A Brief Discussion of Data Used by EPA for Assessing Effects of the GKM Release on Water Quality

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There has been a lot of data collected at many locations

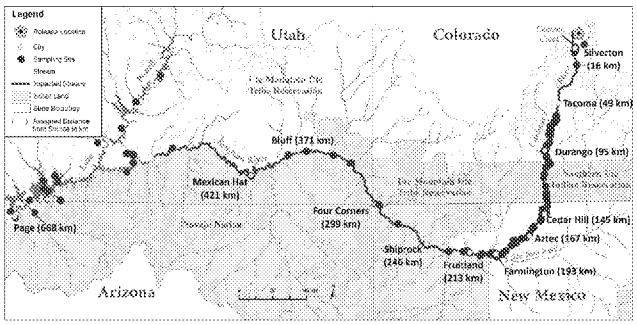
3 Primary Sources of Data

- **State/EPA Websites oriented to Gold King**
- **USGS Gold King database**
- **STORET**

We meticulously chronicle data sources

- **Location (lat/long)**
- **Assign distance from Animas headwaters**

  (very useful organizing variable)
- **What data is available, where it was obtained**
- **Maintain copies of original data**



309 sites from Gold King to Page, Arizona
55 in San Juan River

Whole System:
--1,400 total and dissolved metals river samples from GK event to Sep 1 2016
--818 river sediment samples

San Juan River:
--592 water samples
--298 sediment samples

Completeness and Availability of Data

Sampling Regimen

	Data Providers			Metals Sampling							
				Surface Water				Sediment			
	Entity	Abbreviation	Primary Sampling Area During GMM Plume	GMM Plume Event (Aug 5-10)	Post-Event (Aug 21-Oct)	Snow Melt May/June 2016	Pre-Event/ Historic	GMM Plume Event (Aug 5-10)	Post-Event (Aug 21-Oct)	Snow Melt May/June 2016	Pre-Event/ Historic
Federal	EPA Region 8	EPA08	Upper and Middle Animas in Colorado	x	x	x	x[1]	x	x	x	x
	EPA Region 6	EPA06	Lower Animas in New Mexico, Upper San Juan near Farmington	x	x	x		x	x	x	
	EPA Region 9	EPA09	Upper, Middle and Lower San Juan	x	x	x		x	x	x	
	U.S. Geological Survey	USGS	Upper and Middle San Juan	x	x	x	x				x
States	Colorado Department of Public Health and Environment	COLDPHE	Upper and Middle Animas in Colorado	x	x	x	x	x		x	
	New Mexico Environment Department	NMED	Lower Animas and Upper San Juan in New Mexico	x		x	x				x
	Utah Department of Environmental Quality	UDEQ	Middle and Lower San Juan in Utah	x	x	x	x	x	x		
Tribes	Southern Ute Indian Tribe	SUIT	Middle Animas on tribal lands	x	x	x	x				
	Ute Mountain Tribe	UMT	Middle San Juan on tribal lands	x			x				
	Navajo Nation Environmental Protection Agency	NNEPA	Upper, Middle, and Lower San Juan on tribal lands	x	x		x	x[2]	x[2]		
Municipal	City of Farmington	CFARM	Water intakes on Animas at Farmington	x	x	x					

[1] SWPA Superfund Site; [2] non-detects

Metals

EPA project Focused on 23 TAL metals +molybedenum

Surface Water–Total Recoverable	Federal Agencies				States			Tribes		
	EPA Region 6	EPA Region 8	EPA Region 9	U.S. Geological Survey	Colorado DPHE	New Mexico EIS	Utah DEQ	Southern Ute Indian Tribe	Ute Mountain Tribe	Navajo Nation EPA
Aluminum	x	x	x	x	x	x	x	x	x	x
Antimony	x	x	x	x		x	x	x	x	x
Arsenic	x	x	x	x	x	x	x	x	x	x
Barium	x	x	x	x	x	x	x	x		x
Beryllium	x	x	x	x	x	x	x	x		x
Cadmium	x	x	x	x	x	x	x	x		x
Calcium	x	x	x		x	x	x	x	x	x
Chromium	x	x	x	x	x	x	x	x		x
Cobalt	x	x	x	x	x	x	x	x		x
Copper	x	x	x	x	x	x	x	x	x	x
Iron	x	x	x	x	x		x	x	x	
Lead	x	x	x		x	x	x	x	x	x
Magnesium	x	x	x		x	x	x	x		x
Manganese	x	x	x	x	x	x	x	x	x	x
Mercury	x	x	x	x	x	x	x	x	x	x
Molybdenum	x	x	x	x	x	x	x	x	x	x
Nickel	x	x	x	x	x		x	x	x	x
Potassium	x	x	x		x		x	x	x	x
Selenium	x	x	x	x	x	x	x	x	x	x
Silver	x	x	x	x	x	x	x	x	x	x
Sodium	x	x	x		x		x	x	x	x
Thallium	x	x	x	x		x	x	x	x	x
Vanadium	x	x	x	x	x	x	x	x	x	x
Zinc	x	x	x	x	x	x	x	x	x	x

Availability of Other Types of Data

Continuously Recording:

USGS gages:
Flow, turbidity, SC, temperature

Sondes: SUITs, NMED

- **We have consolidated metals data into working data files**

OTHER CHEMICALS AND CONSTITUENTS

	Federal Agencies				States			Tribes		
	EPA Region 8	EPA Region 6	EPA Region 9	U.S. Geological Survey	Colorado DPHE	New Mexico ED	Utah DEQ	Southern Ute Indian Tribe	Ute Mountain Tribe	Navajo Nation NNEPA
Alkalinity (as CaCO3)							X			
Total hydroxide+1/2										X
Alkalinity, total				X		X	X	X	X	X
Bicarbonate (as $CaCO_3$)				X		X	X	X	X	X
Boron					X	X			X	X
Bromate					X					
Bromide					X	X				
Carbonate						X	X		X	X
Chloride				X		X	X			X
Conductivity	X	X	X				X		X	
Cyanide						X				X
Cyanides amenable to chlorination (HCN & CN)										X
Dissolved oxygen	X	X	X	X	X	X			X	X
DOC						X				
Fluoride				X	X	X			X	X
Gross alpha radioactivity,										X
Hardness (as $CaCO_3$)				X			X	X	X	X
Hydroxide (as $CaCO_3$)								X	X	X
Kjeldahl nitrogen									X	
Nitrate/Nitrite (as N)					X		X		X	
Orthophosphate	X	X	X							
Phosphorus									X	
Phosphate-phosphorus									X	
pH	X	X	X	X	X	X	X	X	X	X
Residue Filterable								X		
Residue Non-filterable								X		
Salinity						X				X
Silica										
Silicon					X					
Specific conductance	X	X	X	X		X				X
Strontium					X					
Sulfate				X	X	X	X		X	X
Temperature, water	X	X	X	X	X	X			X	X
Titanium					X					
Total dissolved solids				X		X	X	X	X	X
Total suspended solids						X	X	X	X	X
Turbidity						X				X
Uranium-234/235/238				X	X	X			X	X
CO_2				X						

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	Organization	Data type	Dates	Sites	Comment	Availability
Pre-event	UDEQ	water, field	1975-2014	(4952940) San Juan R Ab Lake Powell (4953000) San Juan R @ Mexican Hat US163 Xing (4953250) San Juan R @ Sand Island (4953400) San Juan R @ Swinging Footbridge (4953550) San Juan R Ab Cnfl / Montezuma Ck (4953800) San Juan R Bl Confluence W/ W Fk Allen Canyon (4953900) San Juan River Ab Arneth (4953950) San Juan R @ Marble Wash (4954000) San Juan R @ US160 Xing in CO (5952590) Lake Powell off Chs Canyon in San Juan Arm (5952610) Lake Powell at cnfl / San Juan Arm Midchannel	Via STORET. Year range contains gaps. All sites not necessarily sampled on all dates.	have
		biological	1977-2005	(4953000) San Juan R @ Mexican Hat US163 Xing (4953550) San Juan R Ab Cnfl / Montezuma Ck (5952631) Lake Powell-San Juan Arm NW of Neskahi Canyon (5952633) Lake Powell-San Juan Arm N of Neskahi Canyon (5985146) San Juan River @ Sand Island (NOT the same as 4953250)	Via STORET. Year range contains gaps. All sites not necessarily sampled on all dates.	
Event-related	UDEQ	water, field	2015 August: 8-20 2015 September: 22 2015 October: 2, 11, 15, 18-24, 26, 27	(4953000) San Juan R @ Mexican Hat US163 Xing (4953250) San Juan R @ Sand Island (4952942) San Juan Riv @ Clay Hill (4953990) San Juan River @ Town of Montezuma (4954000) San Juan R @ US160 Xing in CO	All sites not necessarily sampled on all dates.	have
		sediment	2015 August: 8, 15, 19 2015 September: 22 2015 October: 26-27	(4953000) San Juan R @ Mexican Hat US163 Xing (4953250) San Juan R @ Sand Island (4953400) San Juan R @ Swinging Footbridge (4952942) San Juan Riv @ Clay Hill (4953990) San Juan River @ Town of Montezuma (4954000) San Juan R @ US160 Xing in CO		
		water	2015 August: 24-28 2015 August: 11	GK-SW-01 to GK-SW-28 Lake Powell San Juan Inlet Bottom Transect Composi Lake Powell San Juan Inlet Water Column Composite		
		fish	2015 November: 3	(5952631) Lake Powell-San Juan Arm NW of Neskahi Canyon (5952633) Lake Powell-San Juan Arm N of Neskahi Canyon	Via STORET Only mercury was tested.	
	Utah Department of Natural Resources, Division of Wildlife Resources	fish	2015 August: 9	Where the San Juan River runs into Lake Powell		don't have
Post-event	UDEQ	water, field	2016 February: 18, 25, 29 2016 March: 1, 9, 15, 22, 28, 29 2016 April: 4, 6, 12, 19, 26 2016 May: 2, 9, 15, 21, 31 2016 June: 5, 13, 18, 25	(4952942) SAN JUAN RIVER AT CLAY HILLS BOAT RAMP (4953000) SAN JUAN RIVER AT MEXICAN HAT SAN JUAN RIVER AT MEXICAN HAT INTEGRATED SAMPLE (4953020) CHINLE CREEK AB CONFLUENCE WITH SAN JUAN RIVER [illegible] (4953250) SAN RIVER AT SAND ISLAND (or Sand Bar Island) (or AT SAND ISLAND BOAT LAUNCH) (4953560) MONTEZUMA CK AT U163 XING [illegible] (4953886) MCELMO CK AT HIWAY U262 XING (or MCELMO) (or AT HIWAY U162 XING) (4953990) SAN JUAN RIVER AT U262 XING NEAR TOWN OF MONTEZUMA CK (or AT U162 XING) (4954000) SAN JUAN RIVER AT US 160 CROSSING (or AT US 60)	All sites not necessarily sampled on all dates.	have
	UDEQ	sediment	2016 February: 16, 17	(4952942) SAN JUAN RIVER AT CLAY HILLS BOAT RAMP (4953000) SAN JUAN RIVER AT MEXICAN HAT (4953250) SAN RIVER AT SAND ISLAND (or Sand Bar Island) (4953990) SAN JUAN RIVER AT U262 XING NEAR TOWN OF MONTEZUMA CK (4954000) SAN JUAN RIVER AT US 60 CROSSING		

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We have created a data file that chronicles every site by provider

This is UDEQ's page

Pre-event or Historic Sites San Juan

San Juan has 44 sites where something has been measured.

(Animas 122)

Agency	SiteID	Description	Distance from source (miles)	Distance from source (km)	Site Type	Location	Latitude	Longitude	Media
COPHS	83	San Juan River Near State Line			Main	San Juan River	37	-108.9833333	SW
EPA	WUTP98-0553	San Juan River	288.84		Main	San Juan River	37.17	-109.83	SW
NMED	49SanJuan111.6	San Juan River stv Animas - 49SanJuan120.6	119.22	191.86589	Reference	San Juan River	36.711036	-108.218042	SW
NMED	49SanJuan113.5	San Juan River at Bakers Bridge near Farmington	119.22	191.86589	Reference	San Juan River	36.708354	-108.150518	SW
NMED	49SanJuan111.5	San Juan River at McGee Park - 49SanJuan113.5	119.22	191.86589	Reference	San Juan River	36.694362	-108.133277	SW
NMED	49SanJuan119.3	San Juan River at Jeff Stagg property	119.22	191.86589	Reference	San Juan River	36.685784	-108.053792	SW
NMED	49SanJuan126.2	San Juan River at Bloomfield Bridge	119.22	191.86589	Reference	San Juan River	36.699894	-107.985677	SW
NMED	49SanJuan140.6	San Juan River at Bridge near Blanco	119.22	191.86589	Reference	San Juan River	36.724572	-107.812994	SW, SED
NMED	49SanJuan162.4	San Juan River near Navajo Dam	119.22	191.86589	Reference	San Juan River	36.79614	-107.7219	SW
NMED	49SanJuan162.6	San Juan River Div Gage Station	119.22	191.86589	Reference	San Juan River	36.699559	-107.69517	SW
NMED	49SanJuan100.2	San Juan River at Betz Bridge	119.79		Main	San Juan River	36.7217	-108.224	SW
NMED	07SanJuan685.3	San Juan River Hogback	141.39		Main	San Juan River	36.745581	-108.535346	SW
NMED	07SanJuan682.5	San Juan River near Kirtland	132.48		Main	San Juan River	36.735581	-108.452755	SW
NMED	07SanJuan686.1	San Juan River @ Lions Park near Kirtland	127.93	204.4349883	Main	San Juan River	36.732156	-108.325215	SW
NMED	07SanJuan690.3	San Juan R Above Farmington	122.19		Main	San Juan River	36.735083	-108.231115	SW
NMED	07SanJuan100.2	San Juan River at Betz Bridge	119.79		Main	San Juan River	36.7217	-108.224	SW
NNEPA	UNEPA-02SAJUUANR08	San Juan River near NM/CO border @ the Four Corners	153.92	246.5248141	Main	San Juan River	36.9882611	-109.0046225	SW
NNEPA	UNEPA-02SAJUUANR07	San Juan River near bridge @ Montezuma Creek	214.57	345.7997453	Main	San Juan River	37.259277	-109.910476	SW
NNEPA	UNEPA-02SAJUUANR06	San Juan River @ US 191 bridge near Bluff	234.92	377.8842933	Main	San Juan River	37.262971	-109.21648	SW
NNEPA	NNEPA-10RUFLNW93	Fruitland Canal @ 25 Arch Rd	139.1		Ditch	San Juan River	36.71537214	-108.0476642	SW
NNEPA	UNEPA-10SAJUUANR05	San Juan River @ the bottom of the Hogback, fish passage	141.44	227.6258154	Main	San Juan River	36.74546622	-108.5226482	SW
NNEPA	UNEPA-10SAJUUANR03	San Juan River near Canal Creek	169.31	272.4769326	Main	San Juan River	36.89382249	-108.8785948	SW
NNEPA	UNEPA-10SAJUUANR02	San Juan River upstream from Shiprock WWTF	154.54		Main	San Juan River	36.78992701	-108.7126682	SW
NNEPA	UNEPA-10SAJUUANR01	San Juan River downstream from Shiprock WWTF	154.95		Main	San Juan River	36.7894623	-108.7124077	SW
UDEQ	4913640	San Juan R Ab Lake Powell	347.74		Main	San Juan River	37.264156	-110.498798	SW
UDEQ	4913600	San Juan R @ Mexican Hat Us163 Xing	261.9	421.4871936	Main	San Juan River	37.150756	-109.987672	SW
UDEQ	4913250	San Juan R @ Sand Island	234.29	377.2532058	Main	San Juan River	37.26622563	-109.6137343	SW
UDEQ	4913400	San Juan R @ Swinging Footbridge	226.88	364.75782	Main	San Juan River	37.260001	-109.492896	SW
UDEQ	4913880	San Juan R Ab Cott Mcelmo Ck	248.93		Main	San Juan River	37.268326	-109.338394	SW
UDEQ	4913600	San Juan R Bl Confluence W W Fk Allen Canyon	212.1		Main	San Juan River	37.253221	-109.257254	SW
UDEQ	4913600	San Juan River Ab Aneth	206.48		Main	San Juan River	37.213224	-109.108505	SW
UDEQ	4913650	San Juan R @ Marble Wash	198.78		Main	San Juan River	37.143284	-109.114296	SW
UDEQ	4914600	San Juan R @ 115150 Xing In CO	156.52	298.7425267	Main	San Juan River	37.091755	-109.032726	SW
UDEQ	5912500	Lake Powell Off Cha Canyon In San Juan Arm	360.15		Lake	Lake Powell	37.165225	-110.81792	SW
UDEQ	5912610	Lake Powell @ Off San Juan Arm Midchannel	370.44		Lake	Lake Powell	37.177409	-110.88676	SW
DMET	UTEMTN-SJ-M2	San Juan @ USGS Gauging station	185.47		Main	San Juan River	37.001113	-109.629585	SW
DMET	UTEMTN-SJ-M1	San Juan River above Chinle River	161.7		Main	San Juan River	36.941657	-109.375112	SW
DMET	UTEMTN-SJ-M3	San Juan below Mexican River	184.75		Main	San Juan River	36.984284	-109.37605	SW
USGS	09357100	San Juan River @ Hardwood Bridge Bloomfield, NM	119.22	191.86589	Reference	San Juan River	36.685444	-108.095	SW, SED
USGS	09355000	San Juan River @ Farmington, NM	119.3	192.0603448	Main	San Juan River	36.723114	-108.225128	SW, SED
USGS	09357500	San Juan R Nr Fruitland, NM			Main	San Juan River	36.745578	-108.4525	SW, SED
USGS	09368000	San Juan River @ Shiprock, NM	153.53	246.9488376	Main	San Juan River	36.781525	-108.63056	SW, SED
USGS	09371010	San Juan River @ Four Corners, CO	165.5	266.3223115	Main	San Juan River	37.000102	-109.050132	SW, SED
USGS	09379500	San Juan River Near Bluff, UT	253.55	408.0223223	Main	San Juan River	37.147014	-109.864438	SW, SED

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Quality Assurance

- **Data files all contain lab QA/QC information needed for understanding samples**
  - We have concluded we can consolidate and integrate data
  - Occasional differences among providers too big to ignore
- Providers differ in some key ways
  - Detection limits
  - Parameters (e.g. which metals; what methods)
- **We have built a link to all QA/QC documentation**
  - Largely complete
  - Some information hard to input cut from documentation (digestion? filtering?)
- **We have done some error checking and find occasional errors and blunders.**
- **For the most part—data error free, good quality and can be integrated (but must constantly stay vigilant)**

	Matrix	Methodology	Parameter	Technology
Metals	Sediment	EPA 6020A	Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Ti, V, Zn	ICP/MS[2]
		EPA 6010B		ICP-AES[1]
		EPA 6010C	Al, Fe, Ca, Mg, K, Na	
		EPA 7471A	Hg	CVAA[3]
	Surface Water (Dissolved and Total)	EPA 200.7	Al, Fe, Ca, Mg, K, Na	
		EPA 200.8	Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Ag, Ti, V, Zn	ICP/MS[2]
		EPA 245.1	Hg	CVAA[3]
General Analytes	Surface Water	SM 2320B	Alkalinity	Titration
		EPA 300.0	Anions-Chloride	Ion Chromatography
		EPA 300.0	Anions-Fluoride	Ion Chromatography
		SM 2340B	Hardness (as $CaCO_3$)	Calculation
		EPA 300.0	Anions-Nitrate as N	Ion Chromatography
		SM 4500H+B	pH	Ion Selective Electrode
		EPA 300.0	Anions-Sulfate	Ion Chromatography
		SM 2540C	Total Dissolved Solids	Gravimetry
		SM 2540D	Total Suspended Solids	Gravimetry

[1] ICP-AES – Inductively Coupled Plasma-Atomic Emission Spectroscopy
[2] ICP/MS – Inductively Couple Plasma/Mass Spectrometry
[3] CVAA – Cold Vapor Atomic Absorption

What is generally used, but there is an exception to everything

Data Availability—EPA/ORD Project Files

- Data files will be shared with EPA OW offices responsible for Gold King Monitoring Plan going forward
- Data files will be shared with Regions as interested
- Data files will be available on website with published report