sen $p = 0.001$), but the slope of the trend line is very shallow (Figure B-22-12). The median change between 2005 and 2017 is estimated to be from 1.3 to 1.0 µg/L nickel. Due to this small change, the trend in nickel over time is considered to be a minor point of instability.

To account for spatial differences among watersheds, the dataset was split into two subsets: one for Chupaderos, Garcia, and Mortandad watersheds, which generally appeared similar, and one for all other watersheds, which appeared more similar to Los Alamos. The resulting subsets may still have subpopulations (Figures B-22-14 and B-22-15). These were evaluated using various location information (i.e., sampling method, plan, analytical laboratory, analytical quality control notes, major and minor watersheds, and major and minor location groupings), but there were no clear reasons for any subpopulations apart from multiple samples with equivalent values being reported. In the larger dataset (Figure B-22-15), a potential subpopulation may be event specific, with the majority of equivalent values (appearing as a flat line in the mid-range of the Q-Q plot) being from the 2010 Western Boundary Station Sampling event. These results, although unusual, do not appear to be unreasonable. Thus, the two subsets are considered final, although with minor instability. The final Chupaderos, Garcia, and Mortandad subset includes 18 samples (100% detects), and the second subset includes 60 samples (with 53 detects).

1.23 Nickel, Filtered, Developed Landscape

The DBG filtered nickel dataset contains 112 samples with 105 detects. Based on the lognormal Q-Q plot, the nickel dataset looks stable, with possible small subpopulations at very low concentrations or high concentrations (Figure B-23-1). SSC and nickel are significantly related ($p = 0.008$), but the relationship is very weak ($r^2 = 0.09$) (Figure B-23-2). Therefore, SSC-normalized nickel data were evaluated alongside raw nickel concentrations.

There were no spatial differences detected in nickel concentrations across watersheds or location groupings for raw concentrations (Figures B-23-4, B-23-6, B-23-8, and B-23-10), but there was a difference in SSC-normalized nickel among location groupings (Figures B-23-9 and B-23-11). Similarly, there was no time trend in raw nickel concentrations, but a significant trend was observed for SSC-normalized concentrations (Figures B-23-12 and B-23-13). Based on these results, SSC-normalization appears to destabilize the nickel concentration dataset (over time), so the final dataset was based on raw nickel concentrations.

The final raw nickel dataset appears to be quite stable (Figure B-23-14) with only small subpopulations possible (e.g., at the tails of the distribution). Deviation from theoretical distributions at the tails of a distribution is common for environmental data. Alternative distribution types are evaluated in Appendices E and F.

1.24 SELENIUM, UNFILTERED, UNDEVELOPED LANDSCAPE

In the NBG unfiltered selenium dataset, there are 79 samples with only 27 detects (Figure B-24-1). Of those detects, 11 (15%) exceeded the ATAL of 5 µg/L, and 3 (4%) exceeded the MTAL of 20 µg/L. Due to this low detection frequency, spatial and temporal differences (evaluated after estimating non-detect values) were suspect. The estimation of non-detect values was substantially different between location groupings and watersheds, resulting in artificial significant spatial differences. For example, all non-detects in the Northern subset were estimated at concentrations above the detection limit, but all non-detects in the SEP reference or Bandelier subsets were estimated at concentrations below the detection limit. This is an additional point of uncertainty associated with this dataset that likely resulted in artificially different concentration subsets. However, the Bandelier-like dataset (n = 4), which is based on a single sampling location ("WR-REF-3") and the only location in the Mortandad watershed, has concentrations well above concentrations in the other location groupings (Figure B-24-4 and B-24-10). As a result, the Bandelier-like dataset is excluded from the selenium dataset as a likely outlier. This location may be associated with some degree of development that was not initially considered when classifying the location as undeveloped.

The estimation of non-detect values also had an effect on the time trend; Figure B-24-12 shows that estimated non-detect concentrations for the older Western reference samples drive the linear regression to some extent, in that the trend follows those values closely. After excluding non-detect values, however, the time trend is still observable (Figures B-24-16 and B-24-17),[4] suggesting that unfiltered selenium concentrations have increased in recent years, particularly in the Northern reference dataset. Older, lower selenium concentrations were specifically measured in the Corral and Cañada de las Latas minor watersheds. Due to the low detection frequency in the NBG unfiltered selenium dataset and the possibility for spatial bias (based on many other storm water concentration datasets evaluated herein), strong conclusions about time dependency could be drawn.

The unfiltered selenium concentration dataset appears to be spatially stable after estimating non-detect values (Figure B-24-15), with four high non-detect estimates that were excluded from the final dataset to reduce bias in BTV estimates. After removing

[4] Figures B24-16 and B24-17 present the time trends of selenium concentrations among detected samples only (after excluding the extreme values from Mortandad and four non-detect values estimated as greater than the maximum detected value). Figure B-24-17 is dissimilar from other time plots in that it shows the minor watershed associated with each sample (rather than the major location grouping).

these samples,[5] the dataset was considered finalized (at n = 71 samples and 23 detects). As noted, the dataset is associated with substantial uncertainty resulting from potential temporal instability.

1.25 Selenium, Unfiltered, Developed Landscape

Unfiltered selenium concentrations were rarely detected in samples from the DBG landscape (4 of 88), but this dataset met the data suitability requirement for the BCF. The high degree of non-detection among DBG selenium concentration data suggests that significant sources of unfiltered selenium are limited in the DBG landscape on or around the Pajarito Plateau.

Unfiltered selenium was detected in Pueblo mainstem (n = 2), Rendija (in Los Alamos) (n = 1), and the tributary to the Rio Grande (n = 1). Detected concentrations ranged from 1.57 to 14.6 µg/L, the highest value being measured in Rendija (location "BM-REF-4" on 7/2/2015). Two of the detected values exceeded the ATAL of 5 µg/L, and zero samples exceeded the MTAL of 20 µg/L. Analytical constraints for unfiltered selenium appear to be an issue with detection limits commonly exceeding the ATAL.

1.26 Thallium, Filtered, Developed Landscape

Thallium samples from the DBG dataset are similarly limited, although the number of detected concentrations (3 of 114) meets the data requirement for a BCF. The data suggest that, similar to the NBG landscape, significant sources of filtered thallium do not exist or are very limited in the DBG landscape on or around the Pajarito Plateau.

Thallium was detected only in Los Alamo (n = 2) and Sandia (n = 1) watersheds at concentrations between 0.38 and 0.58 µg/L. Only the highest concentration (observed at location ID "LA-ROM-2" in Los Alamos, 7/7/2008) exceeded the ATAL of 0.47 µg/L. Detection limits for thallium appear to be a major issue, such that 52 of 111 non-detect thallium concentrations were reported at a detection limit that exceeded the ATAL (2 µg/L).

1.27 Uranium, Filtered, Undeveloped Landscape

The NBG filtered uranium dataset includes 65 samples and 44 detects. The distribution of uranium concentrations appears to have several subpopulations based on visual assessment of the Q-Q plot (Figure B-27-1). There is no relationship between uranium and SSC (p = 0.77), so normalization is not needed to stabilize the dataset (Figure B-27-2).

Spatial differences were determined between watersheds and minor location groupings. Filtered uranium concentrations measured in Mortandad watershed were generally

[5] 1) Canada de las Marias in Chupadero, sampled 8/11/2015; 2) RF09LM01 in Canada de las Marias, sampled 10/4/2010; 3) RF09GU02 in Guaje (Los Alamos), sampled 9/23/2010; and 4) RF09GA01 in Garcia, sampled 8/24/2010.

higher than those measured in Jemez River or Pajarito (Figure B-27-4). Uranium concentrations measured in Bandelier-like (minor location group) samples were higher than concentrations measured in Bandelier or SEP Reference samples (and visually higher than those in either Western or Northern samples) (Figure B-27-10).

There is not a significant trend in uranium concentrations over time (Theil-Sen $p = 0.068$), so the distribution is assumed to be temporally stable (Figure B-27-12).

In order to stabilize the NBG filtered uranium dataset over space, the Mortandad/Bandelier-like subset was excluded from the final dataset. The excluded subset was too small to reasonably calculate filtered uranium BTVs for Mortandad. After removing the subpopulation of high uranium concentrations in Mortandad, it was determined that uranium in samples from Jemez River ($n = 8$, with 4 detects) was significantly lower than in samples from Los Alamos. Thus, the dataset was split into two subsets, one including only Jemez River samples (Figure B-27-15) and the other including all other samples (except those from Mortandad initially excluded) ($n = 53$, with 36 detects) (Figure B-27-14). Both final data subsets meet the minimum requirements for calculating BTVs (e.g., at least three detected samples), although the Jemez River subset is small; BTVs calculated using that subset will be highly uncertain. Based on a lognormal Q-Q plot of the larger final data subset, there appear to be two or more subpopulations remaining that are related to analytical artifacts: estimated ("J" flagged) detect concentrations are one subpopulation, and unqualified ("NQ") detects form one or two subpopulations of higher concentrations (Figure B-27-16). Because the remaining subpopulations in the final subset appear to be primarily artificial rather than driven by spatial or temporal differences, no attempt was made to split this dataset further.

1.28 Uranium, Filtered, Developed Landscape

The DBG filtered uranium dataset includes 101 samples and 38 detects. Many of the uranium samples were reported at a relatively high detection limit of 0.2 µg/L; only seven detected concentrations exceeded that limit. Based on a review of the lognormal Q-Q plot, the dataset appears to be stable through the range of detected values (Figure B-28-1). Filtered uranium is not related to SSC ($p = 0.86$), so normalization to SSC is not needed to stabilize the uranium dataset (Figure B-28-2).

There did not appear to be differences in filtered uranium across watersheds (Figures B-28-4 and B-28-6), but there were differences among location groupings (Figures B-28-8 and B-28-10). Specifically, uranium concentrations were generally higher in Lab Developed samples (particularly the "Runon" minor location group) than in Town Developed samples. After careful review, it was observed that the significant difference between Lab and Town samples was driven by the estimate of non-detect concentrations. Non-detect Lab Developed concentrations were estimated as higher than the analytical detection limit much more frequently (80%) than were Town Developed samples (17%); the result was significantly higher concentrations in Lab

Developed samples. When comparing detected concentrations only, there was no difference between the two groups (Figure B-28-15). Because this spatial difference appears to be artificial, the DBG uranium dataset has not been split into spatial subsets.

There is not a significant change in filtered uranium over time (Theil-Sen p = 0.09).

As noted, the DBG uranium dataset is stable over both space and time, so no splitting is needed to achieve a stable distribution. The final DBG filtered uranium dataset includes all 101 samples and 38 detects (Figure B-28-14).

1.29 VANADIUM, FILTERED, UNDEVELOPED LANDSCAPE

The NBG filtered vanadium dataset is composed of 78 samples, 73 of which are detects. The distribution of vanadium concentrations is relatively stable (Figure B-29-1). Deviation from lognormality appears to be driven by several extreme values in the dataset. Vanadium is not related to SSC (p = 0.07), so normalization to SSC concentrations is not needed to stabilize the vanadium dataset (Figure B-29-2).

There were significant spatial differences in vanadium concentrations among watersheds and location groupings (Figures B-29-4, B-29-6, B-29-8, and B-29-10), driven in large part by a single location ("WR-REF-3"). Vanadium concentrations were significantly higher in Mortandad watershed than in Frijoles or Pajarito, and, visually, vanadium concentrations in Garcia mainstem (n = 2) were elevated (Figure B-29-6). When considering major location groupings, vanadium concentrations in Northern reference samples were significantly higher than concentrations in Western reference samples (Figure B-29-8). However, when considering minor location groupings, these two groups were no longer different (Figure B-29-10). Rather, concentrations from samples in the Bandelier-like minor location group (which is the same as the Mortandad watershed subset) were significantly greater than concentrations in the Western or Bandelier samples.

There is no significantly trend in filtered vanadium over time (Theil-Sen p = 0.20), so the dataset is considered temporally stable (Figure B-29-12).

To account for the high-concentrations in Bandelier-like/Mortandad samples, those four samples (all from "WR-REF-3," sampled July and August 2015) were excluded from the vanadium dataset. Four samples are not sufficient to reasonably calculate BTVs, so BTVs will not be generated for Mortandad.

The four excluded samples were collected using the direct container (DC) grab sampling method and contained elevated SSC (between 24,800 and 48,300 mg/L). In general, the few (n = 8) samples collected using the DC method tended to have higher concentrations than those collected by automated pump samplers (APS) (Figure B-29-15), suggesting that concentrations in samples collected using the DC method may not be comparable to APS-based samples. Removing the four WR-REF-3 samples from the dataset effectively accounted for differences among watersheds, location groupings, and sampling methods. These same locations had consistently higher concentrations of several other storm water constituents, indicating that the WR-REF-3 location may be impacted by development, a heretofore unrecognized source of contamination, or some other factor specific to that location. Uncertainty associated with sampling method and this particular location are described in more detail in Section 3.4 in the main text.

Two samples were evaluated from the Garcia mainstem minor watershed, which had relatively high vanadium concentrations (5.0 to 49.1 μg/L). With only two samples, the dataset could not be said with certainty to be significantly different from those of the other watersheds. Based on the remote location where these two samples were collected, the two high values were considered to realistically represent the upper tail of the NBG vanadium concentration distribution. Thus, the values from Garcia mainstem were retained in the final dataset.

The final dataset, which appears to be stable (Figure B-29-14), includes 74 samples with 69 detects. The distribution of vanadium concentrations appears to be reasonably lognormal with minor deviations (i.e., extreme values, as discussed above).

1.30 Vanadium, Filtered, Developed Landscape

The DBG filtered vanadium dataset includes 113 samples and 109 detects. The distribution appears to be fairly stable (although lognormality may not be the most appropriate distribution assumption for BTV calculations). Vanadium and SSC are not related ($p = 0.07$), so SSC normalization is not needed to stabilize the dataset.

There were neither spatial nor temporal trends in DBG filtered vanadium concentrations. As a result, the entire vanadium dataset is considered final and will be used to calculate BTVs. BTV estimates for DBG vanadium are expected to have very low uncertainty due to high sample size, detection frequency, and stability.

1.31 Zinc, Filtered, Undeveloped Landscape

The NBG filtered zinc dataset includes 78 samples and 49 detects. Detection limits were generally low, but non-detect values at higher detection limits (up to 10 μg/L) were also present in the dataset, as seen in Figure B-31-1. Figure B-31-2 shows that SSC normalization is not needed because the relationship between filtered zinc and SSC is not significant ($p = 0.39$).

Filtered zinc concentrations measured in Garcia were greater than concentrations measured in the Jemez River and Frijoles major watersheds (Figure B-31-4). Although not significant, Mortandad samples also had elevated zinc concentrations, comparable to the higher zinc concentrations measured in Garcia. No differences were observed among major or minor location groupings (Figures B-31-8 and B-31-10).

A significant spatial trend was also identified (Theil-Sen, $p < 0.001$) (Figure B-31-12). This trend may be due, in part, to spatial bias, but it was re-evaluated after the data had been split (described below).[6]

To stabilize the filtered zinc dataset over space, the Garcia samples (n = 4) were excluded. Four samples are not sufficient to reasonably calculate BTVs, so BTVs will not be generated for Garcia.

After excluding the Garcia data, the two highest zinc concentrations in the dataset were estimated non-detect values. The higher of these two values was from Mortandad (location "WR-REF-3," sampled 8/27/2015), and the lower was from Guaje (location "RF09GU02," sampled 8/26/2015). Since these values would have biased BTV values to be high, the two samples were also excluded from the final dataset. The final dataset appears fairly stable (Figure B-31-14) and is composed of 72 samples, including 45 detects.

1.32 Zinc, Filtered, Developed Landscape

The DBG filtered zinc dataset includes 114 samples with 104 detects. Based on a lognormal Q-Q plot of concentrations (Figure B-32-1), there may be multiple subpopulations of concentrations. SSC and filtered zinc are not significantly related (linear regression, $p = 0.54$), so SSC normalization is not needed to stabilize the dataset (Figure B-32-2).

Filtered zinc concentrations were stable over both space and time (Figures B-32-4, B-32-6, B-32-8, B-32-10, and B-32-12). The available location-specific data for the filtered zinc dataset did not distinguish among potential subpopulations in the concentration distribution observed in the initial Q-Q plot (Figure B-32-1). Therefore, the filtered zinc dataset could not be fully stabilized, and any BTVs calculated will be associated with uncertainty. Based on this assessment, dataset instability was not clearly related to differences among watersheds, location groupings, sample dates, sample methods, or sampling plan, nor was the dataset substantially affected by non-detects (or the estimation of non-detects) or any other parameter evaluated. Similarly, the lack of a relationship with SSC (as a surrogate for storm intensity) suggested that subpopulations were unrelated to storm events or storm intensities. Due to the large number of samples that appeared to be within potential subpopulations of the zinc dataset, it was inappropriate to treat samples in different subpopulations as outliers.

DBG filtered zinc BTVs will be calculated for the complete zinc dataset (n = 114) under the assumption of stability, but uncertainty will be carried forward into the discussion of DBG zinc BTVs. When calculating BTVs, it is more reasonable to assume a gamma distribution (Appendix E).

[6] The removed samples were from locations WR-REF-3 (in Mortandad Canyon) and RF09GU02 (in Guaje Canyon), both collected during August 2015.

1.33 GROSS ALPHA, UNFILTERED, UNDEVELOPED LANDSCAPE

The NBG gross alpha dataset includes 55 samples and 48 detects, with 36 samples (65%) in exceedance of the 15 pCi/L IP ATAL. Figure B-33-1 suggests multiple populations of gross alpha activity. Gross alpha activity in NBG is significantly related to SSC, but the relationship is somewhat weak ($p < 0.001$, $r^2 = 0.38$) (Figure B-33-2). Figure B-33-3 shows that SSC normalization appears to marginally improve the spatial stability of the gross alpha activity dataset (i.e., smooths distribution along Q-Q line). Therefore, SSC-normalized values were used to establish a stable dataset for NBG unfiltered gross alpha.

There are no significant differences among spatial groupings after SSC normalization. Thus, the dataset is considered to be spatially stable (Figures B-33-5, B-33-7, B-33-9, and B-33-11).

Figure B-33-13 shows a significant trend in gross alpha concentrations over time (Theil-Sen, $p = 0.041$), which appears to be driven, in large part, by the estimated non-detect values noted above. The line barely passes through older data points. Visually, the data appear to be very consistent over time. Given the spatial differences in sampling groups over time and the non-significant differences among those groups (Figure B-33-9), it is reasonable to conclude that gross alpha is actually stable over time (despite the artificial trend observed in Figure B-33-13).

After estimating non-detect gross alpha activity values (using regression on order statistics [ROS] methods), three SSC-normalized non-detect values were identified as extreme high values. These values were excluded from the dataset to prevent biasing the calculation of BTVs with potentially unreliable non-detect estimates. These samples were collected at location RA092301 (gage E240 in Pajarito mainstem, sampled 10/21/2009) and location RF10E025 (in Los Alamos mainstem, sampled on 7/24/2010 and 8/5/2010).[7]

The final SSC-normalized NBG gross alpha dataset consisted of 45 samples with 43 detects (Figure B-33-14). The sample size decreased from 55 samples as a result of SSC normalization (which required paired SSC and gross alpha activity values that were only available for 45 samples).

1.34 GROSS ALPHA, UNFILTERED, DEVELOPED LANDSCAPE

The DBG unfiltered gross alpha dataset (after excluding negative or zero-activity values) has 53 samples and 44 detects. The lognormal Q-Q plot suggests multiple populations and potentially two extreme high-activity values to consider (Figure B-34-1). The relationship between SSC and DBG unfiltered gross alpha activity is significant ($p < 0.001$) and weak ($r^2 = 0.27$), but it is potentially non-linear (Figure B-34-2). Although normalization is not needed to stabilize gross alpha activity across

[7] Two of the three samples were collected at the RF10E025 location.

spatial categories, SSC normalization does reduce apparent instability (i.e., potential subpopulations) in Q-Q plots (by reducing apparent differences among subpopulations) (Figure B-34-3 relative to Figure B-34-1). SSC normalization also appears to reduce variability over time (Figure B-34-13 relative to Figure B-34-12). However, SSC normalization destabilizes gross alpha activities over space, in that SSC-normalized gross alpha activities differ between Lab Developed and Town Developed groupings (Figures B-34-9 and B-34-11); raw gross alpha activities were not different between Lab Developed and Town Developed groupings (Figure B-34-8 and B-34-10).

The estimation of non-detect values appears to have a substantial influence on distribution, as evidenced by the Q-Q line for SSC-normalized gross alpha values. The line does not pass through the data points in Figure B-34-3 (points not adjusted for non-detects), although the data are reasonably linear (in lognormal Q-Q space). When considering only detected values, there is not a significant difference among location groupings (Figure B-34-15). Therefore, the difference in SSC-normalized gross alpha activities among location groups appears to be artificial.

A significant decreasing trend in gross alpha activity is detectable over time (Theil-Sen $p = 0.002$), although based on the data points shown in Figure B-34-13, the temporal trend is far less clear. The Theil-Sen regression line does not pass through many of the earlier data points, indicating that the trend is driven by the estimation of non-detect values (particularly for earlier Lab Developed samples). Thus, the significant trend in gross alpha is also considered to be artificial and of little concern for dataset stability. This is corroborated by Figure B-34-16, which illustrates the lack of any temporal trend in detected activities of gross alpha (Theil-Sen $p = 0.60$).

As with the NBG dataset, non-detect activity values estimated (using the ROS method) in the DBG dataset are problematic. Six high (yet non-detect) SSC-normalized activity values were removed from the dataset to avoid bias in BTV calculations.[8] The final SSC-normalized DBG gross alpha dataset includes 47 samples with 43 detects, and the distribution appears to be stable (Figure B-34-14).

1.35 Radium-226 and Radium-228, Unfiltered, Undeveloped Landscape

The NBG unfiltered radium activity dataset includes only 15 samples, 11 of which are detects. Based on the initial Q-Q plot (Figure B-35-1), there appear to be strong distinctions in radium activity levels among the major location groups, with Northern reference locations having the highest activities. There is a highly significant relationship between SSC and radium ($p < 0.001$, $r^2 = 0.75$), so SSC-normalized data were evaluated in the BCF assessment (Figure B-35-2). After normalizing radium

[8] The excluded gross alpha samples were from locations 1) RA090102 (ACID-ROM-2(b)) in Acid (n = 2 samples); 2) RA091601 (S-ROM-2(a)) in Sandia; 3) RA090801 (P-ROM-3) in Pueblo; and 4) RA091001 (LA-ROM-2-PCB) in Los Alamos. All 5 samples were collected during the 2009 Western Boundary Station Sampling event. The three highest values had relatively low SSC (between 18 and 63 mg/L).

activity to SSC, there appears to be a single population with two high values that deviate from lognormality; one of these values is a non-detect (Figure B-35-3).

Due in large part to the small sample size for the NBG radium dataset, there were no statistically discernible differences among watersheds or location groupings (Figures B-35-5, B-35-7, B-35-9, and B-35-11). Similarly, there was no trend in SSC-normalized radium activities over time (Theil-Sen $p = 1.0$) (Figure B-35-13). Radium was only sampled in two years, with the majority of radium data being collected in 2010. Only three samples were collected in 2017, two of which also had paired SSC data. Thus, radium activity is not clearly stable over space and time, but the available data suggest that radium activity is stable.

One high non-detect concentration estimate (location ID "RA092301," gage location E240 in Pajarito, sampled on 8/16/2010) was removed to reduce bias in BTV calculations. The final subset of SSC-normalized radium data is composed of 13 samples with 11 detects (Figure B-35-14). Due to the dataset's small size, BTV calculations based on the final NBG radium dataset will be highly uncertain.

1.36 Radium-226 and Radium-228, Unfiltered, Developed Landscape

The DBG unfiltered radium dataset includes 40 samples, 25 of which are detects. The distribution of radium activities appears to be fairly stable, with some extreme values (Figure B-36-1). Radium is significantly related to SSC ($p < 0.001$), but the relationship is relatively weak ($r^2 = 0.30$) (Figure B-36-2). As a result, SSC-normalized and raw radium activity datasets were both evaluated using the BCF. Based on Q-Q plots, there may be multiple subpopulations within either dataset (Figures B-36-1 and B-36-3).

There are no significant differences in unfiltered radium activity among watersheds or location groupings for either raw or SSC-normalized datasets (Figures B-36-4 through B-36-11). Although there is a significant change in radium concentrations over time, the Theil-Sen regression is clearly nonsensical for this dataset (Figure B-36-13); the line hardly passes through the actual data points, which appear to be reasonably consistent over time. Radium data were primarily collected in 2016, with a small subset being sampled in 2012 or 2013. As a result of the biased sampling of radium over time (i.e., mostly in 2016), the stability of the radium dataset over time is uncertain. The Theil-Sen regression shown in Figure B-36-13 does not provide strong evidence of instability.

Subpopulations in the SSC-normalized radium dataset cannot be discerned using the available location data. Therefore, the final SSC-normalized radium dataset remains somewhat unstable, adding uncertainty to the calculation of BTVs. Based on detected concentrations only, the lognormal distribution appears to fit the radium dataset quite well (Appendix E).

Ultimately, the DBG unfiltered radium dataset was SSC-normalized to be consistent with other radionuclide datasets (Sections 33 through 35). The final SSC-normalized

DBG unfiltered radium dataset consists of 39 samples with paired SSC and radium activity values; 24 of these samples are detects (Figure B-36-14).

1.37 Total PCBs, Unfiltered, Undeveloped Landscape

The baseline (undeveloped) unfiltered total PCB dataset includes 50 samples with 100% detection; detection was fixed at 100% by the exclusion of zero-concentration samples (as described in Appendix A). The distribution appears to be fairly stable based on visual inspection of a lognormal Q-Q plot, although some deviation at lower concentrations suggests a second subpopulation (Figure B-37-1). The relationship between SSC and total PCBs is significant ($p = 0.008$) but very weak ($r^2 = 0.16$) (Figure B-37-2). After reviewing Steps 2.2 and 2.3 of the BCF assessment, it was determined that SSC normalization does not substantially improve dataset stability. For example, the significant differences among spatial subsets were not reduced (Figures B-37-4, B-37-6, B-37-8, and B-37-10 relative to Figures B-37-5, B-37-7, B-37-9, and B-37-11, respectively), and the trend over time, while no longer significant after SSC normalization, appeared to be fairly similar (i.e., increasing and decreasing over time, likely related to spatial sampling bias) (Figure B-37-12 relative to Figure B-37-13).

Fairly strong differences in raw total PCB concentrations can be seen in spatial comparisons of watersheds and location groupings. Although few major watersheds are significantly different (only Los Alamos samples have significantly higher concentrations than Jemez River samples), it appears that Pajarito, Chupaderos, Garcia, and Los Alamos Canyons tend to have higher PCB concentrations than do Jemez River, Frijoles, or Water Canyons (Figure B-37-4). Minor watershed comparisons had similar results (Figure B-37-6). SEP reference sample concentrations (major location grouping) were significantly lower than concentrations in either the Northern or Western reference location samples (Figure B-37-8). Because samples from the SEP reference locations are the most recently collected, this spatial difference also results in a significant time trend (Theil-Sen, $p = 0.003$) (Figure B-37-12).

To control for spatial and time differences, the PCB dataset was split into SEP reference samples ($n = 9$) and Western and Northern reference samples ($n = 41$). The Northern and Western reference subset is reasonably stable (Figure B-37-14), whereas some uncertainty remains for the SEP reference dataset. The Q-Q plot for the SEP reference dataset shows some extreme values, which suggest that a lognormal distribution assumption may not be valid when calculating BTVs (Figure B-37-15). BTV estimates based on the SEP reference dataset will be uncertain due to the dataset's small sample size.

1.38 Total PCBs, Unfiltered, Developed Landscape

The DBG unfiltered total PCB dataset includes 96 samples with 100% detection. Visual inspection of a lognormal Q-Q plot (Figure B-38-1) suggests that there are potentially small subpopulations of PCB concentrations. The relationship between SSC and total

PCBs is not significant (p = 0.72), so normalization is not needed to stabilize PCB concentrations (Figure B-38-2).

While the PCB concentrations in the major watersheds are not dissimilar (Figure B-38-4), the South Fork Acid minor watershed (in Pueblo Canyon) PCB concentration is significantly greater than that of the Bayo minor watershed (in Los Alamos Canyon) (Figure B-38-6). Total PCB concentrations are not different across location groupings (Figure B-38-8 and B38-10). It is also clear that PCB concentrations in DBG storm water samples nearly always (in 98% of samples) exceed the ATAL of 0.6 ng/L.

There is a significant, increasing time trend in total PCBs (Theil-Sen, p = 0.03), although visual inspection of the time plot for DBG total PCBs indicates that the trend is unclear (Figure B-38-12). Older PCB concentrations (from 2009) tend to be highly variable and similar to the most recent data (from 2016). The LOESS line corroborates a decreasing and then increasing curved trend over time. Thus, the difference in PCBs over time is considered to be a minor point of uncertainty.

To address spatial instability, the South Fork Acid samples were separated from the rest of the total PCB dataset, resulting in two final subsets. The BTVs calculations for the South Fork Acid subset will be highly uncertain due to the subset's small sample size (n = 9), whereas BTVs for the larger subset (n = 87) will be more certain. The Q-Q plots of final subsets indicate relative stability, with the possible exception of some small subsets of high concentrations (Figure B-38-14 and B38-15). Extreme values are consistently observable across Pueblo and Los Alamos watersheds, suggesting that storm water PCB concentrations are truly highly variable. Thus, the extreme values are not excluded from the final PCB subsets.

As noted in Appendix A, there were no non-detect values included in the PCB dataset (due to non-detects being reported as 0 µg/L and summarily removed before conducting the BCF assessments). The removal of all non-detect PCB values may bias the calculated BTVs higher than if non-detect values had been included in the final subsets. In general, zero-concentration values are considered an inaccurate representation of non-detection, and the inclusion of zeros in statistical calculations can be problematic (e.g., when using a logarithmic transformation).

1.39 BENZO(A)PYRENE, UNFILTERED, DEVELOPED LANDSCAPE

In the DBG unfiltered benzo(a)pyrene dataset, there are 30 samples, 11 of which are detected (Figure B-39-1), and all of which are below the IP ATAL (0.18 µg/L). Due to the low detection frequency of benzo(a)pyrene, there will be uncertainty in associated BTVs. Figure B-39-2 shows that there is not a significant relationship between benzo(a)pyrene and SSC (p = 0.08), so normalization is not needed to stabilize the dataset (in terms of storm intensity).

There are few dates (i.e., summer 2016 data only) and few areas (e.g., Town Developed data only) over which to compare benzo(a)pyrene concentrations (e.g., Figures B-39-4 and B-39-12). Within the limited benzo(a)pyrene dataset, there are no significant differences among major or minor watersheds, although the lack may be due, in part, to small sample sizes for those spatial subsets (Figures B-39-4 and B-39-6).

The complete DBG unfiltered benzo(a)pyrene dataset was retained for calculating BTVs, although BTVs based on this dataset will be highly uncertain (due to low detection frequency) and should be used with caution. The distribution of benzo(a)pyrene values (including estimated non-detect values) is shown in Figure B-39-8.

APPENDIX C. SAMPLING LOCATION INFORMATION FOR THE PAJARITO PLATEAU STORM WATER BACKGROUND DATASET

Appendix C. Database of location information for the background LANL storm water dataset

Location ID	Location ID Alias	Windward ID	Windward ID Notes	Northing	Easting	Landscape	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Fire Affected Watershed	Source	Water Type	NMAC Stream Class	Stream Class	Nearest AU ID	Distance to Nearest AU (ft)	AU Comment
BM-REF-7 at RF16BM07	Baranca Mesa Ref Location 7	BM-REF-7		1783484.724	1631301.197	Developed	Los Alamos	Bayo	Town Developed	Townsite	Yes	LANL	stormwater discharge	NA	NA	NM-97.A_007	1,633.3	
BM-REF-6 at RF13BM06	East end of Los Pueblos St	BM-REF-6		1780810.892	1639675.244	Developed	Los Alamos	Bayo	Town Developed	Townsite	Yes	LANL	stormwater discharge	NA	NA	NM-97.A_007	863.1	
BM-REF-4 at RF13BM04	Navajo Rd and Barranca Rd	BM-REF-4		1784605.177	1633176.679	Developed	Los Alamos	Rendija	Town Developed	Townsite	Yes	LANL	stormwater discharge	NA	NA	NM-9000.A_045	2,595.0	
BM-REF-2 at RF13BM02	San Ild and Paseo Penansco	BM-REF-2		1784629.558	1628491.264	Developed	Los Alamos	Rendija	Town Developed	Townsite	Yes	LANL	stormwater discharge	NA	NA	NM-9000.A_045	1,411.3	
NM-REF-3 at RF13NM03	Terry Ln and Deer Trail	NM-REF-3		1780011.302	1630512.662	Developed	Los Alamos	Bayo	Town Developed	Townsite	Yes	LANL	stormwater discharge	NA	NA	NM-97.A_007	1,850.7	
NM-REF-2 at RF13NM02	Camino Uva near Camino Cereza	NM-REF-2		1779299.88	1627571.689	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-97.A_006	620.2	
DS-REF-1 at RF16DS01	Denver Steel Ref Location 1	DS-REF-1		1778690.93	1621530.631	Developed	Pueblo	Acid	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	1,308.5	
NM-REF-9	End of San Ildefonso Rd.	NM-REF-9		1777955.846	1635325.529	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-97.A_006	812.2	
HS-REF-1	HS down PEEC facility	HS-REF-1		1778448.42	1620866.137	Developed	Pueblo	Acid	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	1,427.7	
NCOM-REF-2 at RF16NC02	North Community Ref Location 2	NCOM-REF-2		1781338.479	1620332.295	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	1,510.8	
NCOM-REF-3 at RF16NC03	North Community Ref Location 3	NCOM-REF-3		1782832.044	1621036.948	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_045	2,486.8	
NCOM-REF-1	RF15NC01	NCOM-REF-1		1780972.005	1621846.933	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	975.7	
QUE-REF-1	RF15QU01	QUE-REF-1		1779861.125	1617654.954	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	843.8	
WA-REF-5	Sandia Dr. between 41st and 40	WA-REF-5		1778409.273	1619669.578	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	1,123.7	
WA-REF-3	Sandia in front of 4920 4930	WA-REF-3		1777843.119	1616931.926	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	330.6	
WA-REF-6 at RF16WA06	Western Area Ref Location 6	WA-REF-6		1777264.264	1619281.623	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_063	1,789.1	
WR-REF-1 at RF13WR01	Meadow Ln and Grand Canyon Dr	WR-REF-1		1754445.519	1658320.37	Developed	Rio Grande	Small Tributary	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_053	1,712.0	
WR-REF-6 AT RF16WR06	White Rock Ref Location 6	WR-REF-6		1753144.108	1658545.741	Developed	Rio Grande	Small Tributary	Town Developed	Townsite	No	LANL	stormwater discharge	NA	NA	NM-9000.A_053	2,930.3	
BAND-REF-3	BAND-REF-3 at RF15BAND03	BAND-REF-3		1757405.797	1608295.878	Undeveloped	Frijoles	Frijoles	Bandelier Reference	Bandelier	Yes	LANL	surface water	98	Intermittent	NM-126.A_03	2,361.6	No AU assignment
BAND-REF-4	BAND-REF-4 at RF15BAND04	BAND-REF-4		1755871.917	1619402.965	Undeveloped	Frijoles	Frijoles	Bandelier Reference	Bandelier	Yes	LANL	surface water	98	Intermittent	NM-128.A_13	1,177.2	No AU assignment
Rio de los Frijoles at Band	E350	E350		1738080.2	1634678.6	Undeveloped	Frijoles	Frijoles	Bandelier Reference	Bandelier	Yes	LANL	surface water	121	perennial	NM-2118.A_70	20.8	
SEP-REF-BM1 at RF17BM01		SEP-REF-BM1		1754660.819	1615636.458	Undeveloped	Frijoles	Frijoles	SEP Reference	SEP Reference	Yes	LANL	surface water	98	Intermittent	NM-128.A_13	3,736.2	No AU assignment
SEP-REF-P1 at RF17P01		SEP-REF-P1		1756279.877	1609944.04	Undeveloped	Frijoles	Frijoles	SEP Reference	SEP Reference	Yes	LANL	surface water	98	Intermittent	NM-126.A_03	3,018.3	No AU assignment
SEP-REF-SJM1 at RF17SJM01		SEP-REF-SJM1		1728030.12	1520615.217	Undeveloped	Jemez River	Jemez River	SEP Reference	SEP Reference	No	LANL	surface water	98	Intermittent	NM-2105.5_10	13,878.9	No AU assignment
SEP-REF-SJM4 at RF17SJM04		SEP-REF-SJM4		1723545.512	1524751.695	Undeveloped	Jemez River	Jemez River	SEP Reference	SEP Reference	No	LANL	surface water	98	Intermittent	NM-2105.5_21	8,722.4	No AU assignment
Los Alamos below Ice Rink	E026	E026		1775624.331	1618215.135	Undeveloped	Los Alamos	Los Alamos	Western Reference	Western	Yes	LANL	surface water	128	E/I	NM-9000.A_063	33.3	
RF09GU02	GUAJE-REF-2	GUAJE-REF-2		1790296.6	1642533.5	Undeveloped	Los Alamos	Guaje	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	9.6	
WR-REF-3 at RF13WR03	172 Meadow Lane	WR-REF-3		1757295.268	1654224.752	Undeveloped	Mortandad	Mortandad	Bandelier Reference	Bandelier-like	No	LANL	surface water	98	Intermittent	NM-9000.A_053	1,428.9	No AU assigned this final reach of Los Alamos drainage before Rio Grande
Pajarito below SR-501	E240	E240	post-washout; coordinates not changed from "W Boundary (E240)", but location has changed	1770945.505	1610350.084	Undeveloped	Pajarito	Pajarito	Western Reference	Western	Yes	LANL	surface water	128	E/I	NM-128.A_07	87.4	
Water above SR-501	E252	E252 up	added "up" to distinguish from "E252"	1760451.049	1607279.987	Undeveloped	Water	Water	Western Reference	Western	Yes	LANL	surface water	98	Intermittent	NM-9000.A_052	75.9	
LA-SMA-0.85 at RA131047	LA-ROM-0.85	LA-ROM-0.85		1774445.466	1617991.518	Developed	Los Alamos	Los Alamos	Lab Developed	Runon	Yes	LANL	stormwater discharge	NA	NA	NM-9000.A_063	1,166.5	
SS081022	LA-ROM-2	LA-ROM-2	same coords as "LA-ROM-2-PCB"	1775864.97	1622925.561	Developed	Los Alamos	Los Alamos	Lab Developed	Runon	Yes	LANL	stormwater discharge	NA	NA	NM-9000.A_063	806.9	
RA091001	LA-ROM-2-PCB	LA-ROM-2-PCB	same coords as "LA-ROM-2"	1775864.97	1622925.561	Developed	Los Alamos	Los Alamos	Lab Developed	Runon	Yes	LANL	stormwater discharge	NA	NA	NM-9000.A_063	806.9	
TA-55 NW above Effluent Canyon	E196	E196		1770021	1624491	Developed	Mortandad	Effluent	Lab Developed	Runon-like	No	LANL	stormwater discharge	NA	NA	NM-9000.A_042	992.8	
M-SMA-10.3 at RA121236	M-ROM-10.3	M-ROM-10.3		1769512.177	1627475.841	Developed	Mortandad	Mortandad	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-9000.A_042	634.1	
SEP-URBAN-PL4 at URBAN171246		SEP-URBAN-PL4		1769513.472	1627473.655	Developed	Mortandad	Tensite	Lab Developed	SEP Urban	No	LANL	stormwater discharge	NA	NA	NM-9000.A_042	632.9	
2M-SMA-1 at RA133222	2M-ROM-1(b)	2M-ROM-1(b)		1773321.758	1616585.555	Developed	Pajarito	Twomile	Lab Developed	Runon	Yes	LANL	stormwater discharge	NA	NA	NM-128.A_15	434.6	
2M-SMA-1.9 at RA133223	2M-ROM-1.9	2M-ROM-1.9		1772768.899	1617897.041	Developed	Pajarito	Twomile	Lab Developed	Runon	Yes	LANL	stormwater discharge	NA	NA	NM-128.A_15	875.0	
SEP-URBAN-PL1 at URBAN173227		SEP-URBAN-PL1		1767815.886	1627060.461	Developed	Pajarito	Twomile	Lab Developed	SEP Urban	Yes	LANL	stormwater discharge	NA	NA	NM-128.A_15	952.2	
SEP-URBAN-PL2 at URBAN173228		SEP-URBAN-PL2		1767783.898	1627008.639	Developed	Pajarito	Twomile	Lab Developed	SEP Urban	Yes	LANL	stormwater discharge	NA	NA	NM-128.A_15	899.6	
SEP-URBAN-PL3 at URBAN173229		SEP-URBAN-PL3		1770938.094	1620592.724	Developed	Pajarito	Twomile	Lab Developed	SEP Urban	Yes	LANL	stormwater discharge	NA	NA	NM-128.A_15	407.8	
SEP-URBAN-PL5 at URBAN173230		SEP-URBAN-PL5		1772803.523	1617001.092	Developed	Pajarito	Twomile	Lab Developed	SEP Urban	Yes	LANL	stormwater discharge	NA	NA	NM-128.A_15	329.3	
RA090101	ACID-ROM-2(a)	ACID-ROM-2(a)		1777105.352	1623665.323	Developed	Pueblo	Acid	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-97.A_029	575.1	
RA090102	ACID-ROM-2(b)	ACID-ROM-2(b)		1777510.566	1623898.775	Developed	Pueblo	Acid	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-97.A_029	439.6	
RA090801	P-ROM-3	P-ROM-3		1779191.02	1622663.805	Developed	Pueblo	Pueblo	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-9000.A_043	425.6	
RA09WC01	Walnut-ROM-1	Walnut-ROM-1		1779694.232	1624760.489	Developed	Pueblo	Walnut	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-97.A_004	3.5	very close to surface water AU but "stormwater discharge" is assigned on basis of LANL 2013 Background report LA-UR-13-22841; check water type assignment since very close to AU
S-SMA-0.25 at RA121629	S-ROM-0.25(c)	S-ROM-0.25(c)		1774231.784	1618711.951	Developed	Sandia	Sandia	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-9000.A_063	1,285.3	

Location ID	Location ID Alias	Windward ID	Windward ID Notes	Northing	Easting	Landscape	Major Watershed	Minor Watershed	Major Location Group	Minor Location Group	Fire Affected Watershed	Source	Water Type	NMAC Stream Class	Stream Class	Nearest AU ID	Distance to Nearest AU (ft)	AU Comment
RA091601	S-ROM-2(a)	S-ROM-2(a)		1773326.021	1619417.327	Developed	Sandia	Sandia	Lab Developed	Runon	No	LANL	stormwater discharge	NA	NA	NM-9000.A_063	2,135.0	
RF09CH01	CHUP-REF-1	CHUP-REF-1		1799335.638	1643744.13	Undeveloped	Chupaderos	Chupaderos	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	8,852.6	
RF09LL01	LAS LATAS-REF-1	LAS LATAS-REF-1		1797171.58	1649986.756	Undeveloped	Chupaderos	Cañada de las Latas	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	9,174.2	
RF09LL02	LAS LATAS-REF-2	LAS LATAS-REF-2		1796056.54	1649855.155	Undeveloped	Chupaderos	Cañada de las Latas	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	8,156.3	
RF09LM01	LAS MARIAS-REF-1	LAS MARIAS-REF-1		1792526.71	1644725.28	Undeveloped	Chupaderos	Cañada de las Marias	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	2,900.4	
RF09CO01	CORRAL-REF-1	CORRAL-REF-1		1805773.933	1638841.46	Undeveloped	Garcia	Corral	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	13,955.6	No AU assignment
RF09GA01	GARCIA-REF-1	GARCIA-REF-1		1803391.532	1634727.4	Undeveloped	Garcia	Garcia	Northern Reference	Northern	Yes	LANL	surface water	98	Intermittent	NM-9000.A_005	9,901.8	
RF10E025	LAC-REF-01	E025		1775830.222	1616882.362	Undeveloped	Los Alamos	Los Alamos	Western Reference	Western	Yes	LANL	surface water	128	E/I	NM-9000.A_063	54.4	
RA092301	W Boundary (E240)	E240 up	pre-washout; coordinates not changed from "E240", but location has changed	1770945.505	1610350.084	Undeveloped	Pajarito	Pajarito	Western Reference	Western	Yes	LANL	surface water	128	E/I	NM-128.A_07	87.4	
RA110402	E252	E252		1760382	1607994	Undeveloped	Water	Water	Western Reference	Western	Yes	LANL	surface water	126	perennial	NM-126.A_03	28.0	
Canon de Valle above SR-501	E253	E253 up	added "up" to distinguish from "E253"	1765374.357	1609373.843	Undeveloped	Water	Cañon de Valle	Western Reference	Western	Yes	LANL	surface water	128	E/I	NM-128.A_02	78.1	
RA113902	E253	E253		1765230	1609707	Undeveloped	Water	Cañon de Valle	Western Reference	Western	Yes	LANL	surface water	128	E/I	NM-128.A_02	77.2	
RA090401	W Boundary (E252)	E252 up	added "up" to distinguish from "E252"	1760451.049	1607279.987	Undeveloped	Water	Water	Western Reference	Western	Yes	LANL	surface water	98	Intermittent	NM-9000.A_052	75.9	
BM-REF-6 at OB14BM06		BM-REF-6		1780810.892	1639675.244	Developed	Bayo	Los Alamos	Town Developed	Townsite	Yes	NMED	stormwater discharge	NA	NA	NM-97.A_007	863.1	
BM-REF-7 at OB16BM07		BM-REF-7		1783484.724	1631301.197	Developed	Bayo	Los Alamos	Town Developed	Townsite	Yes	NMED	stormwater discharge	NA	NA	NM-97.A_007	1,633.3	
NM-REF-3 at OB15NM03		NM-REF-3		1781671.649	1629088.877	Developed	Bayo	Los Alamos	Town Developed	Townsite	Yes	NMED	stormwater discharge	NA	NA	NM-97.A_007	755.0	
BM-REF-2 at OB14BM02		BM-REF-2		1784629.558	1628491.264	Developed	Rendija	Los Alamos	Town Developed	Townsite	Yes	NMED	stormwater discharge	NA	NA	NM-9000.A_045	1,411.3	
BM-REF-4 at OB14BM04		BM-REF-4		1784605.177	1633176.679	Developed	Rendija	Los Alamos	Town Developed	Townsite	Yes	NMED	stormwater discharge	NA	NA	NM-9000.A_045	2,595.0	
DS-REF-1 at OB16DS01		DS-REF-1		1778690.93	1621530.631	Developed	Acid	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_043	1,308.5	
HS-REF-1 at OB15HS01		HS-REF-1		1778395.295	1620819.262	Developed	Acid	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_043	1,470.4	
NCOM-REF-1 at OB15NC01		NCOM-REF-1		1780972.005	1621846.933	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_043	975.7	
NCOM-REF-2 at OB16NC02		NCOM-REF-2		1781338.479	1620332.295	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_043	1,510.8	
NCOM-REF-3 at OB16NC03		NCOM-REF-3		1782832.044	1621036.948	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_045	2,486.8	
NM-REF-2 at OB15NM02		NM-REF-2		1779299.88	1627571.689	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-97.A_006	620.2	
NM-REF-9 at OB14NM09		NM-REF-9		1777955.846	1635325.529	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-97.A_006	812.2	
QUE-REF-1 at OB15QUE01		QUE-REF-1		1779861.125	1617654.954	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_043	843.8	
WA-REF-5 at OB14WA05		WA-REF-5		1778409.273	1619669.578	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_043	1,123.7	
WA-REF-6 at OB16WA06		WA-REF-6		1777264.264	1619281.623	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-9000.A_063	1,789.1	
SF Acid Canyon at Canyon Road		SF Acid Canyon	about 4 ft from "ACID-ROM-2(a)"	1777118.5	1623660.8	Developed	South Fork Acid	Pueblo	Town Developed	Townsite	No	NMED	stormwater discharge	NA	NA	NM-97.A_029	561.2	
PUN-0.01		PUN-0.01	upstream of Diamond Dr, close to "PU-6.7"	1779312.3	1618681	Developed	North Fork Pueblo	Pueblo	Town Developed	Townsite	No	NMED	surface water	98	Intermittent	NM-9000.A_043	82.4	
PU-6.7		PU-6.7	upstream of Diamond Dr, close to "PUN-0.01"	1779196.3	1618181.63	Developed	Pueblo	Pueblo	Town Developed	Townsite	No	NMED	surface water	98	Intermittent	NM-9000.A_043	46.9	
Walnut above Pueblo		Walnut above Pueblo		1778900.928	1625281.049	Developed	Walnut	Pueblo	Town Developed	Townsite	No	NMED	surface water	98	Intermittent	NM-97.A_004	40.1	
Canada de las Marias		Canada de las Marias		1794681	1646169.5	Undeveloped	Cañada de las Marias	Chupaderos	Northern Reference	Northern	Yes	NMED	surface water	98	Intermittent	NM-9000.A_005	5,434.3	
LU-3.89		LU-3.89		1736972.192	1626389.298	Undeveloped	Lummis	Frijoles	Bandelier Reference	Bandelier	No	NMED	surface water	98	Intermittent	NM-97.A_001	40.5	
Guaje above Rendija E089		E089		1788368.8	1646407.7	Undeveloped	Guaje	Los Alamos	Northern Reference	Northern	Yes	NMED	surface water	98	Intermittent	NM-9000.A_005	69.3	
Pajarito below SR-501 E240		E240		1770945.505	1610350.084	Undeveloped	Pajarito	Pajarito	Western Reference	Western	Yes	NMED	surface water	128	E/I	NM-128.A_07	87.4	
Canon de Valle abv SR-501 E253		E253 up	added "up" based on landscape type to distinguish from "E253"	1765374.357	1609373.8	Undeveloped	Cañon de Valle	Water	Western Reference	Western	Yes	NMED	surface water	128	E/I	NM-128.A_02	78.1	
Water above SR-501 E252		E252 up	added "up" based on landscape type to distinguish from "E252"	1760451	1607279.987	Undeveloped	Water	Water	Western Reference	Western	No	NMED	surface water	128	E/I	NM-9000.A_052	75.9	

NA -- not applicable
LANL -- Los Alamos National Laboratory
NMAC -- New Mexico Administrative Code

E/I/P -- ephemeral/intermittent/perennial
AU -- assessment unit

ID -- identification
NMED -- New Mexico Environment Department

Note: Easting/Northing coordinates are based on Central New Mexico State Plane

Appendix D. Potential Background Threshold Value Statistics for Pajarito Plateau Storm Water Background Dataset

Appendix D. Potential background threshold value statistics for Pajarito Plateau storm water

												Distribution Assumption			95-95 UTL					95% UPL					95% USL					Upper Percentiles					
Constituent	Sample Prep.	Landscape	Data Subset Description	Appendix B Section	SSC-Norm.	Units	N	Detection Frequency	No. of Detects	No. of DLs	Non-Detect Estimation Method	Based on ProUCL Test (Step 4.1)	Confirmed with Q-Q Plots (Step 4.2)	Geomean	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	75th	80th	90th	95th	Max.	Note on BTVs
Aluminum	F	Developed	All locations	2	Yes	mg/kg SSC	76	96%	73	4	KM	lognormal	lognormal	280	5300	--	--	--	11000	3400	--	--	--	11000	31000	--	--	--	13000	600	780	2100	5100	13000	none
Aluminum	F	Undeveloped	SEP Reference	1	No	µg/L	16	100%	16	1	--	all	any	1400	9100	6300	5900	4300	3600	5400	4400	4200	3600	6300	8600	6100	5700	4200	3600	2400	2800	3200	3400	3600	limited spatial scope
Aluminum	F	Undeveloped	Locations other than SEP Reference (major group) and E240 (d/s of SR-501)	1	No	µg/L	51	100%	51	3	--	lognormal	lognormal	370	2400	--	--	--	2600	1700	--	--	--	4900	5400	--	--	--	6700	570	730	1200	1400	6700	none
Aluminum	F	Undeveloped	E240 gage location (d/s of SR-501)	1	No	µg/L	14	100%	14	2	--	lognormal	lognormal	1300	15000	--	--	--	12000	7200	--	--	--	15000	12000	--	--	--	12000	1700	1800	2200	5500	12000	limited spatial scope
Aluminum	UF	Developed	All locations	4	Yes	mg/kg SSC	44	100%	44	7	--	gamma	gamma	9100	--	67000	61000	--	100000	--	50000	48000	--	95000	--	110000	97000	--	100000	19000	22000	34000	39000	100000	none
Aluminum	UF	Undeveloped	SEP and Western Reference	3	Yes	mg/kg SSC	39	100%	39	8	--	lognormal or gamma	lognormal or gamma	13000	110000	80000	76000	--	130000	70000	60000	59000	--	130000	220000	130000	110000	--	130000	26000	28000	36000	47000	130000	none
Aluminum	UF	Undeveloped	Northern and Bandelier Reference	3	Yes	mg/kg SSC	30	100%	30	7	--	all	any	4100	46000	26000	24000	17000	20000	27000	19000	18000	15000	29000	82000	37000	32000	20000	20000	9500	9900	12000	15000	20000	none
Antimony	F	Developed	All locations	5	No	µg/L	111	15%	17	1	None	gamma	none (instability)	1.4	--	2.5	2.6	--	6.1	--	2.2	2.3	--	6.5	--	5.1	5.1	--	7.2	3.0	3.0	3.0	4.4	7.2	DF insufficient to reasonably estimate non-detect concentrations; percentiles, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Arsenic	F	Developed	All locations	7	No	µg/L	113	8%	9	2	None	all	any (uncertain)	2.3	1.9	1.9	1.9	1.9	5.0	1.8	1.8	1.8	1.9	2.4	2.1	2.1	2.1	2.2	5.0	5.0	5.0	5.0	5.0	5.0	DF insufficient to reasonably estimate non-detect concentrations, therefore UTLs, UPLs, and USLs are not recommended. Percentiles based on detection limits.
Arsenic	F	Undeveloped	All locations	6	No	µg/L	78	13%	10	2	None	all	any (uncertain)	2	2.5	2.6	2.6	2.9	6.0	2.3	2.4	2.4	2.7	4.4	3.2	3.3	3.3	3.6	6.2	2.6	5.0	6.0	6.0	6.2	Dataset has a relatively high degree of instability, the source of which could not be identified (Appendix B, Section 9). Because of instability, no BTVs are recommended.
Benzo(a)pyrene	UF	Developed	All locations	39	No	µg/L	30	37%	11	16	KM	all	any	0.051	0.12	0.11	0.11	0.10	0.13	0.092	0.089	0.088	0.087	0.16	0.16	0.14	0.13	0.11	0.13	0.062	0.062	0.067	0.10	0.13	Percentiles (except 75th), maximum value, and nonparametric UTL and USL represent analytical detection limits.
Boron	F	Developed	Lab Developed	9	No	µg/L	35	40%	14	1	ROS	lognormal or gamma	none (instability)	24	59	120	91	--	70	45	78	63	--	72	89	220	150	--	70	38	44	50	50	70	Maximum and non-parametric UTL, UPL, and USL represent an analytical detection limit.
Boron	F	Developed	Town Developed	9	No	µg/L	77	23%	18	1	KM	all	any	21	27	38	34	24	50	25	32	30	23	32	41	67	56	28	50	24	50	50	50	50	Maximum and non-parametric UTL, UPL, and USL represent an analytical detection limit.
Boron	F	Undeveloped	Western and Northern Reference	8	No	µg/L	40	38%	15	1	ROS	all	any	17	31	41	38	25	50	26	33	31	24	34	41	60	52	28	50	20	20	23	28	50	none
Boron	F	Undeveloped	SEP and Bandelier Reference	8	No	µg/L	25	40%	10	1	ROS	all	any	17	22	24	23	20	50	20	21	21	19	50	24	26	25	21	50	17	17	21	45	50	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cadmium	F	Developed	All locations	11	No	µg/L	113	3%	3	2	None	normal or lognormal	none (too uncertain)	0.24	0.14	--	--	0.16	1.0	0.14	--	--	0.15	0.21	0.17	--	--	0.19	1.0	1.0	1.0	1.0	1.0	1.0	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cadmium	F	Undeveloped	All locations	10	No	µg/L	77	4%	3	2	None	normal or lognormal	none (too uncertain)	0.16	0.15	--	--	0.17	1.0	0.14	--	--	0.16	0.25	0.19	--	--	0.21	1.0	0.3	0.3	0.3	1.0	1.0	none
Chromium	F	Developed	All locations	13	No	µg/L	114	13%	15	2	None	lognormal	none	3.6	4.9	--	--	--	10	4.4	--	--	--	17	8.3	--	--	--	33	7.7	10	10	10	33	Review of Q-Q plot indicates lognormal as most accurate of distribution assumptions.
Chromium	F	Undeveloped	All locations	12	No	µg/L	78	8%	6	2	None	all	none	2.5	2.3	2.3	2.4	2.5	10	2.1	2.1	2.2	2.4	4.1	3.3	3.3	3.3	3.3	10	3	3	3	10	10	None of the distributions fit to the cobalt data due to the presence of a single extreme concentration. There is no clear reason to exclude the extreme value (Appendix B, Section 14). There is a high degree of uncertainty associated with all BTVs. Maximum, 95th percentile, and non-parametric UTL and USL represent detection limits.
Cobalt	F	Developed	All locations	15	No	µg/L	112	33%	37	2	KM	lognormal	lognormal	1.6	3.2	--	--	--	5.2	2.9	--	--	--	6.6	6.1	--	--	--	7.2	2.3	2.8	5.0	5.0	7.2	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit. This BTV is highly uncertain because the error rate associated with the maximum is unknown.
Cobalt	F	Undeveloped	Western and Northern Reference	14	No	µg/L	57	67%	38	2	KM	all	lognormal	1.9	6.5	5.9	5.8	5.3	6.5	5.3	5.1	5.0	4.8	8.8	12	9.2	8.7	6.7	7.0	3.2	3.4	4.3	4.8	7.0	95th percentile, maximum value, and nonparametric UTL and USL represent an analytical detection limit.
Cobalt	F	Undeveloped	SEP and Bandelier Reference	14	No	µg/L	21	38%	8	1	ROS	none	none	1.2	--	--	--	--	5.0	--	--	--	--	2.0	--	--	--	--	5.0	1.2	1.2	1.9	2.4	5.0	Review of Q-Q plot indicates lognormal and gamma distribution assumptions as more accurate than normality.
Copper	F	Developed	Lab Developed	17	No	µg/L	33	100%	33	2	--	all	lognormal or gamma	5	17	15	14	12	13	13	12	12	11	19	24	19	18	14	13	6.8	8.1	11	12	13	None of the distribution types attempted explain the copper distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Copper	F	Developed	Town Developed	17	No	µg/L	77	99%	76	1	KM	none	none	4	--	--	--	--	20	--	--	--	--	24	--	--	--	--	26	5.2	5.9	8	15	26	none
Copper	F	Undeveloped	Minor groups other than Bandelier	16	No	µg/L	71	82%	58	2	KM	lognormal or gamma	lognormal or gamma	1.9	5.2	4.6	4.5	--	5.1	4.4	4.1	4.0	--	6.7	9.5	7.2	6.8	--	5.6	2.9	3.0	3.3	4.0	5.6	none
Gross alpha	UF	Developed	All locations	34	Yes	pCi/g SSC	46	93%	43	1	KM	normal or gamma	normal or gamma	22	--	82	76	59	63	--	67	63	53	95	--	130	110	72	66	36	40	47	53	66	Review of Q-Q plot indicates lognormal distribution assumption as more accurate than gamma.
Gross alpha	UF	Undeveloped	All locations	33	Yes	pCi/g SSC	45	96%	43	1	KM	lognormal or gamma	lognormal	22	190	130	120	--	100	130	100	98	--	200	450	220	200	--	220	38	53	66	98	220	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit.

Constituent	Sample Prep.	Landscape	Data Subset Description	Appendix B Section	SSC-Norm.	Units	N	Detection Frequency	No. of Detects	No. of DLs	Non-Detect Estimation Method	Distribution Assumption		Geomean	95-95 UTL					95% UPL					95% USL					Upper Percentiles				Max.	Note on BTVs
												Based on ProUCL Test (Step 4.1)	Confirmed with Q-Q Plots (Step 4.2)		Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	75th	80th	90th	95th		
Lead	F	Developed	All locations	19	No	µg/L	114	29%	33	2	KM	none	none	0.87	--	--	--	--	7.1	--	--	--	--	22	--	--	--	--	50	2.0	2.0	2.0	2.9	50	none
Lead	F	Undeveloped	Minor groups other than Bandelier	18	No	µg/L	73	51%	37	2	KM	none	none	0.72	--	--	--	--	4.6	--	--	--	--	6.6	--	--	--	--	10	0.91	0.99	1.5	2.2	10	None of the distributions fit the mercury data due to the presence of a single extreme concentration. There does not appear to be a clear reason to exclude the single high value (Appendix B, Section 20).
Mercury	UF	Developed	All locations	21	No	µg/L	83	8%	7	3	None	all	any (unclear)	0.073	0.014	0.047	0.060	0.14	0.20	0.0072	0.031	0.042	0.13	0.30	0.27	0.19	0.19	0.22	0.48	0.2	0.2	0.2	0.2	0.48	none
Mercury	UF	Undeveloped	Western and Northern Reference, excluding E240 gage location	20	No	µg/L	40	38%	15	2	KM	all	any	0.094	0.31	0.27	0.26	0.23	0.60	0.22	0.21	0.21	0.20	0.40	0.57	0.41	0.39	0.29	0.60	0.14	0.17	0.21	0.29	0.60	Review of Q-Q plot indicates lognormal and gamma distribution assumptions as more accurate than normality.
Mercury	UF	Undeveloped	SEP and Bandelier Reference	20	No	µg/L	21	43%	9	1	ROS	none	none	0.079	--	--	--	--	0.42	--	--	--	--	0.42	--	--	--	--	0.42	0.079	0.079	0.10	0.11	0.42	none
Nickel	F	Developed	All locations	23	No	µg/L	112	94%	105	1	KM	lognormal or gamma	lognormal or gamma	1.5	4.8	4.4	4.4	--	4.4	4.1	3.9	3.9	--	7.6	11	8.2	7.6	--	11	2.2	2.4	3.1	3.8	11	None of the distribution types attempted explain the lead distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset apart from several percentiles which are equal to a detection limit.
Nickel	F	Undeveloped	Chupaderos, Garcia, and Mortandad	22	No	µg/L	18	100%	18	1	--	all	lognormal or gamma	1.9	5.4	4.9	4.8	4.3	4.5	4.1	3.9	3.8	3.7	6.1	5.5	5.0	4.9	4.3	4.5	2.5	2.6	3.1	3.6	4.5	None of the distribution types attempted explain the lead distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Nickel	F	Undeveloped	Watersheds other than Chupaderos, Garcia, and Mortandad	22	No	µg/L	60	88%	53	2	KM	gamma	gamma	0.99	--	2.5	2.4	--	2.1	--	2.2	2.2	--	3.9	--	3.6	3.5	--	4.6	1.4	1.5	1.7	1.8	4.6	none
Radium-226 and radium	UF	Developed	All locations	36	Yes	pCi/g SSC	39	62%	24	1	ROS	lognormal or gamma	lognormal	3.0	17	15	14	--	27	12	11	11	--	25	36	23	21	--	27	5.4	6.1	10	11	27	Insufficient samples to estimate BTVs.
Radium-226 and radium	UF	Undeveloped	All locations	35	Yes	pCi/g SSC	13	85%	11	1	KM	lognormal or gamma	lognormal or gamma	2.5	23	16	15	--	15	11	9.6	9.4	--	19	17	13	12	--	15	3.5	4.1	7.5	11	15	none
Selenium	UF	Developed	All locations	25	No	µg/L	88	5%	4	3	None	all	none (too uncertain)	2.4	2.2	2.6	2.7	4.3	5.6	2.0	2.3	2.4	3.9	8.2	3.4	4.0	4.3	6.3	15	5.0	5.0	5.6	5.6	15	Insufficient samples to estimate BTVs.
Selenium	UF	Undeveloped	Watersheds other than Mortandad	24	No	µg/L	71	32%	23	2	KM	lognormal or gamma	lognormal or gamma	2	7.0	7.1	7.2	--	15	5.6	5.9	6.0	--	15	16	13	13	--	17	2.5	3.5	4.8	7.5	17	Review of Q-Q plot indicated that lognormal distribution assumption was more accurate than gamma (based on upper tail of distribution).
Thallium	F	Developed	All locations	26	No	µg/L	113	3%	3	3	None	normal or lognormal	none (too uncertain)	0.68	0.38	--	--	0.40	2.0	0.37	--	--	0.39	0.50	0.44	--	--	0.45	2.0	2.0	2.0	2.0	2.0	2.0	none
Total PCBs	UF	Developed	Minor watersheds other than South Fork Acid	38	No	µg/L	87	100%	87	8	--	lognormal	lognormal	0.0046	0.064	--	--	--	0.13	0.044	--	--	--	0.14	0.33	--	--	--	0.19	0.012	0.014	0.028	0.048	0.19	There appears to be instability in this dataset (Appendix B, Section 5), but the source of the instability cannot be determined; thus, BTVs are recommended.
Total PCBs	UF	Developed	South Fork Acid	38	No	µg/L	9	100%	9	1	--	lognormal or gamma	none (too uncertain)	0.021	0.53	0.28	0.25	--	0.12	0.17	0.14	0.13	--	0.22	0.20	0.15	0.14	--	0.12	0.038	0.056	0.091	0.11	0.12	DF insufficient to reasonably estimate non-detect concentrations, so UTLs, UPLs, and USLs are not recommended; percentiles appear to be driven by detection limit.
Total PCBs	UF	Undeveloped	Northern and Western Reference	37	No	µg/L	41	100%	41	9	--	lognormal	lognormal	0.001	0.058	--	--	--	0.13	0.027	--	--	--	0.098	0.25	--	--	--	0.13	0.0043	0.0055	0.012	0.017	0.13	none
Total PCBs	UF	Undeveloped	SEP Reference	37	No	µg/L	9	100%	9	1	--	none	none (too uncertain)	0.000048	--	--	--	--	0.0017	--	--	--	--	0.0029	--	--	--	--	0.0017	0.000056	0.00023	0.00075	0.0012	0.0017	Percentiles, maximum, and nonparametric UTL and USL represent an analytical detection limit. Insufficient DF to estimate parametric statistics. Although the geomean was estimated as a BTV (approximately 10% of LANL's 2010 IP ATAL), geomeans are generally not recommended for use as BTVs. The geomean BTV is highly uncertain due to the low DF.
Uranium	F	Developed	All locations	28	No	µg/L	101	38%	38	1	KM	none	none	0.095	--	--	--	--	0.33	--	--	--	--	0.59	--	--	--	--	0.98	0.12	0.19	0.20	0.22	0.98	None of the distribution types attempted explain the uranium distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Uranium	F	Undeveloped	Watersheds other than Mortandad and Jemez River	27	No	µg/L	53	68%	36	1	ROS	lognormal	lognormal	0.12	0.68	--	--	--	0.70	0.49	--	--	--	0.83	1.6	--	--	--	0.71	0.19	0.23	0.31	0.48	0.71	none
Uranium	F	Undeveloped	Jemez River	27	No	µg/L	8	50%	4	1	ROS	all	none (too uncertain)	0.1	0.30	0.31	0.30	0.27	0.19	0.22	0.23	0.22	0.21	0.33	0.22	0.23	0.22	0.21	0.19	0.16	0.16	0.17	0.18	0.19	Insufficient samples to estimate BTVs.
Vanadium	F	Developed	All locations	30	No	µg/L	113	96%	109	2	KM	none	none	2.6	--	--	--	--	9.7	--	--	--	--	18	--	--	--	--	24	3.9	4.4	5.5	8.2	24	None of the distribution types attempted explain the vanadium distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.
Vanadium	F	Undeveloped	Watersheds other than Mortandad	29	No	µg/L	74	93%	69	2	KM	none	none	2.3	--	--	--	--	8.8	--	--	--	--	27	--	--	--	--	49	3.2	3.4	4.3	4.9	49	None of the distributions fit the vanadium data due to the presence of 1 or 2 extreme concentrations. There does not appear to be a clear reason to exclude the high values (Appendix B, Section 29).
Zinc	F	Developed	All locations	32	No	µg/L	114	91%	104	2	KM	gamma	gamma	25	--	130	120	--	120	--	110	100	--	180	--	280	240	--	140	55	58	77	100	140	none
Zinc	F	Undeveloped	Watersheds other than Garcia	31	No	µg/L	72	62%	45	2	KM	none	none	5.4	--	--	--	--	31	--	--	--	--	35	--	--	--	--	43	7.2	7.6	10	16	43	None of the distribution types attempted explain the zinc distribution. It may be explained by a different distribution type, but ProUCL does not have capabilities beyond normal, lognormal, or gamma. Nonparametric statistics should be valid for this dataset.

												Distribution Assumption			95-95 UTL					95% UPL					95% USL					Upper Percentiles					
Constituent	Sample Prep.	Landscape	Data Subset Description	Appendix B Section	SSC-Norm.	Units	N	Detection Frequency	No. of Detects	No. of DLs	Non-Detect Estimation Method	Based on ProUCL Test (Step 4.1)	Confirmed with Q-Q Plots (Step 4.2)	Geomean	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	Log-normal	Gamma (HW method)	Gamma (WH method)	Normal	Non-param.	75th	80th	90th	95th	Max.	Note on BTVs

d/s -- downstream
DL -- detection limit
F -- filtered
HW -- Hawkins-Wixley
KM -- Kaplan-Meier
N -- sample size
PCB -- polychlorinated biphenyl
Q-Q -- quantile-quantile
ROS -- regression on order statistics
SEP -- Supplemental Environmental Program
SR -- state route
SSC -- suspended sediment concentration
TM -- technical memorandum
UF -- unfiltered
UPL -- upper prediction limit
USL -- upper simultaneous limit
UTL -- upper tolerance limit
WH -- Wilson-Hilferty

Notes:

All data subsets were established in Section 3 of the main text (Table 3-4). The development of these subsets is described in Appendix B; the applicable Appendix B section for each subset is provided in Appendix D. All potential BTV statistics in Appendix D have been rounded to two significant figures. Potential BTV statistics that are not recommended have been shaded gray and are italicized. The "Note on Recommendations" column provides rationale for recommendations against using BTVs. Section 5.3.1 of the main text provides rationale for the selection of BTVs; Appendix G provides the BTVs that were ultimately recommended (if any) for each data subset.

To estimate non-detect values, ProUCL software was used. ProUCL provides several options for non-detect value estimation, which are more or less appropriate depending on the specific dataset (Bolks et al. 2014; Antweiler et al. 2008; Annan et al. 2009; EPA 2013). The KM method was used in cases where there were multiple detection limits in a dataset (for non-detected values) and/or when the detection frequency was between 20% and 50%. The KM method was also used when detection frequencies exceeded 85% and sample sizes were greater than or equal to 50. The ROS method was used when there was only one detection limit (for non-detected values) in the dataset, and where the detection frequency was greater than or equal to 50%. If a dataset was not large (n<50), then the ROS method was used at detection frequencies exceeding 85%. Above 85%, the KM and ROS methods are expected to result in similar estimates if both datasets are sufficiently large (n≥50) (Annan et al. 2009); in this case, the KM method is reported. ProUCL recommends not using half the detection limit as a method for non-detect estimation.

ProUCL provides several statistical tests for determining whether the normal, gamma, or lognormal distributions are adequate assumptions for the actual storm water constituent data subsets. ProUCL provides an indication of significance in its standard data output. A significant distribution "goodness-of-fit" test result indicates that the distribution assumption is not valid. In cases where the ProUCL goodness-of-fit test result was significant, no UTL, UPL, or USL statistics are reported for the associated distribution type ("--"). Nonparametric versions of those statistics are reported regardless of the goodness-of-fit test results because nonparametric statistics do not rely on distribution assumptions.

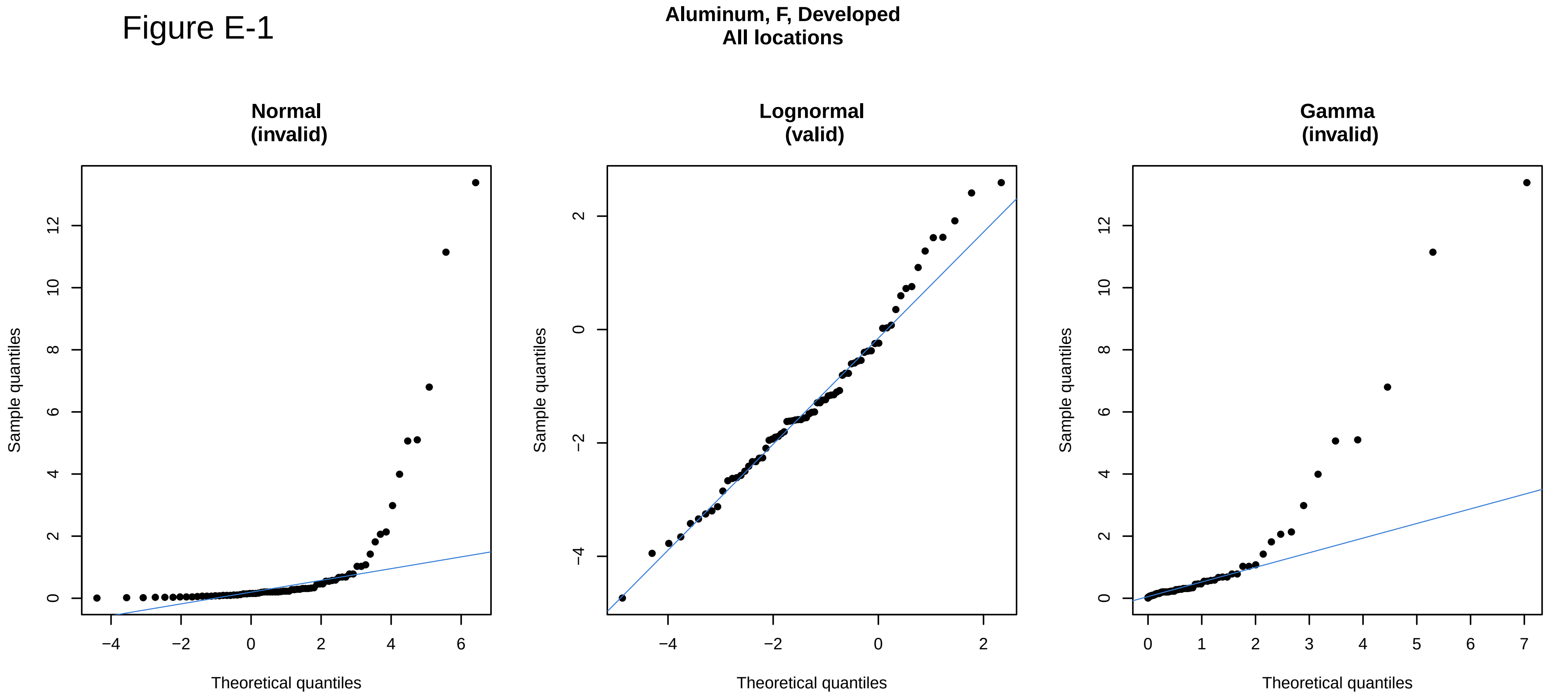
Q-Q plots (Appendix E) were used to confirm or update the results of ProUCL goodness-of-fit tests (Appendix E and F). This process was semi-quantitative, in that professional judgment was used to visually determine if a distribution assumption was valid and if one distribution assumption was more accurate than another. In cases where there were too few data to reasonably assume a distribution type, it was determined that no distribution assumption should be made. Similarly, in cases where the data appeared to be relatively unstable (see "Note on Recommendations"), then no distribution assumption was made. If distributions that were identified as valid by ProUCL were not selected based on Q-Q plot visualization, then the potential BTV statistics based on those distributions were not recommended.

References cited

Annan SY, Liu P, Zhang Y. 2009. Comparison of the Kaplan-Meier, maximum likelihood, and ROS estimators for left-censored data using simulation studies.
Antweiler RC, Taylor HE. 2008. Evaluation of statistical treatments of left-censored environmental data using coincident uncensored data sets: I. Summary statistics. Environ Sci Tech 42:3732-3738.
Bolks A, DeWire A, Harcum JB. 2014. Baseline assessment of left-censored environmental data using R. Tech Notes 10 June 2014:1-28.
EPA. 2013. ProUCL Version 5.0.00 technical guide. Statistical software for environmental applications for data sets with and without nondetect observations. EPA/600/R-07/041. US Environmental Protection Agency, Washington, DC.

Appendix E. Figures, Background Characterization Framework Assessments, Steps 4 and 5

Figure E-1


Aluminum, F, Developed
All locations
Normal
(invalid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0
2
4
6
8
10
12
−4
−2
0
2
4
6
2
0
−2
−4
−4
−2
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8
10
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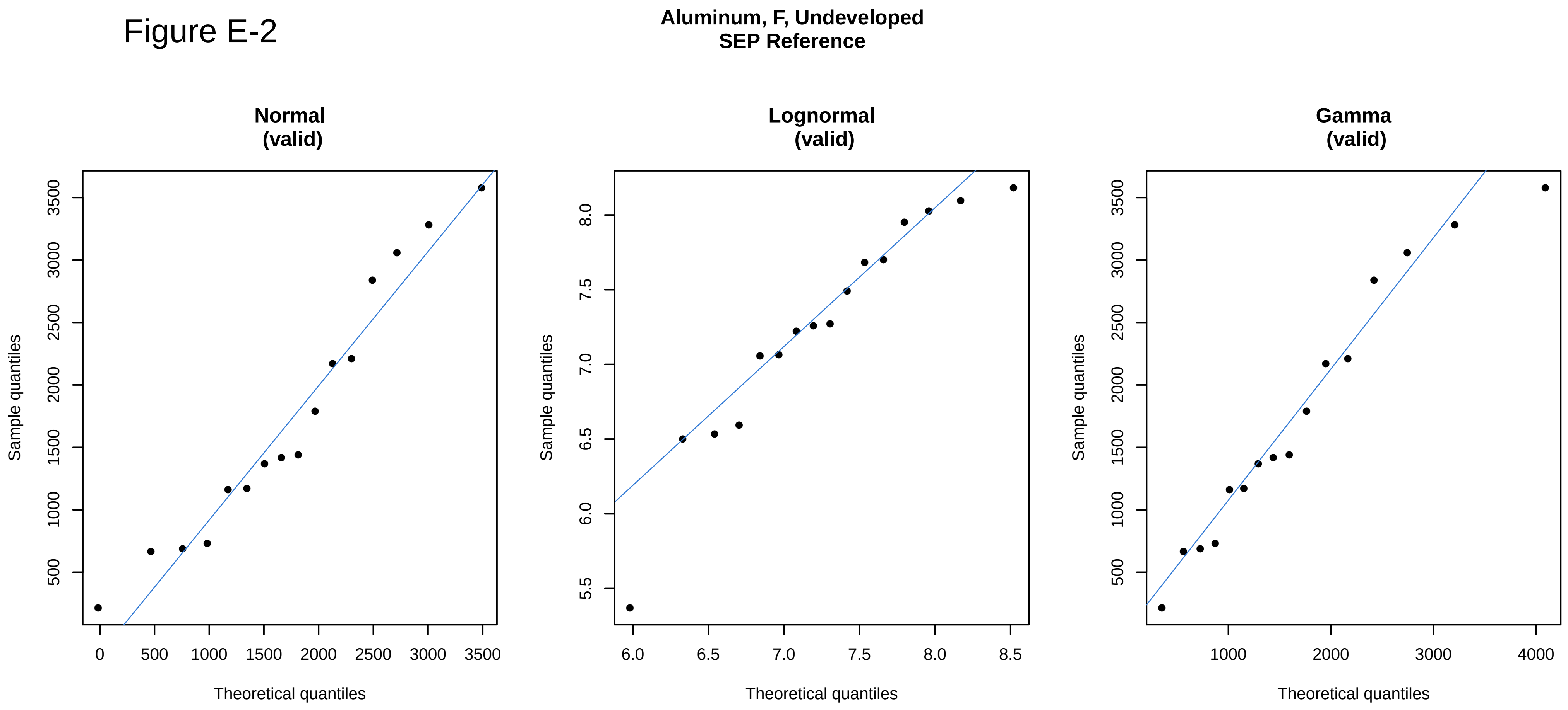
1
2
3
4
5
6
7

Figure E-2



Aluminum, F, Undeveloped
SEP Reference
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
500
1000
1500
2000
2500
3000
3500
0
4000
5.5
6.0
6.5
7.0
7.5
8.0
8.5

Figure E-3

Aluminum, F, Undeveloped
Locations other than SEP Reference (major group) and E240 (d/s of SR−501)

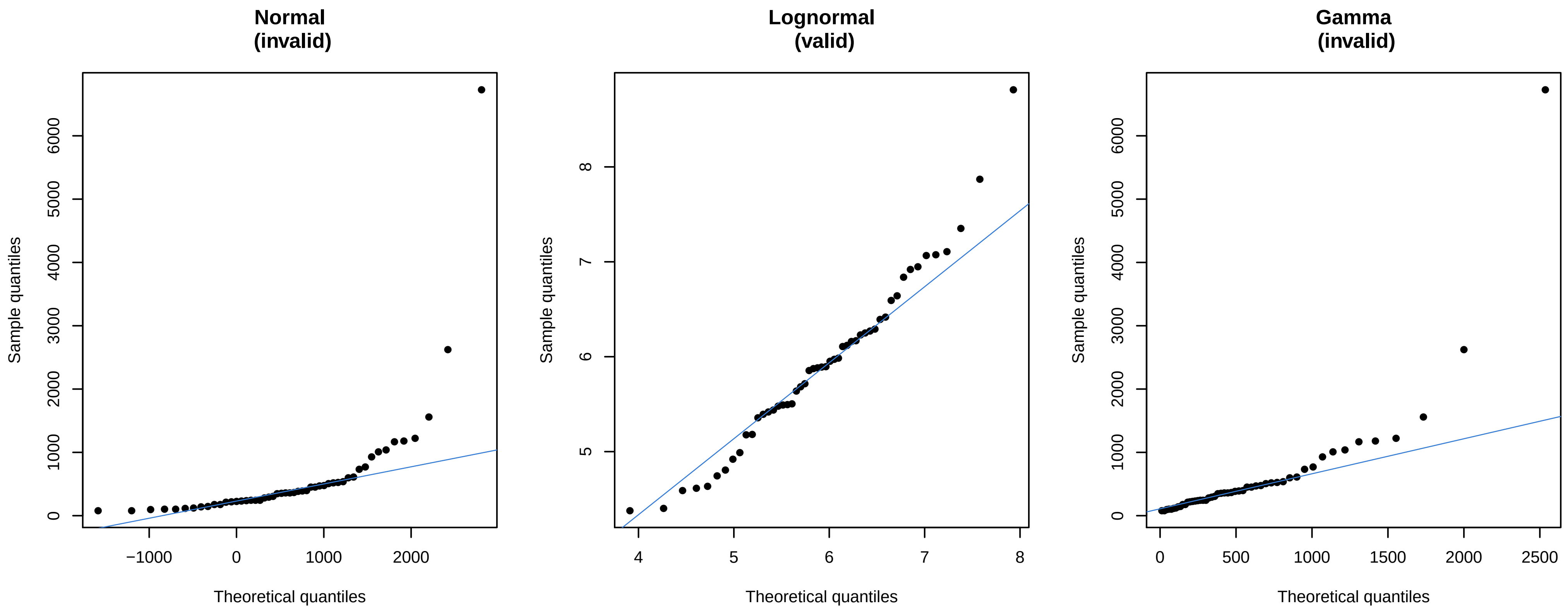


Figure E-4

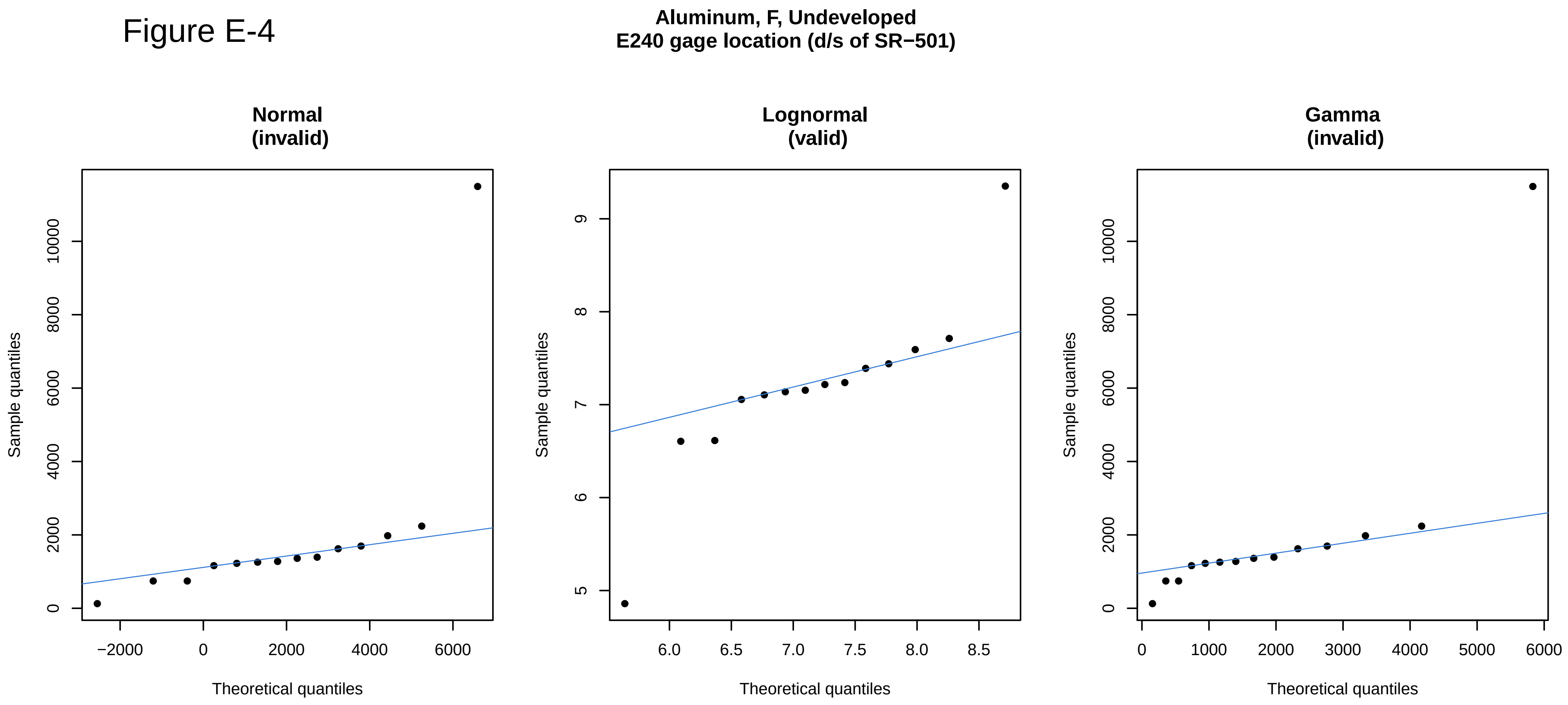
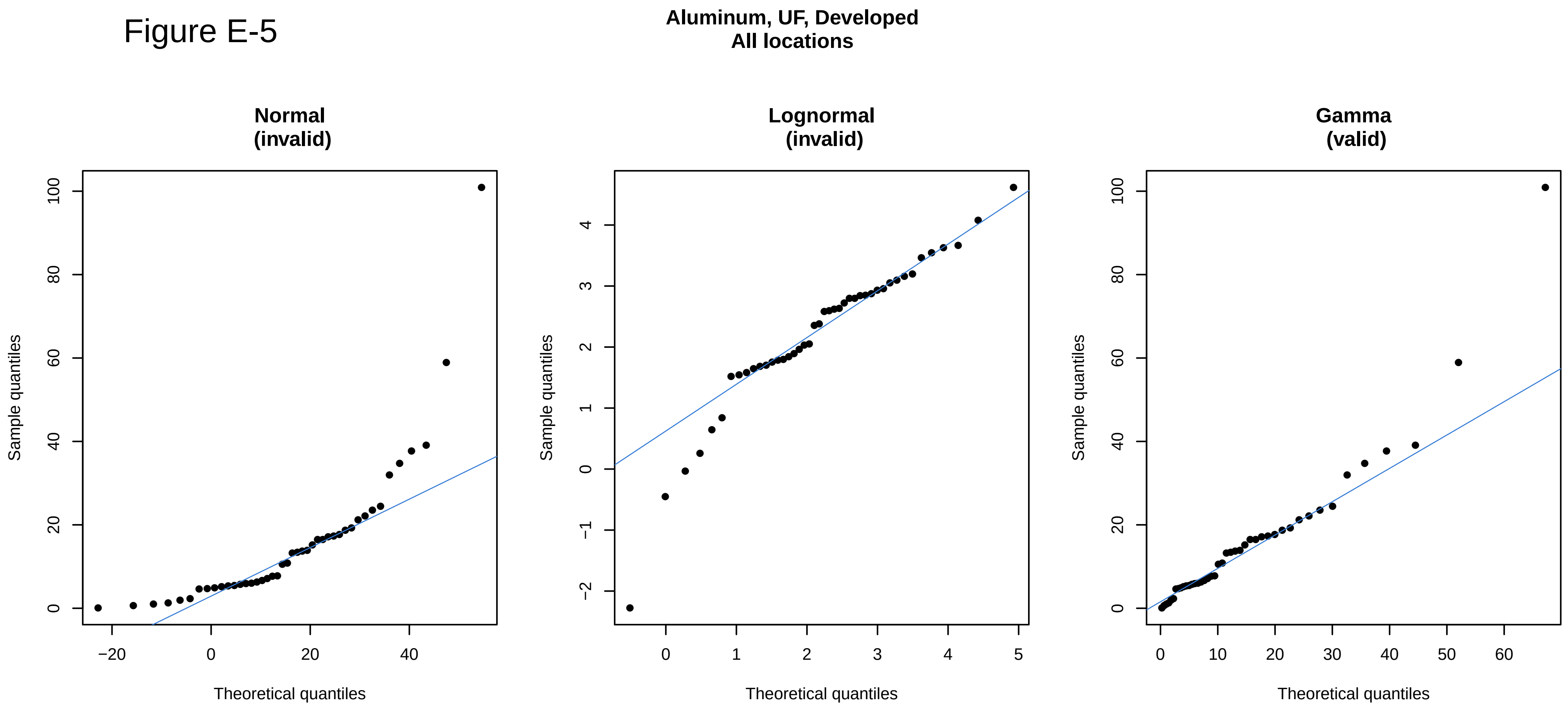

Aluminum, F, Undeveloped
E240 gage location (d/s of SR−501)
Normal
(invalid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0
2000
4000
6000
8000
10000
−2000
5
6
7
8
9
6.0
6.5
7.0
7.5
8.0
8.5
1000
3000
5000

Figure E-5



Aluminum, UF, Developed
All locations
Normal
(invalid)
Lognormal
(invalid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles

Figure E-6

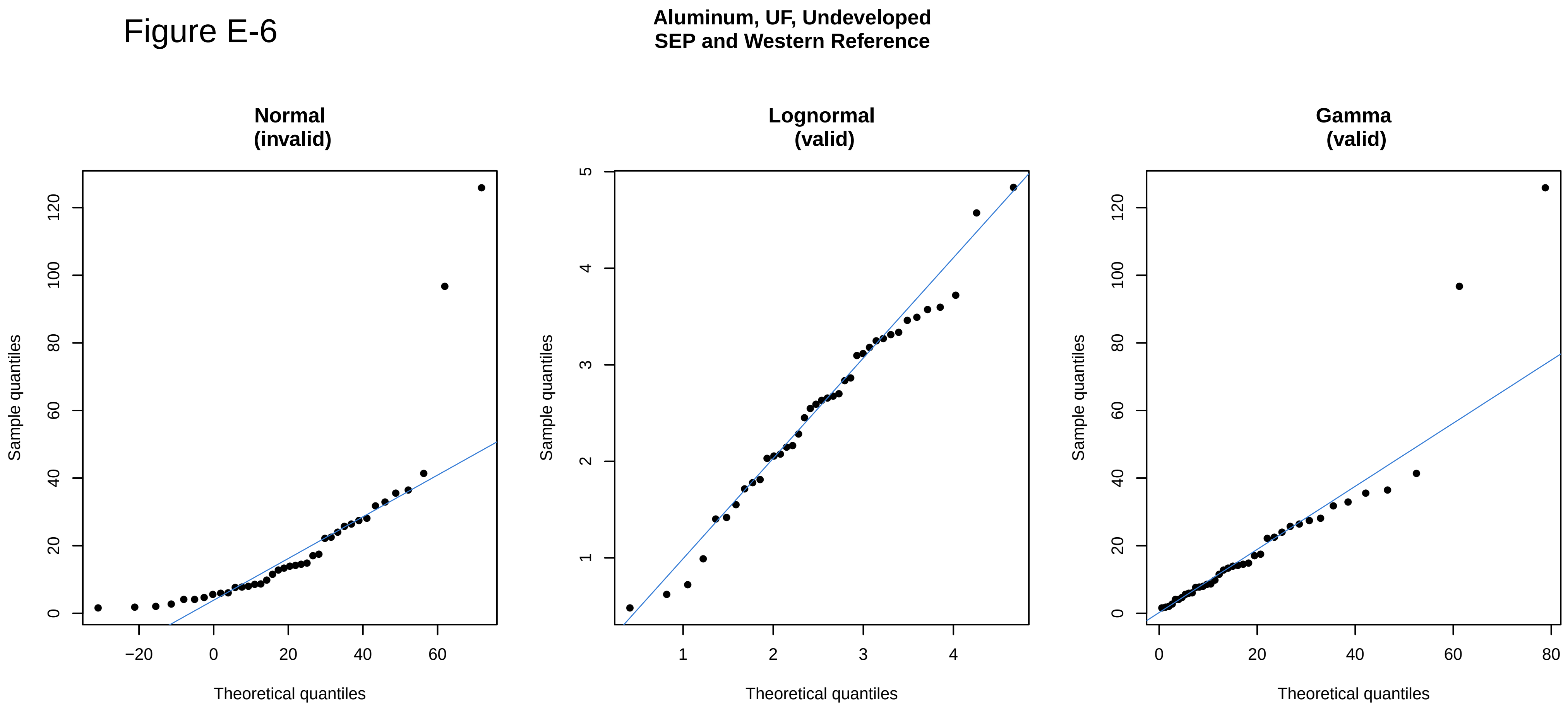

Aluminum, UF, Undeveloped
SEP and Western Reference
Normal
(invalid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0
20
40
60
80
100
120
−20
1
2
3
4
5

Figure E-7

Aluminum, UF, Undeveloped
Northern and Bandelier Reference

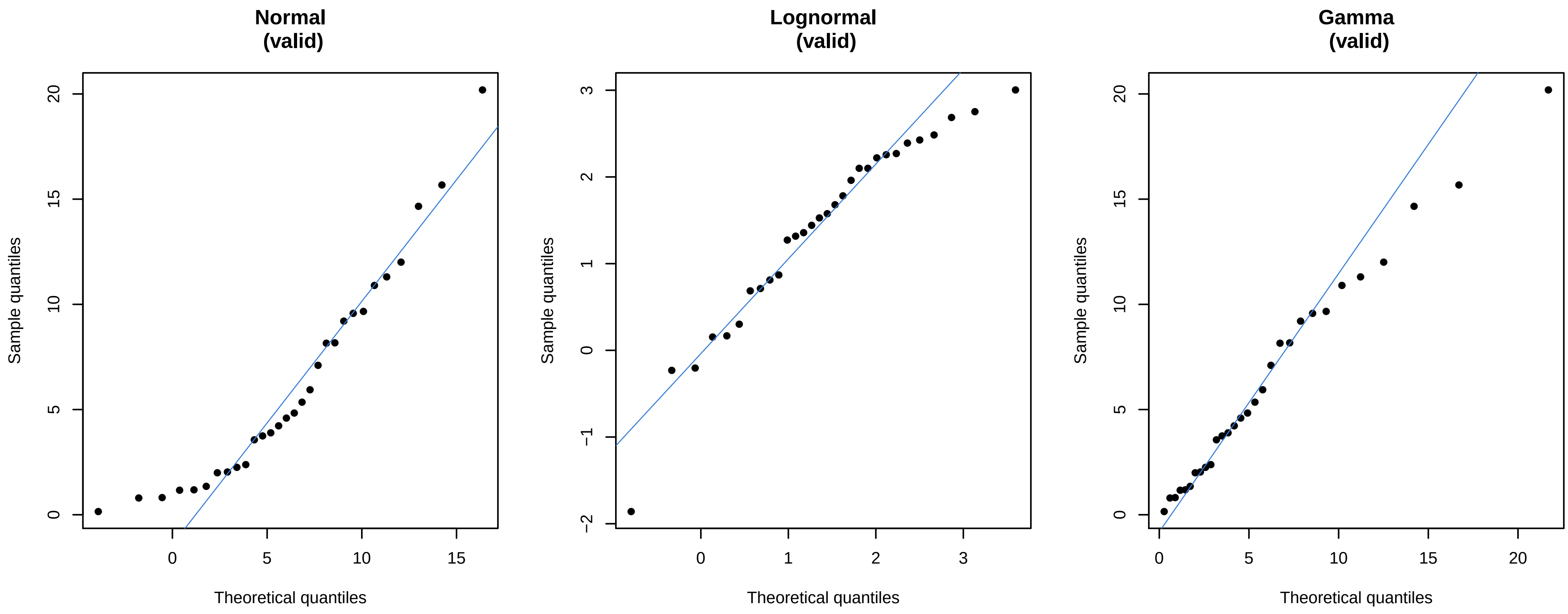
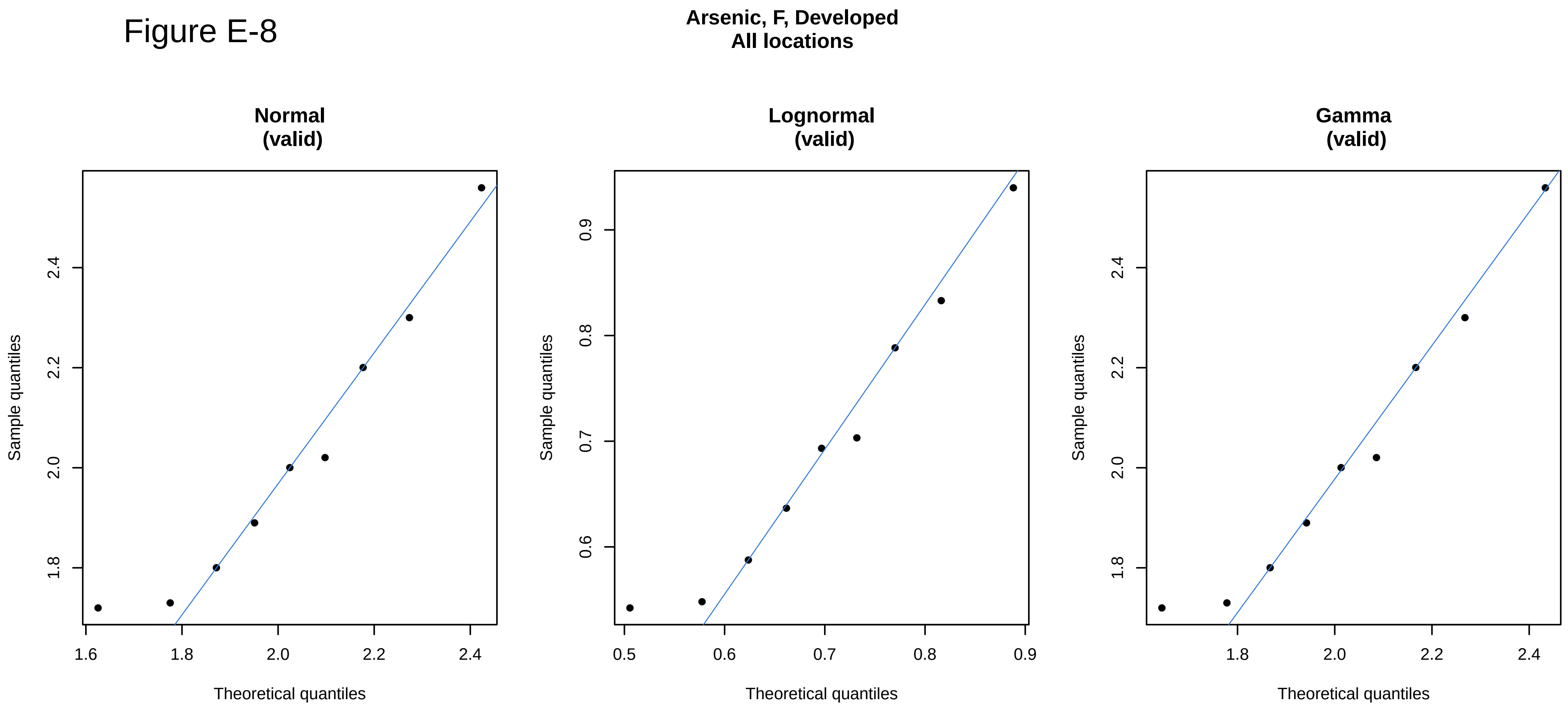


Figure E-8


Arsenic, F, Developed
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
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2.2
2.4
1.6
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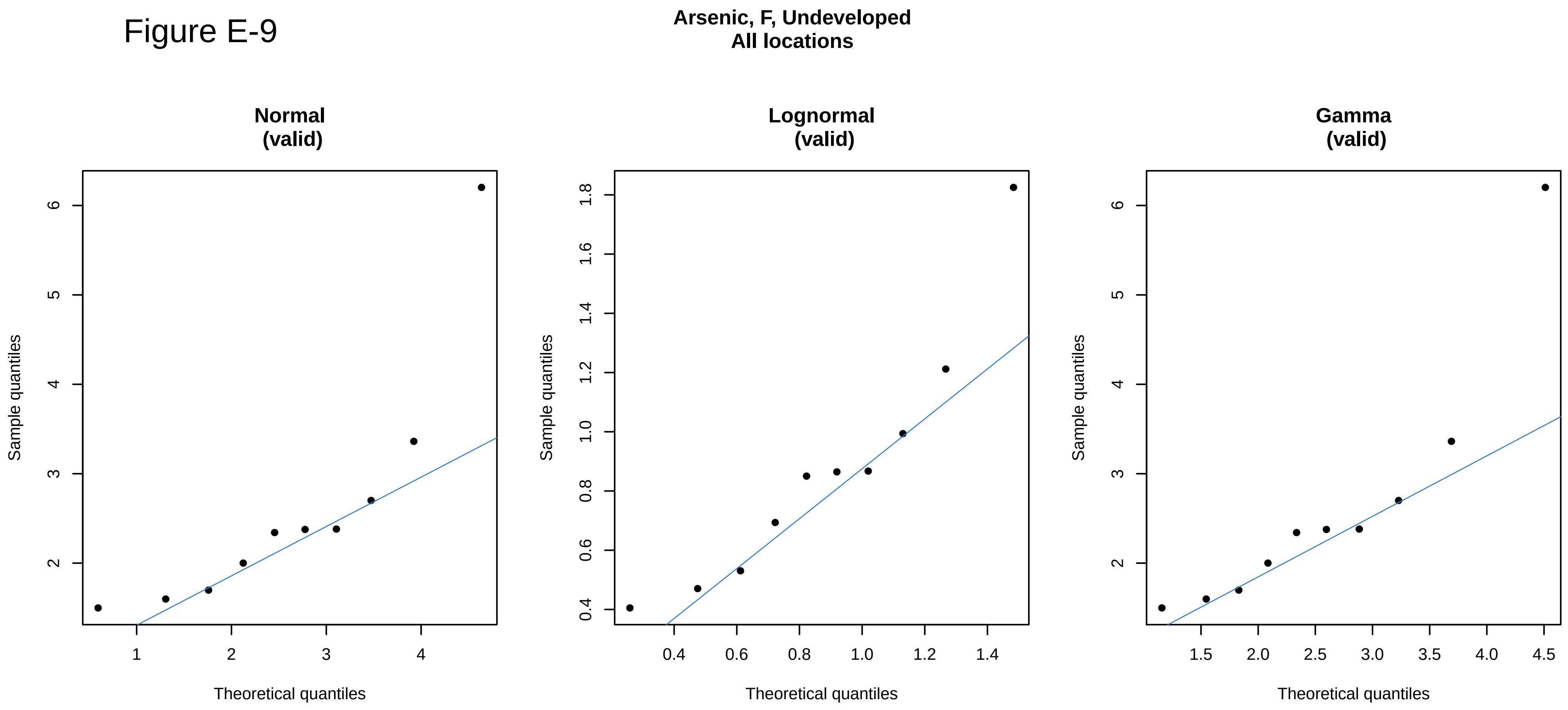
0.6
0.7
0.8
0.9

Figure E-9


Arsenic, F, Undeveloped
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
2
3
4
5
6
1
2
3
4
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
0.4
0.6
0.8
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1.4
1.5
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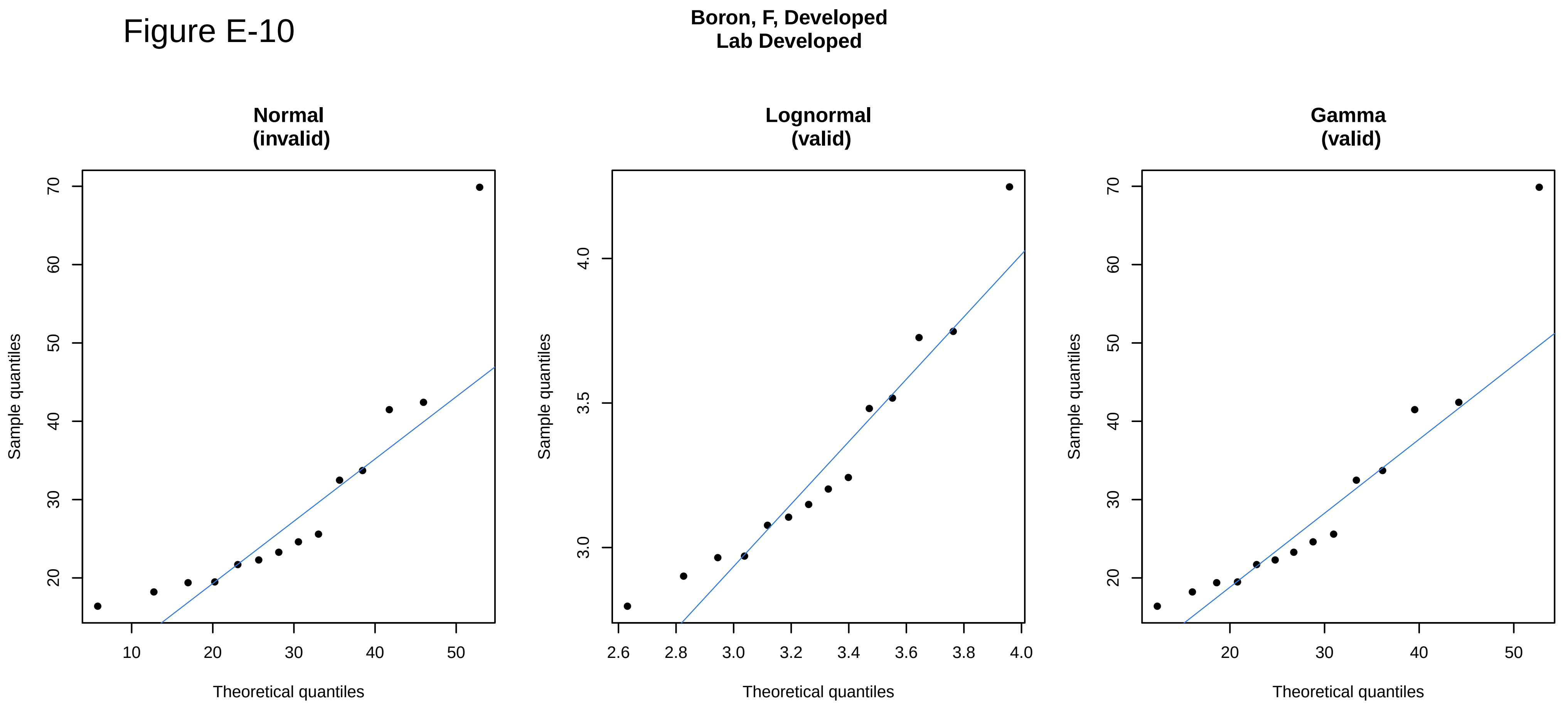
3.0
3.5
4.0
4.5

Figure E-10


Boron, F, Developed
Lab Developed
Normal
(invalid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
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40
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60
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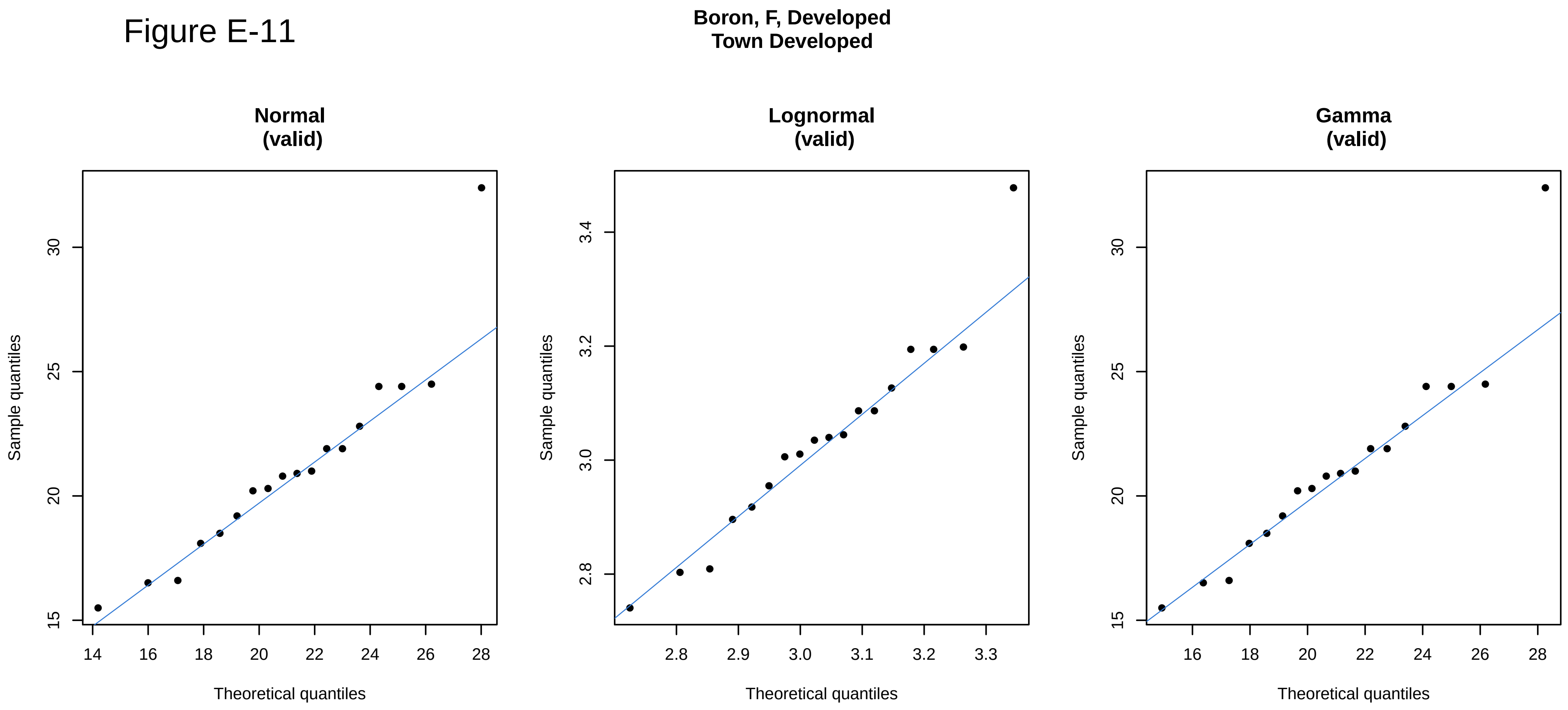
4.0
2.6
2.8
3.2
3.4
3.6
3.8

Figure E-11



Boron, F, Developed
Town Developed
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
15
20
25
30
14
16
18
20
22
24
26
28
2.8
3.0
3.2
3.4
2.9
3.1
3.3

Figure E-12

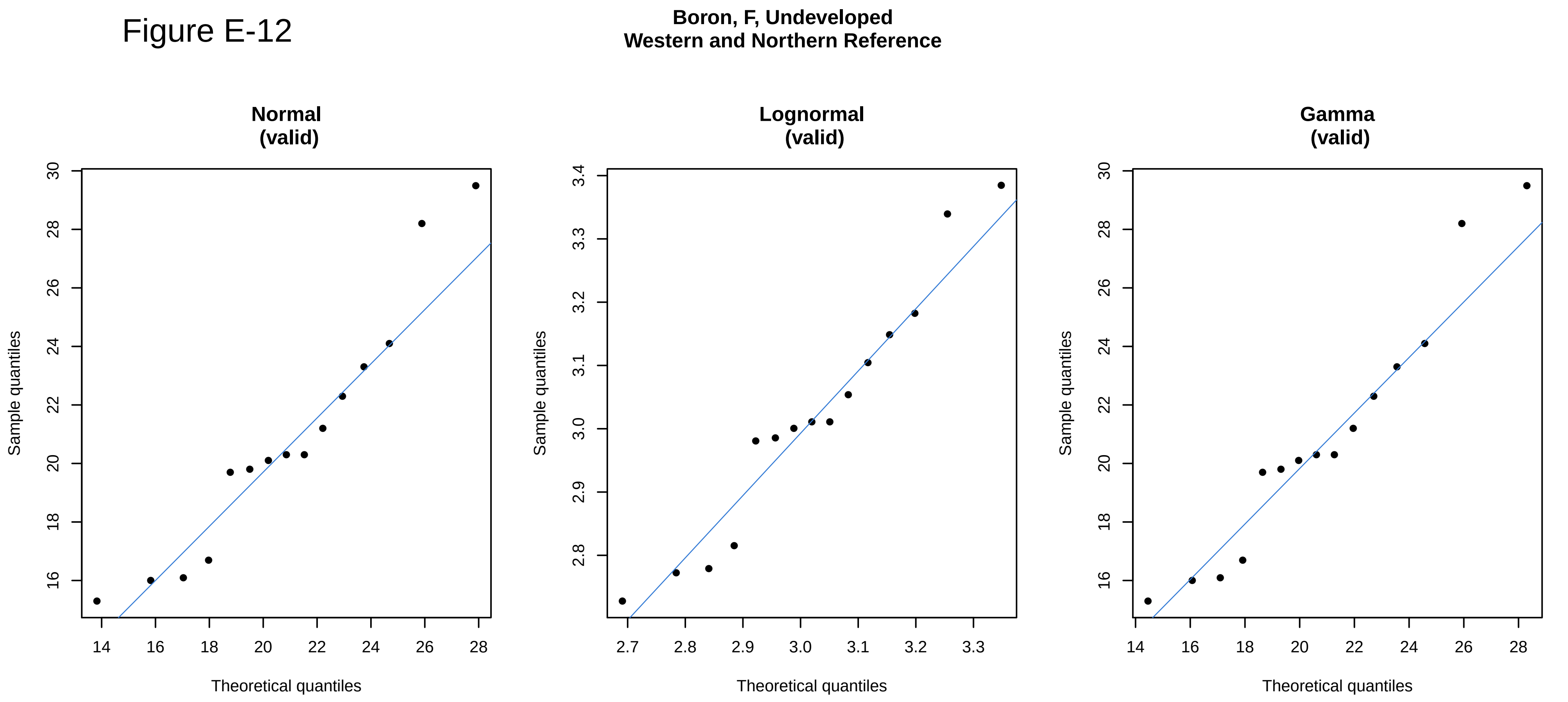
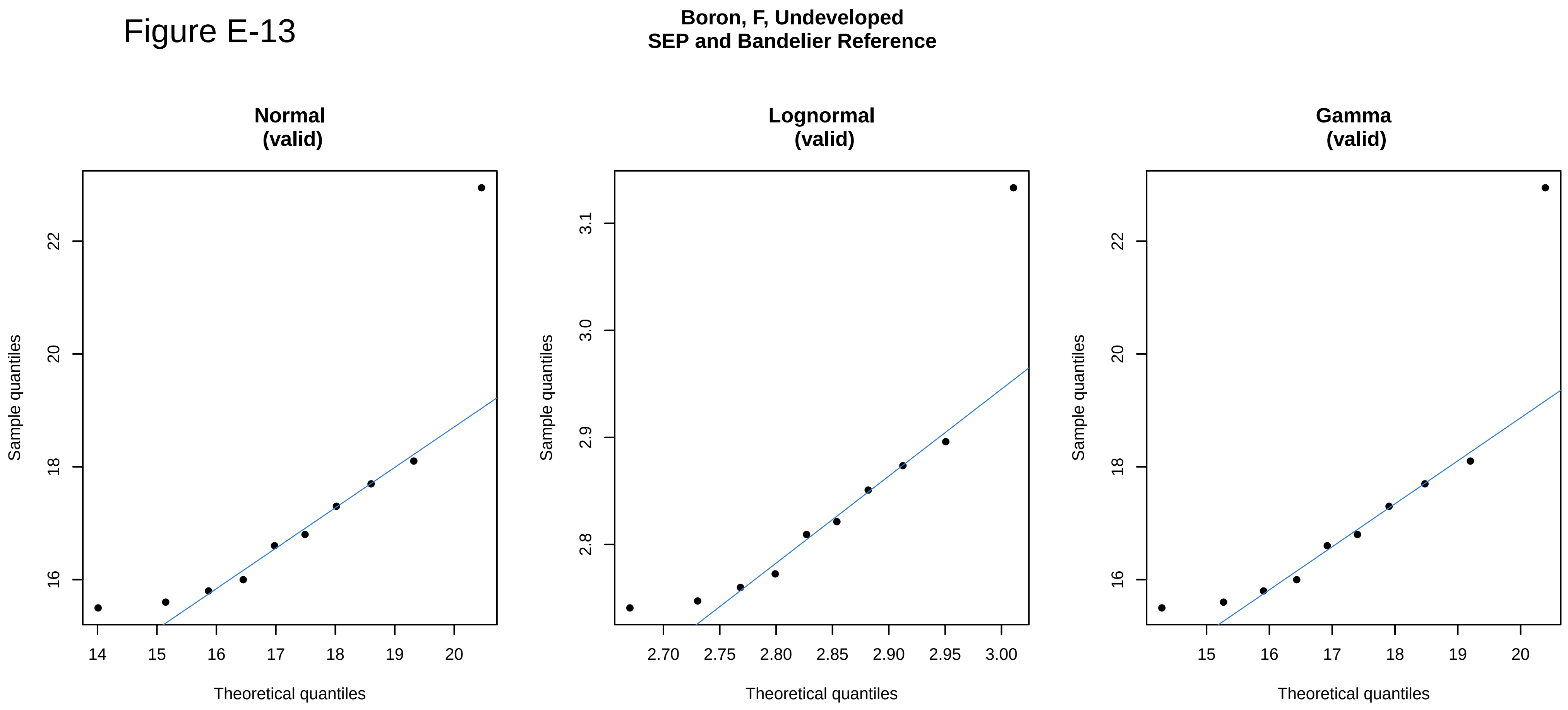

Boron, F, Undeveloped
Western and Northern Reference
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
16
18
20
22
24
26
28
30
14
2.8
2.9
3.0
3.1
3.2
3.3
3.4
2.7

Figure E-13



Boron, F, Undeveloped
SEP and Bandelier Reference
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
14
15
16
17
18
19
20
22
2.70
2.75
2.80
2.85
2.90
2.95
3.00
2.8
2.9
3.0
3.1

Figure E-14

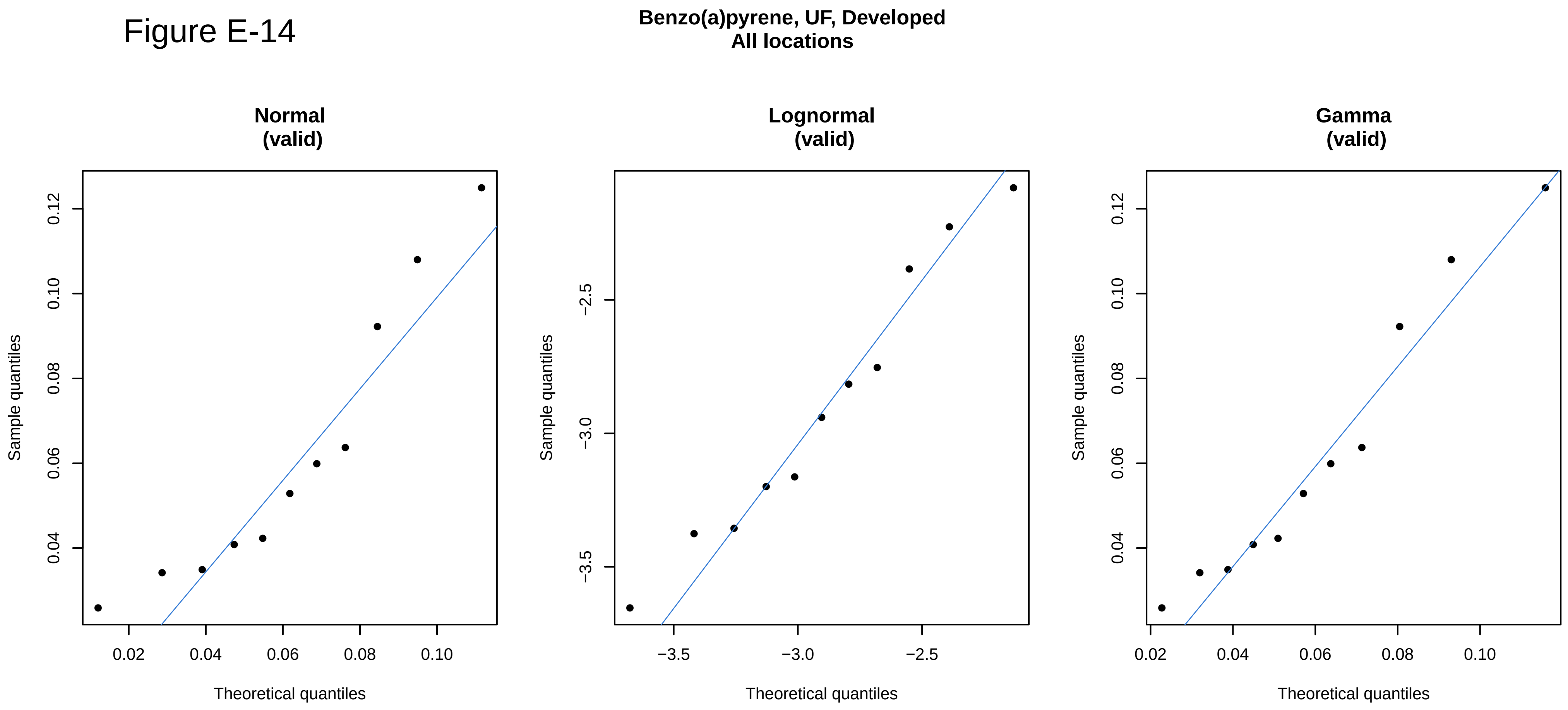

Benzo(a)pyrene, UF, Developed
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0.04
0.06
0.08
0.10
0.12
0.02
−3.5
−3.0
−2.5

Figure E-15

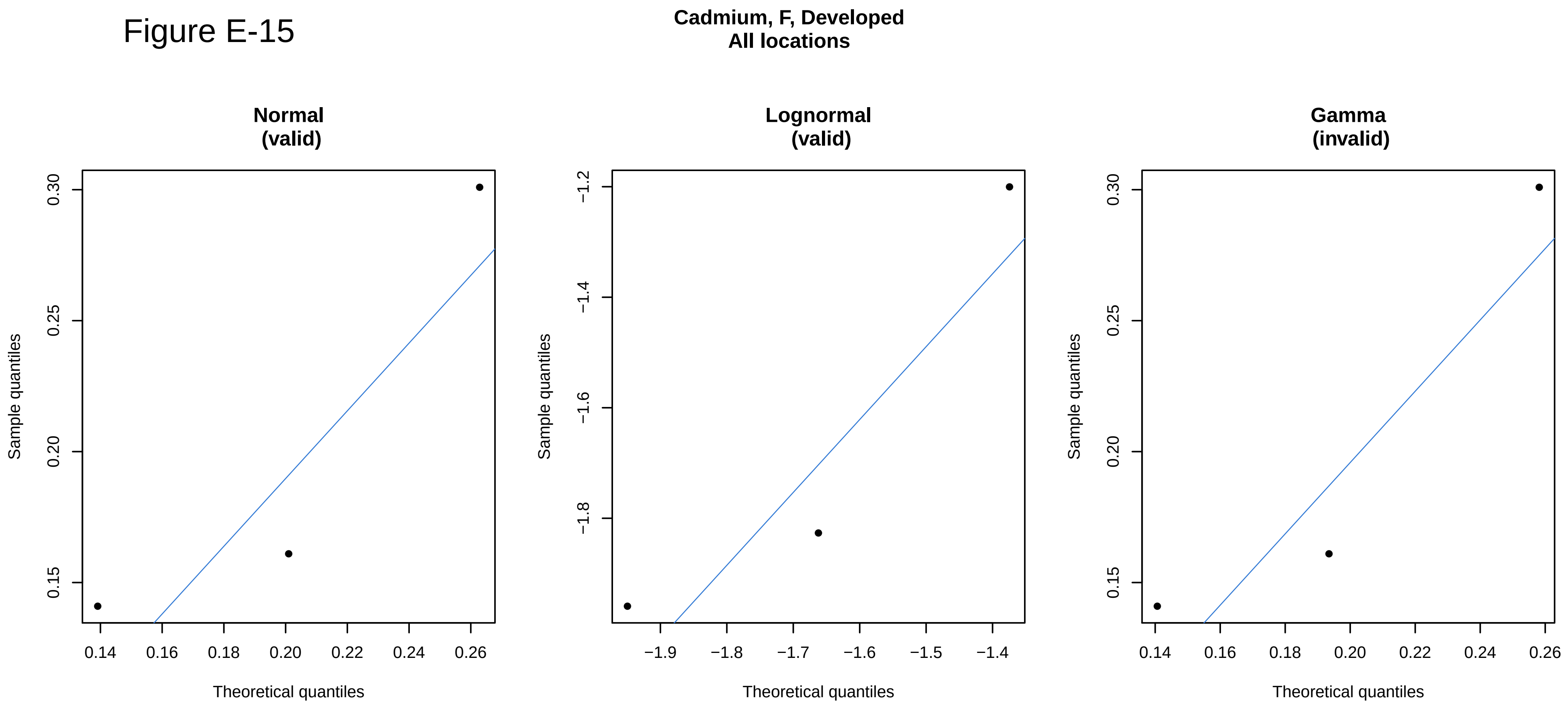

Cadmium, F, Developed
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.15
0.20
0.25
0.30
0.14
0.16
0.18
0.20
0.22
0.24
0.26
−1.8
−1.6
−1.4
−1.2
−1.9
−1.8
−1.7
−1.6
−1.5
−1.4

Figure E-16

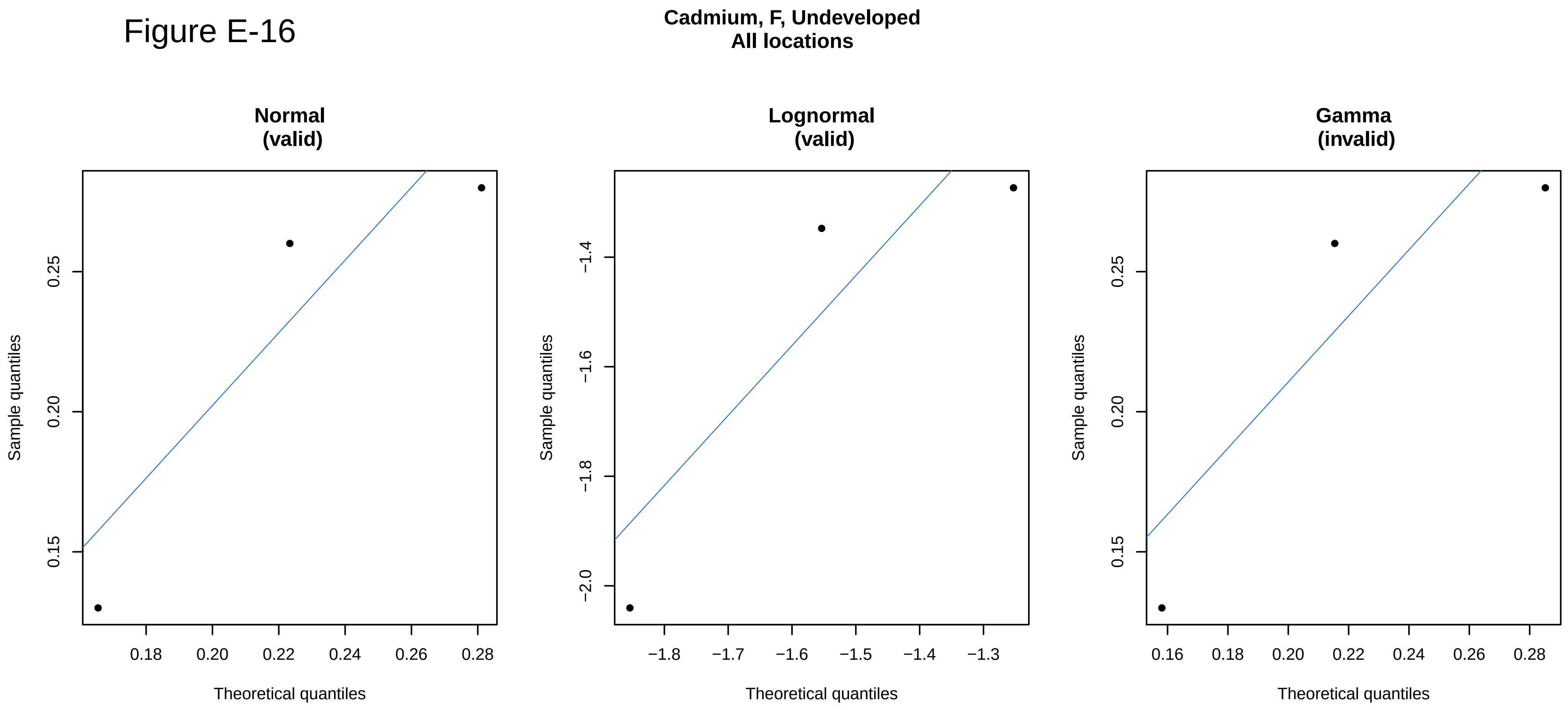
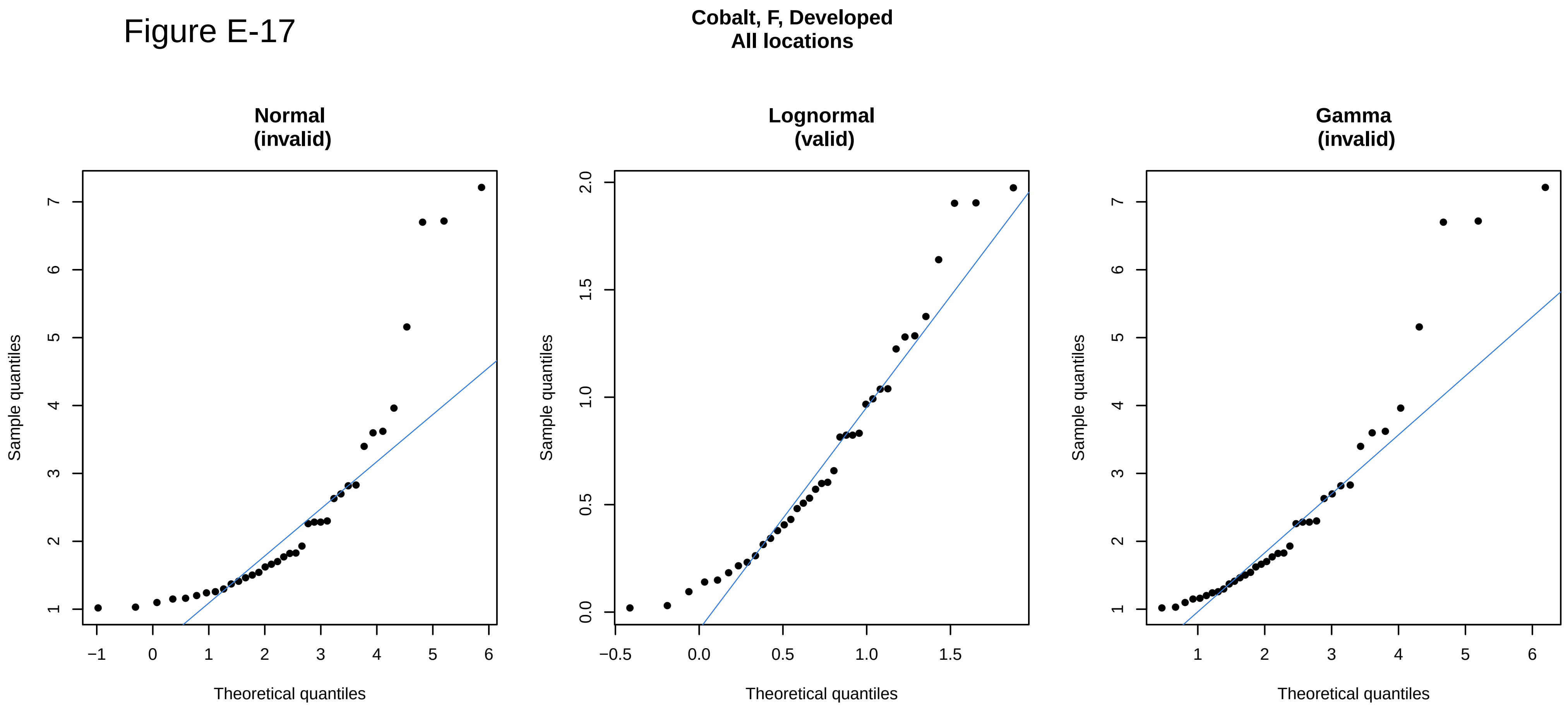

Cadmium, F, Undeveloped
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.15
0.20
0.25
0.18
0.20
0.22
0.24
0.26
0.28
−2.0
−1.8
−1.6
−1.4
−1.8
−1.7
−1.6
−1.5
−1.4
−1.3
0.16

Figure E-17



Cobalt, F, Developed
All locations
Normal
(invalid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles

Figure E-18

Cobalt, F, Undeveloped
Western and Northern Reference

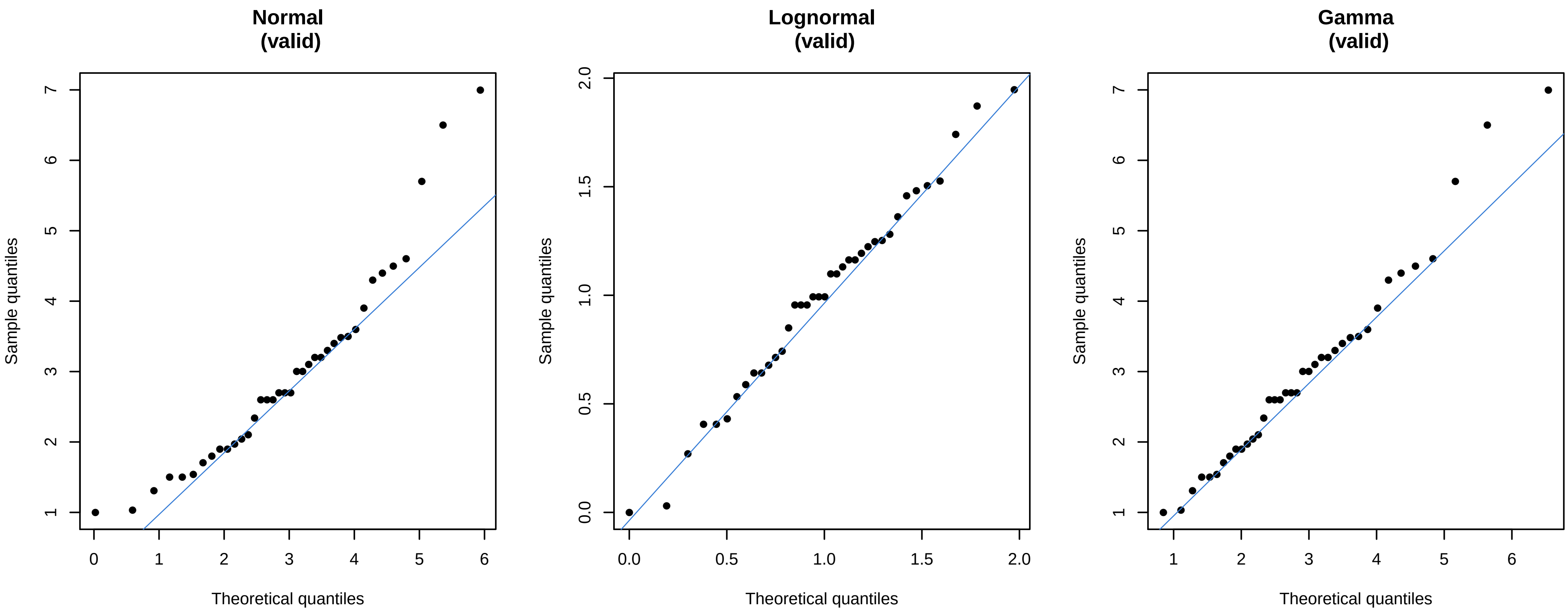
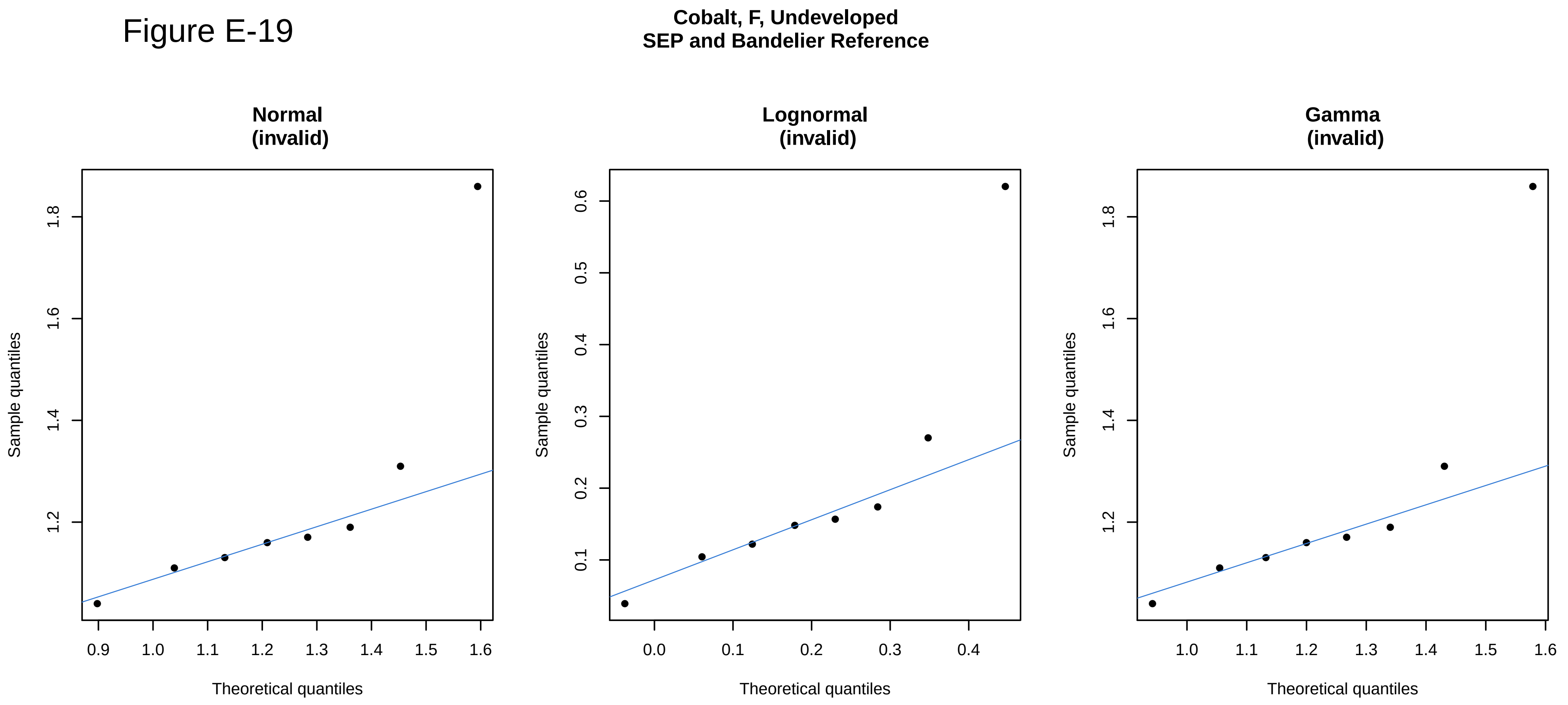
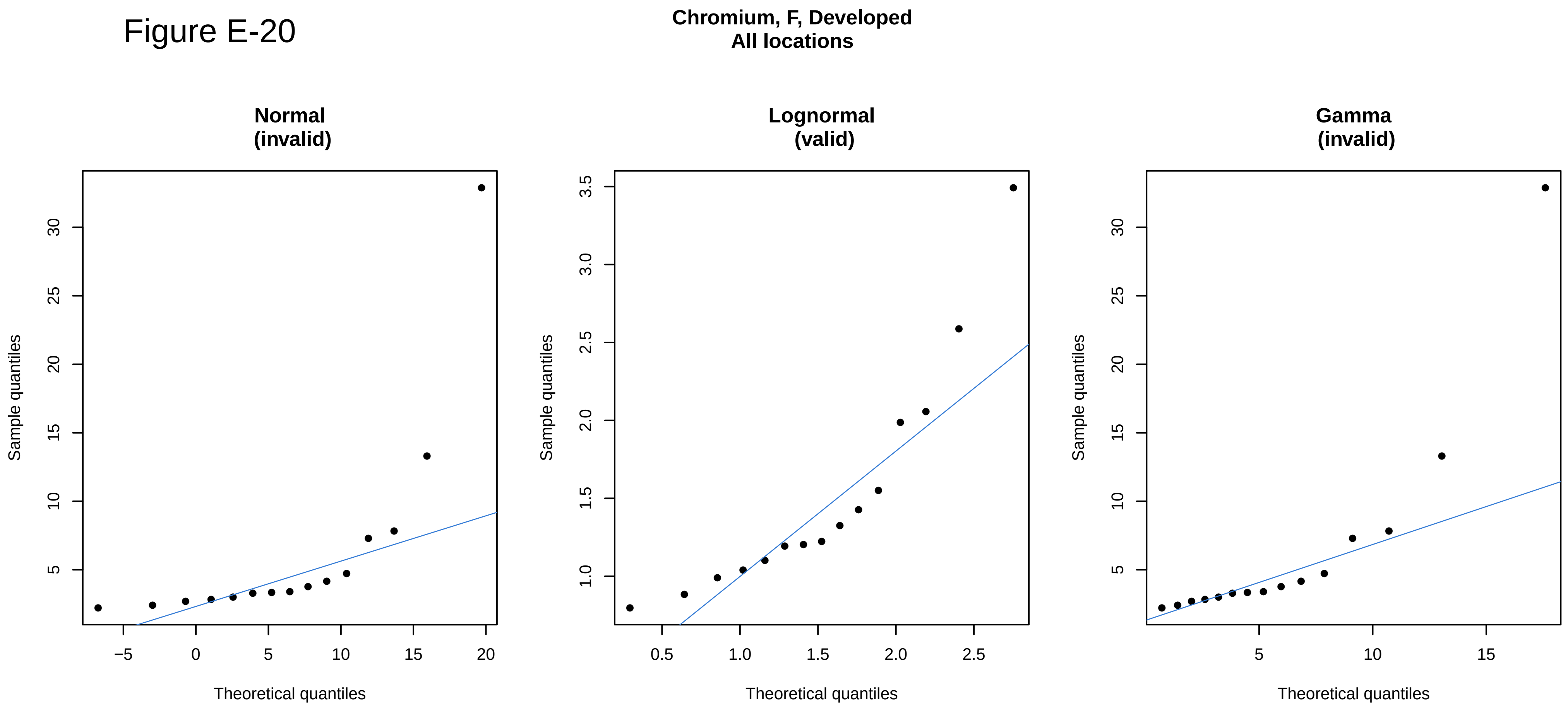


Figure E-19



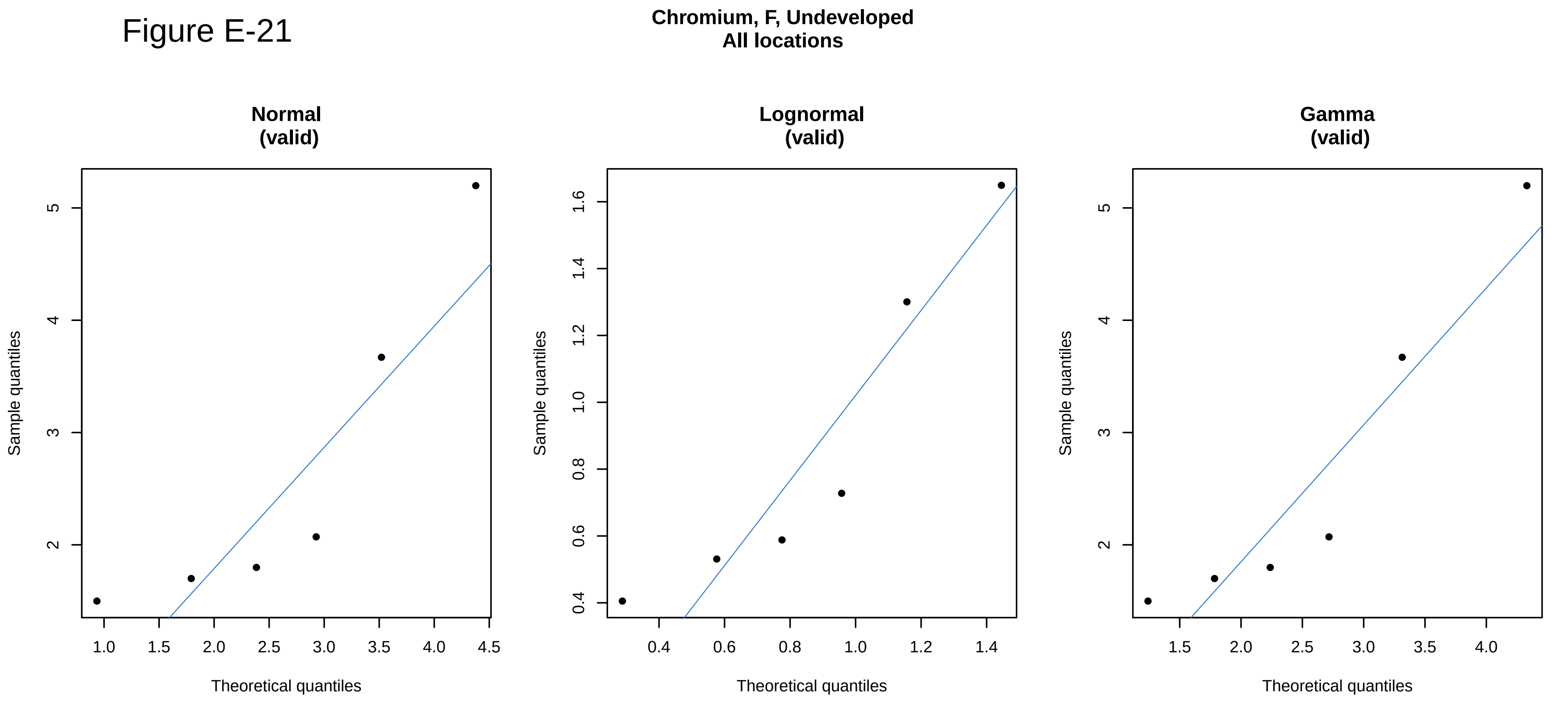
Cobalt, F, Undeveloped
SEP and Bandelier Reference
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles

Figure E-20



Chromium, F, Developed
All locations
Normal
(invalid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles

Figure E-21



Chromium, F, Undeveloped
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
2
3
4
5
0.4
0.6
0.8
1.0
1.2
1.4
1.6

Figure E-22

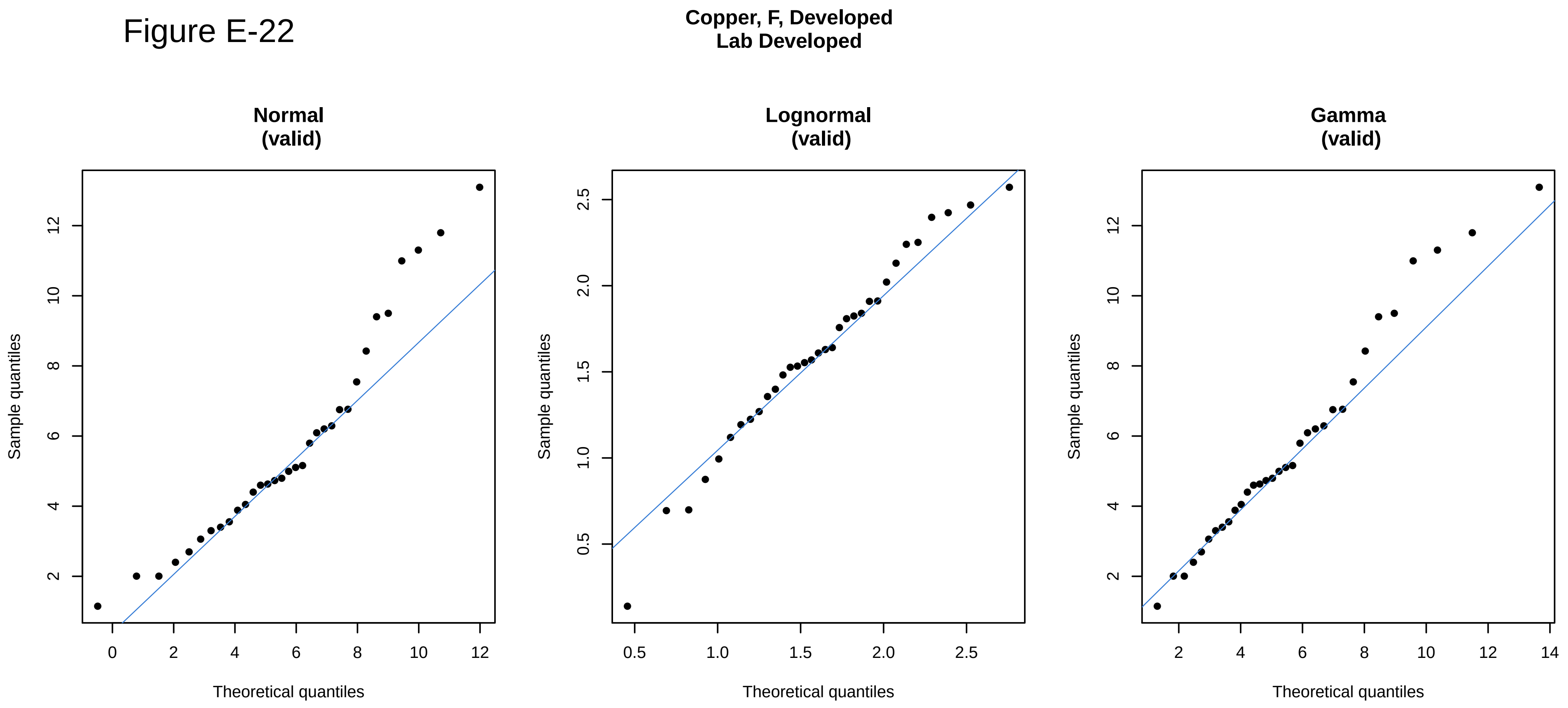

Copper, F, Developed
Lab Developed
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0
2
4
6
8
10
12
0.5
1.0
1.5
2.0
2.5
14

Figure E-23

Copper, F, Developed
Town Developed

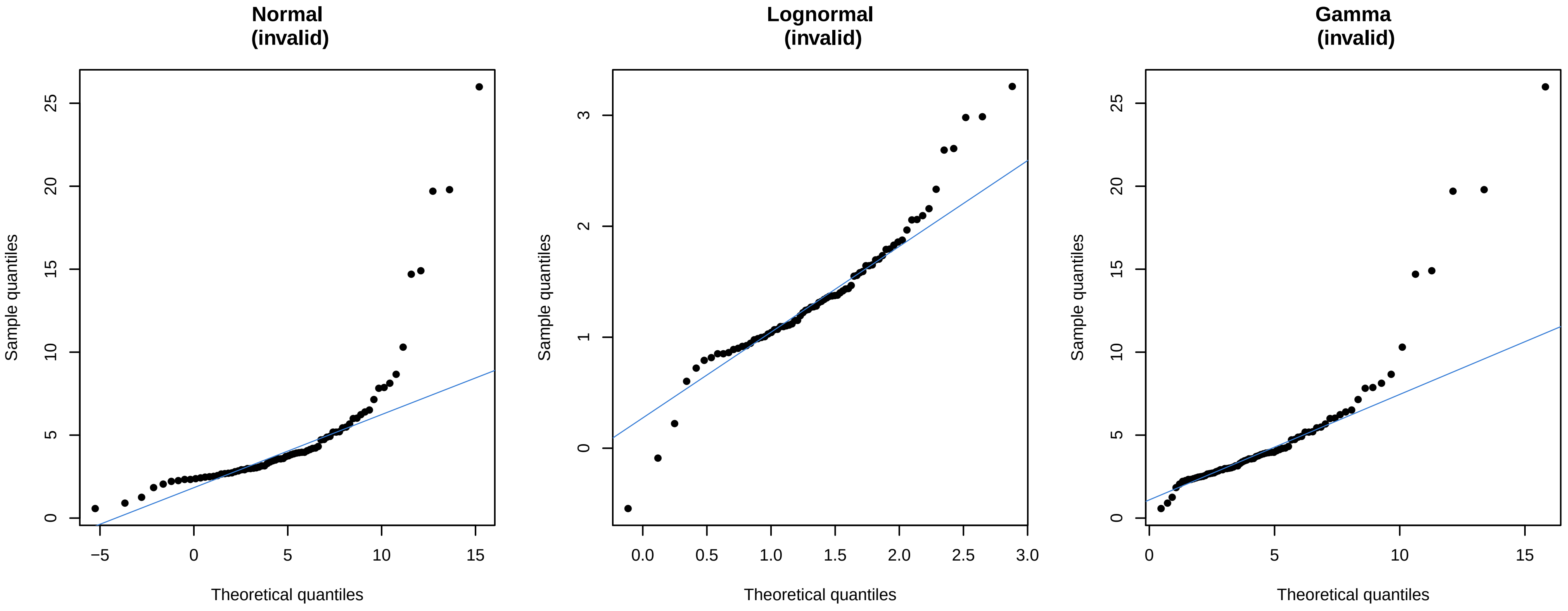


Figure E-24

Copper, F, Undeveloped
Minor groups other than Bandelier

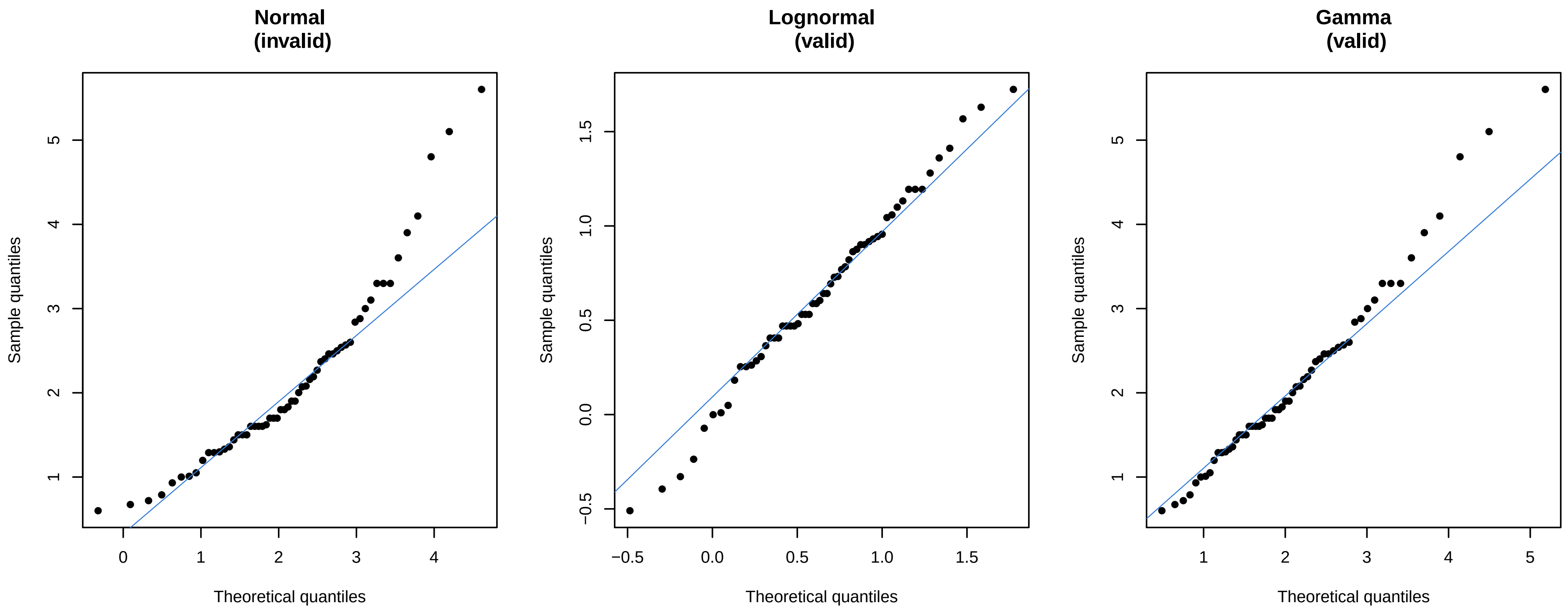


Figure E-25

Gross alpha, UF, Developed
All locations

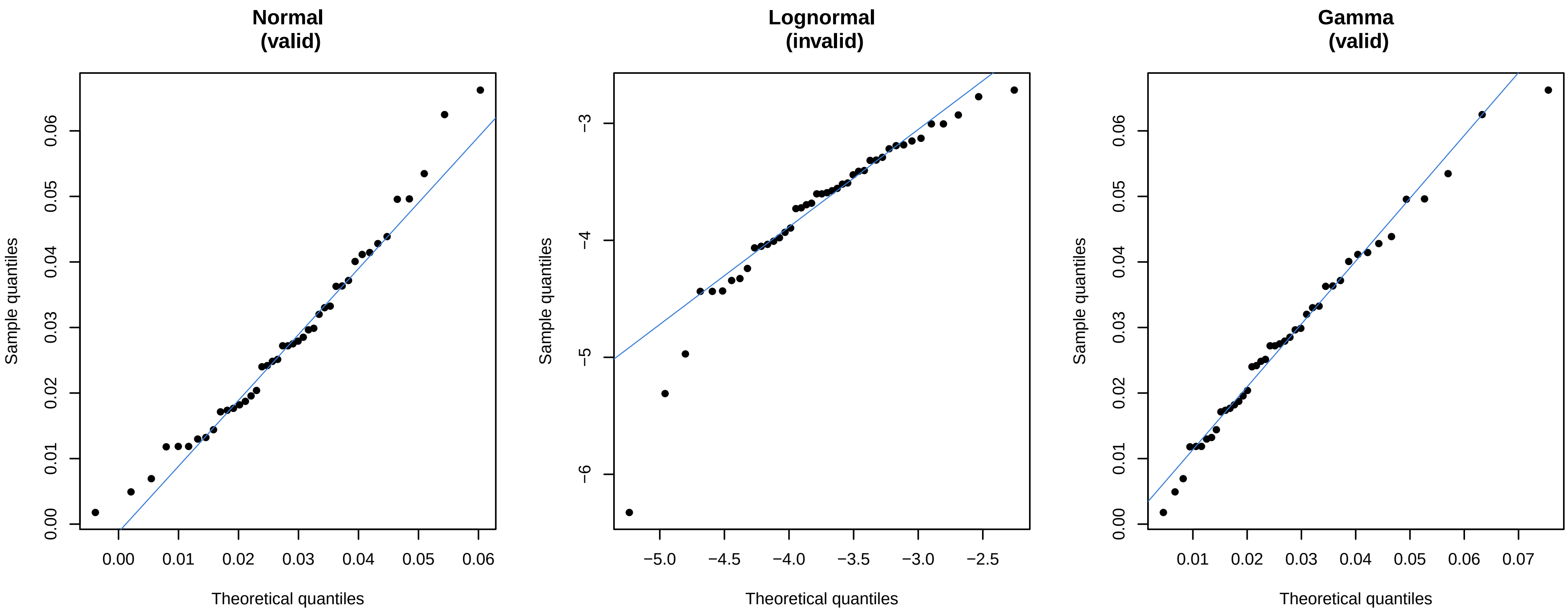


Figure E-26

Gross alpha, UF, Undeveloped
All locations

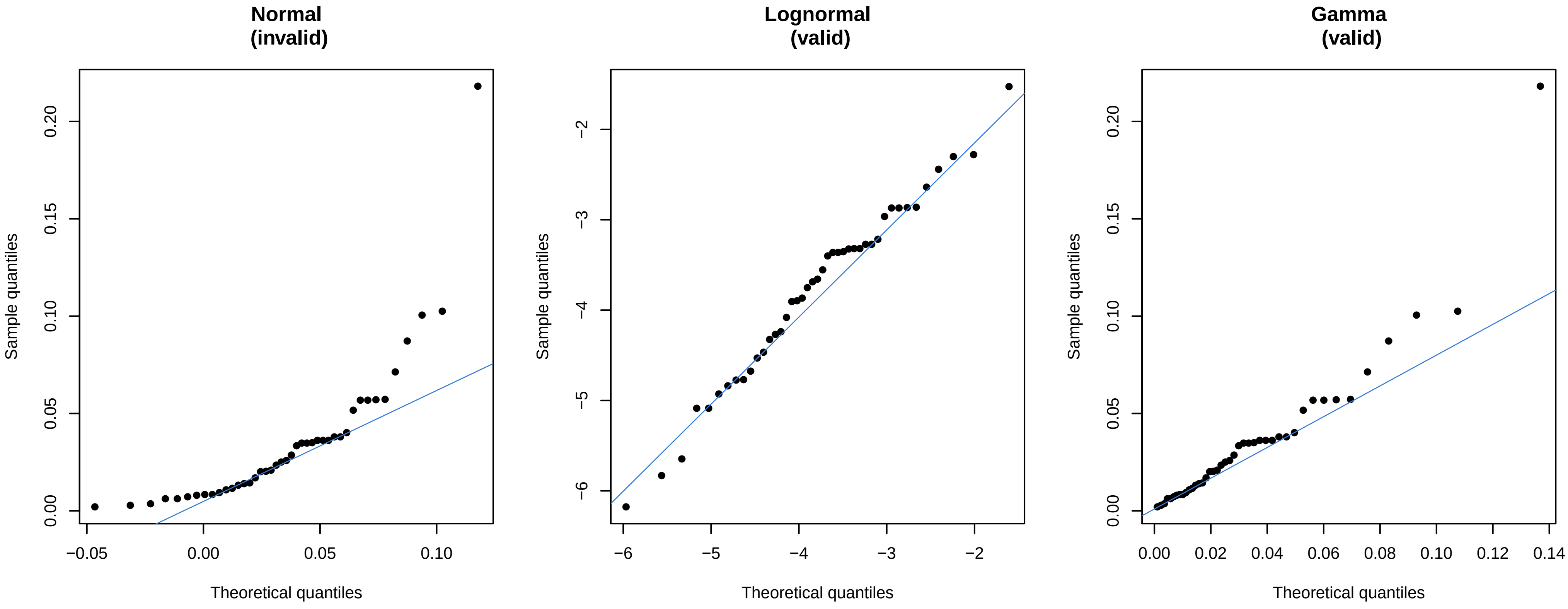


Figure E-27

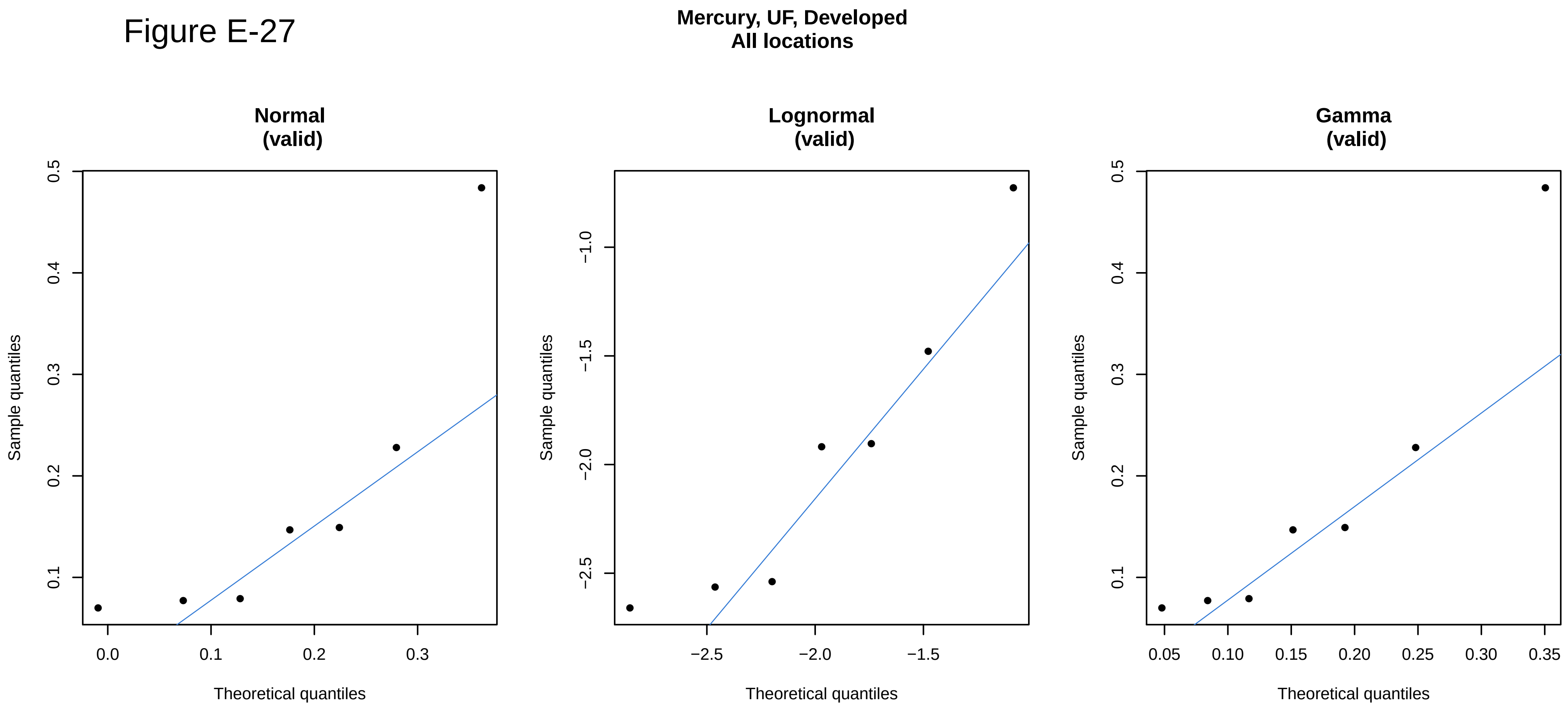
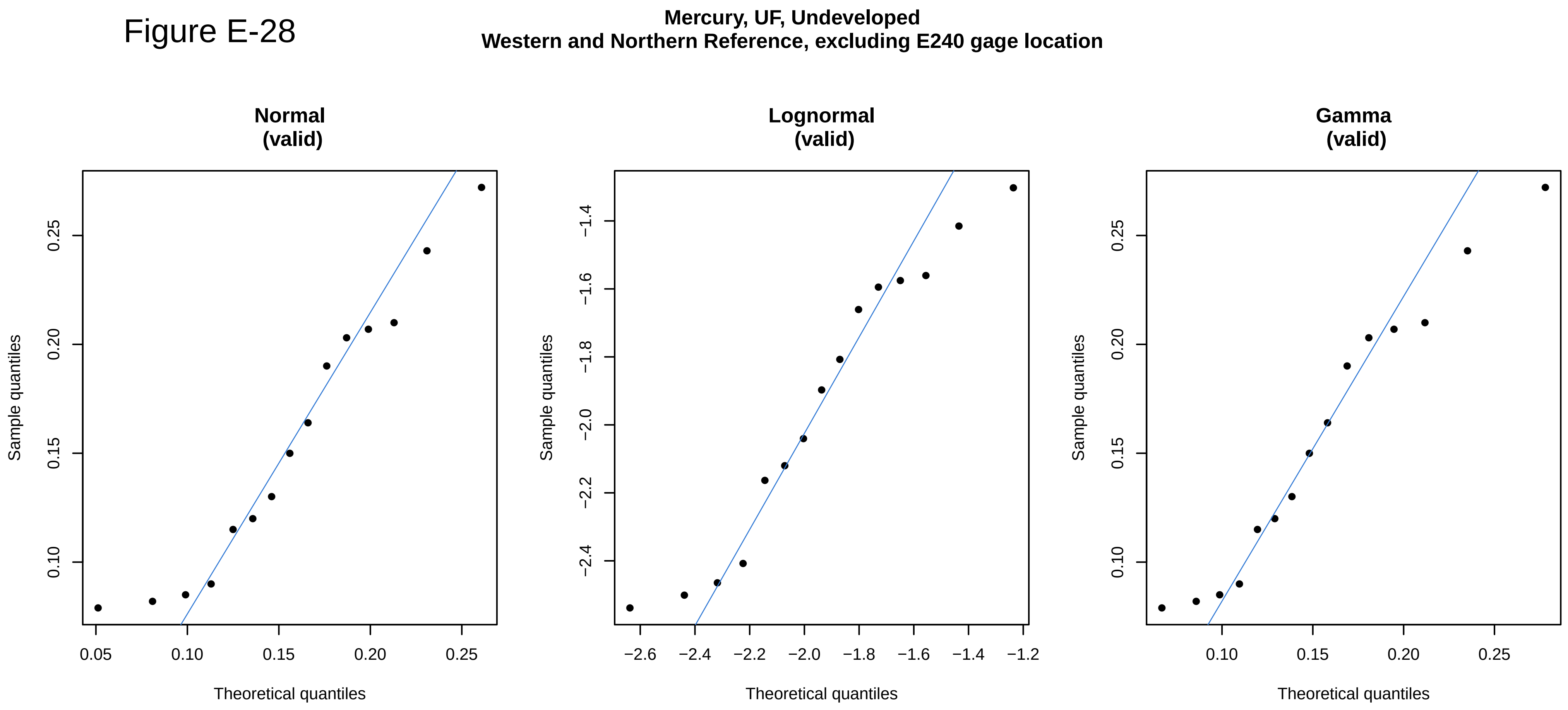
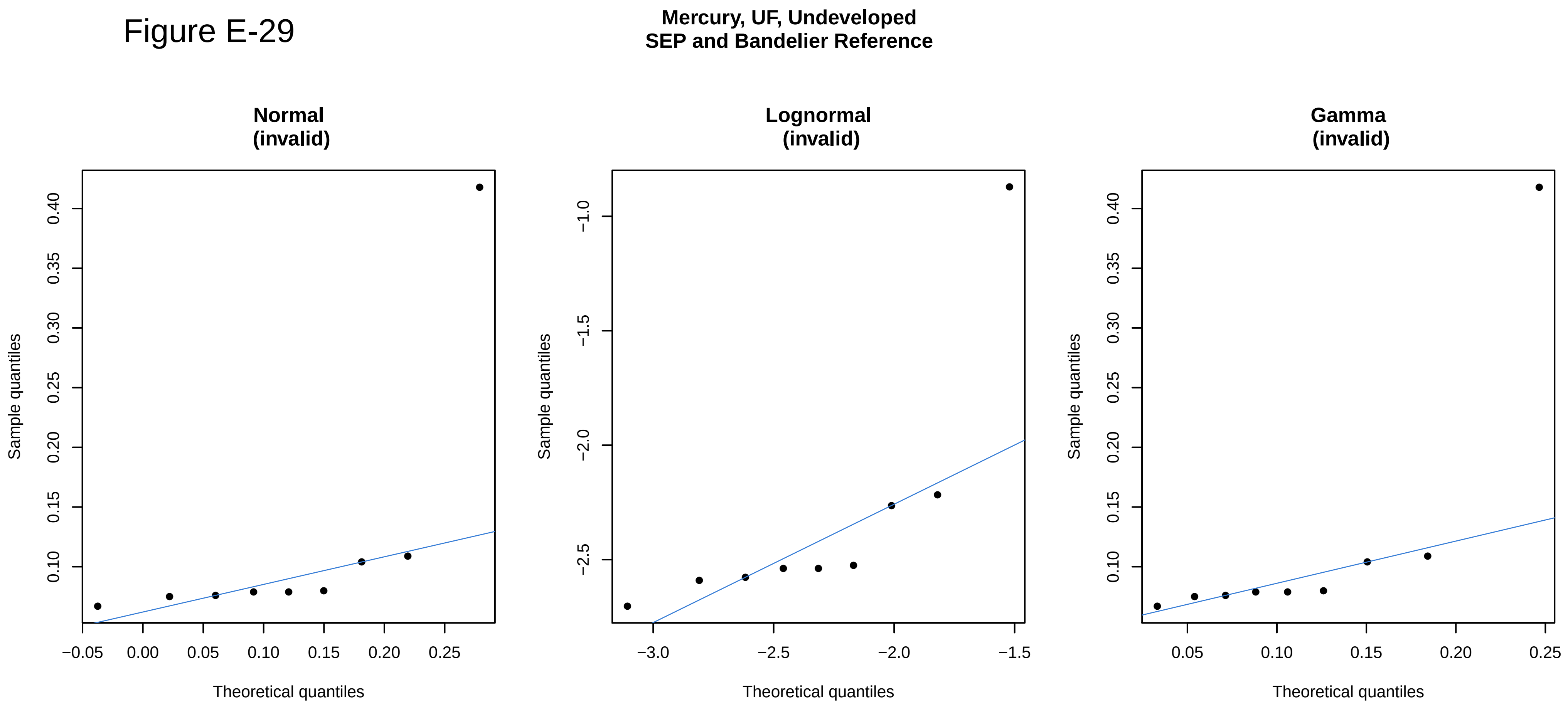

Mercury, UF, Developed
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0.0
0.1
0.2
0.3
0.4
0.5
−2.5
−2.0
−1.5
−1.0
0.05
0.10
0.15
0.20
0.25
0.30
0.35

Figure E-28



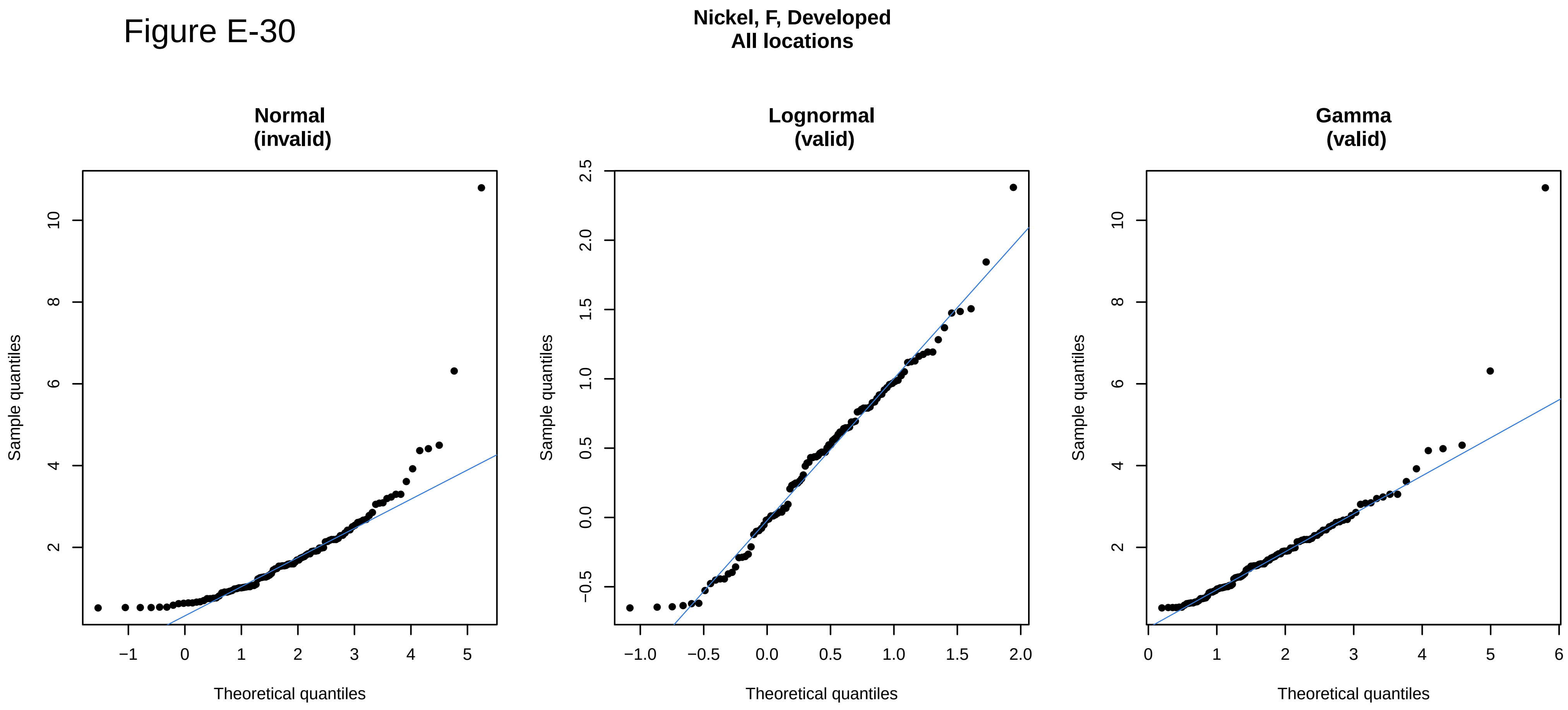
Mercury, UF, Undeveloped
Western and Northern Reference, excluding E240 gage location
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0.05
0.10
0.15
0.20
0.25
−2.6
−2.4
−2.2
−2.0
−1.8
−1.6
−1.4
−1.2

Figure E-29



Mercury, UF, Undeveloped
SEP and Bandelier Reference
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.10
0.15
0.20
0.25
0.30
0.35
0.40
−0.05
0.00
0.05
0.10
0.15
0.20
0.25
−1.0
−1.5
−2.0
−2.5
−3.0
−2.5
−2.0
−1.5

Figure E-30



Nickel, F, Developed
All locations
Normal
(invalid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles

Figure E-31

Nickel, F, Undeveloped
Chupaderos, Garcia, and Mortandad

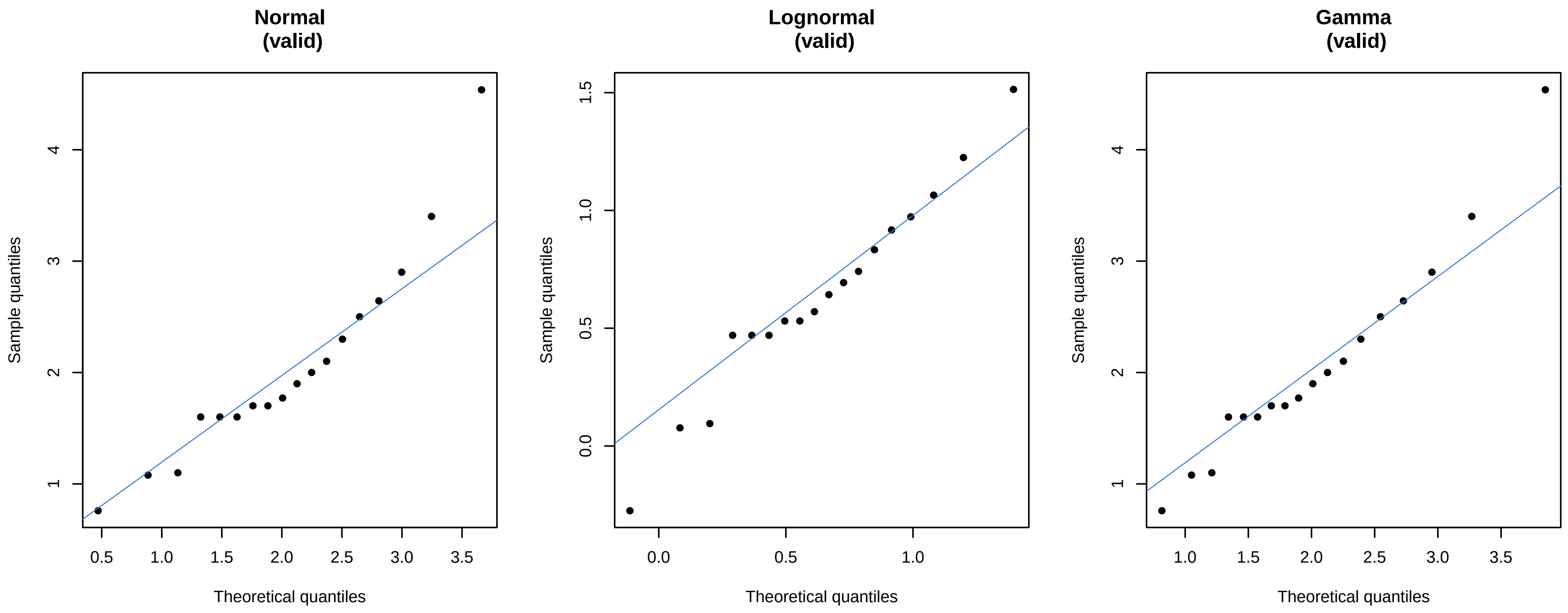
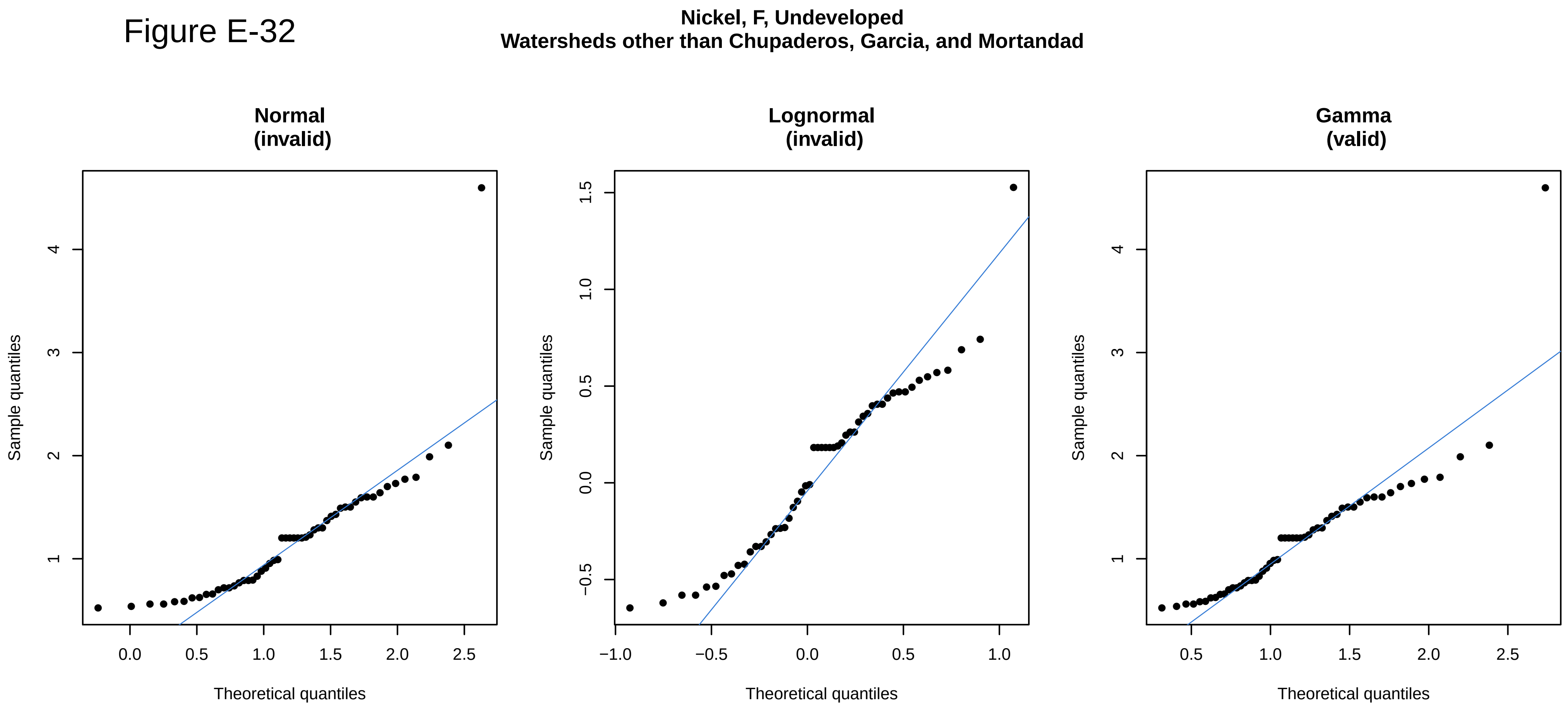


Figure E-32



Nickel, F, Undeveloped
Watersheds other than Chupaderos, Garcia, and Mortandad
Normal
(invalid)
Lognormal
(invalid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0.0
0.5
1.0
1.5
2.0
2.5
1
2
3
4
−1.0
−0.5

Figure E-33

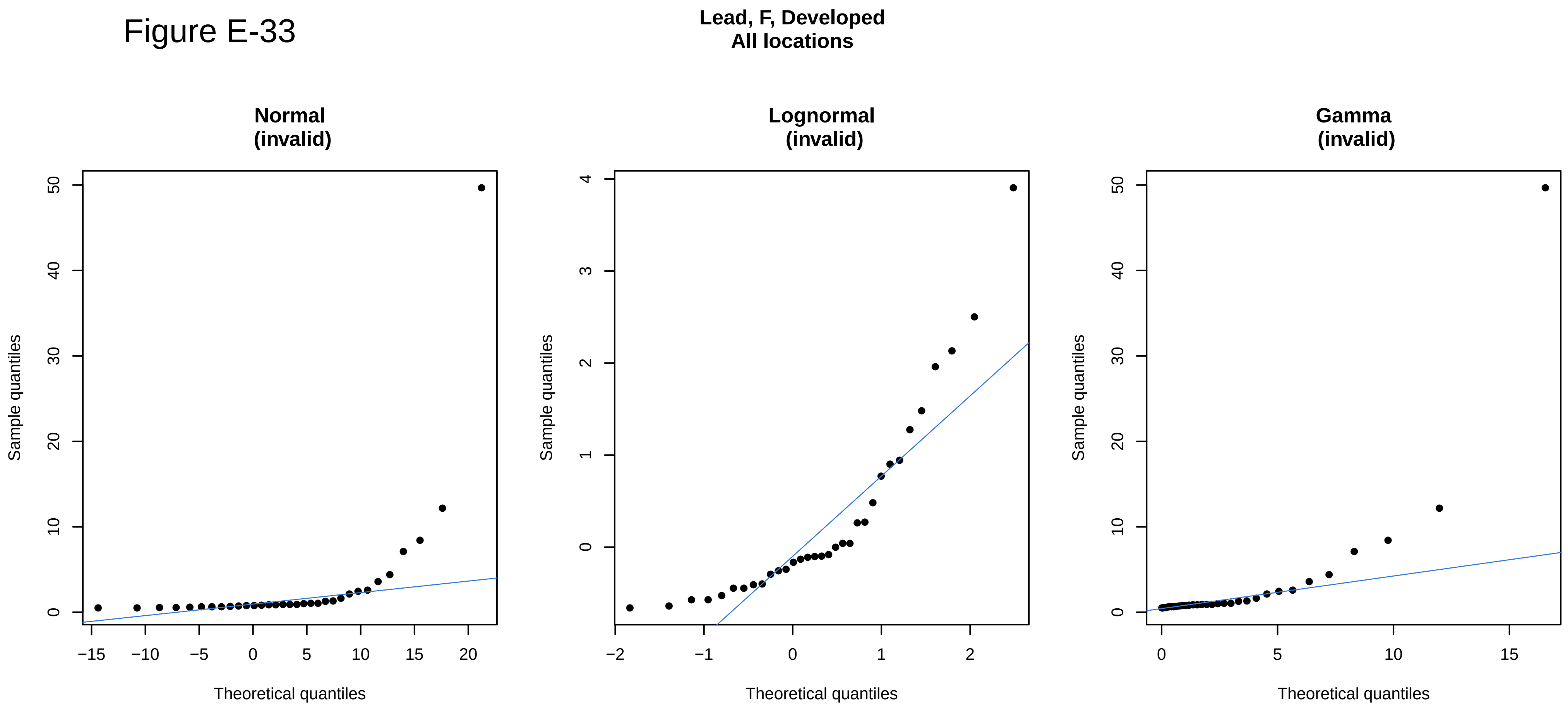

Lead, F, Developed
All locations
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
50
40
30
20
10
0
−15
−10
−5
0
5
10
15
20
4
3
2
1
0
−2
−1
0
1
2
50
40
30
20
10
0
0
5
10
15

Figure E-34

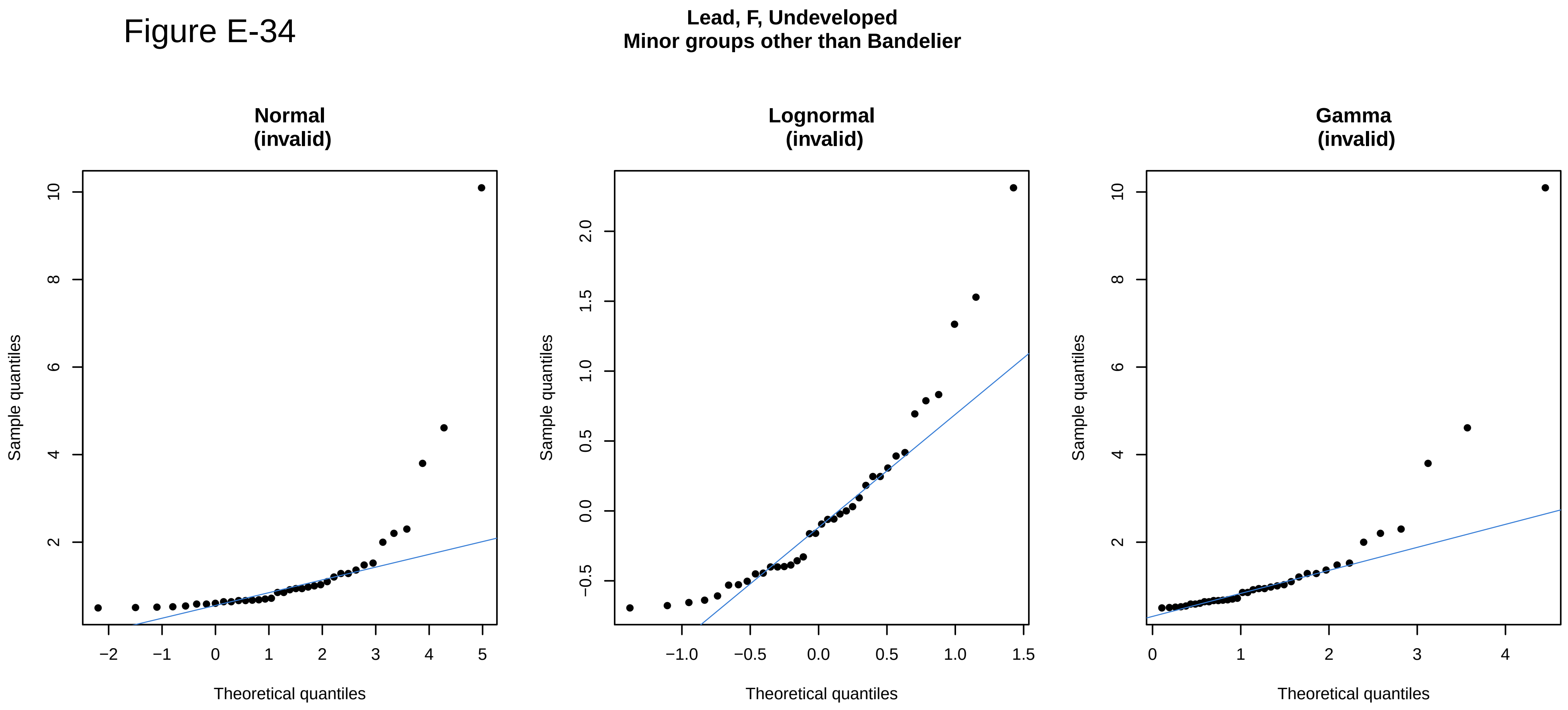

Lead, F, Undeveloped
Minor groups other than Bandelier
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles

Figure E-35

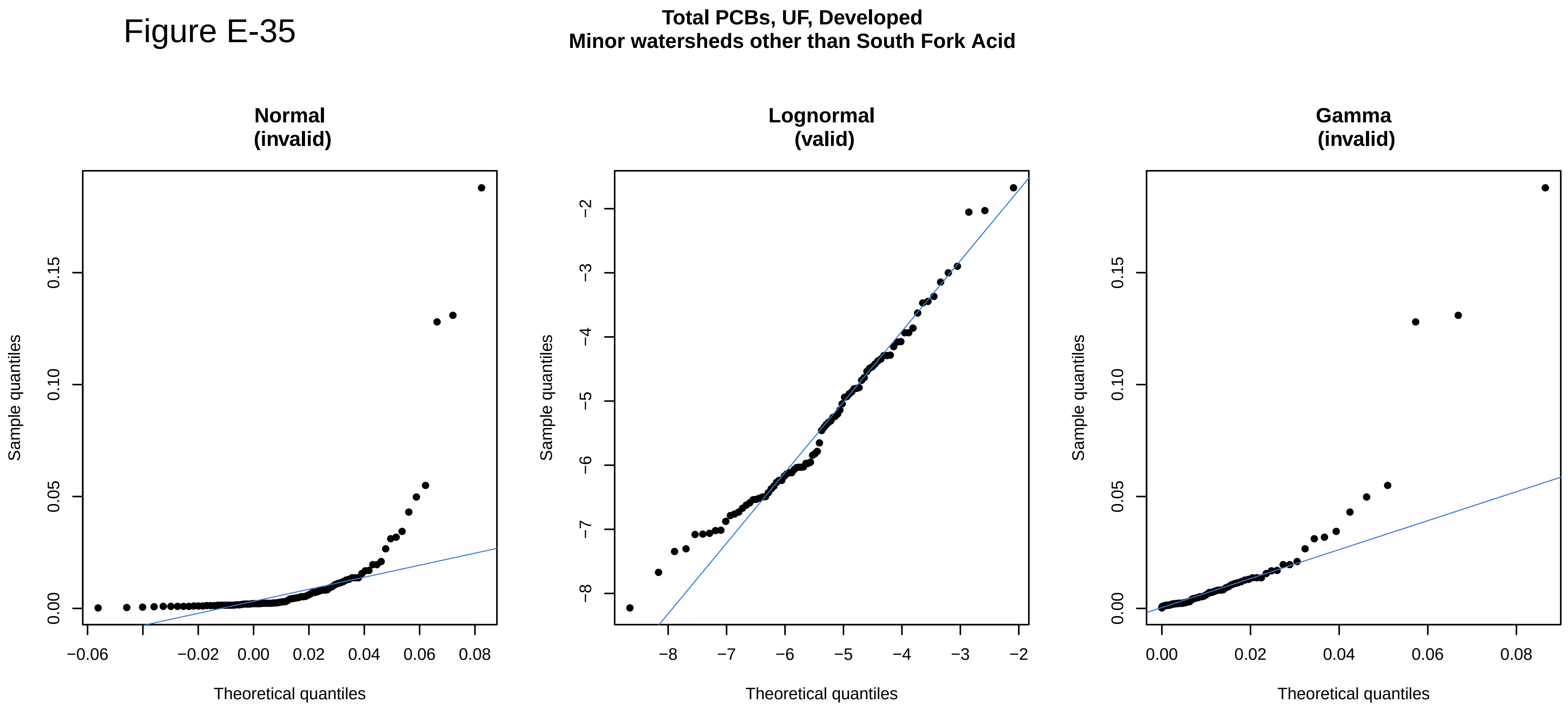
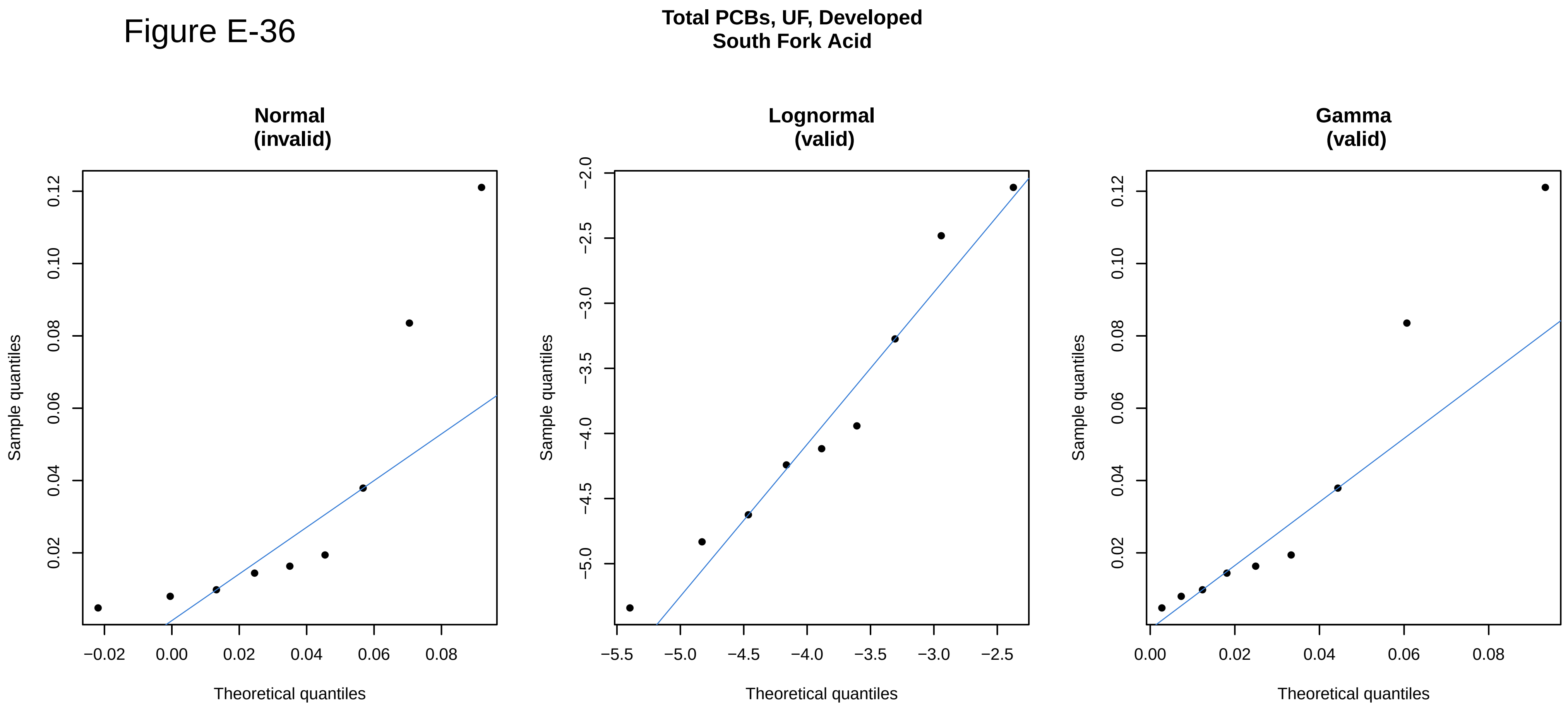

Total PCBs, UF, Developed
Minor watersheds other than South Fork Acid
Normal
(invalid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.00
0.05
0.10
0.15
−0.06
−0.02
0.00
0.02
0.04
0.06
0.08
−2
−3
−4
−5
−6
−7
−8

Figure E-36



Total PCBs, UF, Developed
South Fork Acid
Normal
(invalid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0.02
0.04
0.06
0.08
0.10
0.12
−0.02
0.00
−2.0
−2.5
−3.0
−3.5
−4.0
−4.5
−5.0
−5.5

Figure E-37

Total PCBs, UF, Undeveloped
Northern and Western Reference

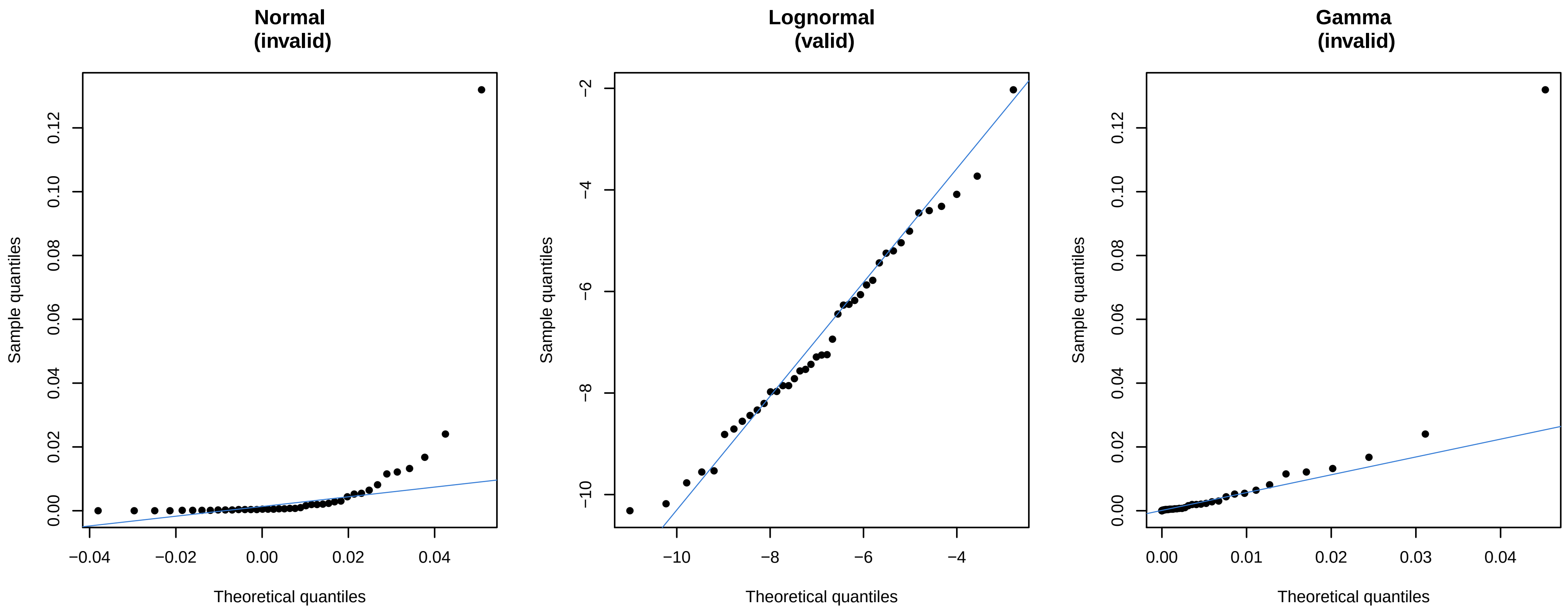
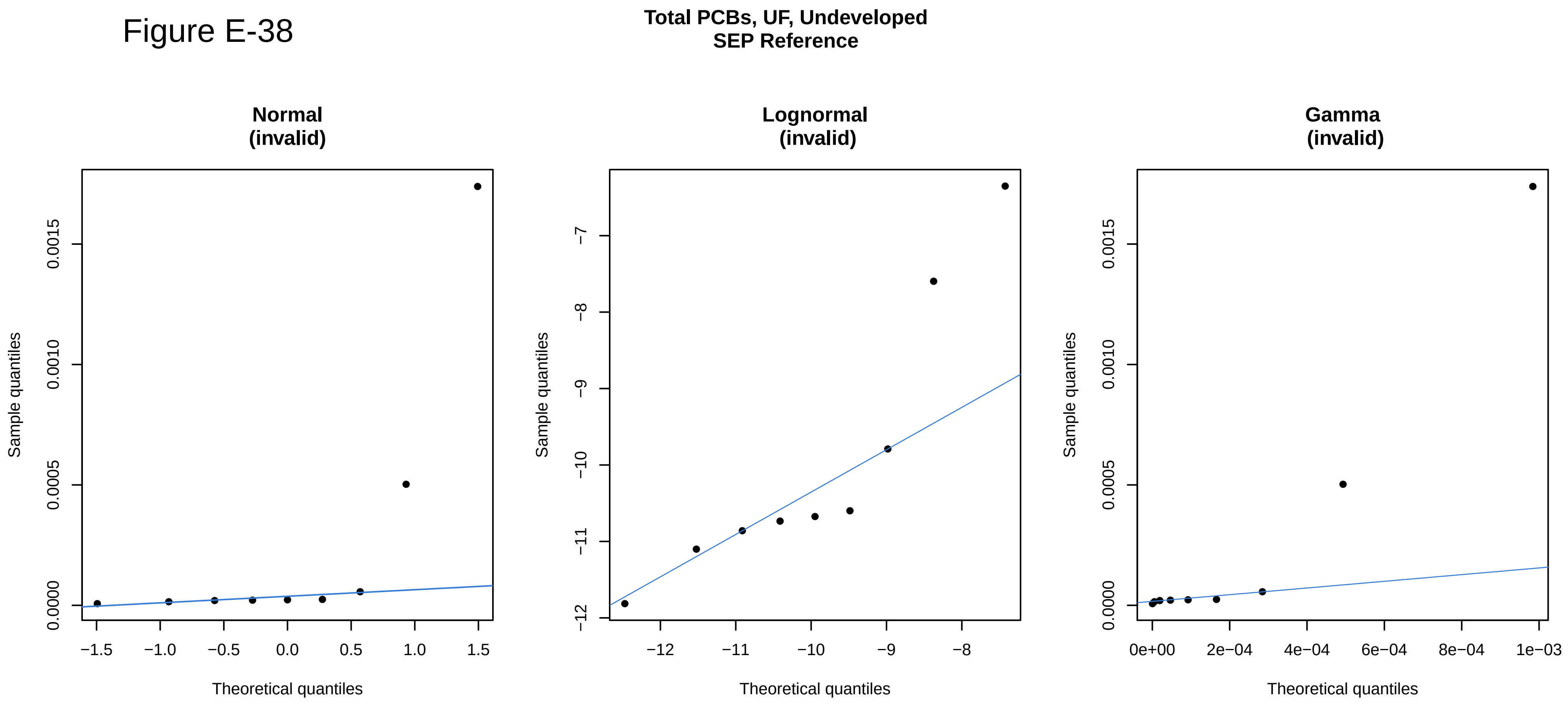


Figure E-38



Total PCBs, UF, Undeveloped
SEP Reference
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.0000
0.0005
0.0010
0.0015
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
−7
−8
−9
−10
−11
−12
−11
−10
−9
−8
0e+00
2e−04
4e−04
6e−04
8e−04
1e−03

Figure E-39

Radium−226 and radium−228, UF, Developed
All locations

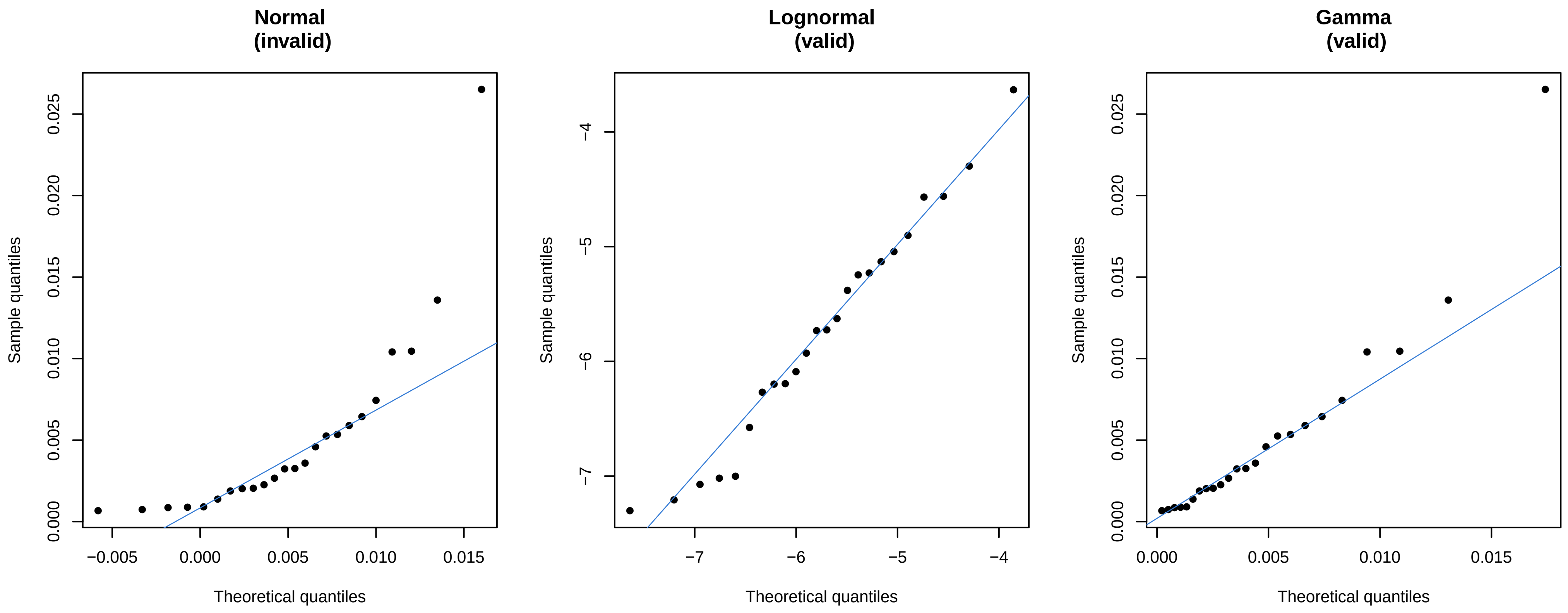
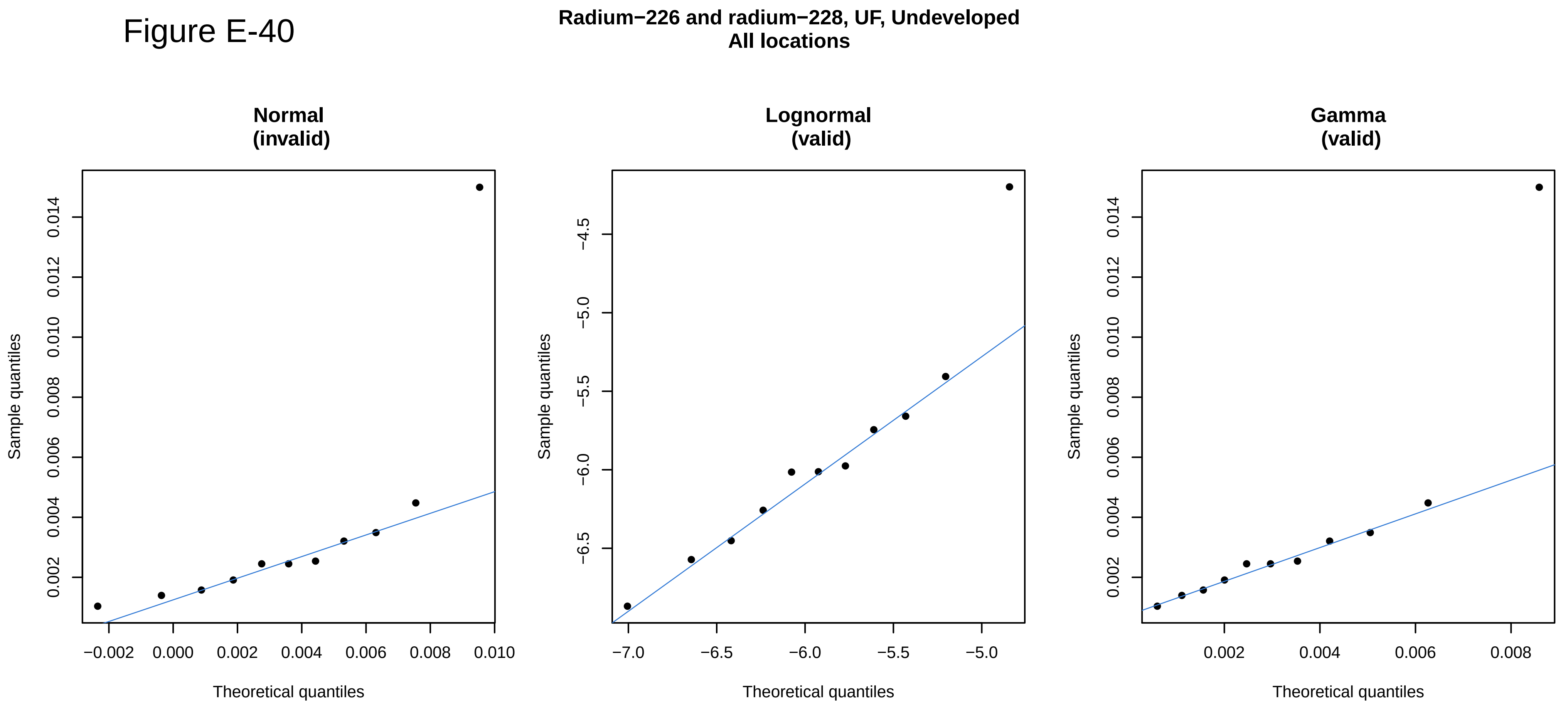


Figure E-40



Radium−226 and radium−228, UF, Undeveloped
All locations
Normal
(invalid)
Sample quantiles
0.002
0.004
0.006
0.008
0.010
0.012
0.014
−0.002
0.000
0.002
0.004
0.006
0.008
0.010
Theoretical quantiles
Lognormal
(valid)
Sample quantiles
−6.5
−6.0
−5.5
−5.0
−4.5
−7.0
−6.5
−6.0
−5.5
−5.0
Theoretical quantiles
Gamma
(valid)
Sample quantiles
0.002
0.004
0.006
0.008
0.010
0.012
0.014
0.002
0.004
0.006
0.008
Theoretical quantiles

Figure E-41

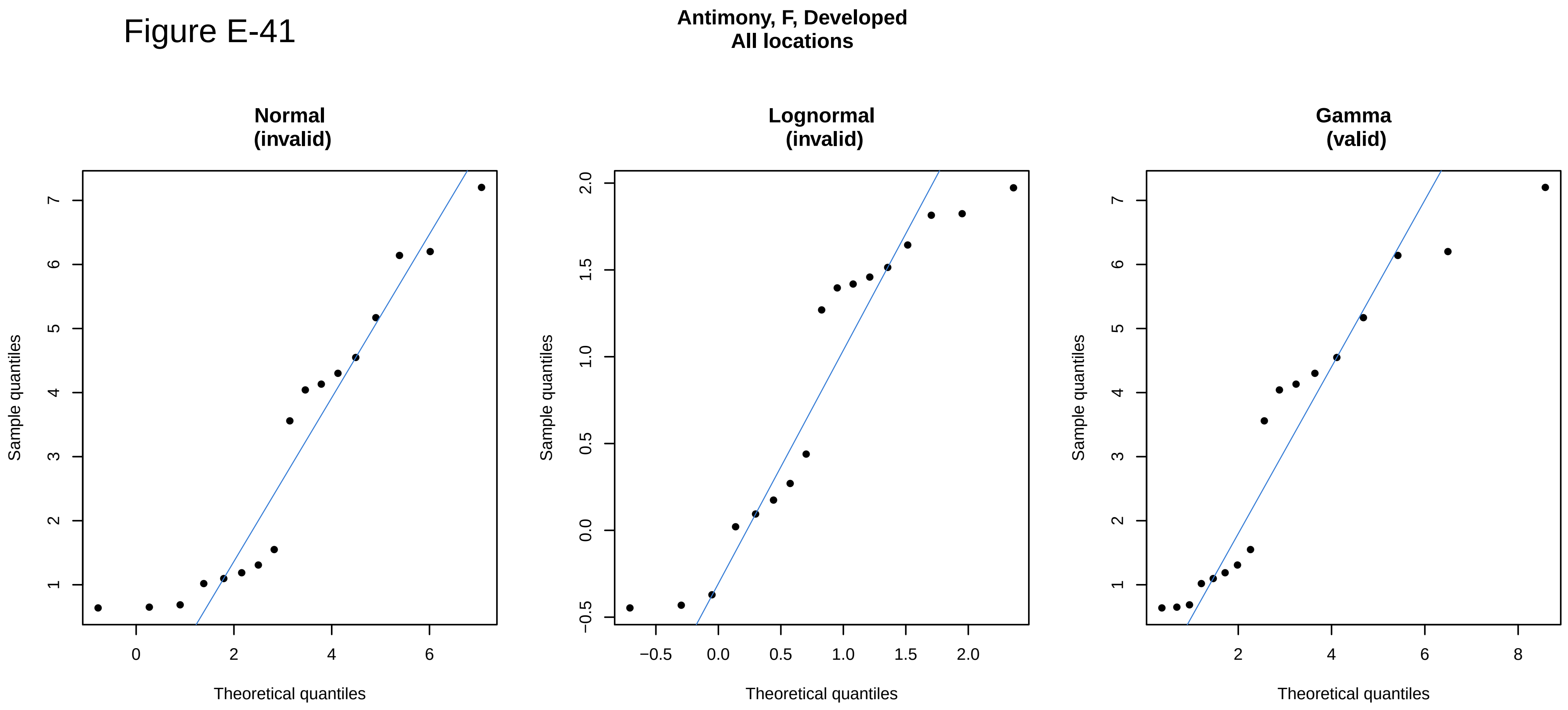

Antimony, F, Developed
All locations
Normal
(invalid)
Sample quantiles
Theoretical quantiles
Lognormal
(invalid)
Sample quantiles
Theoretical quantiles
Gamma
(valid)
Sample quantiles
Theoretical quantiles

Figure E-42

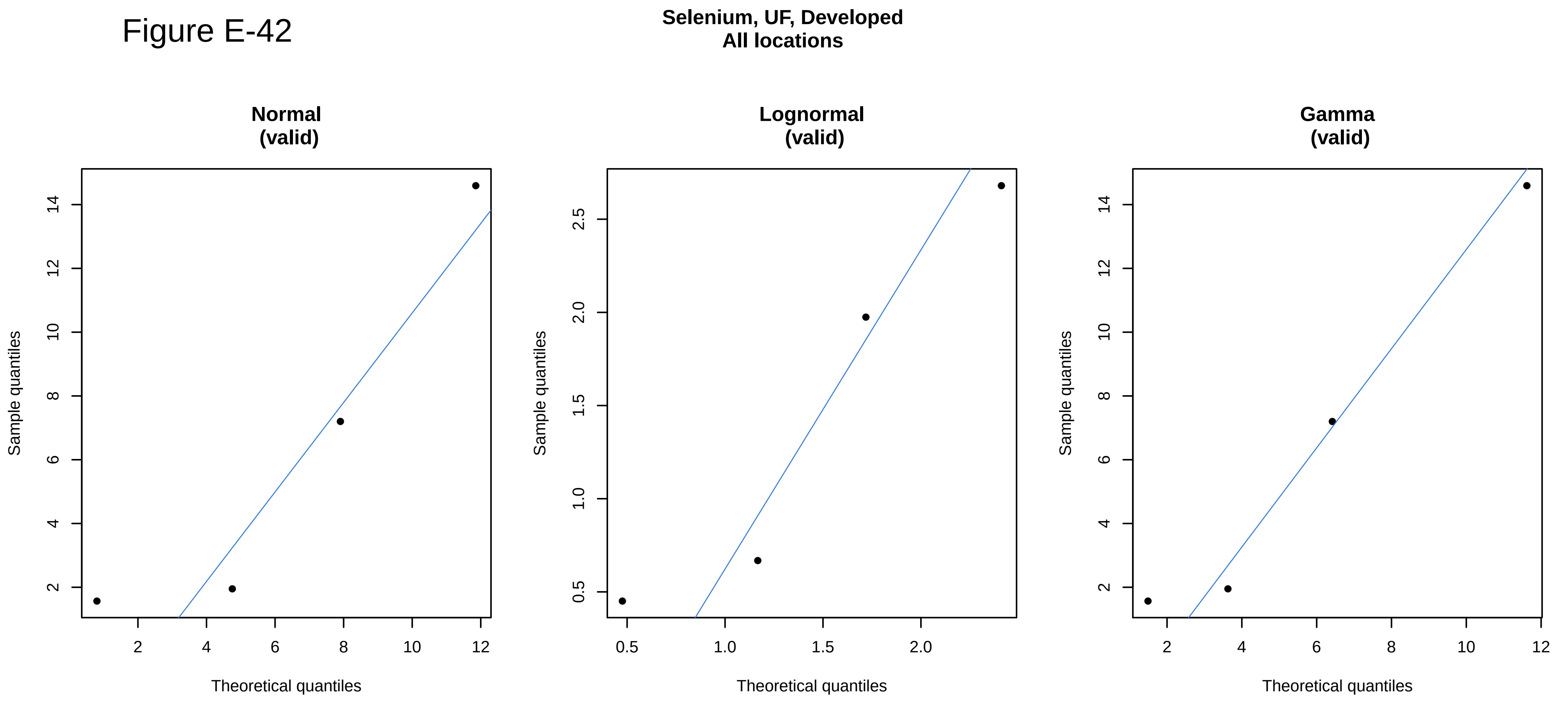
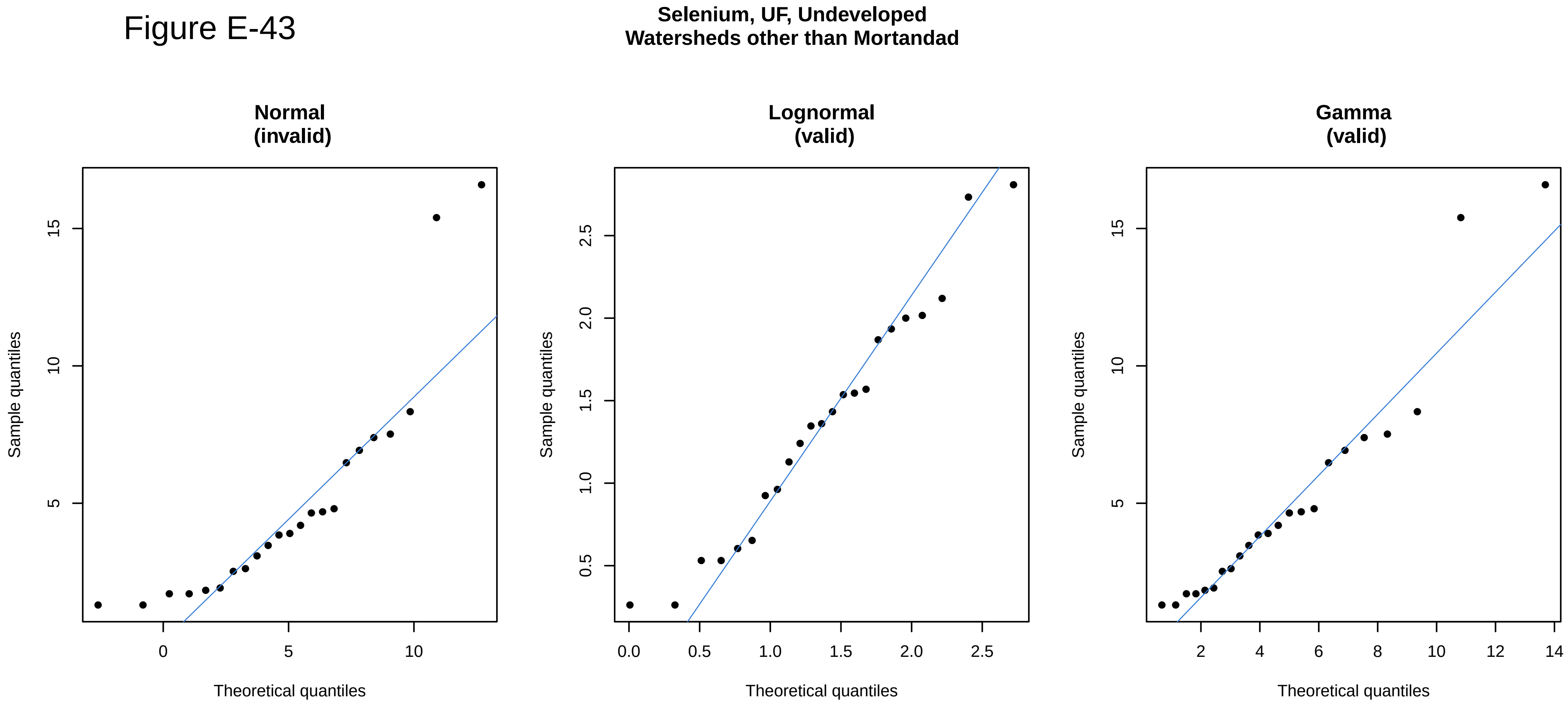
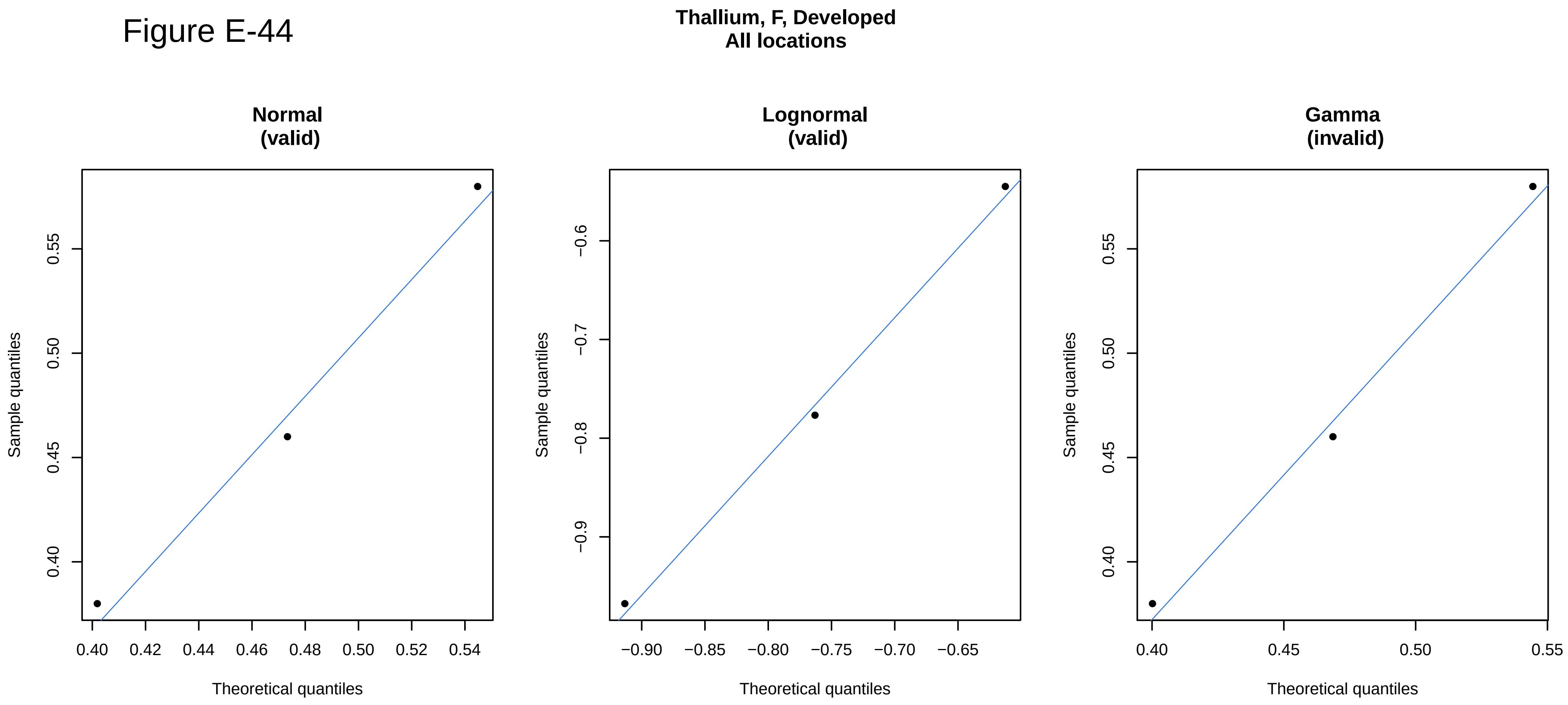

Selenium, UF, Developed
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
2
4
6
8
10
12
14
0.5
1.0
1.5
2.0
2.5

Figure E-43



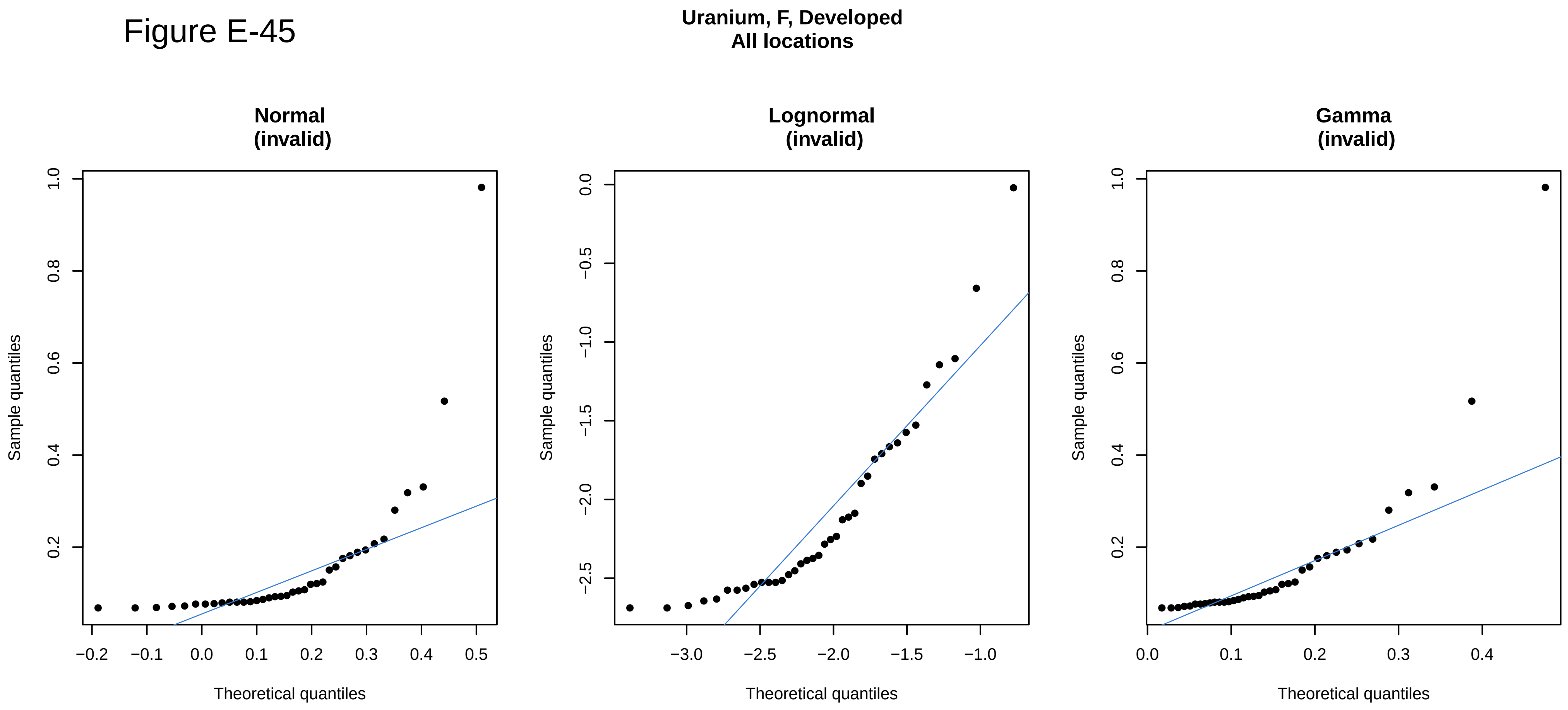
Selenium, UF, Undeveloped
Watersheds other than Mortandad
Normal
(invalid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles

Figure E-44



Thallium, F, Developed
All locations
Normal
(valid)
Lognormal
(valid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.40
0.45
0.50
0.55
0.42
0.44
0.46
0.48
0.52
0.54
−0.6
−0.7
−0.8
−0.9
−0.90
−0.85
−0.80
−0.75
−0.70
−0.65

Figure E-45



Uranium, F, Developed
All locations
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0.2
0.4
0.6
0.8
1.0
−0.2
−0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
−3.0

Figure E-46

Uranium, F, Undeveloped
Watersheds other than Mortandad and Jemez River

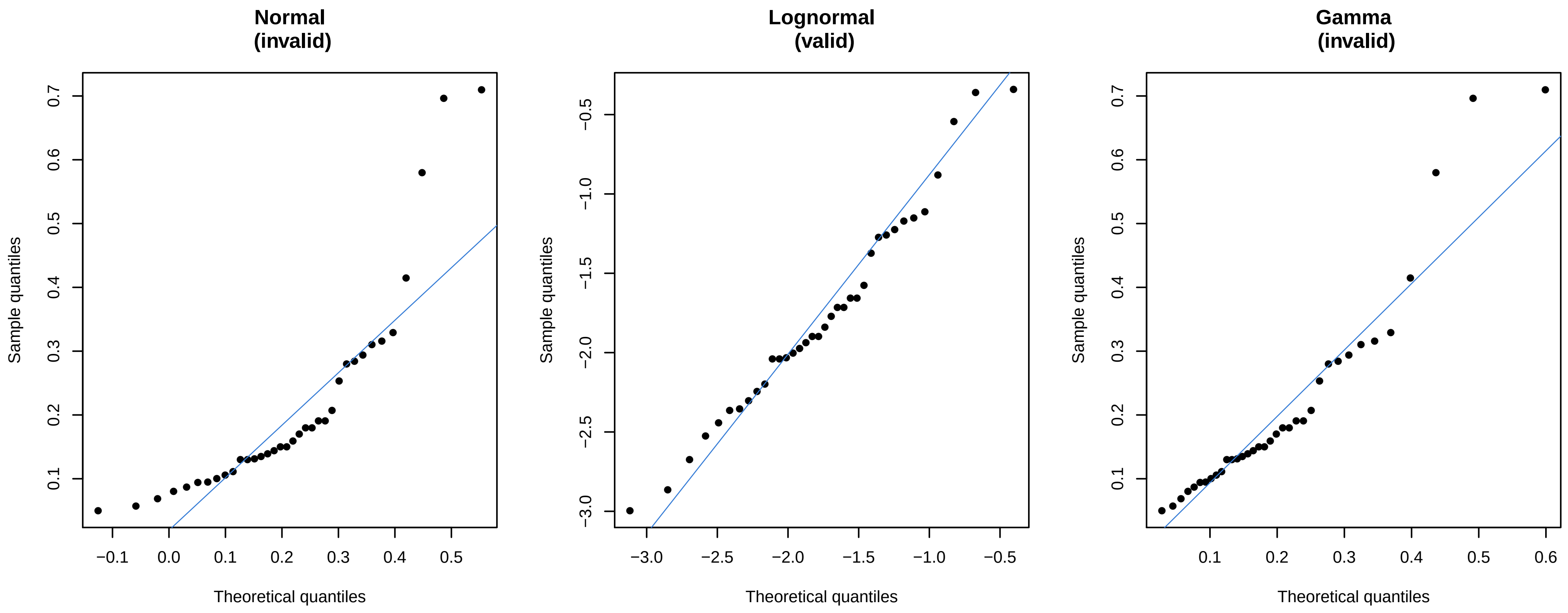
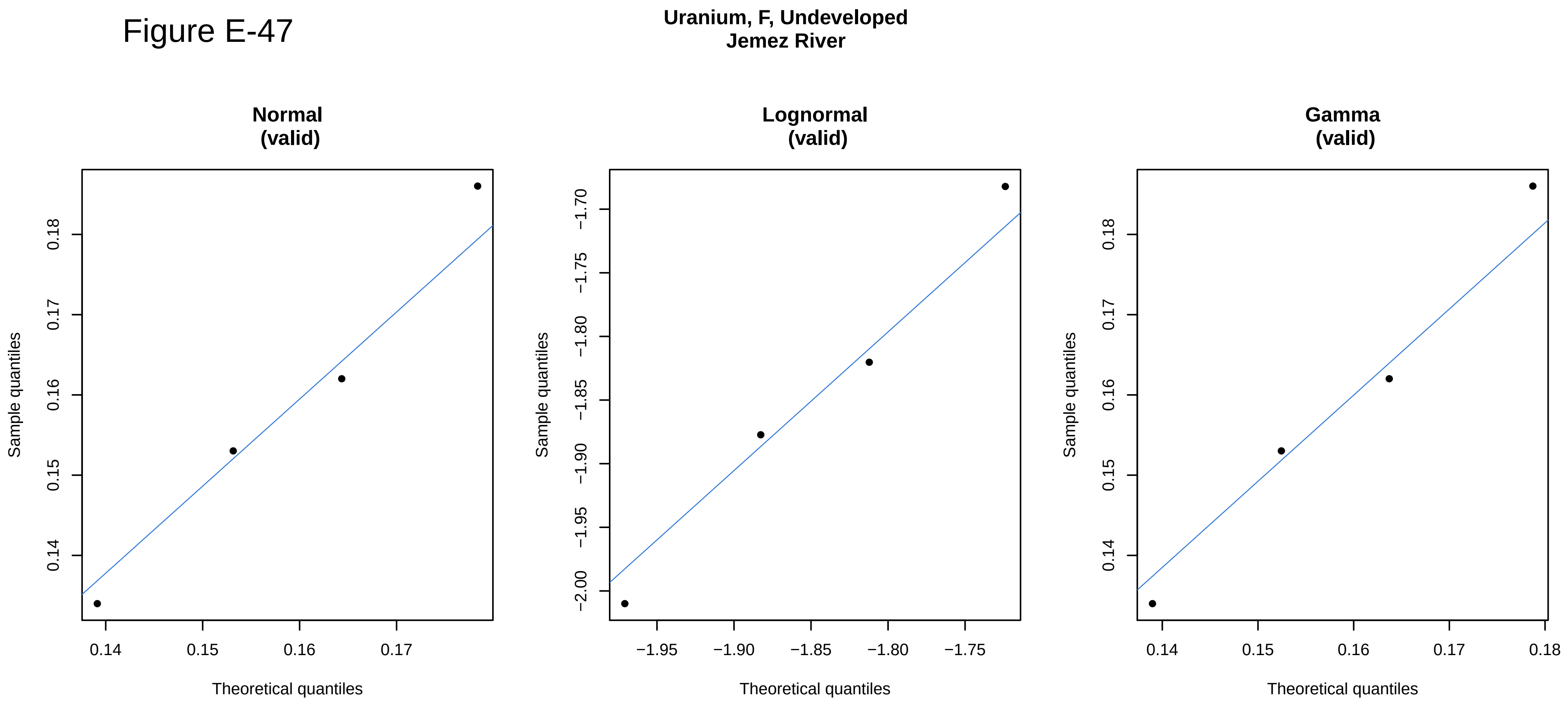


Figure E-47



Uranium, F, Undeveloped
Jemez River
Normal
(valid)
Lognormal
(valid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0.14
0.15
0.16
0.17
0.18
−2.00
−1.95
−1.90
−1.85
−1.80
−1.75
−1.70

Figure E-48

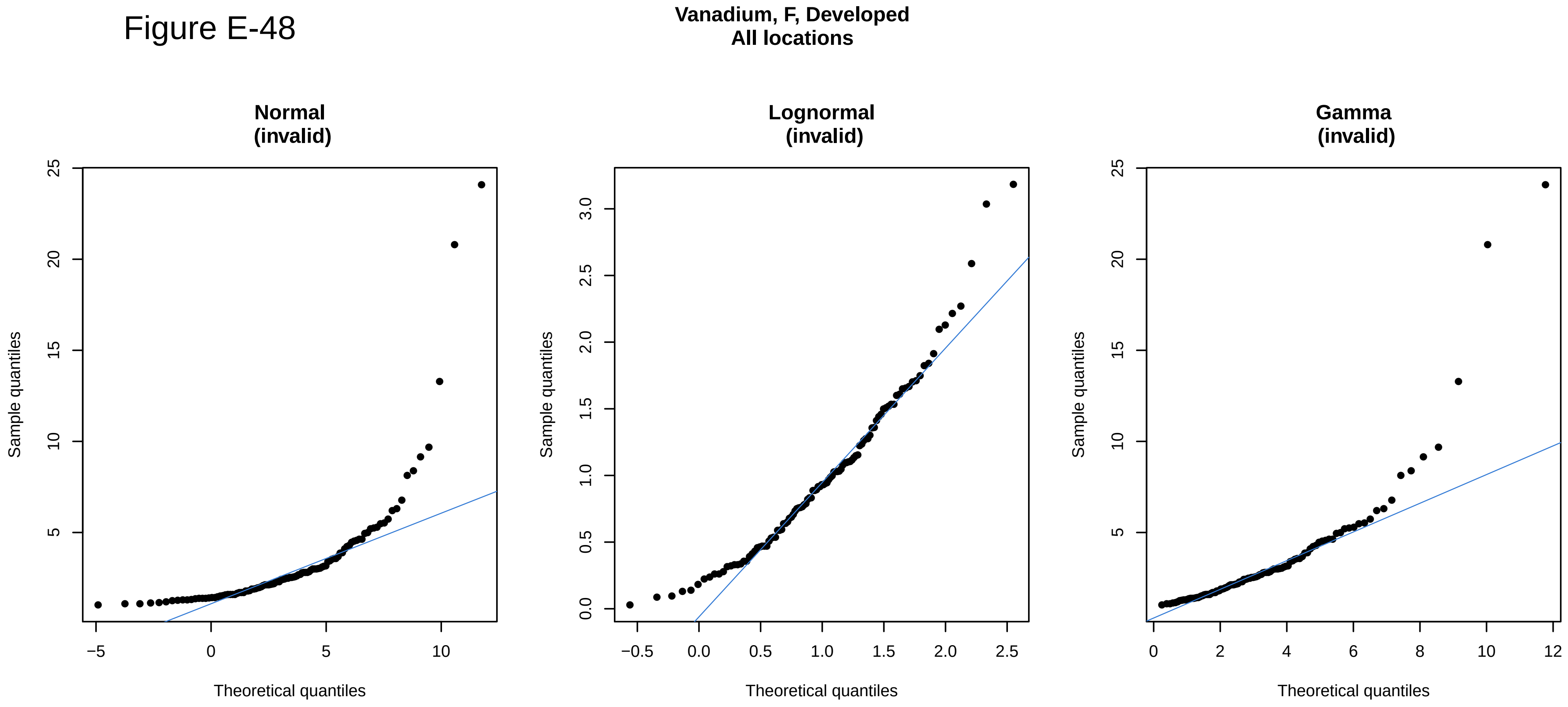

Vanadium, F, Developed
All locations
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
25
20
15
10
5
−5
0
5
10
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
0
2
4
6
8
10
12

Figure E-49

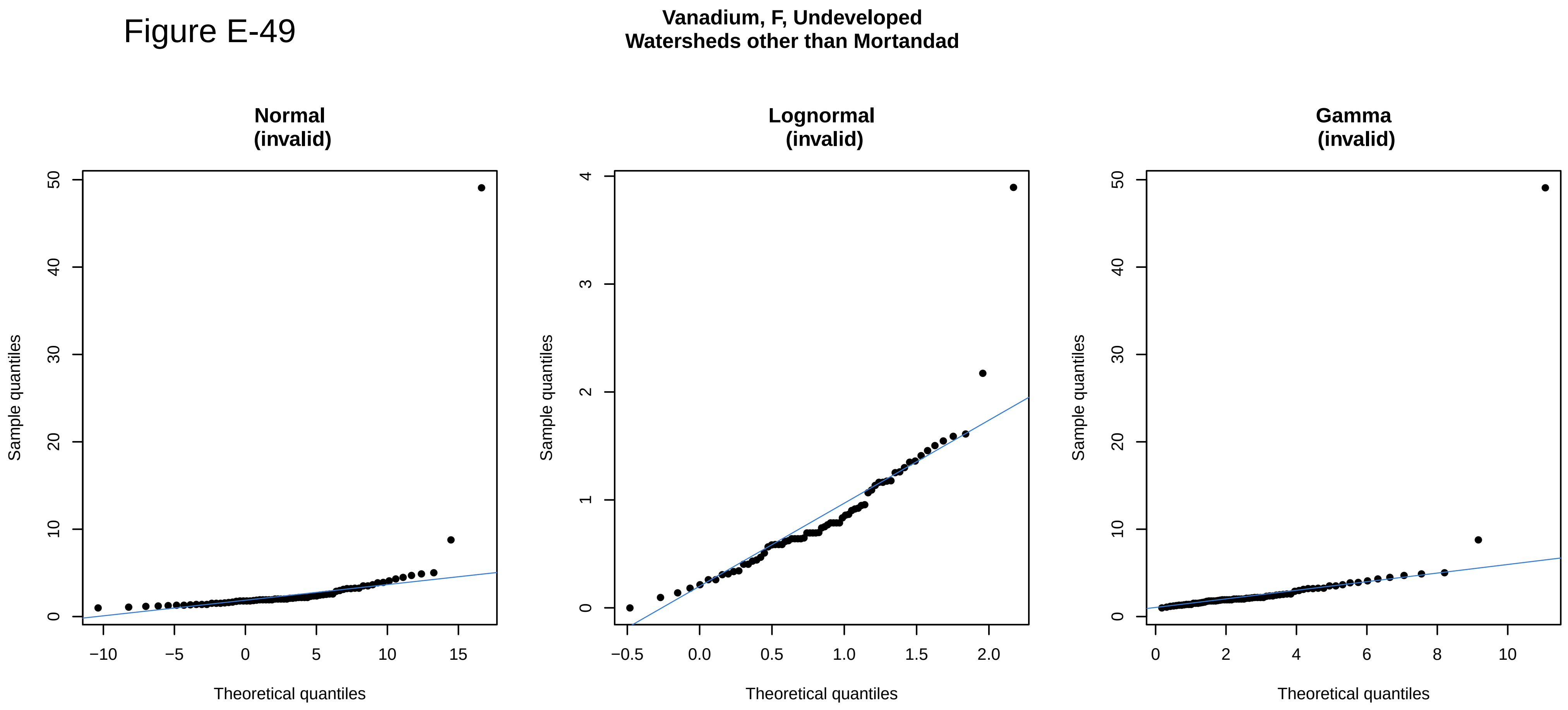

Vanadium, F, Undeveloped
Watersheds other than Mortandad
Normal
(invalid)
Lognormal
(invalid)
Gamma
(invalid)
Sample quantiles
Theoretical quantiles
0
10
20
30
40
50
−10
−5
0
5
10
15
1
2
3
4
−0.5
0.0
0.5
1.0
1.5
2.0
2
4
6
8

Figure E-50

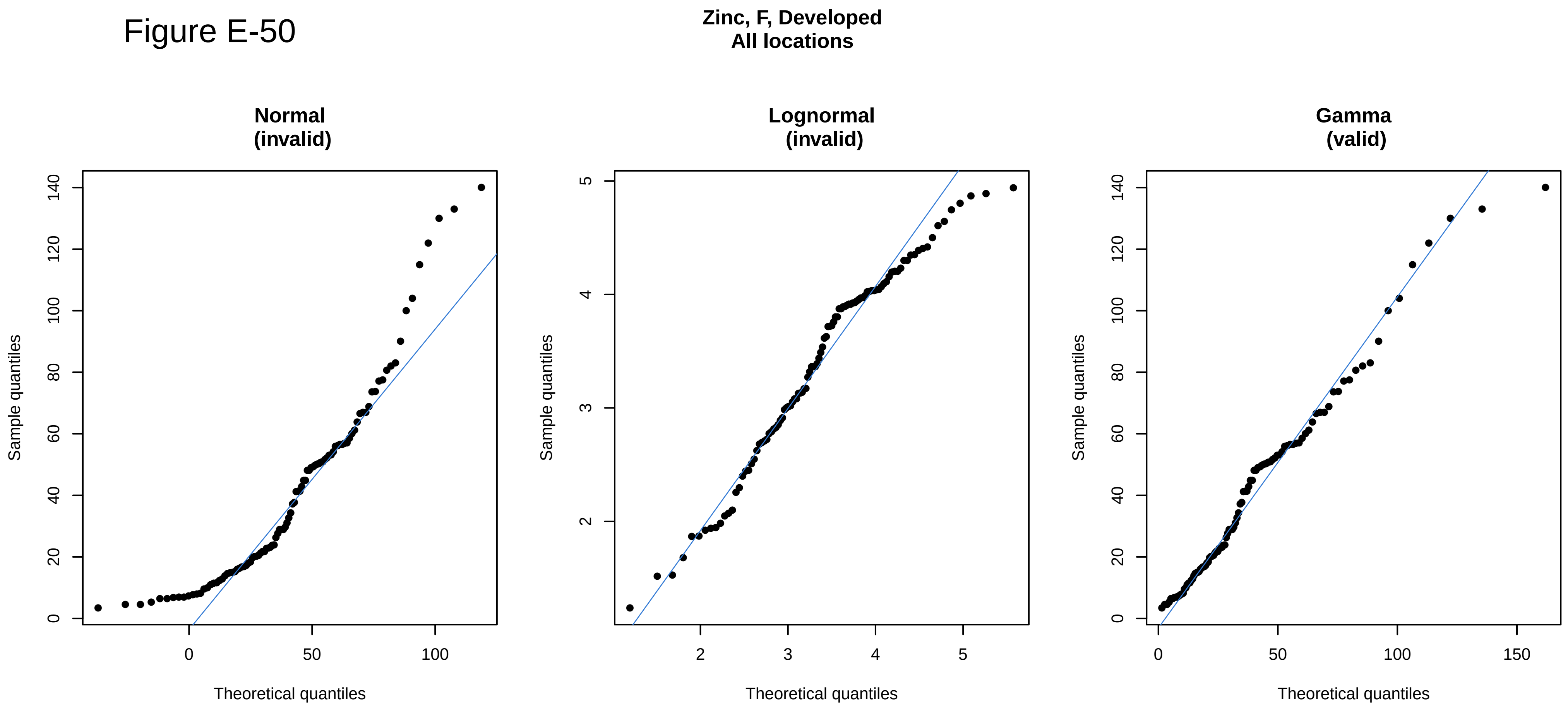
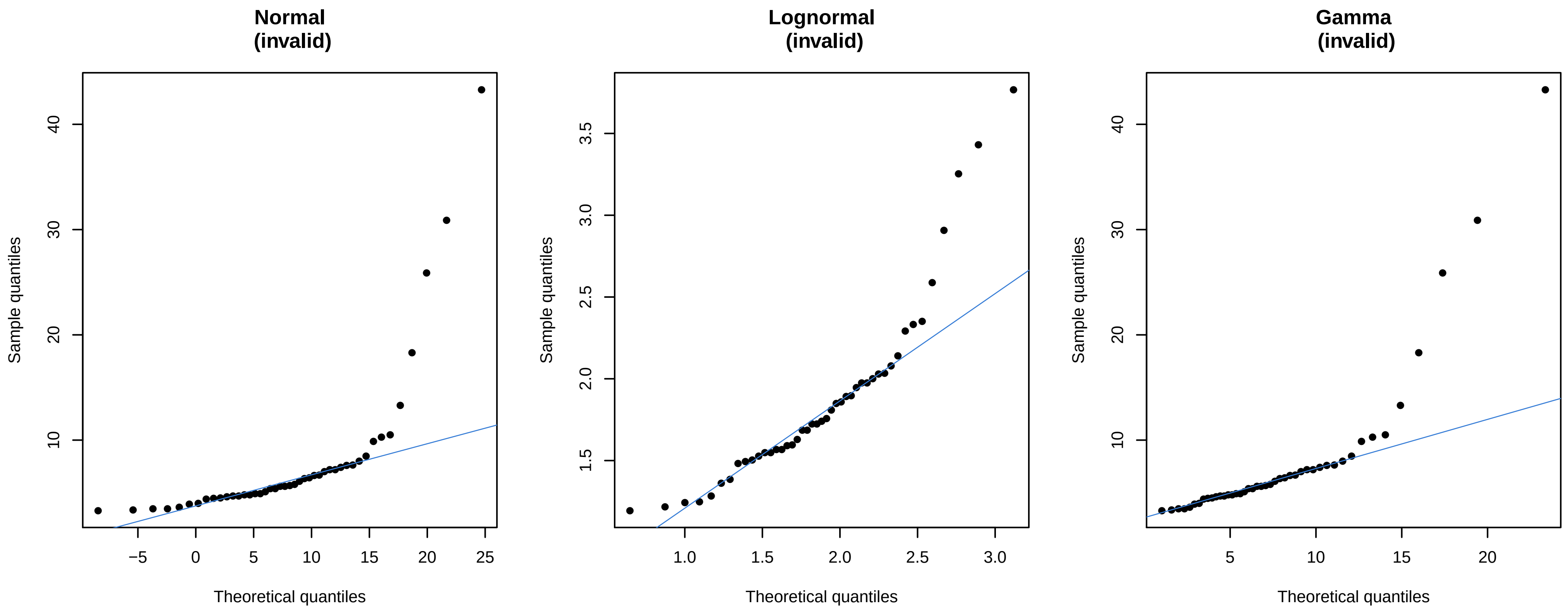

Zinc, F, Developed
All locations
Normal
(invalid)
Lognormal
(invalid)
Gamma
(valid)
Sample quantiles
Theoretical quantiles
0
20
40
60
80
100
120
140
0
50
100
2
3
4
5
150

Figure E-51

Zinc, F, Undeveloped
Watersheds other than Garcia



Appendix F. Input and Output Files for ProUCL Calculations of BTVs for the Pajarito Plateau Storm Water Background Dataset

Electronic data available upon request

Appendix G. Comparison of Storm Water Background Threshold Values for Pajarito Plateau to IP TALs and Other Relevant Thresholds

Appendix G. Comparison of storm water background threshold values for Pajarito Plateau to IP TALs and other relevant thresholds

						2018 LANL BTVs (µg/L or pCi/L)					SSC-Normalized 2018 LANL BTVs (mg/kg SSC or pCi/g SSC)					IP TALs (µg/L or pCi/L)			Historical LANL BTVs (ug/L or pCi/L for raw values; mg/kg SSC or pCi/g SSC for SSC-normalized values)								BLM-Based Values (µg/L)		Aluminum MLR-Based Values (µg/L)		
Constituent	Sample Prep.	Landscape	Data Subset Description	Selected Distribution Assumption	BTV Units	95-95 UTL	95% UPL	95% USL	95th Percentile	Max.	95-95 UTL	95% UPL	95% USL	95th Percentile	Max.	2010 IP ATAL	2010 IP MTAL	2015 Draft IP MTAL (Range)	Northern Reference (LANL 2013) (Raw)	Western Boundary (LANL 2013) (Raw)	Urban (LANL 2013) (Raw)	Northern Reference (LANL 2013) (SSC-Norm.)	Western Boundary (LANL 2013) (SSC-Norm.)	Urban (LANL 2013) (SSC-Norm.)	Baseline (LANL 2012) (Raw)	Urban (LANL 2012) (Raw)	BLM IWQC (Range of Medians)	BLM FMB	Al MLR IWQC (Range of Medians)	Al MLR FMB	New Mexico Hardness-Based Acute Criterion (µg/L)
Aluminum	F	Developed	All locations	lognormal	mg/kg SSC	1100-3700	680-2400	6200-22000	1000-3600	2600-9100	**5300**	3400	31000	5100	13000	--	--	270-4100	--	--	245	--	53030	91500	--	--	640-1800	170-1400	2100-3900	880-5000	370-1900
Aluminum	F	Undeveloped	E240 gage location (d/s of SR-501)	lognormal	µg/L	**15000**	7200	12000	5500	12000	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	--	270-4100	2210	1780	--	29000	--	--	--	--	640-1800	170-1400	2100-3900	880-5000	370-1900
Aluminum	F	Undeveloped	Locations other than SEP Reference (major group) and E240 (d/s of SR-501)	lognormal	µg/L	**2400**	1700	5400	1400	6700	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	--	270-4100	2210	1780	--	--	--	--	--	--	640-1800	170-1400	2100-3900	880-5000	370-1900
Aluminum	F	Undeveloped	SEP Reference	normal	µg/L	**4300**	3600	4200	3400	3600	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	--	270-4100	2210	1780	--	--	--	--	--	--	640-1800	170-1400	2100-3900	880-5000	370-1900
Aluminum	UF	Developed	All locations	gamma	mg/kg SSC	12000-43000	9600-34000	19000-68000	7800-27000	20000-70000	**61000**	48000	97000	39000	100000	--	--	270-4100	--	--	17700	--	--	91500	--	--	640-1800	340-3100	2100-3900	830-4700	370-1900
Aluminum	UF	Undeveloped	Northern and Bandelier Reference	normal	mg/kg SSC	15000-170000	14000-150000	18000-200000	14000-150000	18000-200000	**17000**	15000	20000	15000	20000	--	--	270-4100	161000	35000	17700	29000	53030	--	--	--	640-1800	340-3100	2100-3900	830-4700	370-1900
Aluminum	UF	Undeveloped	SEP and Western Reference	gamma	mg/kg SSC	68000-780000	53000-600000	99000-1100000	42000-480000	120000-1300000	**76000**	59000	110000	47000	130000	--	--	270-4100	161000	35000	17700	29000	53030	--	--	--	640-1800	340-3100	2100-3900	830-4700	370-1900
Antimony	F	Developed	All locations	none (b)	µg/L	nr (d)	nr (d)	nr (d)	nr (d)	nr (d)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	640	--	--	--	--	9.25	--	--	--	--	--	--	--	--	--	--
Arsenic	F	Developed	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	9	340	--	--	--	2.55	--	--	--	--	--	--	--	--	--	--
Arsenic	F	Undeveloped	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	**6.2**	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	9	340	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	UF	Developed	All locations	normal	µg/L	**0.10**	0.09	0.11	0.10	0.13	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Boron	F	Developed	Lab Developed	nonparametric	µg/L	nr (d)	nr (d)	nr (d)	nr (d)	nr (d)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	5000	--	--	--	--	47.3	--	--	--	--	--	--	--	--	--	--
Boron	F	Developed	Town Developed	normal	µg/L	**24**	23	28	nr (e)	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	5000	--	--	--	--	47.3	--	--	--	--	--	--	--	--	--	--
Boron	F	Undeveloped	SEP and Bandelier Reference	normal	µg/L	**20**	19	21	45	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	5000	--	--	30	--	--	--	--	--	--	--	--	--	--	--	--
Boron	F	Undeveloped	Western and Northern Reference	normal	µg/L	**25**	24	28	28	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	5000	--	--	30	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	F	Developed	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	0.6	0.34 -1.9	--	--	0.36	--	--	--	--	--	--	--	--	--	--
Cadmium	F	Undeveloped	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	0.6	0.34 -1.9	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	F	Developed	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	**33**	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	210	--	--	--	4.07	--	--	--	--	--	--	--	--	--	--
Chromium	F	Undeveloped	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	nr (e)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	210	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt	F	Developed	All locations	lognormal	µg/L	**3.2**	2.9	6.1	5.0	7.2	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	1000	--	--	--	--	9.2	--	--	--	--	--	--	--	--	--	--
Cobalt	F	Undeveloped	SEP and Bandelier Reference (f)	nonparametric	µg/L	5.0 (f)	2.0 (f)	5.0 (f)	2.4 (f)	5.0 (f)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	1000	--	--	7.53	4.64	--	--	--	--	--	--	--	--	--	--	--
Cobalt	F	Undeveloped	Western and Northern Reference	lognormal	µg/L	**6.5**	5.3	12	4.8	7.0	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	1000	--	--	7.53	4.64	--	--	--	--	--	--	--	--	--	--	--
Copper	F	Developed	Lab Developed	gamma	µg/L	**14**	12	18	12	13	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	4.3	2.4-15	--	--	32.3	--	--	--	--	--	6.5-120	4.8-85	--	--	3.0-9.5
Copper	F	Developed	Town Developed	nonparametric	µg/L	**20**	24	26	15	26	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	4.3	2.4-15	--	--	32.3	--	--	--	--	--	6.5-120	4.8-85	--	--	3.0-9.5
Copper	F	Undeveloped	Minor groups other than Bandelier	gamma	µg/L	**4.5**	4	6.8	4.0	5.6	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	4.3	2.4-15	3.43	5.7	--	--	--	--	--	--	6.5-120	4.8-85	--	--	3.0-9.5
Gross alpha	UF	Developed	All locations	normal	pCi/g	12-41	11-37	14-50	11-37	13-46	**59**	53	72	53	66	15	--	--	--	--	32.5	--	--	118	--	--	--	--	--	--	--
Gross alpha	UF	Undeveloped	All locations	lognormal	pCi/g	170-1900	120-1300	410-4600	88-1000	200-2200	**190**	130	450	98	220	15	--	--	1490	104	--	184	82.1	--	--	--	--	--	--	--	--
Lead	F	Developed	All locations	nonparametric	µg/L	**7.1**	22	50	2.9	50	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	17	8.3-75	--	--	3.3	--	--	--	--	--	120-710	58-1100	--	--	10-48
Lead	F	Undeveloped	Minor groups other than Bandelier	nonparametric	µg/L	**4.6**	6.6	10	2.2	10	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	17	8.3-75	9.03	--	--	--	--	--	--	--	120-710	58-1100	--	--	10-48
Mercury	UF	Developed	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	**0.48**	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.77	1.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	UF	Undeveloped	SEP and Bandelier Reference	nonparametric	µg/L	**0.42**	0.42	0.42	0.11	0.42	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.77	1.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury	UF	Undeveloped	Western and Northern Reference, excluding E240 gage location	normal	µg/L	**0.23**	0.20	0.29	0.29	0.60	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.77	1.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nickel	F	Developed	All locations	gamma	µg/L	**4.4**	3.9	7.6	3.8	11	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	170	99-730	--	--	7.57	--	--	--	--	--	--	--	--	--	--
Nickel	F	Undeveloped	Chupaderos, Garcia, and Mortandad	gamma	µg/L	**4.8**	3.8	4.9	3.6	4.5	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	170	99-730	3.53	1.54	--	--	--	--	--	--	--	--	--	--	--
Nickel	F	Undeveloped	Watersheds other than Chupaderos, Garcia, and Mortandad	gamma	µg/L	**2.4**	2.2	3.5	1.8	4.6	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	170	99-730	3.53	1.54	--	--	--	--	--	--	--	--	--	--	--
Radium-226 and radium-228	UF	Developed	All locations	lognormal	pCi/g	3.4-12	2.4-8.4	7.2-25	2.2-7.7	5.4-19	**17**	12	36	11	27	30	--	--	--	--	8.94	--	--	78.1	--	--	--	--	--	--	--
Radium-226 and radium-228	UF	Undeveloped	All locations	gamma	pCi/g	14-150	8.5-96	11-120	9.9-110	14-150	**15**	9.4	12	11	15	30	--	--	52.7	--	--	6.3	39	--	--	--	--	--	--	--	--
Selenium	UF	Developed	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (e)	**15**	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	5	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Selenium	UF	Undeveloped	Watersheds other than Mortandad	lognormal/ gamma (g)	µg/L	**7.0**	5.6	13	7.5	17	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	5	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	F	Developed	All locations	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (h)	nr (h)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	6.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	UF	Developed	Minor watersheds other than South Fork Acid	lognormal	µg/L	**0.064**	0.044	0.33	0.048	0.19	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.00064	--	--	--	--	--	--	--	--	--	0.098	--	--	--	--	--
Total PCBs	UF	Developed	South Fork Acid	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (h)	nr (h)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.00064	--	--	--	--	--	--	--	--	--	0.098	--	--	--	--	--
Total PCBs	UF	Undeveloped	Northern and Western Reference	lognormal	µg/L	**0.058**	0.027	0.25	0.017	0.13	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.00064	--	--	--	--	--	--	--	--	0.013	--	--	--	--	--	--
Total PCBs	UF	Undeveloped	SEP Reference	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (h)	nr (h)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	0.00064	--	--	--	--	--	--	--	--	0.013	--	--	--	--	--	--
Uranium	F	Developed	All locations	nonparametric	µg/L	**0.33**	0.59	0.98	0.22	0.98	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Uranium	F	Undeveloped	Jemez River	none (b)	µg/L	nr (c)	nr (c)	nr (c)	nr (h)	nr (h)	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	--	--	0.52	--	--	--	--	--	--	--	--	--	--	--	--
Uranium	F	Undeveloped	Watersheds other than Mortandad and Jemez River	lognormal	µg/L	**0.68**	0.49	1.60	0.48	0.71	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	--	--	0.52	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	F	Developed	All locations	nonparametric	µg/L	**9.7**	18	24	8.2	24	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	100	--	--	--	--	10.6	--	--	--	--	--	--	--	--	--	--
Vanadium	F	Undeveloped	Watersheds other than Mortandad	nonparametric	µg/L	**8.8**	27	49	4.9	49	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	100	--	--	5.77	5.86	--	--	--	--	--	--	--	--	--	--	--
Zinc	F	Developed	All locations	gamma	µg/L	**120**	100	240	100	140	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	42	30-180	--	--	1120	--	--	--	--	--	200-480	200-2100	--	--	37-110
Zinc	F	Undeveloped	Watersheds other than Garcia	nonparametric	µg/L	**31**	35	43	16	43	nc (a)	nc (a)	nc (a)	nc (a)	nc (a)	--	42	30-180	109	43.3	--	--	--	--	--	--	200-480	200-2100	--	--	37-110

SSC -- suspended sediment concentration
UTL -- upper tolerance limit
UPL -- upper prediction limit
USL -- upper simultaneous limit
F -- filtered
UF -- unfiltered
IWQC -- instantaneous water quality criterion
MLR -- multiple linear regression
SR -- state route
SEP -- Supplemental Environmental Program
d/s -- downstream
PCB -- polychlorinated biphenyl
TM -- technical memorandum
LANL -- Los Alamos National Laboratory
IP -- individual permit
MTAL -- maximum TAL
nd -- not determined
na -- not applicable
FMB -- fixed monitoring benchmark
BLM -- biotic ligand model
TAL -- target action level
ATAL -- average TAL

(a). SSC-normalized BTVs were not calculated for the particular constituent subset based on the assessment of dataset dependen cies presented in Section 3 and Appendix B.
(b). No distribution was selected for the particular data subset based on either ProUCL goodness -of-fit tests (Appendix F) or visual inspection of quantile-quantile (Q-Q) plots (Appendix E). Parametric UTLs, UPLs, and USLs were, therefore, not calculated .
(c). Insufficient detection frequency to reasonably calculate UTLs, UPLs, or USLs using ProUCL (detection < 20%)
(d). Data subset was instable, and source of instability could not be identified; no BTVs are recommended.
(e). The BTV was calculated as equivelent to a detection limit. BTVs equivalent to detection limits are not recommended.
(f). In the case of cobalt (undeveloped, SEP and Bandelier), the nonparametric UTL, 95th percentile, and maximum value are all equivalent to detection limits. The 90th percentile (0.19 ug/L), equivalent to the maximum detected concentration, is recommended instead for this dataset.
(g). Minimum BTVs for unfiltered, undeveloped selenium (watersheds other than Mortandad) were based on either lognormal or gamma calculations. The 95% USL was based on gamma, and the 95-95 UTL and 95% UPL were based on lognormal.
(h). Insufficient sample size in data subset to calculate BTVs (n<10).

General notes:

All data subsets were established in Section 3 of the main text (and Appendix B) and presented in Table 3 -4. All potential BTV statistics, ranges of 2015 draft IP MTALs, BLM IWQCs, FMBs, and hardness-based criteria in the table have been rounded to two significant figures. Thresholds reported in units that are not directly comparable to 2018 LANL potential BTV statistics are highlighted in gray a nd italicized. For SSC-normalized BTVs, raw BTV values are estimated using the 25th and 75th percentile SSC values from the relevant landscape dataset (developed or undeveloped). The BTVs are calculated as (SSC-normalized BTV * SSC * 0.001), where SSC is the appropriate 25th or 75th percentile value, and 0.001 is a unit conversion factor (to convert mg/kg SSC to µg/L or pCi/g SSC to pCi/L). The units pCi/L and pCi/g SSC correspond to gross alpha and radium-226 and radium-228. All other constituents are based on µg/L or mg/kg SSC.

The 2018 LANL BTVs reported in this table were selected among valid values presented in Section 4 of the main text (and Appen dix D). If more than one parametric value was valid for a statistic (and recommended based on visual inspection of distribution assumptions), then the minimum value among parametric values was selected to be conservative. If a parametric assumption was not reasonable (among normal, l ognormal, and gamma), then the nonparametric statistic was used. In a few cases, insufficient detection frequencies made it unreasonable to calculate UTLs, UPLs, or USLs, so only the percentile or maximum are reported herein. The 95th percentile is the recommended percentile value among possible percentiles, though, in general, percentile values are not strongly recommended as BTVs; the uncertainty associated with percentile values has not been quantified, so the confidence in percentile BTVs will be low (qualitatively). The maximum value is also reported, an d is associated, like percentiles, with unquantified uncertainty.

Q-Q plots were used to confirm or update the results of ProUCL goodness -of-fit test. This process was semi-quantitative, in that professional judgment was used to visually determine if a distribution assumption was valid and if one distribution assumptio n was more accurate than another. In cases where there were too few data to reasonably assume a distribution type, it was determined that no distribution assumpti on should be made. In cases where the data appeared to be relatively unstable (see "Notes on BTVs"), then no distribution assumption was made, and no BTVs were recommended. If distributions that were identified as valid by ProUCL were not selected based on Q -Q plot visualization, then the potential BTV statistics based on those distributions were not recommended.

The range of 2015 draft IP MTALs includes the values for all watersheds.

Ranges of IWQCs and FMBs are based on median values measured among receiving water sampling locations (both background and Si te-affected locations). New Mexico hardness-based criteria values for aluminum are based on the range across canyons (using the median hardness summarized by canyon). The IWQCs, FMBs, and hardness-based criteria values are based on background and Site-affected data.

Gross alpha 2010 IP TAL is based on adjusted gross alpha. All BTVs are calculated based on total gross alpha.

BLM and MLR FMB values based on filtered aluminum inputs were reported in a separate Windward product (unpublished); those va lues are reported in this table. The output from the BLM and MLR models for aluminum are based on toxicity and bioavailability data for total aluminum, so the comparability of BLM and MLR FMB values to calculated BTVs is questionable.

Recommended BTVs are shaded green with **bold** values.