Los Alamos Canyon Watershed Stormwater Monitoring from 2003 through 2008: Contaminant Transport Assessment

Los Alamos County, New Mexico

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Executive Summary

During 2003 to 2008, the Department of Energy Oversight Bureau of the New Mexico Environment Department evaluated stormwater conditions in the Los Alamos watershed and prepared this report. The Los Alamos watershed heads in the Sierra de los Valles and extends eastward through the Los Alamos National Laboratory to the Rio Grande. This report quantifies the redistribution rates of legacy contaminant-bound sediments in stormwater after the Cerro Grande fire in 2000. The contaminant sources originate from Laboratory discharges during 1943 to 1986 of treated and untreated industrial wastewater containing radioactive and other research derived contaminants. In 2000, the Cerro Grande fire burned through the mountains changing the canyon hydrology and ensuing floods began redistributing contaminant laden sediments downstream to and into the Rio Grande.

This summary presents two components of the report, among other assessments, which might be of interest;

1. Estimates of plutonium$^{239/240}$ and sediment transport at six stations within the watershed are made.
2. Concentration and Inventory Rating Coefficients are developed for individual stations to identify changing transport conditions across the watershed.

Both the inventory estimates and the metrics are based on assumptions that sediment and contaminant concentrations increase or decrease proportionately with changing flow. These assumptions were developed from empirical measurements and observations in previous reports and well characterized events during the period of this report. At individual stations strong relationships between discharge, suspended sediment concentrations and plutonium$^{239/240}$ measurements in water were observed in multiple samples collected from single events.0 Linear equations were developed that defined the relationships between concentrations and discharge. If that relationship is defined for an event, the "concentration slope coefficient" can be used to predict an instantaneous concentration throughout the event based on flow. Cumulative mass transport can then be estimated for the event.

Station specific relationships between inventory and peak discharge were then used to establish "Inventory Rating Coefficients" and cumulative transport estimates over multiple events. It was not the intent of this report to fully characterize every event, but use the assumptions, rating coefficients, and samples collected from a representative set of events to estimate sediment and contaminant transport inventories for events not sampled. We made those estimates based on;

1. The preceding assumptions of proportional increases or decreases with changing discharge.
2. An additional observation that most storm flows in the ephemeral channels on the Pajarito Plateau are "flashy". Storm surges typically generate hydrographs that illustrate a quick rising limb of the flood bore to peak discharge, followed by a slower declining trailing limb.

3. Inventory Rating Coefficients based on contaminant and sediment transport-inventory linear correlations to peak discharge. These coefficients are relevant for specific stations. If the coefficients change over time or between stations, we can conclude that sediments and/or contaminants are being transported at different rates.
    a. While the plutonium$^{239/240}$ concentrations in suspended sediments vary across the watershed, they are fairly consistent at individual stations.
    b. Concentrations of sediments and contaminants in water measure these rates or availability as well. The difference we suggest is concentration values in water, pCi/L or mg/L, define the instantaneous mass relationship to volume of water. In our report, the rating coefficients also define the relationship of plutonium$^{239/240}$ or sediment concentrations to flow rates, L/s.
    c. If the coefficients change over time or between reaches, we can conclude that sediments and/or contaminants are being transported at different rates. For example, in an improving watershed reach, not only does average peak discharge decline along with proportionate loads, but so does the flood capacities to carry sediment or contaminant loads relative to similar flood energies (e.g. 5000 mg/L SSC in a 100 cfs discharge relative to 500 mg/L measurement in a similar 100 cfs discharge).

Based on these methods we have estimated that approximately;

- 250 mCi of plutonium$^{239/238}$ in 36000 tons of sediment have been transported off Laboratory property since the Cerro Grande fire through 2008.
- From 2003 to 2008, 34 mCi of plutonium$^{239/238}$ in 7500 tons of sediment were transported to the Rio Grande.
- Over 30% of offsite transport and 80% of contaminant transport to the Rio Grande occurred during one storm event. On August 8th, 2006 flow was report at E060 and E050 as 1926 cfs and 252 cfs respectively. Farther downstream at E110 flow was reported at 1642 cfs.
- The rating coefficients identify low contaminant availability to stormwater transport in background reaches like Guaje Canyon or the headwaters of Pueblo Canyon, moderate contaminant availability in mid Los Alamos Canyon, followed by the largest levels of contaminants available in Pueblo Canyon downstream to lower Los Alamos Canyon.
- The sediment coefficients indicate Upper Pueblo and upper to mid Los Alamos Canyons develop smaller sediment loads than much larger sediment supplies in downstream Pueblo and Los Alamos Canyons.

In the context of this report, we demonstrate the relation between suspended sediment, plutonium$^{239/240}$ measurements in sediment, and plutonium$^{239/240}$ measurements in water. Of particular significance are the magnitudes of plutonium$^{239/240}$ values in sediment and the relation it bears on plutonium$^{239/240}$ transport availability. For example, stormwater from Acid Canyon typically contains suspended sediment that has large values of plutonium$^{239/240}$ measured in it; the average of 17 pCi/g was calculated from samples taken for this report. Yet because Acid Canyon contributes relatively small amounts of suspended sediment to stormwater, an average of 2000 mg/L, a relatively small downstream contribution of contaminants is made. The average $plutonium^{239/240}$ concentration in water from Acid Canyon is 29 pCi/L, while other stormwater at stations downstream in Pueblo Canyon contain lower $plutonium^{239/240}$ concentrations in sediment, much larger sediment loads, and consequently total $plutonium^{239/240}$ values in water that exceed 100 pCi/L.

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Abstract

During 2003 to 2008, the Department of Energy Oversight Bureau of the New Mexico Environment Department collected stormwater samples from the Los Alamos watershed. The Los Alamos National Laboratory discharged radioactive and industrial effluents into the watershed during the 1940's through the 1980's that have spread throughout the canyon channel systems to the Rio Grande. Commercial analytical laboratories analyzed the samples for radiochemical, metal and physical characteristics. This report evaluates the chemical and hydrological data to determine mass transport of sediments and Los Alamos National Laboratory legacy plutonium$^{239/240}$ in stormwater runoff, describe spatial and temporal trends in suspended sediment loads and contaminant levels, and determine exceedance of applicable water quality criteria.

Introduction

During 2003 to 2008, the Department of Energy Oversight Bureau (DOEOB or the Bureau) of the New Mexico Environment Department (NMED) collected stormwater samples from the Los Alamos watershed, and submitted them to commercial analytical laboratories for radiochemical, trace and heavy metal, and suspended sediment concentration analysis. We compared the resulting data to applicable water quality standards, assessed plutonium$^{239/240}$ concentrations in water and in suspended sediments, determined transport rates of sediments and plutonium$^{239/240}$, developed basic descriptive statistics for all chemical data, described spatial and temporal trends based on comparisons of data between watershed locations and time periods, and evaluated Los Alamos National Laboratory (LANL or Laboratory) gage stage and discharge data.

The Los Alamos watershed is at roughly the northern boundary of the Laboratory facility. It extends east from the Sierra de los Valles 17 miles (27 km) to the Rio Grande through US Forest Service, Los Alamos County, LANL, and Pueblo de San Ildefonso lands. The watershed area is approximately 58 mi^2 (150 km^2) and contains the 14 mi^2 (36 km^2) Los Alamos, 8 mi^2 (22 km^2) Pueblo, and 35 mi^2 (92 km^2) Guaje Canyons sub-watersheds. Legacy LANL discharge points and solid waste management units (SWMUs) are located in canyon bottoms and valley walls of the Los Alamos watershed. Of most significance are the radioactive wastewater discharges into Acid Canyon a tributary to Pueblo Canyon, and DP Canyon a tributary to Los Alamos Canyon. Legacy contaminants have been distributed throughout the watershed since Laboratory operations began in the 1940's and re-distribution rates were accelerated since the May 2000 Cerro Grande fire but are diminishing as the watershed recovers from the fire impacts.

After the Cerro Grande fire, we found that stormwater flows increased in frequency and magnitude within the Pajarito Plateau, distributing LANL legacy contaminants from Laboratory property to the Rio Grande at increasing rates. These conclusions are described in a Bureau report 'Post Cerro Grande Fire Channel Morphology in Lower Pueblo Canyon, Reach P-4 West: and Stormwater Transport of Plutonium$^{239/240}$ in

Suspended Sediments." The report describes Bureau stormwater monitoring efforts during 2000 to 2002, primarily at LANL gage station E060. The E060 gage station is just above the Los Alamos/Pueblo Canyon confluence near the Laboratory/Pueblo de San Ildefonso boundary. The shared property line is at the Laboratory's eastern down-gradient-boundary and Pueblo de San Ildefonso's western-boundary.

This report is an extension and expansion of the preceding 2000 to 2002 stormwater evaluation. It describes our stormwater monitoring efforts during 2003 through 2008. We expanded the number of monitoring stations in Pueblo Canyon and Los Alamos Canyon stations downstream to and including the Rio Grande. Hydrographs were also generated for all flows at 12 LANL gage stations in the watershed and evaluated.

The following transport estimates were made from assumptions developed by observation and empirical measurements in stormwater since the Cerro Grande fire. General assumptions we found true were that suspended sediment concentrations in stormwater increase and decrease proportionately with discharge, that plutonium$^{239/240}$ concentrations in suspended sediments were fairly consistent at individual stations, and total plutonium$^{239/240}$ measurements in water increased uniformly with suspended sediment concentrations. Based on these assumptions and the correlations between stormwater discharge and suspended sediment and plutonium$^{239/240}$ concentrations, we estimated sediment and plutonium$^{239/240}$ contaminant transport in individual storm events and then developed an accumulative estimate for six stations within the watershed. The accumulative estimate was developed for the 2003 through 2008 time period of this report.

Rating coefficients are also developed and presented that identify stream function, relative channel stability, and sediment and contaminant availability at stations monitored during this period. Use of these coefficients in future storm water assessments may identify changes in the watershed. These changes may reflect potential destabilization of the water courses or watershed improvements made by LANL to reduce off-site contaminant migration.

Uncertainty is associated with these estimates but not quantified in this report. All measurements contain uncertainty. Environmental surveillance measurements contain uncertainty from multiple sources, including sampling, chemical analysis, and the inherent variability in the environment. Our estimates potentially contain the same sources of uncertainty compounded and propagated through multiple iterations of the transport estimate process.

In summary this report describes the following estimates:

- that up to 182 milli Curies (mCi) of plutonium$^{239/240}$ has been transported out of Pueblo Canyon into lower Los Alamos Canyon on Pueblo de San Ildefonso lands during the 2003 to 2008 period of this report
- that 1 mCi has been transported out of mid Los Alamos Canyon into lower Los Alamos Canyon
- that 34 mCi of plutonium$^{239/240}$ has been transported to the Rio Grande during the period of this report

- that 149 mCi or 82% of plutonium$^{239/240}$ transported beyond the Laboratory boundaries during the time frame of this report remains on Pueblo de San Ildefonso lands in lower Los Alamos Canyon.
- Laboratory contaminants were carried off site in 19000 tons of suspended sediments, of which 7500 tons entered the Rio Grande
- that approximately 246 mCi of plutonium$^{239/240}$ in 35543 tons of suspended sediment have been transported out of Pueblo Canyon into lower Los Alamos Canyon since the 2000 Cerro Grande fire
- rating coefficients that describe the relationships between peak discharge and inventory estimates of suspended sediments and plutonium$^{239/240}$ can be used to identify contaminant and sediment transport availability, and thereby temporal and spatial condition changes in the watershed channels. For example lower Pueblo Canyon followed by lower Los Alamos Canyon stations develop the largest coefficients and contribute the largest amount of sediment for transport. Upper Pueblo and upper to mid Los Alamos stations contribute the smallest levels.
- plutonium$^{239/240}$ concentrations in suspended sediments throughout Pueblo Canyon average about 5 pCi/g, the levels are similar in lower Los Alamos Canyon above the Rio Grande when floods originate from Laboratory property, averaging 4.6 pCi/g. The average from Guaje Canyon, a baseline tributary to lower Los Alamos Canyon, is 0.4 pCi/g.
- until a July 2008 waterline break at TA-21 in upper Los Alamos Canyon, the average plutonium$^{239/240}$ concentration in the canyon suspended sediments was 1 pCi/g, after the excursion it increased to almost 40 pCi/g. The concentrations have steadily declined since the waterline break. Acid Canyon, a main source term to Pueblo Canyon, contributes an average 17 pCi/g in suspended sediments
- the average concentrations of total plutonium$^{239/240}$ in all storm samples from upper Los Alamos Canyon is 5 pCi/L, the average concentration in mid Pueblo Canyon above a wetland is 90 pCi/L. Beyond the wetlands the concentrations decline to an average 15 pCi/L measured at the Pueblo Canyon endpoint and then 19 pCi/L downstream to the Rio Grande confluence
- it appears that an 85% reduction of sediment transport rates occur through the Pueblo Canyon wetlands, identified by suspended sediment concentrations
- an 80% reduction of sediment transport rates occurs through the Los Alamos Canyon low head weir, up to 86% when flows completely impounded by the structure are included in the evaluation. Approximately 3700 tons of sediment was retained within the impoundment from 2003 to 2008
- a subset of gross alpha, uranium, americium, strontium, and cesium measurements also identified Laboratory impacts in the Los Alamos watershed
- few metals analysis exceed New Mexico 20.6.4 NMAC Standards for Interstate and Intrastate Surface Waters, although some measurements of dissolved lead, copper, and zinc did exceed acute aquatic life standards and some total mercury measurements did exceed wildlife habitat standards
- the frequency and magnitude of floods in the Los Alamos watershed are decreasing, but urban and residential stormwater discharges will continue to contribute to future flood magnitudes and probabilities.

Stream flows are unique in response to storms on the Pajarito Plateau. In part, our metrics measure the differences derived from changing flow responses to precipitation. Not only do flow characteristics respond to storms, but they reflect changing conditions within a watershed. We suggest that flow will be reduced relative to storm energies in an improving watershed, as well as sediment and contaminant transport rates relative to similar flow conditions, i.e. suspended sediment concentration (SSC) changes of 5000 mg/L to 100 cfs relative to values measured in an improved watershed of 500 mg/L to 100 cfs.

Background

In May 2000, the Cerro Grande fire burned 17402 hectares or 67 mi^2 (174 km^2) of land along the eastern flanks of the Jemez Mountains and on the Pajarito Plateau. A complete loss of vegetative cover (over story, under story, and ground cover) and intense heat created conditions that reduced the soil's ability to absorb moisture, increasing runoff. We found stormwater runoff conditions below the areas burned by the Cerro Grande fire were similar to those after the 1977 La Mesa and the 1996 Dome fires in the Jemez Mountains as described by Veenhuis (2002). He documented that peak discharge increased over 100 times in the first two years compared to pre-fire conditions, and decreased rapidly after that to 3-5 times pre-fire flows. Los Alamos watershed peak discharges have increased by the same magnitudes, but have not diminished to the same levels described by Veenhuis. Multiple storm flow events have exceeded 100 times the pre-fire conditions during most years after the Cerro Grande fire, although the frequency continues to diminish.

LANL has indicated that by 2003 stormwater runoff and sediment transport from most of the burned watersheds had recovered to near pre-fire conditions except Pueblo Canyon (LANL ESR, 2003, 2004, 2005, 2006, and 2007). The Los Alamos watershed, consisting of three main sub-watersheds, Los Alamos, Pueblo, and Guaje, is one of seven that drain LANL property located on the Pajarito Plateau. The headwaters of each Los Alamos sub-watershed originate in the Sierra de los Valles, and Guaje and Pueblo Canyons drain into Los Alamos Canyon before it drains to the Rio Grande. Los Alamos and Pueblo Canyons contain LANL legacy contaminants from historical wastewater discharges that have been re-distributed throughout the watershed from the discharge sources to the Rio Grande.

The headwater reach of Pueblo Canyon is steep and rocky that had a thin soil horizon even before the fire. Recovery from the fire may have been impaired due the steepness of the headwater reach of the watershed, severity of the burn, and loss of covering soil horizons. LANL has indicated the Pueblo watershed recovery has been impaired by urbanization in the upper reaches of the canyon. The Los Alamos town site has large areas of impermeable surfaces which also contribute significant amounts of runoff into the canyons. The amount of impermeable surfaces has also increased since the Cerro Grande fire from expanded residential development in the Pueblo Canyon watershed.

Most of the flow in Los Alamos and its tributary canyons are ephemeral and intermittent and flow in response to rain and snow-melt. Intermittent flow in Pueblo and Los Alamos Canyon is fed by snowmelt during the spring of the year flowing from the mountains across the Laboratory and often beyond its eastern boundaries to the Rio Grande. During the time of this report, snowmelt discharge at the eastern boundary of the Laboratory ranged in duration from nonexistent to four months. In 2003, 2004, and 2006 snowmelt flow volumes were negligible ranging up to 700 acre feet (ac ft) volume in 2005 (LANL ESR, 2003, 2004, 2005, 2006, and 2007).

Discharge from the Los Alamos County wastewater treatment plants in Pueblo Canyon also contribute to intermittent flow during the winter and early spring. In 2007 a new county wastewater treatment plant was constructed to replace the Pueblo Canyon Bayo plant. During 2008, 130 ac ft of discharge from the new plant passed the eastern LANL boundary in Pueblo Canyon (LANL ESR, 2008). Most of the discharge is redirected to irrigation of the Los Alamos community during the summer.

Ephemeral flow or stormwater discharge is the focus of this report because of its capacity to carry suspended sediments and Laboratory contaminants off-site quickly and in large quantities. Intermittent flow or snowmelt runoff may also have the capacity to transport large quantities of contaminated bedload but does so in lower concentrations over longer time durations. Bedload transport is not discussed as part of this investigation.

Sampling Methods

Our sample collection techniques included grab and automated sample collection methods and follow procedures described in the DOE OB Standard Operating Procedures for Sampling and Analytical Activities (Englert, 1996 and SW QAPP 2006). Most of the stormwater samples we used to evaluate plutonium$^{239/240}$ and sediment transport were multiple samples per event per station.

We deployed portable ISCO® programmable liquid samplers in the Los Alamos watershed and since 2008 in the Rio Grande. Single ISCO® sampling units are capable of collecting 24 discrete 1-liter samples in varying programmable arrays. The samplers can be programmed to begin a sampling routine based on stage height and the sample collection intervals can be based on elapsed time. ISCO® flow meters activated the sample routines based on water level rise. The flow meters also recorded a hydrograph and sample history from which we verified and correlated our sample collection history and hydrographs to the Los Alamos National Laboratory rated gage stations. It should be noted that LANL uses Mountain Standard Time at their gages throughout the year while our gage times change with Daylight Savings Time.

Very few grab samples were collected. Grab samples are opportunistic, in that field employees must be present during a storm event and at an appropriate location. During the stormwater program initiated in 2000 through 2002, sampling teams were organized and deployed upon storm events. This program was simple in that sampling methods consisted of submerging appropriate sample containers into the stormwater flow and recording the appropriate stage and time of collection, but was labor intensive and inefficient. The program also included few automated samplers. From 2003 onward, more automated samplers were acquired and the stormwater program consisted primarily of automated sampling.

Almost 300 samples were collected by automated ISCO® 3700 programmable liquid samplers and 4230 Bubbler Flow Meters during the period covered by this report. The ISCO® 3700 sample collection equipment was deployed along open stream channels in a dormant mode until a rise in water level was detected by the 4230 Flow Meter. If the stage level increase exceeds a level prescribed as a storm event, the flow meter activated a sample routine comprised of multiple regular timed intervals. The numbers of samples and sample volumes per event range from 12 2-L samples to two 6-L samples. Equipment failures were common and introduced regular variability in the sample arrays.

The 4230 flow meters, comprised of air pumps and differential pressure transducers, use a bubbler method to monitor stage in an open channel or alternate weir or flume. The hydrostatic pressure changes from increasing or decreasing water levels during a storm event is directly related to the water column height. Stage and discharge in the form of a hydrograph, and sampling history are recorded on paper charts.

Except for Rio Grande locations at Otowi and Buckman, all locations are ephemeral and more susceptible to incising or aggrading channel bottoms during storm flow. A length of small diameter flexible tubing is extended from the flow meter and fastened to near the channel bottom. Care that the end of the air tube is not covered by sediment is necessary and discharge data contains uncertainty relative to unstable channel bottom changes.

The flow meter can use the Manning equation to calculate discharge. Cross sectional area and slope of the channels were measured, and roughness was estimated at most locations. These parameters were entered into the flow meters so that flows could be estimated. Early on we found that flows did not correlate with LANL gage measurements and began to use stage changes only to activate the ISCO® samplers.

The 3700 ISCO® programmable liquid sampler is comprised of a computerized control box, liquid detector, peristaltic pump, and a distribution system. The control box receives and stores a sample program, runs the pump, moves the sample distributor, and controls the volume of sample distributed into containers. The liquid detector gives the 3700 sampler the ability to deliver accurate, repeatable sample volumes regardless of changing head conditions and with a programmed setting provide for automatic rinsing of the suction line. The peristaltic pump speed is 250 RPM that generates an approximate pump rate of 3.5 liters/minute. The distribution system is comprised of an armature that rotates to discrete sequential sample bottles. Varying arrays of bottle configurations were used, but for the most part the bottle configuration consisted of 24 1-L polypropylene bottles. A PCB and TMDL study were run in conjunction with this stormwater project and 1-L and 350-ml glass bottles with Teflon lined lids were included into some arrays.

The pump tubing consists of SilasticTM medical grade silicon rubber and the suction line which transfers the sample from the stream source to the pump is 3/8 inch ID Teflon®

tubing. The suction lines attached to the 3700 samplers were commonly extended and fastened to the side of a channel more than four inches from its bottom. The pump and suction tubing are changed annually or when equipment is moved to new locations. Tubing replacement and automatic rinsing between samples reduce cross contamination concerns.

Storm surges within the ephemeral streams of the Pajarito Plateau are random and unpredictable but typically generate a hydrograph that illustrates a fairly quick rise to peak discharge and then a slower declining limb. They vary depending on the intensity, duration and movement of storm patterns, and the drainage basin characteristics. The sample arrays were developed to demonstrate the changing characteristics of the storm flow. Our original sample programs included samples collected as soon as the samplers were enabled and then at regular intervals during the storm flow. The programs evolved into a delayed sample collection at or near the hydrograph peak and then at regular intervals throughout the flow.

Antecedent conditions can influence stormwater suspended sediment concentrations significantly, particularly in low flow storm events in which case relatively small inventories of sediment and contaminants are transported. In larger events, we believe that antecedent conditions are reflected by hysteresis observed during the rising leg of a hydrograph, whether it is from the cleaning affects from previous storm flow or bank failure contribution from preceding events. This period of the hydrograph is relatively short in relation to the flood duration. By the time peak flows are achieved antecedent conditions are replaced by the overall conditions of a channel reflected by the general relationship of suspended sediment concentrations and discharge.

At the end of each sample event, and then the end of each season, the storm hydrographs were evaluated to determine the peak discharge, time to peak flow, and then duration of the storm flow event. Based on these evaluations we introduced a delay for the initial sample in order to sample close to peak discharge, and sample interval variations along the declining limb of the hydrograph to extend the program through the entire duration of the storm event. This allowed us to accurately characterize transport within the greatest proportion of the flood.

The U.S. Geologic Survey (USGS) recommends using equal-width-increment (EWI) sampling methods for producing the most representative stream flow samples. These methods create water quality cross sections across a stream. Automated pumping samplers with a single-fixed intake, like ISCO® samplers, are sometimes used to collect samples at remote sites or small streams with flashy hydrologic responses (Shelton, 1994). Samples collected with automated pumping samplers can introduce an unknown bias when compared with EWI sampling methods.

Location Descriptions

This project includes a stormwater investigation at 13 stations within the Los Alamos watershed including one station below the watershed in the Rio Grande. Eight stations are located within the Acid-Pueblo Canyon drainage, and four stations are located within the DP-Los Alamos drainage above the Pueblo/Los Alamos Canyon confluence. One station in lower Los Alamos Canyon below the Pueblo/Los Alamos confluence is approximately 0.7 miles above the Los Alamos Canyon confluence with the Rio Grande on Pueblo de San Ildefonso lands. During 2008, an additional nine samples were collected approximately 3 miles downstream of this intersection near the Buckman Landing area and the new Santa Fe Community Buckman Direct Diversion for municipal drinking water.

The following figure identifies LANL gage stations in the Los Alamos watershed evaluated for this report.

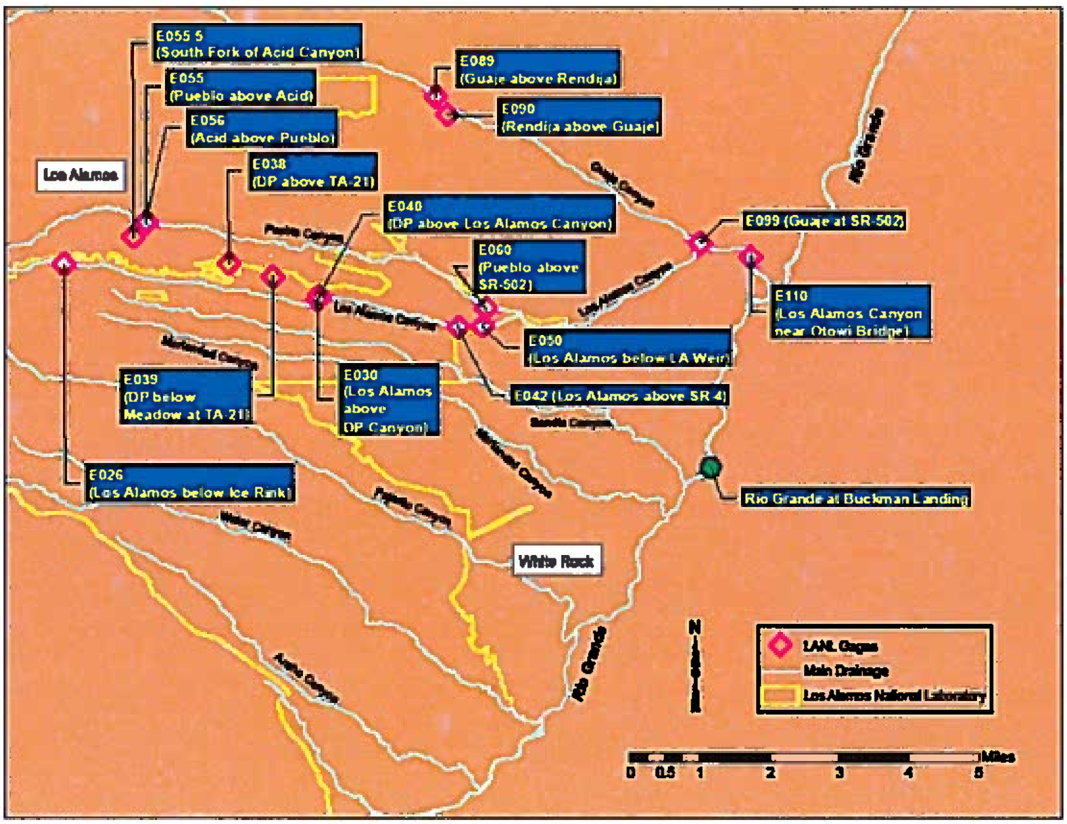


Figure 1 LANL Gage Stations in Los Alamos Canyon Watershed

The focus of this investigation is at the LANL boundary stations, E050 and E060, as well as the E110 station in lower Los Alamos Canyon, just above the Rio Grande. The naming convention for the LANL gage stations generally follows the USGS down-stream order convention. The letter E replaces the United States Geologic Survey (USGS) number 08313 assigned to the Otowi gage on the Rio Grande and the remaining number assigns a downstream proximity to the USGS station. We used a similar identification protocol for naming the stations co-located at the LANL gage stations as well as stations not associated with gages. The naming convention includes the abbreviation of the canyon it is located in and the distance in miles above its next downstream confluence.

We evaluated canyon and transport conditions by grouping our stations into reference reaches. Baseline stations are generally identified as upstream from Acid and DP Canyons and are considered free of LANL impacts. There are multiple Solid Waste Management Units (SWMUs) located in Los Alamos Canyon above the DP confluence and limited impacts are seen in the upstream Los Alamos Canyon station. Most stations are located below the Acid and DP source terms and extend downstream. They were located to identify influences from side tributaries and changes in downstream conditions, particularly those attributed to the Pueblo wetlands downstream of the Bayo wastewater treatment plant and the Los Alamos Canyon low head weir located just above the Pueblo confluence.

Although we recognize precipitation data is important in determining runoff origin in relation to contaminant source terms, as well as flood intensity and volume, our evaluations are based on the discharge and concentrations measured at each station. Contaminant and sediment transport estimates are made in regard to the immediate measurements at each LANL gage station monitored during the period of this report. Those estimates clearly describe impacts from upstream reaches and contaminant contributions to downstream reaches in the Los Alamos watershed.

The LANL E060 gage station is located at the most down-gradient station in Pueblo Canyon and is near the eastern Laboratory property boundary. The references to station E060 also include PU0.3, a Pueblo Canyon station approximately 0.3 mile above its confluence with Los Alamos Canyon. The LANL E050 gage is located at the eastern most down-gradient station near the Laboratory boundary in Los Alamos Canyon. This report also refers to the station as LA5.0, a Los Alamos canyon station approximately 5 miles above its confluence with the Rio Grande. The LANL E110 gage, also referred to as LA0.7, is located in lower Los Alamos Canyon approximately 0.7 mile above its confluence with the Rio Grande on Pueblo de San Ildefonso lands.

A new public wastewater treatment plant built during this investigation period, discharges approximately 0.5 mile above the original discharge point of the old Bayo treatment plant. We expect that the wetlands will extend to the new discharge point and provide additional sinks to Pueblo Canyon floods and associated contaminant load discharges. E050 and E060 gage stations, located near LANL's eastern boundary, identify contaminant loads that leave LANL property headed for Pueblo de San Ildefonso lands and the Rio Grande. Station E110 is the last monitoring station 0.7 miles above the Rio Grande.

Since 2008, a station near the Buckman Direct Diversion has been monitored for stormwater conditions. Another station along the Rio Grande has recently been deployed above the Los Alamos Canyon confluence near the Otowi Bridge and is currently being monitored. The following figure identifies the stations sampled for stormwater during this report.

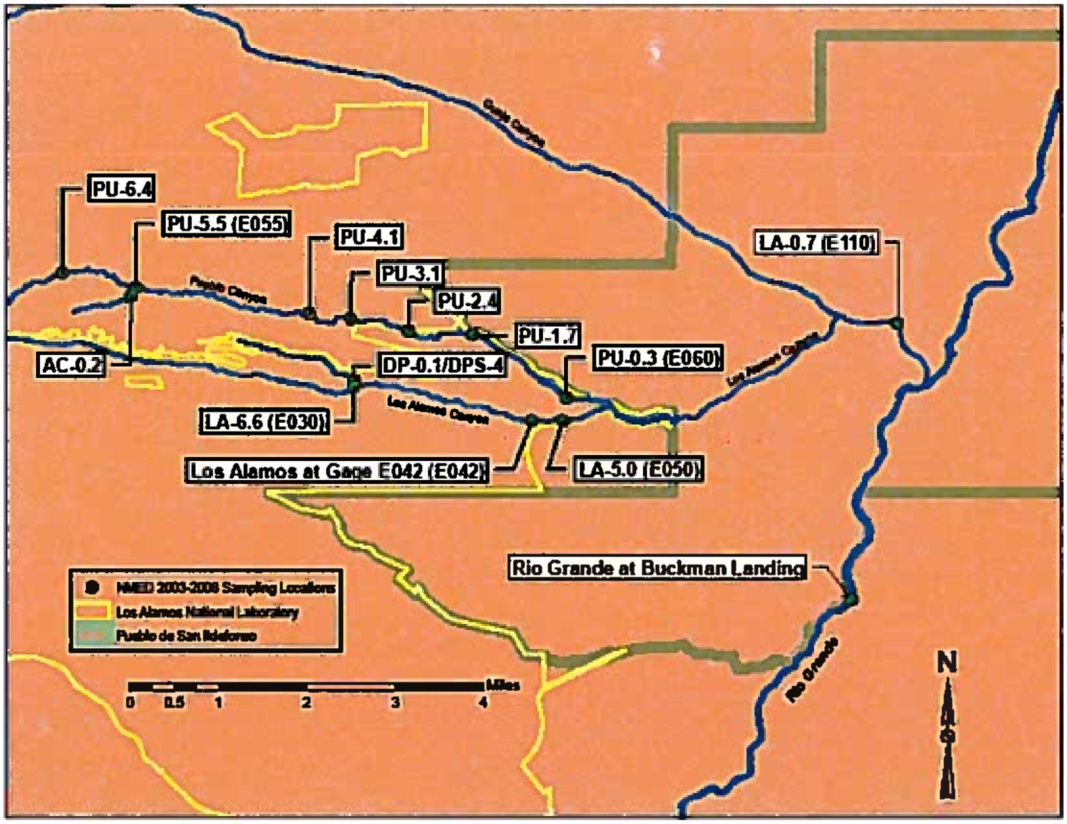


Figure 2 Stormwater stations

The following narrative provides a reference for the name and location of the stations monitored during this report period.

Stations in Pueblo Canyon

- PU-6.4 Upper Pueblo watershed sample location above Acid Canyon, used as baseline
- PU-5.5 LANL gage station E055, upper watershed sample location above Acid Canyon, used as baseline
- AC-0.2 LANL gage station E056, in Acid Canyon, just above its confluence with Pueblo Canyon. Acid Canyon received LANL TA-1 and TA-45 radioactive wastewater discharge.
- PU-4.1 Middle Pueblo Canyon, approximately 4.1 miles above confluence with LA Canyon, approximate 1 mile below the Acid confluence.
- PU-3.1 Middle Pueblo Canyon, approximately 3.1 miles above confluence with LA Canyon, above Kwage Canyon and approximate 2 mile below Acid confluence. Kwage Canyon is a tributary to Pueblo Canyon that heads in North Community. It is a possible clean source of sediments that may provide dilution to contaminated sediments in Pueblo Canyon.
- PU-2.4 Middle Pueblo Canyon, approximately 2.4 miles above confluence with LA Canyon, below the Kwage Canyon confluence and above the new Bayo

wastewater treatment plant discharge. A wetlands system has developed below the treatment discharge point.

- PU-1.7 Middle Pueblo Canyon, approximately 1.7 miles above the confluence with Los Alamos Canyon, below the treatment plant discharge, and within the wetlands
- PU-0.3 LANL gage station E060, in lower Pueblo Canyon, below the wetlands, at the LANL eastern boundary, and approximately 0.3 mile above confluence with LA Canyon. The LA/Pueblo Canyon confluence downstream to the Rio Grande is on Pueblo de San Ildefonso land

Stations in Los Alamos Canyon above the Pueblo Confluence

- LA-6.6 LANL gage station E030, in upper LA Canyon 6.6 miles above the Rio Grande confluence and just above the DP confluence. Used as a baseline station but multiple SWMUs exist in Los Alamos Canyon above this station. It is above the main TA-21 source term for radiochemical contaminants but downstream from several PCB source terms.
- DP0.1/DPS-4 LANL gage station E040, lower DP Canyon just above confluence with LA Canyon. DP Canyon received radiochemical wastewater discharge from the TA-21 plutonium processing plant.
- LA @ E042 LANL gage station E042, mid LA Canyon just above the Los Alamos Canyon low head weir built shortly after the Cerro Grande fire
- LA-5.0 LANL gage station E050, just below the low head weir, at LANL's eastern boundary, and just above the Pueblo confluence

Station LA0.7 is on Pueblo de San Ildefonso land in lower Los Alamos Canyon and retains the LANL gage station identification E110. It is located about 0.7 mile above the Los Alamos Canyon confluence with the Rio Grande and approximately 5 miles below LANL property. It is below a major contributing tributary, Guaje Canyon which headwaters in US National Forest Service lands. Additional gage stations exist within Guaje Canyon but are presently de-activated. Station E110 identifies contaminant levels that reach the Rio Grande.

The Rio Grande at Buckman station is approximately 3 miles downstream of the Los Alamos confluence. It is located near the new Santa Fe water resource diversion, the Buckman Direct Diversion, and is used to identify water quality there as well as possible impacts from LANL discharges.

The following table lists the LANL gage stations, associated project names for the locations, and the dates and times for the stormwater samples collected during the period of this report.

Table 1 Location, Date, and Time for All Stormwater Samples

Gage#	Station	Date/Time	Gage#	Station	Date/Time	Gage#	Station	Date/Time	Gage#	Station	Date/Time
E055.5	AC-0.2	9/11/06 13:36	E110	LA-0.7	8/25/06 16:41	E060	PU-0.3	7/23/04 22:02	NA	PU-2.4	7/23/04 16:22
E055.5	AC-0.2	7/14/07 17:47	E110	LA-0.7	8/25/06 17:41	E060	PU-0.3	7/23/04 22:07	NA	PU-2.4	7/23/04 16:29
E055.5	AC-0.2	7/30/07 13:24	E110	LA-0.7	8/25/06 18:41	E060	PU-0.3	7/23/04 22:12	NA	PU-2.4	7/23/04 16:51
E055.5	AC-0.2	8/4/07 14:02	E110	LA-0.7	7/22/08 15:47	E060	PU-0.3	7/23/04 22:17	NA	PU-2.4	7/23/04 17:18
E055.5	AC-0.2	8/4/07 14:22	E110	LA-0.7	8/20/08 16:40	E060	PU-0.3	7/27/04 18:06	NA	PU-2.4	7/27/04 15:19
E055.5	AC-0.2	8/18/07 13:16	E110	LA-0.7	8/20/08 17:25	E060	PU-0.3	7/27/04 18:09	NA	PU-2.4	7/27/04 15:31
E055.5	AC-0.2	8/18/07 13:34	E110	LA-0.7	8/20/08 18:10	E060	PU-0.3	7/27/04 18:16	NA	PU-2.4	7/27/04 15:33
E055.5	AC-0.2	8/29/07 15:02	E110	LA-0.7	8/20/08 18:55	E060	PU-0.3	7/27/04 18:23	NA	PU-2.4	7/27/04 15:49
E055.5	AC-0.2	8/29/07 15:20	E110	LA-0.7	8/20/08 20:40	E060	PU-0.3	7/27/04 18:30	NA	PU-2.4	7/27/04 16:01
E055.5	AC-0.2	8/29/07 15:40	E110	LA-0.7	8/21/08 1:10	E060	PU-0.3	7/27/04 18:32	NA	PU-2.4	7/27/04 16:08
E055.5	AC-0.2	8/29/07 16:00	E050	LA-5.0	8/1/06 17:09	E060	PU-0.3	7/27/04 18:34	NA	PU-2.4	7/27/04 16:30
E055.5	AC-0.2	8/29/07 16:20	E050	LA-5.0	8/5/06 1:50	E060	PU-0.3	7/27/04 18:39	NA	PU-2.4	7/27/04 16:57
E055.5	AC-0.2	9/1/07 14:28	E050	LA-5.0	8/7/06 14:29	E060	PU-0.3	7/27/04 18:41	NA	PU-3.1	8/18/04 13:56
E055.5	AC-0.2	9/1/07 14:46	E050	LA-5.0	8/8/06 14:40	E060	PU-0.3	7/27/04 18:47	NA	PU-3.1	7/15/05 17:56
E055.5	AC-0.2	9/1/07 15:06	E050	LA-5.0	8/6/07 19:31	E060	PU-0.3	8/18/04 18:56	NA	PU-3.1	7/15/05 19:06
E055.5	AC-0.2	9/1/07 16:19	E050	LA-5.0	8/29/07 16:49	E060	PU-0.3	8/18/04 18:59	NA	PU-3.1	8/12/05 9:48
NA	BM @ RG	7/26/08 22:03	E050	LA-5.0	8/29/07 19:45	E060	PU-0.3	8/18/04 19:02	NA	PU-3.1	8/12/05 13:18
NA	BM @ RG	8/24/08 19:59	E050	LA-5.0	9/1/07 16:10	E060	PU-0.3	8/18/04 19:08	NA	PU-3.1	8/24/05 15:26
NA	BM @ RG	8/24/08 20:57	E050	LA-5.0	9/1/07 17:36	E060	PU-0.3	8/18/04 19:16	NA	PU-3.1	8/24/05 17:46
NA	BM @ RG	8/24/08 21:57	E050	LA-5.0	9/1/07 19:06	E060	PU-0.3	8/18/04 19:26	NA	PU-3.1	8/24/05 18:56
NA	BM @ RG	9/9/08 22:28	E050	LA-5.0	9/2/07 16:45	E060	PU-0.3	8/18/04 19:38	NA	PU-4.1	7/23/04 15:12
NA	BM @ RG	9/9/08 23:26	E050	LA-5.0	9/2/07 18:15	E060	PU-0.3	8/18/04 20:17	NA	PU-4.1	7/23/04 15:16
NA	BM @ RG	10/11/08 19:47	E050	LA-5.0	9/2/07 19:45	E060	PU-0.3	8/18/04 20:44	NA	PU-4.1	7/27/04 14:53
NA	BM @ RG	10/11/08 20:44	E050	LA-5.0	7/5/08 16:02	E060	PU-0.3	8/18/04 21:16	NA	PU-4.1	7/27/04 14:59
NA	BM @ RG	10/11/08 21:44	E050	LA-5.0	7/5/08 16:47	E060	PU-0.3	8/19/04 0:29	NA	PU-4.1	7/27/04 15:05
E040	DP-0.1/DPS-4	8/12/05 15:00	E050	LA-5.0	7/5/08 17:37	E060	PU-0.3	8/19/04 4:35	NA	PU-4.1	7/27/04 15:13
E110	LA-0.7	7/27/04 18:51	E050	LA-5.0	7/5/08 18:17	E060	PU-0.3	8/19/04 6:17	NA	PU-4.1	7/27/04 15:23
E110	LA-0.7	7/27/04 19:01	E050	LA-5.0	7/5/08 19:17	E060	PU-0.3	8/19/04 8:39	NA	PU-4.1	7/27/04 15:35
E110	LA-0.7	8/19/04 15:15	E050	LA-5.0	8/9/08 15:49	E060	PU-0.3	8/20/04 18:27	NA	PU-4.1	8/18/04 13:36
E110	LA-0.7	8/19/04 15:23	E050	LA-5.0	8/9/08 16:34	E060	PU-0.3	8/20/04 18:33	NA	PU-4.1	8/18/04 13:42
E110	LA-0.7	8/19/04 15:32	E050	LA-5.0	8/9/08 17:19	E060	PU-0.3	8/20/04 18:39	NA	PU-4.1	8/18/04 13:48
E110	LA-0.7	8/19/04 16:00	E050	LA-5.0	8/9/08 18:04	E060	PU-0.3	8/20/04 18:45	NA	PU-4.1	8/18/04 13:56
E110	LA-0.7	8/19/04 16:00	E050	LA-5.0	8/9/08 19:04	E060	PU-0.3	8/20/04 18:57	NA	PU-4.1	8/18/04 14:06
E110	LA-0.7	8/19/04 16:49	E050	LA-5.0	8/23/08 7:40	E060	PU-0.3	8/20/04 19:09	NA	PU-4.1	7/15/05 17:28
E110	LA-0.7	8/19/04 17:21	E050	LA-5.0	8/23/08 8:25	E060	PU-0.3	8/20/04 19:26	NA	PU-4.1	7/15/05 18:18
E110	LA-0.7	8/20/04 0:00	E050	LA-5.0	8/23/08 9:10	E060	PU-0.3	8/20/04 19:48	NA	PU-4.1	7/15/05 19:58
E110	LA-0.7	8/20/04 17:28	E050	LA-5.0	10/11/08 18:08	E060	PU-0.3	8/20/04 20:15	NA	PU-4.1	8/12/05 9:12
E110	LA-0.7	8/20/04 17:35	E050	LA-5.0	10/11/08 18:08	E060	PU-0.3	8/20/04 20:47	NA	PU-4.1	8/12/05 10:02
E110	LA-0.7	8/20/04 17:48	E050	LA-5.0	10/11/08 18:53	E060	PU-0.3	8/20/04 21:24	NA	PU-4.1	8/12/05 10:52
E110	LA-0.7	8/20/04 17:58	E050	LA-5.0	10/11/08 19:53	E060	PU-0.3	8/20/04 22:06	NA	PU-4.1	8/12/05 11:42
E110	LA-0.7	8/20/04 18:15	E050	LA-5.0	10/11/08 20:23	E060	PU-0.3	8/20/04 22:58	NA	PU-4.1	8/25/05 15:08
E110	LA-0.7	8/20/04 19:36	E030	LA-6.6	8/12/05 22:34	E060	PU-0.3	8/21/04 0:01	NA	PU-4.1	8/25/05 16:08
E110	LA-0.7	8/20/04 20:05	E030	LA-6.6	8/13/05 0:04	E060	PU-0.3	8/21/04 2:34	NA	PU-4.1	8/25/05 17:08
E110	LA-0.7	8/21/04 2:27	E030	LA-6.6	8/13/05 1:36	E060	PU-0.3	8/24/05 18:15	E055	PU-5.5	8/8/06 14:20
E110	LA-0.7	8/21/04 9:49	E030	LA-6.6	8/13/05 3:36	E060	PU-0.3	8/24/05 20:15	E055	PU-5.5	8/25/06 13:23
E110	LA-0.7	7/17/05 17:56	E030	LA-6.6	8/22/05 13:39	E060	PU-0.3	8/24/05 22:15	E055	PU-5.5	8/25/06 15:48
E110	LA-0.7	7/17/05 19:56	E030	LA-6.6	8/22/05 15:09	E060	PU-0.3	8/25/05 0:15	E055	PU-5.5	8/25/06 16:48
E110	LA-0.7	7/17/05 21:56	E030	LA-6.6	8/24/05 15:42	E060	PU-0.3	7/26/06 15:13	E055	PU-5.5	7/14/07 18:02
E110	LA-0.7	7/17/05 23:56	E030	LA-6.6	8/24/05 16:32	E060	PU-0.3	7/26/06 19:13	E055	PU-5.5	7/14/07 19:02
E110	LA-0.7	8/12/05 14:21	E030	LA-6.6	8/24/05 18:02	E060	PU-0.3	8/5/06 9:52	E055	PU-5.5	7/14/07 20:02
E110	LA-0.7	8/12/05 16:21	E030	LA-6.6	8/24/05 19:32	E060	PU-0.3	8/5/06 11:22	E055	PU-5.5	7/26/07 14:16
E110	LA-0.7	8/12/05 18:21	E030	LA-6.6	8/12/05 14:50	E060	PU-0.3	8/8/06 15:47	E055	PU-5.5	7/26/07 15:15
E110	LA-0.7	8/12/05 20:21	E042	LA @ E042	8/12/05 14:26	E060	PU-0.3	8/8/06 16:47	E055	PU-5.5	7/26/07 16:15
E110	LA-0.7	8/24/05 18:37	E042	LA @ E042	8/25/05 15:45	E060	PU-0.3	8/8/06 17:47	E055	PU-5.5	7/26/07 17:15
E110	LA-0.7	8/24/05 20:37	E042	LA @ E042	8/25/05 17:16	E060	PU-0.3	8/8/06 18:47	E055	PU-5.5	7/26/07 18:15
E110	LA-0.7	8/24/05 22:37	E042	LA @ E042	8/25/05 18:47	E060	PU-0.3	8/8/06 19:47	E055	PU-5.5	8/4/07 14:16
E110	LA-0.7	8/25/05 18:20	E060	PU-0.3	8/11/03 23:44	E060	PU-0.3	8/8/06 20:47	E055	PU-5.5	8/4/07 15:15
E110	LA-0.7	7/6/06 6:42	E060	PU-0.3	8/11/03 23:52	E060	PU-0.3	8/25/06 14:21	E055	PU-5.5	8/4/07 16:15
E110	LA-0.7	7/6/06 7:42	E060	PU-0.3	8/12/03 0:44	E060	PU-0.3	8/25/06 15:21	E055	PU-5.5	8/4/07 17:15
E110	LA-0.7	7/6/06 8:42	E060	PU-0.3	8/12/03 1:44	E060	PU-0.3	8/25/06 16:21	E055	PU-5.5	8/4/07 18:15
E110	LA-0.7	7/6/06 21:22	E060	PU-0.3	8/22/03 13:41	E060	PU-0.3	8/6/07 20:01	E055	PU-5.5	9/1/07 14:38
E110	LA-0.7	7/6/06 23:22	E060	PU-0.3	8/22/03 13:46	E060	PU-0.3	8/6/07 20:46	E055	PU-5.5	9/1/07 15:37
E110	LA-0.7	7/7/06 1:22	E060	PU-0.3	8/22/03 14:26	E060	PU-0.3	8/6/07 21:31	E055	PU-5.5	9/1/07 16:37
E110	LA-0.7	8/6/06 2:09	E060	PU-0.3	8/22/03 15:11	E060	PU-0.3	8/6/07 22:16	E055	PU-5.5	9/1/07 17:37
E110	LA-0.7	8/6/06 4:14	E060	PU-0.3	9/6/03 19:08	E060	PU-0.3	8/6/07 23:01	E055	PU-5.5	9/1/07 18:37
E110	LA-0.7	8/6/06 6:14	E060	PU-0.3	9/6/03 19:53	E060	PU-0.3	9/6/03 22:38	NA	PU-6.4	8/11/03 17:42
E110	LA-0.7	8/8/06 16:25	E060	PU-0.3	9/6/03 20:38	NA	PU-1.7	8/18/04 14:35	NA	PU-6.4	8/11/03 18:00
E110	LA-0.7	8/8/06 17:25	E060	PU-0.3	9/6/03 22:38	NA	PU-2.4	7/23/04 15:41	NA	PU-6.4	8/11/03 18:27
E110	LA-0.7	8/8/06 18:25	E060	PU-0.3	7/23/04 21:52	NA	PU-2.4	7/23/04 15:49	NA	PU-6.4	8/23/03 14:45
E110	LA-0.7	8/8/06 19:25	E060	PU-0.3	7/23/04 21:54	NA	PU-2.4	7/23/04 15:52	NA	PU-6.4	8/30/03 0:52
E110	LA-0.7	8/8/06 20:26	E060	PU-0.3	7/23/04 21:56	NA	PU-2.4	7/23/04 16:00	NA	PU-6.4	9/3/03 16:58
E110	LA-0.7	8/8/06 21:25	E060	PU-0.3	7/23/04 21:58	NA	PU-2.4	7/23/04 16:10	NA	PU-6.4	9/6/03 16:54
E110	LA-0.7	8/19/06 15:47	E060	PU-0.3	7/23/04 22:00						

Samples and Analytical Suites

Two hundred and ninety stormwater samples were collected from the Pajarito Plateau during 2003 through 2008. Twenty of the samples are from 2003, 99 from 2004, 49 from 2005, 41 from 2006, 47 from 2007, and 34 from 2008, including nine stormwater samples collected in White Rock Canyon at Buckman Landing. These samples originate from eighty storm events identified at individual stations. Some of these are duplicated at different stations, for example an individual event was sampled at more than one station and counted multiple times.

Commercial analytical laboratories analyzed the samples for a variety of chemical suites, including polychlorinated biphenyls, dioxin/furans, metals, radionuclides, general water chemistry, and the physical parameter suspended sediments. Some of the data from this report was used for a New Mexico Surface Quality Bureau Pajarito Plateau assessment for the CWA §303(d)/§305(b) 2010-2012 Integrated List which is available at http://www.nmenv.state.nm.us/SWQB/303d-305b/2010-2012/Pajarito/index.html. Reports detailing the PCB and dioxin/furan results will be available at later dates.

The radiochemical suite includes gross alpha/beta, uranium isotopes 234, 235, and 238, plutonium isotopes 238, 239/240 (total recoverable in water and/or in suspended sediments), americium^{241}, strontium^{90}, and cesium^{137}. Most samples are analyzed for plutonium^{238}, plutonium$^{239/240}$, and suspended sediments. Subsets of the other analyses are included to expand the breadth and to investigate specific questions beyond the original scope of this project, and when funding was available.

Commercial analytical laboratories performed plutonium^{238} and plutonium$^{239/240}$ isotope measurements on unfiltered stormwater and/or suspended sediment separated from whole water samples.

Plutonium^{238} levels were consistently low and/or below detection levels and are not included in further discussions except that legacy plutonium can be identified by the consistent plutonium$^{239/240}$ to plutonium^{238} isotope ratio differences seen between background and LANL derived plutonium. Legacy plutonium$^{239/240}$ concentrations are consistently two orders of magnitude greater than plutoium^{238}, when detected, while background concentrations of plutonium$^{239/240}$ are consistently one order of magnitude greater than detected plutonium^{238} concentrations. Plutonium$^{239/240}$ isotopes are indistinguishable using alpha spectroscopy and the term plutonium is used in this report to reference the -239 and -240 isotope combination of plutonium.

The unit conversions are therefore:

To obtain plutonium activity in sediments from a plutonium measurement in water:

$$pCi/L_{\text{(Pu water)}} \div mg/L_{\text{(SSC water)}} \times 1000\ (mg/g) = pCi/g_{\text{(Pu Suspended Sediment)}}$$

and to obtain plutonium activity in water from a plutonium measurement in suspended sediment:

$$pCi/g_{\text{(Pu Suspended Sediment)}} \times mg/L_{\text{(SSC water)}} \div 1000\ (mg/g) = pCi/L_{\text{(Pu water)}}$$

Fifty-three stormwater samples collected from the Pajarito Plateau during 2005, 2006, and 2008 were submitted to analytical laboratories for dissolved (filtered through a 0.45 micron filter) metal analysis, and 73 samples during 2003, 2005, 2007, and 2008 were submitted for total (unfiltered) metal analysis. We saw similar patterns in constituent loading as that seen for the plutonium mass transport evaluations when using total metal measurements in water though most water quality criteria for metals are for the dissolved phase. Only mercury and selenium have total metals criteria. Stormwater samples were also collected in the Rio Grande at Buckman Landing, three miles below the Los Alamos Canyon confluence and analyzed for dissolved metals.

An inventory transport assessment for plutonium and suspended sediments is completed and presented in this report as well as comparisons of dissolved and total metals to applicable New Mexico Water Quality Control Commission (NM WQCC) criteria. A total metals transport assessment was completed which demonstrates similar characteristics but is not presented in this report.

Analytical Methods

The ALS Laboratory Group commercial analytical laboratory analyzed our samples for radiochemical, trace and heavy metal, and suspended sediment concentrations. ALS use routine analytical methods prescribed by DOE and EPA federal agencies, or equivalent methods described by professional organizations, and developed by individual laboratories. Descriptions of the analytical methods for major classes of radionuclide measurements normally requested by this bureau are found in Appendix A

ALS utilizes alpha spectrometry methods that meet or exceed the requirements referenced by DOE/EML 4.5.2.1. used to identify and quantify alpha-emitting radionuclides. The radionuclides include americium^{241}, plutonium^{238}, plutonium$^{239/240}$, uranium^{234}, uranium^{235}, and uranium^{238}. ALS uses low-background gas-flow proportional counting ASTM D3811-95M methods to measure strontium^{90} and ASTM D3972-90M methods for gross alpha/beta measurements. These methods meet the calibration, data collection, and analysis requirements of EPA method 900.0/9310. ALS measured cesium^{137} and other gamma emitters using gamma spectroscopy methods that are equivalent or exceed EPA Procedure 901.1 and DOE/EML Procedure 4.5.2.3. EPA methods 903.0 and 904 are used to measure radium^{226} and radium^{228}.

ALS measured a target analyte list of 23 metals plus total uranium using combined 6010/6020 EPA procedures. These measurements include inductively coupled plasma and mass spectroscopy procedures. Suspended sediment concentration measurements follow ASTM D3977-97 methodology which is a measure of the mass difference between a total water sample and the sample after all moisture is removed by filtration, centrifuge, and/or evaporation.

Analytical laboratories often use combinations of both chemical and instrument techniques to quantify low contaminant levels found in environmental samples. Analytical procedures consist of several parts assembled in laboratory SOPs for specific projects or sample types. These parts describe the chemical processes that isolate and purify, and then measure a constituent. The SOPs usually include:

- laboratory sample preparation
- sample dissolution
- sample purification
- preparation for counting
- counting
- data reduction

Laboratories are capable of adjusting their methodologies to achieve various detection limits. Some customers only require levels to satisfy regulatory requirements. The Oversight Bureau normally requests analytical methods capable of measuring contaminants below most environmental background reference levels. Target detection limits should be 10 to 50% of background reference values. Analytical methods adjusted to achieve lower detection limits often require a substantial increase in laboratory efforts.

Laboratories normally state detection limits based on ideal or optimistic situations and may not be achievable under actual measurement conditions. These levels could be considered their advertised limits. Detection limits for individual measurements are quite variable and are subject to variation between samples, instruments, and procedures. Sample size and geometry, element or compound abundance, self-absorption, and matrix interferences, instrument efficiency, ambient laboratory background, chemical recovery, and counting times contribute to these variations. ALS advertised Method Detection Limits for the radiochemical measurements used for this project are listed in the following table.

Table 2 Analytical Methods

Analytical Method	Short Description	MDL/MDA for water		MDL/MDA for solid
Alpha Spectroscopy				
ASTM D3972-90	Isotopic Plutonium	0.03 pCi/L		0.03 pCi/g
ASTM D3972-90	Isotopic Uranium	0.2 pCi/L		0.1 pCi/g
EPA 903.0	Radium 226	0.2 pCi/L		1 pCi/g
Gamma Spectrometry				
EPA 901.1 Low Level Gamma Spec.	(0.05 pCi/g or 5 pCi/L as Cs-137)	5 pCi/L		0.05 pCi/g
EPA 904	Radium 228	1 pCi/L		1 pCi/g
Gas Flow Proportional Counting				
EPA 900.0/9310	Gross Alpha/Beta	3.0 / 4.0 pCi/L		3.0 / 4.0 pCi/g
ASTM D5811-95M	Strontium-90 ("Total Radiostrontium Reported as Sr-90")	1 pCi/L		0.5 pCi/g

The term background above is used to describe two contexts. Environmental background references describe the highest probable levels normally measured in the environment. Laboratory backgrounds are low, ubiquitous levels in the laboratory subtracted from sample measurements. Both uses are based on multiple or continuous measurements, are statistically developed, and used to establish accurate and precise evaluations of constituents in the environment.

Routine analytical methods have been issued by federal or state agencies, described by professional organizations, published in refereed journals, or developed by individual laboratories. Non-routine methods continue to be developed to address situations with unusual or problematic matrices, improve detection limits, or identify new parameters. Non-routine methods include adjustments to routine methods and new method developments published in refereed literature.

Performance characteristics, such as detection limits, precision, and accuracy are routinely documented with each analysis. These characteristics are evaluated as closely as the reported measured values. Sample specific detection limits and analytical uncertainties, reported as two times the total propagated uncertainty, are reported with each radiological analysis and included in the data tables in Appendix B.

Detection limits are not listed for Suspended Sediment Concentrations but are generally accurate between 50 and 550000 mg/L. Detection limits for metals are listed for individual metal measurements and included in the data tables.

Plutonium and Sediment Transport

Two rating coefficients are developed within this section to describe the relationship of plutonium and sediment measurements to discharge; a rating coefficient that describes the relation between instantaneous discharge and plutonium and/or suspended sediment concentrations in each storm flow event; and a rating coefficient that describes the relation between peak discharge and mass inventories of plutonium and/or sediments transported during storm events specific to a station.

References are then often made regarding contaminant or sediment availability for transport in relation to the slope coefficients and measured concentrations. The difference we make between the two is that plutonium and sediment values of concentration in water, pCi/L or mg/L, define the instantaneous mass relationship to volume of water. In this report, the slope or rating coefficients define the relationship of plutonium or sediment to flow, L/s. If that relationship is defined for an event, the "concentration slope coefficient" can be used to predict an instantaneous concentration based on flow. Cumulative mass transport can then be calculated over time from changing flow through the event.

If the slope coefficient changes over time, we can conclude that sediments and/or contaminants are being transported at different rates. Future floods through an improving watershed capable of trapping more sediment would generate smaller slope coefficients. These coefficients can be compared through time or space to identify differences in availability.

Event Transport of Plutonium and Sediment

During 2000 to 2002 after the Cerro Grande fire, we found strong correlations existed between discharge (Q), suspended sediment concentration, and total plutonium$^{239/240}$ in stormwater. Using these relationships we estimated and reported that approximately 87 mCi of plutonium$^{239/240}$ contained in 22000 tons of suspended sediment were transported beyond LANL gage station E060 out of Pueblo Canyon (Englert et al., 2004). During 2003 to 2008 we used similar methods to estimate plutonium and sediment transport inventory at six LANL gage stations in the Los Alamos watershed. Transport estimates are presented for LANL gage stations E030, E042, E050, E055, E060, and E110.

We calculated plutonium mass transport for individual runoff events using relationships between plutonium concentrations and instantaneous discharge measurements from multiple samples collected during the event. Estimates of mass transport for events not sampled could then be made by evaluating the relationships between peak flows and masses calculated from the individual events that had been sampled. Sediment transport was determined using similar methods, except the suspended sediment concentrations were used in place of plutonium concentrations.

It should be noted that the Storm-Event-Transport evaluations are based on assumptions that sediment and contaminant concentrations increased proportionately with increasing flow. These assumptions were developed from empirical measurements in previous reports and a few well characterized events during the period of this report. It was not the intent of this report to fully characterize every event, but use the assumptions and samples collected during an event to estimate its sediment and contaminant transport.

Plutonium and suspended sediment mass transport calculations for individual runoff events were based on linear regression equations that describe a relationship between paired (plutonium or suspended sediment) concentrations and associated discharge rates for multiple samples collected during an event. The linear equation was used to predict concentrations based on recorded flows throughout an event hydrograph. The stormwater gages operated by the LANL Water Stewardship Program (EP-WSP), automatically records discharge in five minute intervals. Integrating concentrations with associated flow volumes provided the mass transport value for each interval. The total mass transport is calculated by iterations of the calculation for the entire time duration of the event or any time interval during the event.

We saw relationships demonstrating increasing concentrations of total plutonium in water and suspended sediment as discharge increased, ranging from zero concentrations in no flow to maximum concentrations limited by water velocity and turbulence. To determine these relationships, we developed scatter or x-y plots for the paired data of each event that we sampled, where x is the independent flow variable, and y is the dependent concentration variable. We used Microsoft Excel to fit trend lines through those data points to develop the regression equation that best described the data relationship. Predictions of concentration values for the remaining discharge recorded during a runoff event can then be made using this equation.

The following example in Figure 3 demonstrates the correlation of plutonium concentrations in 14 samples and associated flows collected during a 21 cfs peak storm event that occurred at E060 on August 18, 2004.

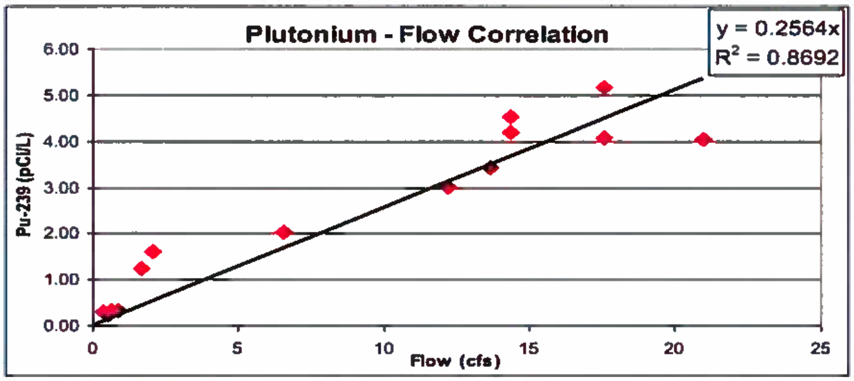


Figure 3 Discharge and Plutonium Concentration Linear Correlation Example

The equation y = 0.2564x demonstrates the correlation where y, the dependant variable for plutonium concentration, is equal to 0.2564 (the slope coefficient) times x, the independent variable of water flow. For every increment increase in discharge there is a corresponding 0.2564 times increase in plutonium concentration. The coefficient of determination (R^2) = 0.8692 expresses the amount of the variation in y that is explained by the regression line, and its square root r, the linear correlation coefficient, measures the strength or significance of the relationship. In this case, 87% of variation is explained by the trend line and the square root of R^2 equal to 0.93, is evidence of greater than a 99% degree of confidence in the correlation (critical value for r at 0.01 alpha is 0.661).

Figure 4 demonstrates the predicted concentrations based on recorded discharge and the regression equation throughout an event hydrograph. To determine mass transport the flow volume is integrated with the predicted concentration. For each five minute recorded discharge an estimate of flow volume is determined by multiplying the rate in cubic feet per second by 300, the number of seconds in five minutes, and then by 28.31685, the factor for converting cubic feet to liter volume. This volume of water measured in liters is multiplied by the associated suspended plutonium or sediment concentration in pCi or mg per liter to determine the mass transported during that 5 minute interval. Using plutonium and suspended sediment concentrations derived from the fitted curve, mass can be obtained from the discharge for any time interval during the storm flow event. In this case at E060 on August 18th, 2004, we estimated 0.009 mCi mass transport of plutonium over a three hour and 40 minute duration.

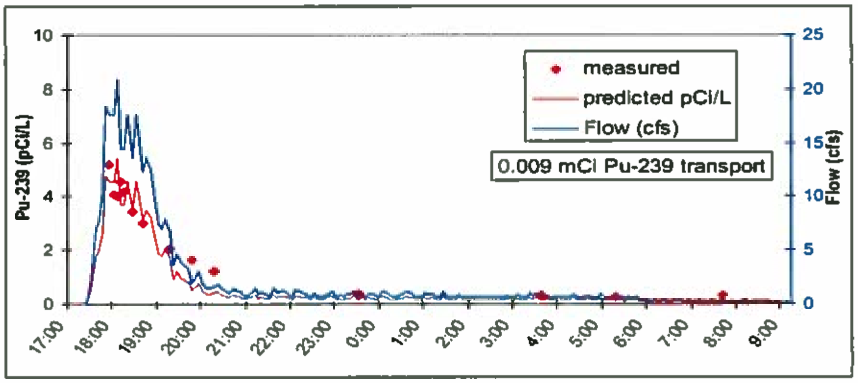


Figure 4 Measured and Predicted Plutonium Concentrations Based on Flow/Concentration Linear Correlation

Spatial and temporal total transport estimates are derived using relationships between peak discharge and associated mass transport in a similar fashion as mass transport evaluations were accomplished for individual storm events. Rating curves were generated for each station correlating plutonium or sediment inventories from each event and its paired peak discharge. An equation that described the correlation was then used to predict the transport mass for events not sampled. Transport inventories between stations or seasons could then be evaluated by comparing the sum of the inventories at individual stations or between the seasons of interest.

For example, we estimate that 134 to 182 mCi of plutonium was transported beyond E060 from 2003 to 2007, and that the transport inventory was diminishing from a 22 mCi level in 2003 to one mCi in 2007, except for 2006. During 2006, up to 88 mCi of plutonium was transported beyond E060 due to an extraordinary 1926 cfs peak storm event on August 8 in which 77 mCi of that estimate was moved.

We also suggest that the majority of the contaminant is originating from Pueblo Canyon. While up to 182 mCi came from Pueblo Canyon, approximately 1.08 mCi originates from mid Los Alamos Canyon above E050, and approximately 34 mCi moved beyond E110 to the Rio Grande. Additional discussion regarding seasonal and sub-watershed transport differences are discussed in later sections.

The uncertainty associated with these estimates originates from random measurement error; including chemical analysis, discharge measurement, sampling inconsistencies, as well as natural environmental dispersion. We found that in some cases, the correlations are over influenced by single measurements and might underestimate the inventory at large discharge rates and overestimate it at low flows, or the inverse. Individual judgments were sometimes used to identify the significance and source of variability. For example, at E110, our assessment suggests that contaminant inventory transport is affected by the origin of the storm event. Contaminant loads are greater when the floods originate from Pueblo Canyon rather than Guaje Canyon. At E060 we generated a range of inventory transport to compensate for the uncertainty.

Strong linear and nonlinear relationships developed that demonstrate increasing concentrations of total plutonium in water and suspended sediment as discharge increased, ranging from zero concentrations in no flow to maximum concentrations limited by water velocity and turbulence. Nonlinear or exponential relationships suggest the rates of concentration increases were not uniform, although many of them are close to linear. This linearity is indicated by an exponent approaching one. In some cases, the relationships did not exist, we were only able to collect a single sample during an event, or suspect the discharge recordings were in error. Alternate methods exist for estimating mass transport, such as using single concentrations or averages and integrating them with discharge, but the inventory estimate errors would be much larger. We found linear correlations with the intercept set at zero provided the best estimates.

The following Table 3 contains the evaluations for the individual storm events sampled during the period of this report. It includes the station, date, peak discharge, plutonium and sediment mass transported during each event. The evaluations for each event are presented in Appendix C. Additional runoff was sampled but evaluations are only possible for locations that have reliable discharge measurements.

Table 3 Plutonium and Sediment Transport Evaluations for Each Sampled Event

Station	Date	Peak Flow (cfs)	Plutonium (mCi)	Sediment (tons)
E055	8/25/2006	45	0.0015	50
E055	7/14/2007	0.7	0.0000053	0.2
E055	7/26/2007	21	0.00036	7.7
E055	8/4/2007	0.9	0.0000054	0.1
E055	9/1/2007	4.2	0.0000259	1
E030	8/12/2005	11	0.009	7
E030	8/13/2005	7	0.004	3
E030	8/22/2005	5	0.004	3.5
E030	8/24/2005	27	0.029	23
E042	8/12/2005	70	0.172	232
E042	8/12/2005	135	0.137	184
E050	8/1/2006	16	0.005	4.5
E050	8/7/2006	24	0.014	20
E050	8/8/2006	252	0.21	122
E050	8/6/2007	5	0.0003	3.8
E050	8/29/2007	18	0.012	15
E050	9/1/2007	3	0.003	1.9
E050	9/2/2007	30	0.017	21
E050	7/4/2008	1.5	0.1977	1.7
E050	8/9/2008	5.3	0.0233	1.5
E050	8/23/2008	2.7	0.0015	0.8

Station	Date	Peak Flow (cfs)	Plutonium (mCi)	Sediment (tons)
E060	8/12/2003	60	0.314	99
E060	8/22/2003	90	0.03	158
E060	9/6/2003	243	4.25	1345
E060	7/23/2004	21	0.015	3
E060	7/27/2004	262	1.28	171
E060	8/18/2004	21	0.009	2
E060	8/20/2004	40	0.015	15
E060	8/24/2005	85	0.39	207
E060	7/26/2006	2	0.00013	1.05
E060	8/5/2006	1	0.00043	0.06
E060	8/8/2006	1926	76.95	4559
E060	8/25/2006	102	1.273	125
E060	8/6/2007	4	0.0007	4
E110	8/12/2005	18	0.0063	7
E110	8/24/2005	16	0.041	2
E110	8/25/2005	11	0.015	7
E110	7/6/2006	9	0.0004	7
E110	7/6/2006	11	0.003	8
E110	8/6/2006	49	0.007	20
E110	8/8/2006	1642	28.8	5209
E110	8/19/2006	16	0.004	14
E110	8/25/2006	89	1.17	368
E110	7/22/2008	69	0.005	64

Station Transport of Plutonium and Sediment

We found that linear relationships also exist between transport estimates and peak discharge from multiple events at stations that demonstrate similar watershed conditions. Using these correlations transport masses can be estimated for events not sampled. Evaluating the differences of the relationships between events and stations, especially the Inventory Rating Coefficients, can also be useful in identifying changes in the watershed.

Spatial and temporal total transport estimates are derived using relationships between peak discharge and associated mass transport in a fashion similar to mass transport evaluations accomplished for individual storm events. Rating curves were established for each station correlating plutonium and sediment inventories from each event to its paired peak discharge. An equation that described the correlation was then used to predict the transport mass for events not sampled. Transport inventories and rating coefficient comparisons between stations and time frames may provide insight into watershed conditions.

We assessed these relationships at six stations. One station, E055 is the furthest upstream station in Pueblo Canyon and is considered a background location for contaminant transport. The furthest upstream station in Los Alamos Canyon is E030 which is considered baseline for contaminant transport in that canyon, though it shows some radiological and PCB contaminant inputs. The remaining four, E060, E042, E050, and E110, are down-gradient of contaminant source terms. Station E110 is the Los Alamos Canyon watershed endpoint just prior to it entering the Rio Grande, and E060 is the Pueblo Canyon endpoint that discharges to mid-Los Alamos Canyon. Stations E042 and E050 are above and below a low head weir impound in mid-Los Alamos Canyon. They are located just above the Pueblo Canyon/Los Alamos confluence. An additional relevance for stations E050 and E060 are that they are both just above the eastern down-gradient boundary of the Laboratory.

The plutonium and suspended sediment relative transport assessments in this discussion are based on rating coefficients generated for typical storm flow events. Transport loading is relative to the size of the coefficient, and inference is made from comparison of baseline station coefficients to those downstream or below impaired reaches. Generally, the smaller the coefficient, the more stable the channel conditions and smaller amounts of sediments and contaminant are available for transport.

Hydrographs generated within the ephemeral streams of the Pajarito Plateau, including the Los Alamos watershed are generally considered "flashy". Storm surges typically generated hydrographs that illustrated fairly quick rises to peak discharge and then slower declining limbs. While storm intensity, duration and movement of storm patterns, and drainage basin characteristics produce variations in flood hydrographs, those variations are most pronounced between the frequent summer monsoonal events that produce short-lived and intense floods relative to the infrequent autumn large-frontal system rainfall that produce longer, broader, and less intense floods.

Most of the events evaluated during this report period are from the monsoonal events that produced short flood durations relative to their peak flow. Using station specific inventory rating coefficients for subsequent events that generate longer duration floods with multiple peak surges would under-estimate transport inventories. Although using these evaluations includes additional error in our estimates, we believe they are reasonable.

Table 4 summarizes the variables introduced above for the 2003 to 2008 stormwater conditions at six stations in the Los Alamos watershed. Those variables are plutonium and sediment transport inventories, count of flows greater than 10 cfs, and the rating coefficients that identify transport availability. Those parameters are listed in the upper part of the table. In the lower section, gross calculations for the concentrations are presented for comparison. Gross plutonium concentrations presented here refer to average concentrations derived from the total plutonium mass divided by the total sediment load. The calculations are based on the total plutonium inventory estimate divided by the tons of sediment transported. More precise values are presented in later sections that describe the spatial and temporal trends of plutonium and suspended sediment in stormwater.

These factors demonstrate near-background conditions in upstream Pueblo and downstream Guaje Canyons, and moderate LANL impacts within the mid Los Alamos Canyon reach relative to large impacts in Pueblo and lower Los Alamos Canyons.

Table 4 Plutonium and Sediment Transport Rating-Curve Summary

Station	E030	E042	E050	E055	E060	E110
flow count	16	58	33	31	48	33
max pu inventory (mCi)	0.32	3.21	1.08	0.13	182	34.4
min pu inventory (mCi)					134	
max rating coefficient	0.001	0.0013	0.0008	0.00003	0.037	0.018
min rating coefficient					0.019	0.00005*
max Sediment inventory (tons)	255	4384	755	4182	19348	7548
min Sediment inventory (tons)			576		13848	6119
max rating coefficient	0.80	1.78	0.75	0.98	4.78	3.17
min rating coefficient			0.51		2.71	0.72
Gross calculation of plutonium in sediments based on total tranported sediments and plutonium						
Station	E030	E042	E050	E055	E060	E110
pCi/g	1.38	0.81	1.20	0.03	8.01	5.02
						0.28*

*based on projected plutonium and sediment transport from Guaje Canyon

The following narrative describes the evaluations at each station.

E055

We sampled five of 31 runoff events at E055 in upper Pueblo Canyon above the Acid Canyon confluence. Plutonium concentrations are near background levels and the inventory/peak discharge rating coefficient, 0.00003, identifies little availability of the contaminant for transport. The sediment rating coefficient, 0.98, identifies stable channel conditions similar to those in upper watershed areas like E030. Its coefficient is 0.80. E055 demonstrates contaminant and sediment baseline conditions. The following charts in Figures 5 and 6 demonstrate the plutonium and sediment mass transport correlation to peak discharge at E055.

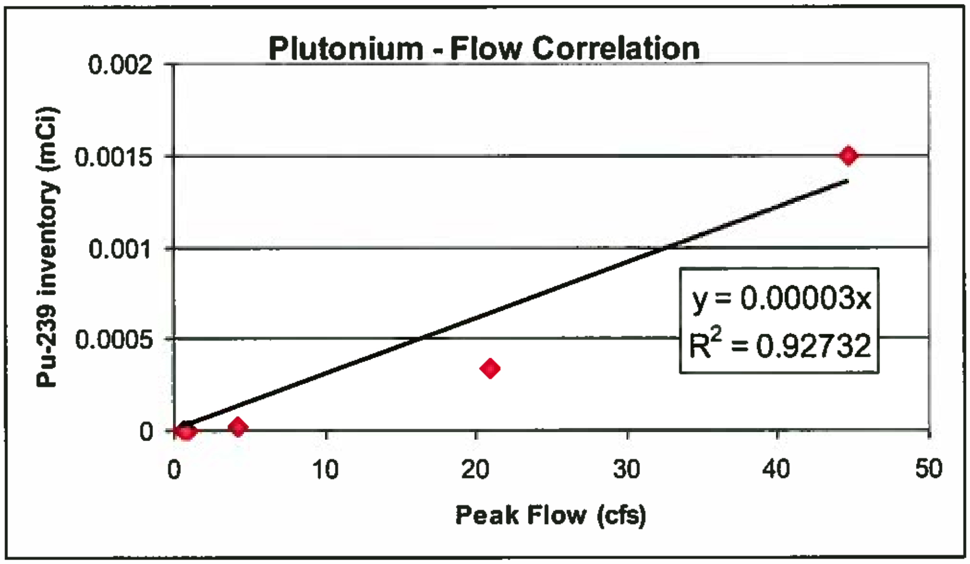


Figure 5 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E055

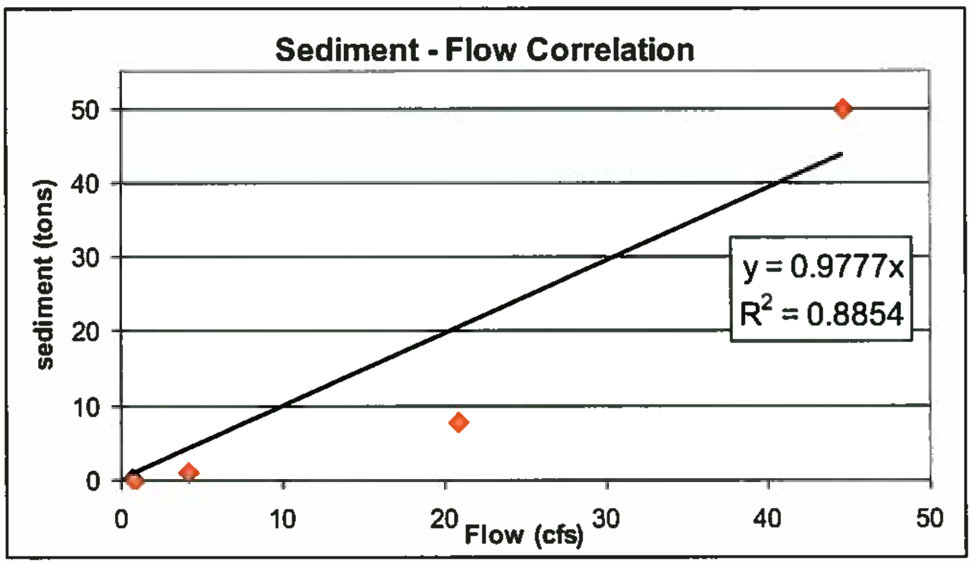


Figure 6 Sediment Mass and Maximum Instantaneous Discharge Correlation at E055

Table 5 lists all of the recorded flow events above 10 cfs at E055. The dates, peak discharge, measured plutonium and sediment mass transport masses evaluated in the preceding section, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on the relationships presented in the preceding charts. The cells in the lower right of the table are estimates of cumulative plutonium and sediment transport during 2003 to 2008.

Table 5 Plutonium and Suspended Sediment Transport at E055 from 2003 through 2008

Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons)	Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons)
1/28/2008	68	0.00204	66.5	7/15/2005	30	0.0009	29.3
7/14/2007	0.71	0.0000053	0.2	8/12/2005	14	0.00042	13.7
7/26/2007	21	0.00036	7.7	8/13/2005	123	0.00369	120.3
8/4/2007	0.9	0.0000054	0.1	8/24/2005	53	0.00159	51.8
9/1/2007	4.24	0.0000259	1.0	9/28/2005	10	0.0003	9.8
8/1/2006	16	0.00048	15.6	9/29/2005	16	0.00048	15.6
8/7/2006	15	0.00045	14.7	9/27/2004	11	0.00033	10.8
8/7/2006	14	0.00042	13.7	10/5/2004	28	0.00084	27.4
8/8/2006	1780	0.0534	1740.3	12/18/2004	10	0.0003	9.8
8/19/2006	12	0.00036	11.7	8/11/2003	26	0.00078	25.4
8/25/2006	45	0.0015	50.0	8/23/2003	1179	0.03537	1152.7
1/3/2005	14	0.00042	13.7	8/26/2003	61	0.00183	59.6
2/9/2005	13	0.00039	12.7	8/30/2003	19	0.00057	18.6
2/10/2005	18	0.00054	17.6	9/3/2003	14	0.00042	13.7
2/12/2005	11	0.00033	10.8	9/6/2003	651	0.01953	636.5
4/16/2005	11	0.00033	10.8	sum	31	0.128	4182

Measured events in red

We estimate 0.128 mCi plutonium in 4182 tons of sediment was transported over the six year period of this report. The rating coefficient for the plutonium/peak discharge correlation is 0.00003 and for the sediment/peak discharge 0.98. Dividing the plutonium transport mass by the suspended sediment mass and applying unit conversions results in a gross estimate of plutonium concentration in sediments of 0.03 pCi/g. These figures generally describe background contaminant concentrations and a watershed condition that delivers relatively small sediment loads. As a check on the calculated 0.03 value, the average concentration of plutonium$^{239/240}$ measured in nine suspended sediment samples collected during 2002 was 0.03 pCi/g (Englert et al., 2004). Also, Figure 25 in the Spatial Trends section demonstrates the average measured concentration of plutonium in suspended sediment for twenty E055 samples collected for this report is 0.06 pCi/g. The background plutonium$^{239/240}$ concentration in canyon sediments on the Pajarito Plateau is 0.068 pCi/g (Ryti et.al., 1998). Ryti's value demonstrates a 95% upper confidence level for plutonium$^{239/240}$ concentrations in sediments originating from atmospheric testing of nuclear weapons fallout. Transport of 4182 tons suspended sediment is comparable to the other baseline stations located in the upper reaches of the watershed relative to the size and number of storm events.

Table 6 summarizes the annual transport masses of plutonium and sediment. The plutonium and sediment transport mass variability is relative to precipitation rates and associated stormwater runoff from both the upper Pueblo watershed and urban developed areas of Los Alamos County. The estimates for 2003 and 2006 reflect two large events at E055, the August 23rd, 2003 1179 cfs and August 8th, 2006 1780 cfs events. These two of the total 31 floods transported approximately 69% of suspended sediment and contaminant loads, 28% in the August 23rd, 2003 flood and 42% in the August 8th, 2006 flood.

Table 6 Annual Estimates of Plutonium and Suspended Sediment Transport at E055

Year	Plutonium transport (mCi)	Sediment transport (tons)
2003	0.062	1907
2004	0.001	48
2005	0.009	306
2006	0.057	1846
2007	0.0004	9
2008	0.002	67

An extrapolation to the 1780 and 1179 cfs values at E055 could introduce a significant amount of error in the transport estimates as demonstrated by evaluations at E050, E060, and E110. Although similar assessments for variability could not be made at E055; the contaminant load, the inventory rating coefficients, and gross concentrations of plutonium in sediments, all derived from the extrapolation appear to substantiate the fairly low estimates that might be expected for a station located above probable LANL impacts. These data appear to reflect background conditions well and became useful reference information.

E030

We sampled four of 16 runoff events at E030 in upper Los Alamos Canyon above the DP Canyon confluence. Plutonium concentrations are above background levels and the inventory/peak discharge correlation rating coefficient 0.001 identifies a greater availability of the contaminant for transport at E030 than E055 demonstrating Laboratory impacts. The following charts in Figures 7 and 8 demonstrate the plutonium and sediment mass transport correlation to peak discharge at E030.

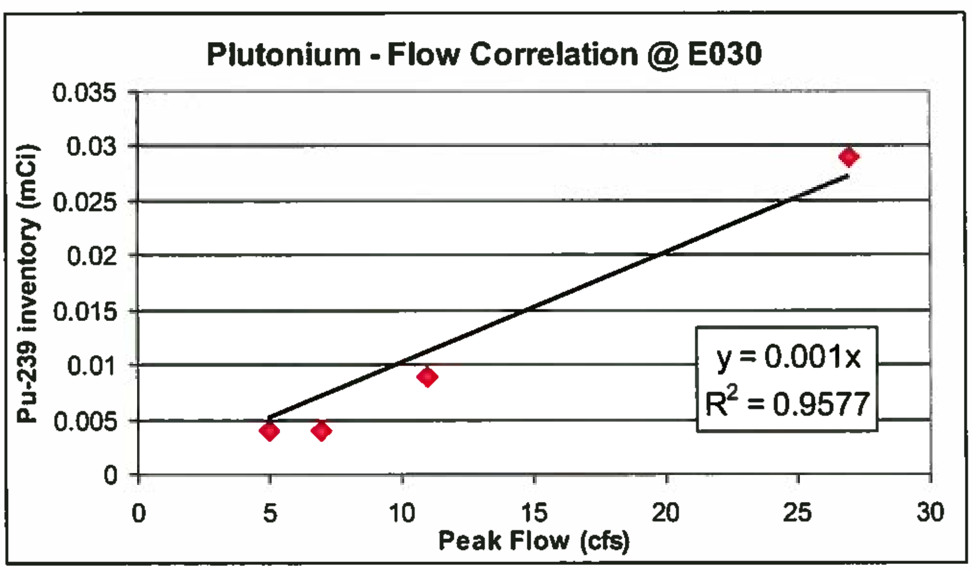


Figure 7 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E030

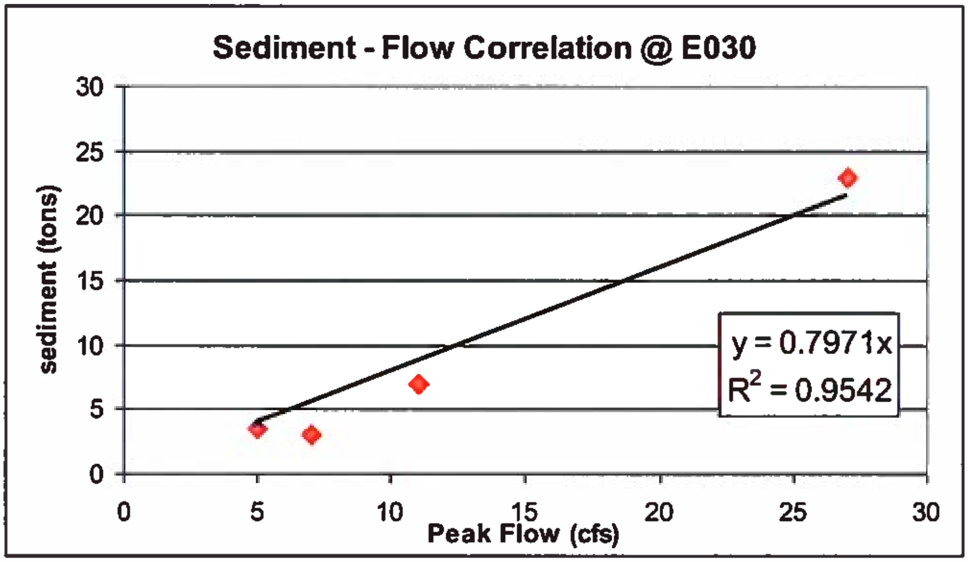


Figure 8 Sediment Mass and Maximum Instantaneous Discharge Correlation at E030

Table 7 lists all of the recorded flow events above 10 cfs at E030. The dates, peak discharge, measured plutonium and sediment mass transport masses evaluated in the preceding section, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on the relationships presented in the preceding charts. The cells in the lower right of the table provide the cumulative approximations for plutonium and sediment transport during 2003 to 2008 at E030.

Table 7 Plutonium and Suspended Sediment Transport for E030 from 2003 through 2008

Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons)
9/4/2008	17	0.017	13.5
9/2/2007	17	0.017	13.5
9/6/2007	24	0.024	19.1
12/1/2007	13	0.013	10.4
8/8/2006	90	0.09	71.7
8/25/2006	40	0.04	31.9
7/15/2005	12	0.012	9.6
8/12/2005	11	0.009	7.0
8/13/2005	7	0.004	3.0
8/22/2005	5	0.004	3.5
8/24/2005	27	0.029	23.0
7/24/2004	14	0.014	11.2
5/20/2003	10	0.01	8.0
5/21/2003	10	0.01	8.0
8/23/2003	15	0.015	12.0
9/6/2003	12	0.012	9.6
sum	16	0.32	255

Measured events in red

We estimate 0.32 mCi plutonium in 255 tons of sediment was transported over the six year period of this report. The inventory/peak discharge rating coefficient is 0.001 and a gross estimate of plutonium concentration in sediments is 1.38 pCi/g. The average measured concentration seen in Figure 28 in the Spatial Trends section is 1.70 pCi/g. Both the plutonium concentration in suspended sediments and rating coefficient are greater than at E055 and demonstrate more availability of the contaminant for transport and a Laboratory impact in Los Alamos Canyon. They are similar to the other mid Los Alamos Canyon stations, E042 and E050, and exhibit the same contaminant availability.

The E030 sediment/peak discharge rating coefficient is 0.80 and is similar to E042, E050, and E055. This suggests they deliver similar sediment loads relative to storm events. While comparable, the differences may also demonstrate their location in the watershed. Like E030, Pueblo Canyon station E055 is relatively high in the watershed. E042 retains a larger value and is lower in the watershed. While E050 is farther downstream, it is located below an impoundment that reduces sediment availability.

E030 plutonium/peak discharge and sediment/peak discharge rating coefficients are much less than the Pueblo Canyon E060 station and the lower Los Alamos Canyon station E110. The rating coefficients demonstrate a smaller level of sediment and contaminant availability at E030 than E060 or E110.

Table 8 summarizes the annual transport masses of plutonium and sediment at E030. The estimate reflects a larger event at E030 during 2006, the August 8th 90 cfs event. This one of 16 events transported approximately 28% of the total suspended sediment and contaminant loads. Otherwise the plutonium and sediment transport mass reflect fairly uniform conditions during the period of this report.

Table 8 Annual Estimates of Plutonium and Suspended Sediment Transport at E030

Year	Plutonium transport (mCi)	Sediment transport (tons)
2003	0.047	38
2004	0.01	11
2005	0.06	46
2006	0.13	104
2007	0.05	43
2008	0.02	14

E042

We sampled only two of 58 runoff events at E042 in mid-Los Alamos Canyon. This location is above a low head weir and many of the flows at E042 were completely impounded by the structure, while E050 is located below the weir. An assessment of this location may provide information regarding the effectiveness of the impoundment in sediment load reduction. Although this number of samples is inadequate to describe the conditions of the watershed here, they begin to provide values similar to what we expected. Additional sampling would be required to characterize this assessment more fully.

Plutonium concentrations are above background levels and the inventory/peak discharge rating coefficient identifies availability of the contaminant for transport demonstrating Laboratory impacts. The sediment/peak discharge rating coefficient may identify an increasing sediment load as the area or percentage of impermeable area of the watershed drained increases. The following charts in Figures 9 and 10 demonstrate the plutonium and sediment mass transport correlation to peak discharge at E042.

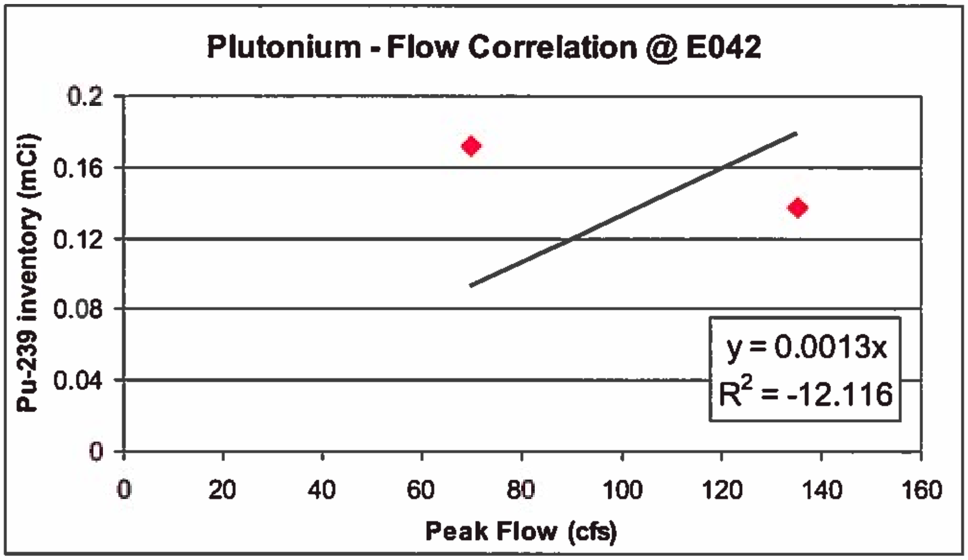


Figure 9 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E042

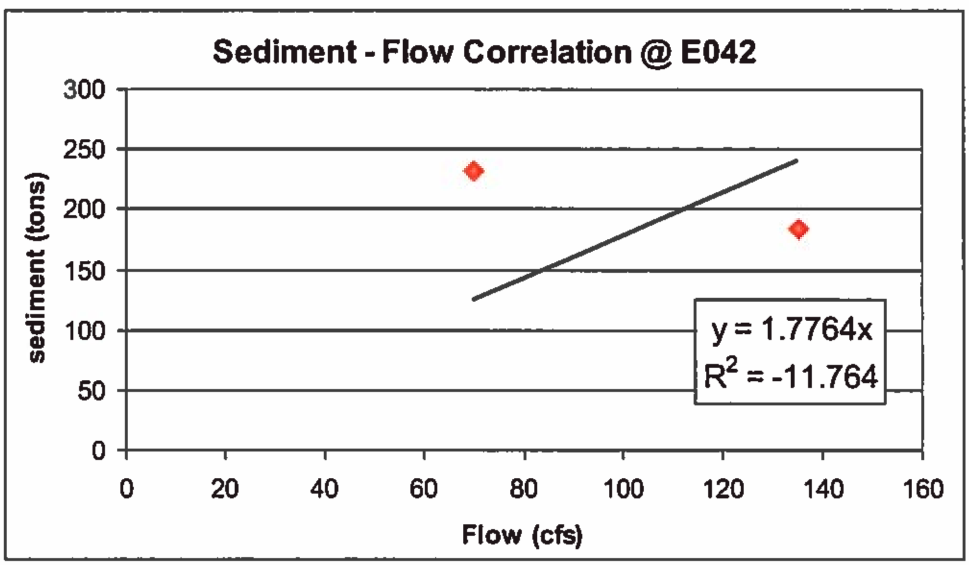


Figure 10 Sediment Mass and Maximum Instantaneous Discharge Correlation at E042

Table 9 lists all of the recorded flow events above 10 cfs at E042. The dates, peak discharge, measured plutonium and sediment mass transport masses evaluated in the preceding section, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on the relationships presented in the Figures 9 and 10. The cells in the lower right of the table provide the cumulative approximations for plutonium and sediment transport during 2003 to 2007 from E042.

Table 9 Plutonium and Suspended Sediment Transport for E042 from 2003 through 2008

Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons)
3/23/2007	24	0.0312	43
3/24/2007	16	0.0208	28
5/2/2007	20	0.026	36
5/8/2007	13	0.0169	23
5/13/2007	13	0.0169	23
6/12/2007	13	0.0169	23
6/16/2007	41	0.0533	73
7/30/2007	15	0.0195	27
8/6/2007	10	0.013	18
8/29/2007	52	0.0676	93
9/1/2007	10	0.013	18
9/2/2007	86	0.1118	153
9/6/2007	64	0.0832	114
9/23/2007	10	0.013	18
9/23/2007	16	0.0208	28
9/29/2007	10	0.013	18
7/3/2006	31	0.0403	55
7/5/2006	194	0.2522	345
7/9/2006	43	0.0559	77
8/1/2006	36	0.0468	64
8/7/2006	43	0.0559	77
8/8/2006	240	0.312	427
8/25/2006	221	0.2873	393
10/9/2006	17	0.0221	30
1/4/2005	25	0.0325	45
2/12/2005	13	0.0169	23
6/16/2005	28	0.0364	50
3/17/2005	20	0.026	36
4/16/2005	37	0.0481	66

Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons)
4/18/2005	15	0.0195	27
4/19/2005	16	0.0208	28
4/24/2005	40	0.052	71
4/25/2005	11	0.0143	20
4/26/2005	10	0.013	18
5/3/2005	31	0.0403	55
5/8/2005	10	0.013	18
5/11/2005	10	0.013	18
7/15/2005	30	0.039	53
8/4/2005	35	0.0455	62
8/12/2005	70	0.172	232
8/12/2005	135	0.137	184
8/13/2005	22	0.0286	39
8/22/2005	39	0.0507	69
8/24/2005	138	0.1794	246
8/25/2005	65	0.0845	116
9/29/2005	20	0.026	36
7/23/2004	18	0.0234	32
7/24/2004	40	0.052	71
7/27/2004	10	0.013	18
8/20/2004	18	0.0234	32
10/5/2004	16	0.0208	28
10/11/2004	18	0.0234	32
5/20/2003	14	0.0182	25
5/21/2003	14	0.0182	25
5/25/2003	18	0.0234	32
8/23/2003	94	0.1222	167
8/25/2003	94	0.1222	167
9/6/2003	22	0.0286	39
sum	58	3.21	4384

Measured events in red

We estimate 3.2 mCi plutonium in 4384 tons of sediment was transported over a five year period. This station has not been in operation since October 2007 and does not include an increase in contaminant load due to an upstream TA-21 waterline break in 2008. The plutonium concentrations temporarily increased by three orders of magnitude at E050 after the waterline break. Subsequent stormwater evaluations there demonstrate that the levels are reducing and may continue to drop to levels seen before the break.

The 0.0013 plutonium rating coefficient and a 0.81 pCi/g plutonium concentration estimate are greater than those values at the background station E055 and similar to those in mid Los Alamos Canyon. Stations E030 and E050 demonstrate a Laboratory impact, yet relative to those at Pueblo Canyon station E060 and lower Los Alamos Canyon E110 the impact is small. After the July 4th waterline break in 2008 those impacts have surely increased as seen in the E050 evaluation.

The E042 sediment coefficient 1.78 is larger than the E055, E030, and E050 values, 0.98, 0.80 and 0.75 respectively. The differences may demonstrate an increasing sediment load as the watershed drainage area increases, as well as an expected 58% sediment load reduction within the low head weir impoundment.

Table 10 summarizes the annual transport masses of plutonium and sediment. The estimates for 2005 and 2006 reflect a larger frequency of events during 2005 and three events much larger than average in 2006. Those events occurred July 5th, August 8th, and August 25th contributing peak discharges of 194, 240, and 221 cfs respectively. These three of the 58 events contribute approximately 27% of the suspended sediment and contaminant transport load. The difference in flood variability between E030 (16 events) and E042 (58 events) may originate from the Los Alamos town-site stormwater contributions at DP Canyon.

Table 10 Annual Estimates of Plutonium and Suspended Sediment Transport at E042

Year	Plutonium transport (mCi)	Sediment transport (tons)
2003	0.33	455
2004	0.16	213
2005	1.37	1512
2006	1.07	1468
2007	0.69	736

E050

We sampled ten of 33 runoff events at E050 in mid Los Alamos Canyon above the Pueblo Canyon confluence. This station is at the eastern boundary of the Laboratory and below the Los Alamos low head weir. The plutonium/peak discharge rating coefficient demonstrates Laboratory impact similar to that found at mid Los Alamos stations E030 and E042. The suspended sediment coefficient is similar to the E030 and E055 stations in the upper Los Alamos watershed, but slightly smaller than E042 located just above the low head weir impoundment. An overall reduction in the plutonium inventory transport occurred, from 3.2 mCi in 4384 tons of sediment at E042 to 1.1 mCi in up to 727 tons of sediment at E050. Many of the flows observed at E042 were completely impounded above the low head weir and contributed to the 3657 tons of sediment retained there. Stormwater discharge was monitored for only 5 years at E042, from 2003 to 2007. Only 33 flows greater than 10 cfs were observed at E050 compared to 58 flows at E042. Additional charts are presented in Figure 11 to demonstrate the plutonium and sediment mass transport correlations to peak flows at E050, including and excluding the extraordinary August 8th, 2006 storm event and the impacts from the July 4th, 2008 waterline break at TA-21.

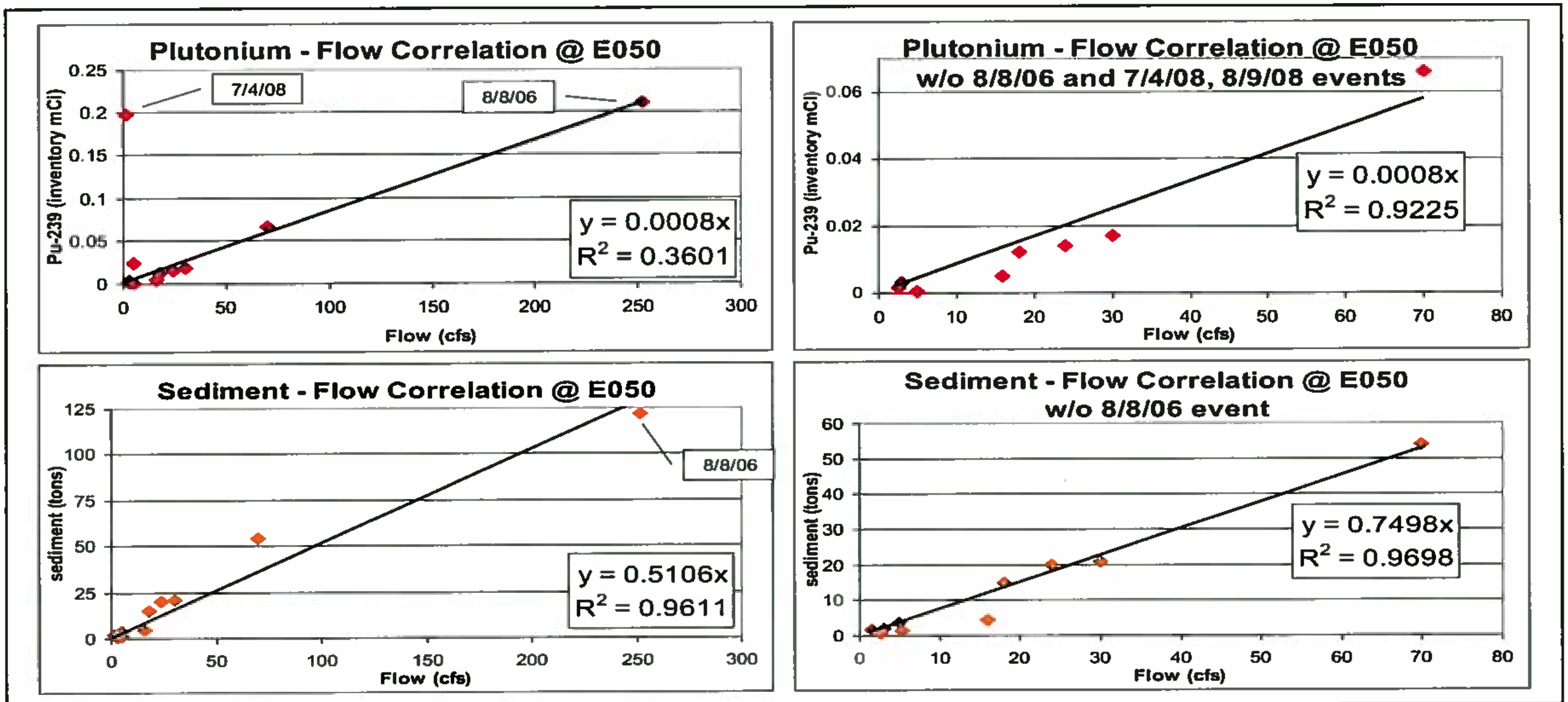


Figure 11 Plutonium and Sediment Mass Correlations to Maximum Instantaneous Discharge at E050, Including Charts with and without Extraordinary Runoff Events

While these correlations are good, a number of noteworthy conditions exist. The upper left hand plutonium to peak discharge chart includes the mass transport evaluation from the July 4th waterline break at TA-21. Approximately 0.2 mCi was transported past E050 within a very low flow condition relative to 0.2 mCi transported in a 252 cfs event on August 8th, 2006. The concentrations or plutonium availability was much greater resulting from the waterline break that flowed through a SWMU at TA-21. The sediment to discharge correlations also provide important insight to these evaluations. By excluding the large August 8th event in the correlation, sediment transport estimates in relatively large events might be overestimated. This is reflected by the smaller 0.51 rating coefficient in the left chart compared to the 0.75 coefficient developed in the right chart excluding the August flood.

Table 11 lists all of the recorded events above 10 cfs at E050. The dates, peak discharge, measured plutonium and sediment mass transport masses evaluated in the preceding section, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on the relationships presented in the preceding charts. The cells in the lower right of the table provide the cumulative approximations for plutonium and sediment transport during 2003 to 2008 at E050.

Table 11 Plutonium and Suspended Sediment Transport for E050 from 2003 through 2008

Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons) using 0.51 coefficient	Sediment transport (tons) using 0.75 coefficient	Date	Peak Flow (cfs)	Plutonium transport (mCi)	Sediment transport (tons) using 0.51 coefficient	Sediment transport (tons) using 0.75 coefficient
8/23/08	2.7	0.0015	1	1	6/29/06	26	0.0208	13	19
8/10/08	18	0.0144	9	13	9/29/05	21	0.0168	11	16
8/9/08	5.3	0.0233	2	2	9/28/05	13	0.0104	7	10
7/4/08	1.5	0.1977	2	2	8/25/05	28	0.0224	14	21
2/4/08	23	0.0184	12	17	8/24/05	51	0.0408	26	38
1/28/08	16	0.0128	8	12	8/22/05	10	0.008	5	7
12/1/07	35	0.028	18	26	8/13/05	10	0.008	5	7
9/6/07	22	0.0176	11	16	8/12/05	22	0.0176	11	16
9/2/07	30	0.017	21	21	5/3/05	15	0.012	8	11
9/1/07	3	0.003	2	2	4/24/05	16	0.0128	8	12
8/29/07	18	0.012	15	15	4/16/05	20	0.016	10	15
8/6/07	5	0.0003	4	4	1/4/05	16	0.0128	8	12
3/23/07	11	0.0088	6	8	8/20/04	12	0.0096	6	9
8/25/06	72	0.0576	37	54	7/24/04	34	0.0272	17	25
8/8/06	252	0.21	122	122	7/23/04	11	0.0088	6	8
8/7/06	24	0.014	20	20	9/26/03	16	0.0128	8	12
8/1/06	16	0.005	5	5	8/23/03	43	0.0344	22	32
7/9/06	17	0.0136	9	13	8/22/03	15	0.012	8	11
7/5/06	148	0.1184	76	111	5/20/03	10	0.008	5	7
					sum	38	1.08	576	755

Measured events in red

We estimate 1.08 mCi plutonium in 576 to 755 tons of sediment was transported beyond this station over the six year period of this report. The slope coefficient for the plutonium/peak discharge correlation, the rating coefficient, is 0.0008. The coefficient for the sediment/peak discharge correlation ranges from 0.75 to 0.51. A piecewise evaluation of sediment yield produces a 727 ton estimate. The gross estimate of plutonium concentration in sediments ranges from 1.58 to 2.08 pCi/g, although these estimates include the increased plutonium availability during 2008. A better estimate might be 1.2 pCi/g excluding the temporary influx from the TA-21 waterline break. The average measured concentration seen in Figure 28 in the Spatial Trends section is 1.28 pCi/g.

Two estimates are made to present the possible differences that developed from an extraordinary flood event August 8^{th}, 2006 and the impact from the waterline break at TA-21 on July 4^{th}, 2008. The August flood was by far the largest to occur in the watershed during this period and the TA-21 waterline break introduced new legacy contaminant levels to the canyon bottom. Plutonium concentrations in suspended sediments temporarily increased by two orders of magnitude, from an average of 1.2 pCi/g to 160 pCi/g. Subsequent storm flows have almost reduced levels to those before the break.

The left Plutonium/Discharge Correlation chart in Figure 11 includes all evaluations. Notice that the plutonium transport for both the August 8^{th} event and the July 4th are the same, 0.2 mCi. The difference between a 122 ton sediment load that contained smaller concentrations of contaminant, similar to the August event, and that of a 1.5 ton sediment load with large contaminant concentrations, like the July event, is evident. Subsequent events sampled on August 9th and 23rd demonstrate that contaminant concentrations are reducing. Although due to the changing conditions, an underestimation has likely been made on the 18 cfs August 10th event. It may have transported as much as 0.2 mCi of plutonium rather than the 0.0144 mCi estimate presented in Table 11.

An alternate correlation without the extraordinary events is presented on the right in Figure 11. The plutonium/peak discharge rating coefficient did not change, but the coefficient of determination (R^2) increased. The E050 rating coefficient 0.0008 is much larger than 0.00003 at the background station E055, and similar to the mid Los Alamos stations E030 and E042. Those coefficients are 0.001 and 0.0013 respectively. E050, E042, and E030 evaluations demonstrate impact by the Laboratory at mid Los Alamos Canyon but less than seen at the Pueblo endpoint station E060 and lower Los Alamos Canyon station E110.

The E050 sediment/peak discharge rating coefficient 0.75 is similar to those at E030 and E055, 0.80 and 0.98 respectively, and less than the 1.78 value at E042. The sediment rating coefficient comparisons to the upper Los Alamos watershed stations demonstrate similar watershed conditions or capacity to carry sediment, as well as a load reduction within the low head weir impoundment when compared to E042. Based on the 0.75 and 1.78 coefficients at E050 and E042 we expected a 58% reduction in sediment transmission through the weir impoundment.

Excluding the August 8th event increased the slope by a small degree. This suggests using the 0.75 slope overestimates sediment load for larger events while use of the 0.51 slope could underestimate the sediment transport in small events. An alternate method provides a modification to the assessment. A piecewise linear approximation includes multiple steps of correlations, in this case two. The linear approximation between 0 and 72 cfs generates the 0.75 slope coefficient and between 72 and 252 cfs a linear equation $y = (0.3778*x) + 26.8$ is developed. This equation was applied to a 148 cfs discharge recorded July 7th, 2006. An 83 ton estimate was generated and included in the transport sum rather than a 76 to 111 ton range for this event.

Table 12 summarizes the annual transport masses of plutonium and sediment. The estimates for 2005 and 2006 reflect a higher frequency of events during 2005 and two events much larger than average in 2006. Those two events in seven measured runoffs in 2006 occurred July 5th and August 8th contributing peak discharges of 148 and 252 cfs respectively. The plutonium and sediment contributions were 0.12 mCi in 111 tons and 0.21 mCi in 122 tons of the 0.44 mCi in 344 tons sum for 2006. They contributed almost a third of the total suspended sediment and contaminant transport from 38 events during the period of this report. The plutonium transport estimate in 2008 includes the large amount of plutonium available resulting from the waterline break at TA-21. That relatively small flow event on July 4th contributed 19% of the total contaminant transport at E050.

Table 12 Annual Estimates of Plutonium and Suspended Sediment Transport at E050

Year	Plutonium transport (mCi)	Sediment transport (tons)
2003	0.07	63
2004	0.05	42
2005	0.18	166
2006	0.44	344
2007	0.09	93
2008	0.27	47

Although we expected a 58% reduction in sediments based on the differences in rating coefficients, we estimated an average 80% reduction of sediment transport in events flowing through the weir to E050, and a total 86% reduction including events completely impounded above the weir. A corresponding reduction in plutonium transport is also observed; an average 71% reduction measured in flows from both sites and a total 77% reduction when impounded flows are included in the evaluation.

Nine percent enrichment in plutonium content (difference between the sediment and plutonium reductions) may originate from the "fining" of suspended sediments as it passes through the impoundment. Retention time within the impoundment may allow coarser grained materials to settle. The enrichment is associated with the propensity of plutonium to adhere to the finer grained sediments.

This estimate covers 58 flows observed at E042 and 31 flows at E050 during 2003 to October of 2007 when discharge measurements were halted at E042. It does not include 2000 through 2002 or 2008, four of the nine years since the weir was constructed. From 2003 to 2007, 31 events were completely impounded by the weir and 27 corresponding flows were observed at both E042 and E050. Four additional events gauged at E050 were not observed at the upstream E042 station and we suspect the E042 gage was not functioning.

During this time period, we estimate that approximately 3757 tons of sediment was retained above the weir. At E042 we estimate that 4384 tons of suspended sediments passed the station in storm water. At E050 below the weir, 627 tons of suspended sediments passed. These estimates did not include an additional 125 tons transported at E050 during 2008 or for four flows observed at E050 but not at E042.

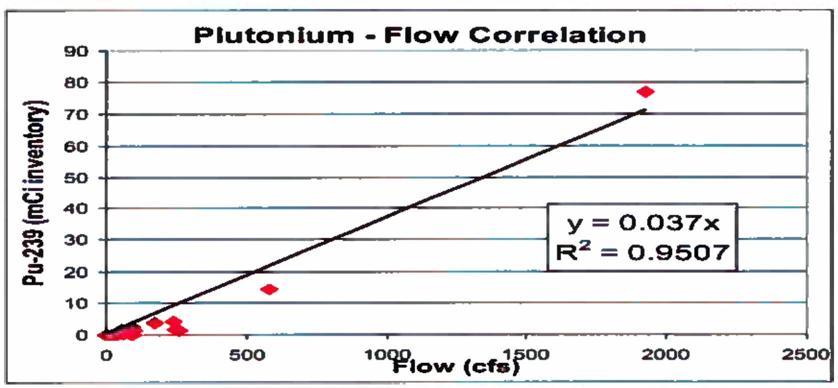
Work performed by LANL in 2009 may partially substantiate this estimate. In May of 2009, LANL began sediment removal at the weir at the direction of the New Mexico Environment Department. Approximately 80 yd^3 of sediment from the impoundment surface containing higher concentrations of several constituents, including dioxins/furans, was segregated and disposed of as low-level radioactive waste at TA-54, Area G (LANL, 2009). These materials probably originate from the TA-21 SWMU eroded during the waterline break in July of 2008. An additional 5000 yd^3 was excavated and placed onto the adjacent hill slope upstream of the weir.

Using a 1.28 gram/cm^3 density conversion factor for clay loam sediments, the 5080 yd^3 of excavated material is equivalent to 5480 tons. Our 3757 ton estimate for five of the nine year period of sediment accumulation above the weir appears fairly consistent with the 5480 tons of sediment excavated by LANL.

E060

We sampled thirteen of 48 runoff events at E060 at the Pueblo Canyon endpoint from 2003 to 2007. This station is at the eastern boundary of the Laboratory and reflects the largest amounts of legacy contaminant transport in the Los Alamos watershed. We found the present evaluation substantiated the earlier linear relationships derived from our 2000 -2002 stormwater report (Englert et al., 2004). Data from 2000 through 2002 is included in this evaluation and inventory summations are presented for each time segment, 2000-2002, 2003-2008, and the total transport inventory from the Cerro Grand fire to 2008. Like the E050 evaluation, the correlations are made with and without the extraordinary August 8th, 200 flood. Additional charts are presented that include data from both scenarios and demonstrate the correlation variances.

Plutonium concentrations, inventories and rating coefficients are larger than at any location and demonstrate Laboratory impact. Sediment inventories and rating coefficients are also larger than any other station and reflect less stable channel conditions and more sediment available for transport. The following six charts in Figures 12 through 15 present the correlation of plutonium and sediment transport inventories to peak discharge from eighteen events sampled during 2000 to 2007. Thirteen sampled events originate during 2003 to 2007 and five occurred during 2000 to 2002. There were no flows observed during 2008. Charts in Figures 13 and 15 combine the correlations to present ranges between all events including an extraordinary 1926 cfs flood August 8th, 2006 and without.



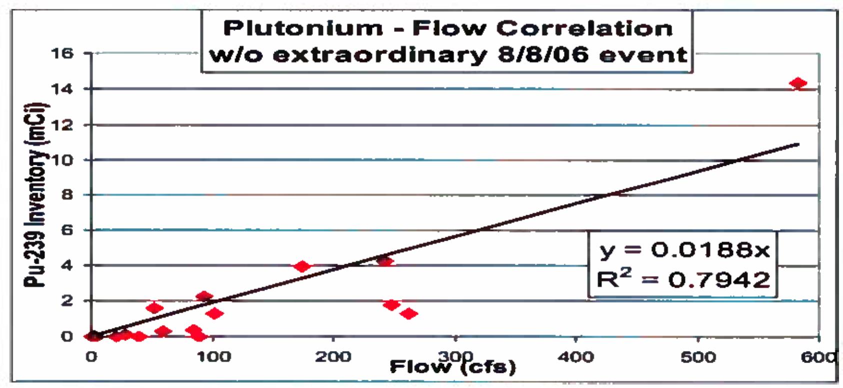


Figure 12 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E060, Including Charts with and without Extraordinary Runoff Event

The August flood was by far the largest to occur in the watershed during this report period. The left correlation in Figure 12 includes the August 1926 cfs event and develops a 0.037 rating coefficient. It appears to overestimate transport for smaller flood events. The correlation on the right does not include the large event and develops a 0.019 coefficient, similar to the original 0.02 coefficient derived in our 2000–2002 report (Englert et al., 2004). Using that coefficient for large events may underestimate the transport inventory.

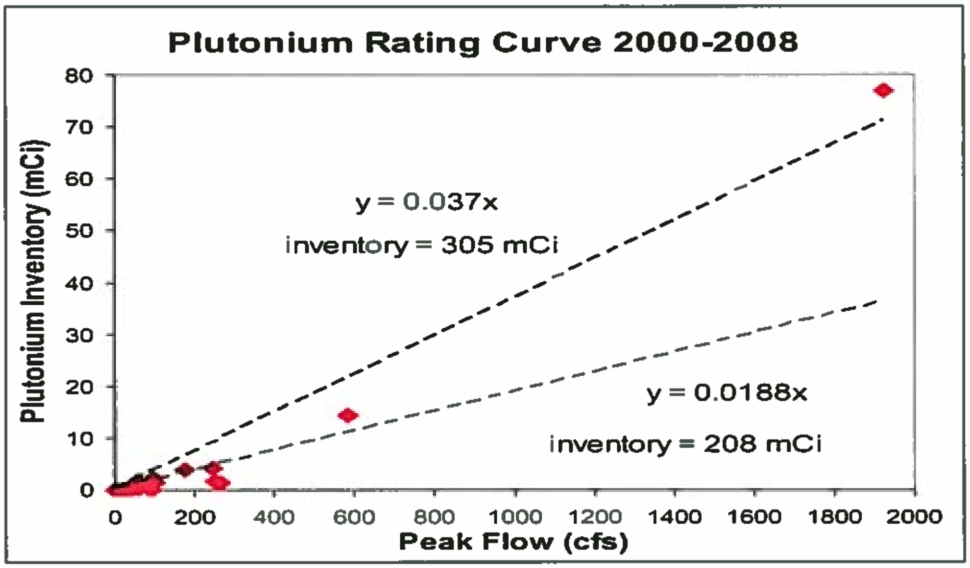


Figure 13 Alternate E060 Plutonium Mass Rating Curve that Includes Range

Figure 13 combines both correlations and represents the range of inventory estimates derived from them. The transport estimate derived from inclusion of the August 1926 cfs flood develops a 0.037 coefficient while that from the smaller floods develops a 0.019 coefficient. These coefficients are applied to all flows at E060 to develop 208 mCi to 305 mCi range of the transport inventories.

A similar treatment is presented for the sediment transport estimates in Figure 14. Inclusion of the August event in the upper chart generates a 2.7 rating coefficient but appears to underestimate the smaller events. If the correlation developed from exclusion of the August event is used a 4.78 coefficient is derived and an overestimation is made on the large events.

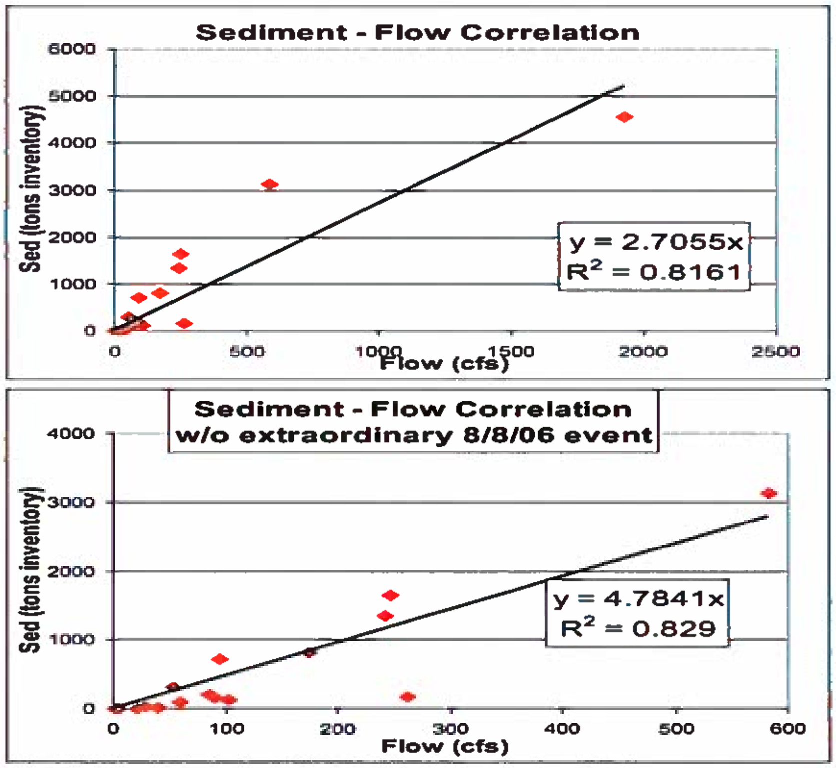


Figure 14 Sediment Mass and Maximum Instantaneous Discharge Correlation at E060, Including with and without Extraordinary Runoff Event

Figure 15 below combines both correlations and represents the range of inventory estimates derived from the correlations. The rating coefficients for the sediment/peak discharge correlation range from 2.71 to 4.78 and develop a 27714 ton to 38766 ton transport inventory estimate.

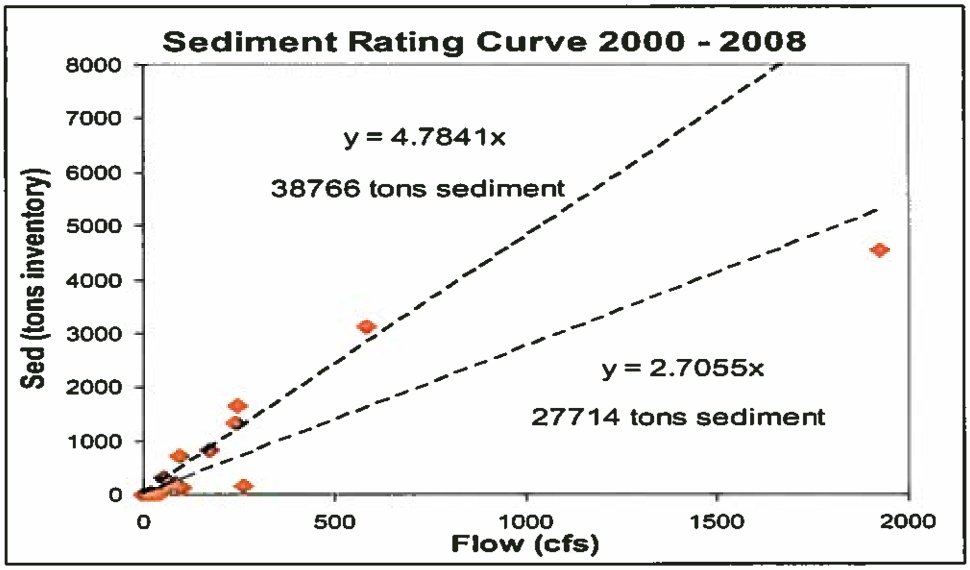


Figure 15 Alternate E060 Sediment Mass Rating Curve Range

The E060 plutonium rating coefficients, 0.019 or 0.037 are three orders of magnitude greater than the background station E055 coefficient which is 0.00003. They are also one order of magnitude greater than the coefficients at the mid Los Alamos Stations, E030, E042 and E050, which are 0.001. The sediment rating coefficients, 2.7 to 4.8, are about three to five times greater than at upper Pueblo E055 and the mid Los Alamos watershed stations. Those values are all near one. These differences identify a greater sediment load capacity for floods at the Pueblo station E060, reflecting a less stable channel system and a larger contaminant supply. Some of the flows at E110 in lower Los Alamos Canyon, discussed later, will also reflect these conditions.

A LANL gage station at the NMED PU2.4 site above the wetlands, also referred to as E059, was installed in 2010 and is intended to supply an index to measure reduction of contaminated sediment transport. Accurate discharge measurements at this station were not available for this report.

Table 13 lists all of the recorded flow events above 10 cfs at E060. The dates, peak discharge, measured plutonium and sediment mass transport masses evaluated in the preceding section, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on the relationships presented in the preceding charts. The cells in the lower right of the table provide the cumulative approximations for plutonium and sediment transport during 2000 to 2008 and 2003 to 2008 at E060.

Table 13 Plutonium and Suspended Sediment Transport for E060 from 2003 through 2008

Date	Peak Flow (cfs)	Plutonium transport (mCi) using 0.0188 coefficient	Plutonium transport (mCi) using 0.0.037 coefficient	Sediment transport (tons) using 2.7 coefficient	Sediment transport (tons) using 4.8 coefficient	Date	Peak Flow (cfs)	Plutonium transport (mCi) using 0.0188 coefficient	Plutonium transport (mCi) using 0.0.037 coefficient	Sediment transport (tons) using 2.7 coefficient	Sediment transport (tons) using 4.8 coefficient
8/3/2000	60	1.13	2.22	162	287	8/23/03	749	14.08	27.71	2026	3583
8/12/2000	13	0.24	0.48	35	62	8/26/03	38	0.71	1.41	103	182
9/8/2000	114	2.14	4.22	308	545	9/6/03	243	4.25	4.25	1345	1345
10/12/2000	11	0.21	0.41	30	53	9/11/03	10	0.19	0.37	27	48
10/24/2000	147	2.76	5.44	398	703	7/23/04	21	0.015	0.015	3	3
10/27/2000	39	0.73	1.44	106	187	7/24/04	504	9.48	18.65	1364	2411
7/2/2001	1440	27.07	53.28	3896	6889	7/27/04	262	1.28	1.28	171	171
7/26/2001	114	2.14	4.22	308	545	8/18/04	21	0.009	0.009	2	2
7/27/2001	16	0.30	0.59	43	77	8/20/04	40	0.015	0.015	15	15
8/4/2001	60	1.13	2.22	162	287	8/23/04	12	0.23	0.44	32	57
8/5/2001	28	0.53	1.04	76	134	9/12/04	14	0.26	0.52	38	67
8/6/2001	21	0.39	0.78	57	100	9/20/04	18	0.34	0.67	49	86
8/9/2001	244	4.59	9.03	660	1167	9/21/04	16	0.30	0.59	43	77
8/10/2001	18	0.34	0.67	49	86	9/22/04	25	0.47	0.93	68	120
8/11/2001	248	1.74	1.74	1650	1650	9/25/04	29	0.55	1.07	78	139
8/13/2001	19	0.36	0.70	51	91	9/26/04	21	0.39	0.78	57	100
8/14/2001	29	0.55	1.07	78	139	9/28/04	18	0.34	0.67	49	86
8/16/2001	174	3.93	3.93	818	818	9/30/04	27	0.51	1.00	73	129
8/17/2001	25	0.47	0.93	68	120	10/4/04	13	0.24	0.48	35	62
8/20/2001	16	0.30	0.59	43	77	10/5/04	77	1.45	2.85	208	368
8/27/2001	14	0.26	0.52	38	67	10/11/04	30	0.56	1.11	81	144
8/31/2001	14	0.26	0.52	38	67	1/1/05	47	0.88	1.74	127	225
9/26/2001	13	0.24	0.48	35	62	8/14/05	116	2.18	4.29	314	555
6/22/2002	583	14.34	14.34	3136	3136	8/24/05	85	0.39	0.39	207	207
6/23/2002	22	0.41	0.81	60	105	9/29/05	40	0.75	1.48	108	191
6/24/2002	11	0.21	0.41	30	53	10/30/05	130	2.44	4.81	352	622
7/5/2002	11	0.21	0.41	30	53	7/5/06	117	2.20	4.33	317	560
7/6/2002	12	0.23	0.44	32	57	7/9/06	41	0.77	1.52	111	196
7/7/2002	16	0.30	0.59	43	77	7/26/06	2	0.00013	0.00013	1.05	1.05
7/8/2002	11	0.21	0.41	30	53	8/5/06	1	0.00043	0.00043	0.06	0.06
7/9/2002	73	1.37	2.70	198	349	8/7/06	127	2.39	4.70	344	608
7/18/2002	53	1.59	1.59	312	312	8/8/06	1926	76.95	76.95	4559	4559
7/26/2002	94	2.26	2.26	724	724	8/25/06	102	1.273	1.273	125	125
8/9/2002	18	0.34	0.67	49	86	8/25/06	220	4.14	8.14	595	1053
9/10/2002	29	0.11	0.11	32	32	9/8/06	11	0.21	0.41	30	53
9/13/2002	13	0.24	0.48	35	62	9/22/06	12	0.23	0.44	32	57
5/25/03	62	1.17	2.29	168	297	10/1/06	11	0.21	0.41	30	53
5/26/03	17	0.32	0.63	46	81	4/29/07	19	0.36	0.70	51	91
5/31/03	20	0.38	0.74	54	96	4/30/07	18	0.34	0.67	49	86
6/18/03	14	0.26	0.52	38	67	5/5/07	10	0.19	0.37	27	48
8/12/03	60	0.314	0.314	99	99	8/6/07	4	0.0007	0.0007	4	4
8/21/03	13	0.24	0.48	35	62	2000-2008	84	208	304	27668	38659
8/22/03	90	0.03	0.03	158	158	2003-2008	48	134	182	13848	19348

Measured events in red

We estimate that 134 mCi to 182 mCi plutonium in 13848 to 19348 tons of sediment was transported out of Pueblo Canyon beyond the eastern boundary of the Laboratory since 2003. Since the Cerro Grande fire in 2000, 208 mCi to 304 mCi in 27668 to 38659 tons of sediment were transported beyond the Laboratory boundaries. Logarithmic, exponential, or power functions do not represent the relationships well, and we considered a piecewise treatment that generated a 246 mCi of plutonium in 35543 tons sediment transport estimate since the fire. A gross estimate of plutonium concentration in sediments from that estimate is 7.6 pCi/g. The average measured concentration seen in Figure 24 of the Spatial Trends section of this report is 4.5 pCi/g.

Plutonium and sediment transport inventories and rating coefficients are larger than at any location and demonstrate the largest Laboratory impacts in the least stable channel conditions. Although a larger number of events passed this station than E050 and E110 contributing to a larger overall transport inventory, the rating coefficients as well as plutonium concentrations identify larger contaminant sources and sediment available for transport. A flow evaluation in this report discusses the relative number of flows at each station. The plutonium and sediment rating coefficients identify greater increments of material for each increment of discharge increase.

Table 14 summarizes the annual transport masses of plutonium and sediment. The estimates from 2003 through 2007 indicate diminishing transport inventories except for 2006. Stream flow in 2006 on the Pajarito Plateau was record setting and dominated by large rainfall events in August (LANL ESR, 2006). Four events greater than 100 cfs occurred during August of 2006, including the 1926 cfs flood, contributing over 84 mCi plutonium in approximately 6000 tons sediment of the annual estimates. The August 8th, 2006 1926 cfs flood contributed over 30% of the total plutonium transport in 48 recorded events since the 2000 fire but only 13% of the suspended sediment load. We surmise that increasing stage levels and flood energies entrain sediments from flood plain and bank deposits unaffected by lower flood stages. Those sediments may contain larger contaminant concentrations than those in the active channel.

Table 14 Annual Estimates of Plutonium and Suspended Sediment Transport at E060

Year	Plutonium transport (mCi)	Sediment transport (tons)
2003	22.2	6018
2004	16.4	4034
2005	6.6	1800
2006	88.4	7265
2007	0.9	229

E110

The last station evaluated is at the E110 station near the Los Alamos watershed endpoint just before the Rio Grande. It may provide the most important information in this report, LANL contaminant mass entering the Rio Grande above the new Santa Fe Buckman Diversion community water resource.

The gage began operation at the end of 2002 and other stations in Guaje Canyon have operated intermittently. Guaje Canyon is a main tributary to the lower Los Alamos Watershed reach. It is outside the LANL perimeter and probably demonstrates background conditions, providing clean sediments from a relatively stable canyon reach.

We sampled ten of 33 runoff events at E110 in lower Los Alamos Canyon above the Rio Grande confluence. Like E050 and E060, multiple charts are developed to demonstrate variations due to changing conditions at E110. Those changes include the August 8th, 2006 flood that peaked at 1642 cfs, and event origin, whether the flows developed in Pueblo and mid Los Alamos Canyons or Guaje Canyon. Plutonium and sediment concentrations and rating coefficients demonstrate a large variance, some demonstrating background conditions and some demonstrating Laboratory impacts. The following figures demonstrate the plutonium and sediment mass transport correlation to peak discharge at E110.

Figure 16 contains the plutonium/peak discharge correlation from all ten samples. The plutonium transport mass in the August 8th event becomes a large influencing value to the correlation and develops a rating coefficient of 0.018 similar to the 0.019 coefficient developed at E060. A large interval exists between flood levels. The next largest peak discharge during the period of this report is 89 cfs recorded August 25th, 2006. Although the E110 gage was not in operation during 2000 to 2002, multiple flows greater than 100 cfs were recorded upstream at E060 including a 1440 cfs discharge July 2, 2001 and a potential for large floods will continue into the future.

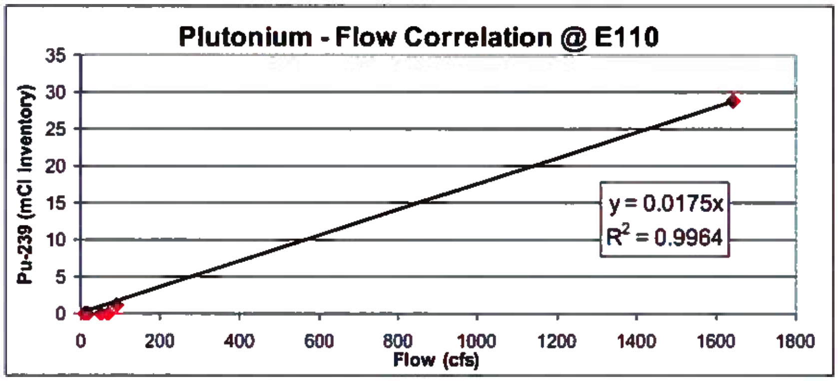


Figure 16 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E110

Figure 17 contains only evaluations from events that are identified as originating in Pueblo or mid Los Alamos Canyons. We identified the origins from the Flow Evaluation section later in this report. These include runoff events from August 8th, 2006, August 25th, 2008, August 24th, 2005, and August 25th, 2005. The evaluation also contains the large influencing August 8th value and demonstrates the same 0.018 rating coefficient as Figure 16. Review of the data without that large event provides a similar 0.013 coefficient.

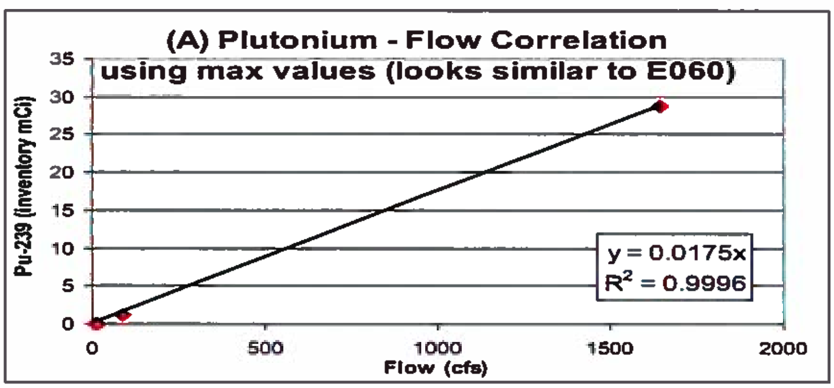


Figure 17 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E110 from LANL Runoff

Figure 18 contains evaluations from events that are identified as originating from some place other than mid Los Alamos or Pueblo Canyons. The origin could be from Guaje or lower Los Alamos Canyon below the confluence of Pueblo and the mid Los Alamos Canyon reaches. The slope coefficient as well as the strength of the correlation diminishes. Both changes can be explained by low plutonium concentrations that would be expected in background conditions and are similar to those at the background station E055.

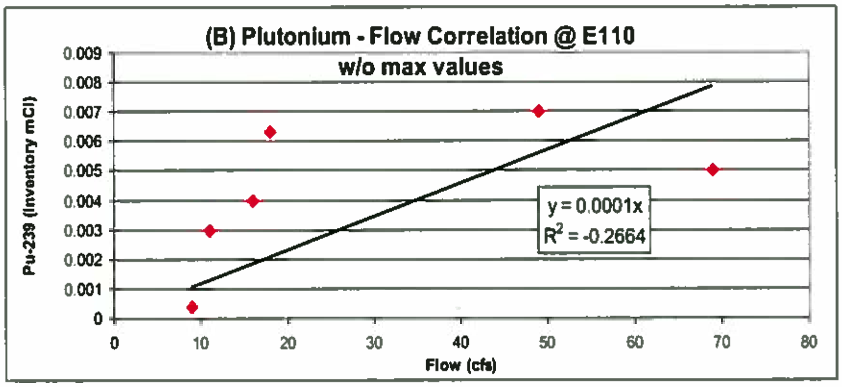


Figure 18 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E110 from Runoff Originating Outside LANL Boundaries

These charts identify the role of flood origin to transport of LANL legacy contaminants to the Rio Grande. Another possible aspect is the use of these transport evaluations to determine mixing rates. We suggest that 77 mCi of plutonium in 4681 tons of sediment was transferred downstream in the August 8th event beyond E050 and E060 at the LANL boundary. By the time the flood reached E110, 4 miles downstream, 29 mCi in 5209 tons of sediment remained in the flood runoff to be transported into the Rio Grande. This suggests that over 48 mCi of plutonium was deposited within the lower reach of Los Alamos Canyon and that an additional 528 tons of sediment was entrained in stormwater runoff. Further evaluations of stormwater runoff mixing are beyond the intent of this report.

Figure 19 combines the plutonium mass transport to peak discharge correlations developed from the floods originating within the LANL perimeter and those outside. Unlike a similar table for E060 that developed a range of transport by combining upper and lower estimations, this chart identifies the difference based on the origin of floods.

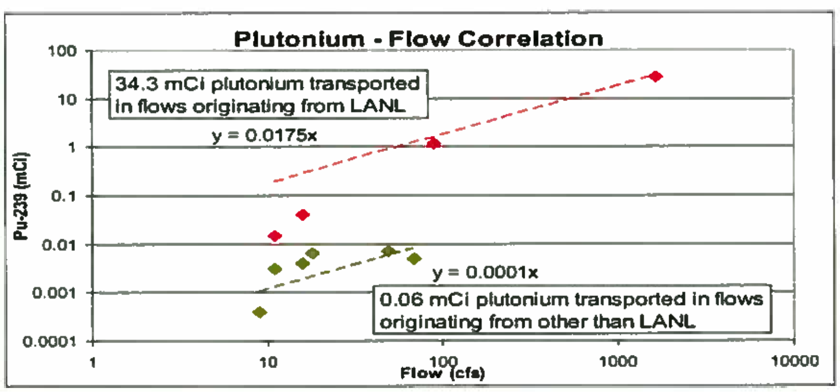


Figure 19 Plutonium Mass and Maximum Instantaneous Discharge Correlation at E110 from Combined Runoff Origin

Ten of 33 storm events that flowed greater than 10 cfs were sampled at E110. Four of those events are identified as originating from within the LANL perimeter and six potentially originate from Guaje Canyon or in lower Los Alamos Canyon. The correlations presented above demonstrate the plutonium transport from canyon reaches within the LANL perimeter to those from Guaje Canyon within background conditions and can be used to predict contaminant loads of runoff events not sampled.

An additional ten samples originate from only Guaje Canyon during the period of this report, six from only Pueblo Canyon, and seven from only mid Los Alamos Canyon. A plutonium/peak discharge rating coefficient of 0.0001 is applied to those flows from Guaje, and 0.0175 to flows with combined flows from Pueblo and mid Los Alamos Canyons. The rating coefficient from E050, 0.001, is applied to flows that originate from mid Los Alamos Canyon. These combined flows generate 34.4 mCi of plutonium transported to the Rio Grande, of which 34.3 mCi originates from combined Pueblo and mid Los Alamos Canyon flows, and 0.06 mCi from Guaje.

Table 15 lists all of the recorded flow events above 10 cfs at E110 and their origin. The dates, peak discharge, measured plutonium transport masses evaluated in preceding sections, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on the relationships developed for the origin of the flow. The cells in the lower section of the table provide the cumulative approximations for plutonium transport at E110.

Table 15 Plutonium Transport for E110 from 2003 through 2008

Origination	Date	Flow	Guaje 0.0001*flow predicted Pu inventory mCi	Los Alamos 0.001*flow predicted Pu Inventory mCi	Pueblo 0.0175*flow predicted Pu inventory mCi	measured Plutonium inventory mCi
Guaje	8/17/08	19	0.0019			
Guaje	7/22/08	69				0.005
LA	1/28/08	40		0.04		
Guaje	7/30/07	26	0.0026			
Guaje	3/28/07	12	0.0012			
Pueblo, LA	8/25/06	89				1.17
Guaje	8/19/06	16				0.004
Pueblo, LA	8/8/06	1642				28.8
Pueblo, LA	8/7/06	45			0.7875	
Guaje	8/6/06	49				0.007
Guaje	8/2/06	14	0.0014			
Guaje	7/6/06	11				0.003
Guaje	7/6/06	9				0.0004
Pueblo, LA	7/5/06	67			1.1725	
Guaje	10/19/05	10	0.0032			
LA	9/28/05	36		0.036		
Guaje	9/7/05	21	0.0021			
LA	8/25/05	11				0.015
Pueblo, LA	8/24/05	16				0.041
LA	8/13/05	36		0.036		
LA	8/12/05	18				0.0063
Guaje	6/25/05	10	0.001			
LA	5/3/05	10		0.01		
LA	4/24/05	16		0.016		
LA	4/16/05	11		0.011		
Guaje	2/12/05	11	0.0011			
LA	1/4/05	18		0.018		
Pueblo	10/11/04	11			0.1925	
Pueblo	10/5/04	49			0.8575	
Pueblo, LA	8/23/03	55			0.9625	
Pueblo, LA	8/22/03	10			0.175	
Guaje	8/11/03	17	0.0017			
Guaje	8/3/03	30	0.003			
sums		33	0.02	0.17	4.1	30.1
from LA and Pueblo						**34.33**
from Guaje						**0.06**
Total						**34.40**

Measured events in red

Figure 20 contains sediment data from ten events sampled during the period of this report. The sediment transport mass in the August 8th event becomes a large influencing value to the correlation and develops a slope coefficient of 3.17. This value is within the 2.7 to 4.8 range developed at E060.

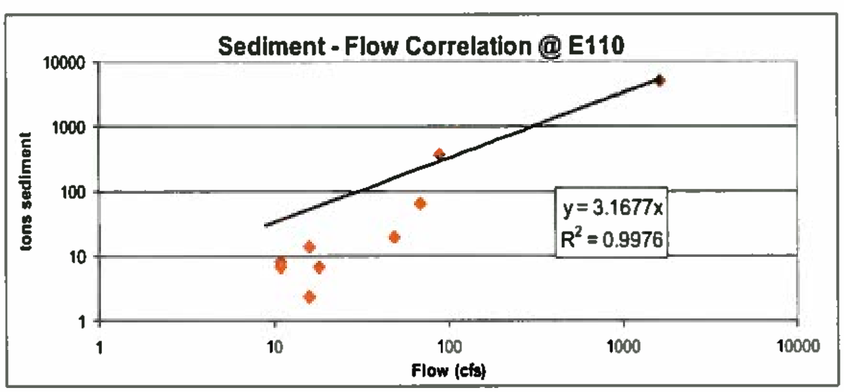


Figure 20 Sediment Mass and Maximum Instantaneous Discharge Correlation at E110

Figure 21 contains evaluations from runoff events excluding the two largest discharges that also happened to originate in Pueblo Canyon. A smaller 0.72 slope coefficient develops that is considered for a minimum range of sediment transport at E110.

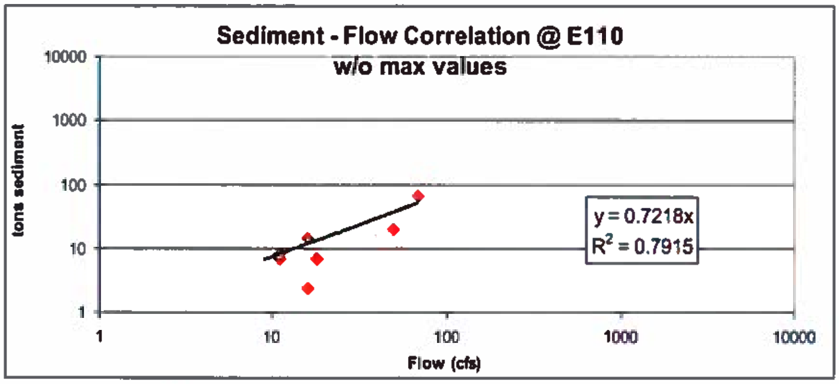


Figure 21 Sediment Mass and Range of Smaller Maximum Discharge Correlations at E110

A total of 33 runoff events were recorded at E110 from which 10 were sampled. Our evaluation of two scenarios: sediment transport from discharges that ranged from 10 to 69 cfs and then up to 1600 cfs produced rating coefficients of 0.72 to 3.17. Both were applied to runoff events not sampled to develop a 6100 to 7500 tons range of sediments transported during this time period. At least six events (8/20/2008, 8/21/2008, 7/6/2006, 7/17/2005, 8/20/2004, and 8/19/2004) were sampled but discharge measurements were not recorded nor included in the evaluation. Almost all of those events contained large suspended sediment concentrations of 10000 mg/L to greater than 100000 mg/L indicative of substantial runoff rates. These runoff and sediment transport rates may have substantiated the larger rating coefficient and an additional component of sediment transport, although without corresponding discharge measurements, it remains impossible to determine.

Table 16 lists all of the recorded flow events above 10 cfs at E110 and their origin. The dates, peak discharge, measured sediment transport masses evaluated in preceding sections, and estimated transport masses from this section are listed. The events, dates, and measured transport masses are in red, the remaining are estimates based on both the 0.72 and 3.17 rating coefficients described above. The cells in the lower section of the table provide the cumulative approximations for sediment transport at E110.

Table 16 Suspended Sediment Transport for E110 from 2003 through 2008

Origination	Date	Flow	0.72*flow predicted sediment inventory (tons)	3.17*flow predicted sediment inventory (tons)
Guaje	8/17/2008	19	14	60
Guaje	7/22/2008	69	64	64
LA	1/28/2008	40	29	127
Guaje	7/30/2007	26	19	82
Guaje	3/28/2007	12	9	38
Pueblo, LA	8/25/2006	89	368	368
Guaje	8/19/2006	16	14	14
Pueblo, LA	8/8/2006	1642	5209	5209
Pueblo, LA	8/7/2006	45	32	143
Guaje	8/6/2006	49	20	20
Guaje	8/2/2006	14	10	44
Guaje	7/6/2006	11	8	8
Guaje	7/6/2006	9	6	29
Pueblo, LA	7/5/2006	67	48	212
Guaje	10/19/2005	10	7	32
LA	9/28/2005	36	26	114
Guaje	9/7/2005	21	15	67
LA	8/25/2005	11	7	7
Pueblo, LA	8/24/2005	16	2	2
LA	8/13/2005	36	26	114
LA	8/12/2005	18	7	7
Guaje	6/25/2005	10	7	32
LA	5/3/2005	10	7	32
LA	4/24/2005	16	12	51
LA	4/16/2005	11	8	35
Guaje	2/12/2005	11	8	35
LA	1/4/2005	18	13	57
Pueblo	10/11/2004	11	8	35
Pueblo	10/5/2004	49	35	155
Pueblo, LA	8/23/2003	55	40	174
Pueblo, LA	8/22/2003	10	7	32
Guaje	8/11/2003	17	12	54
Guaje	8/3/2003	30	22	95
sums		33	6119	7548
from LA and Pueblo			5884	6874
from Guaje			235	674
Total			6119	7548

Measured events in red

Table 17 summarizes the annual transport masses of plutonium and sediment during 2003 through 2008. The most exceptional feature in the table identifies the large plutonium and sediment transport in 2006. Almost 32 mCi in 6000 tons of sediment was transported in that year of which most was transported in the August 8th flood. About 80% of the total suspended sediment and contaminant inventories transported to the Rio Grande since 2003 occurred in this event. The following years, 2007 and 2008, demonstrate a largely reduced transport rate and all storm runoff events originate from off-site Laboratory property. Average plutonium concentrations and flow evaluations at the Laboratory boundary stations E050 and E060 substantiated the flood sources.

Table 17 Annual Estimates of Plutonium and Suspended Sediment Transport at E110

Year	Plutonium transport (mCi)	Sediment transport (tons)
2003	1.1	355
2004	1.1	190
2005	0.2	583
2006	31.9	6047
2007	0.004	120
2008	0.05	251

Table 18 summarizes the transport masses of plutonium and sediment from Pueblo, mid Los Alamos, and Guaje Canyons. As described in the preceding evaluations, the majority of contaminant transport originates in Pueblo Canyon upstream of the Laboratory boundary.

Table 18 Origin Based Estimates of Plutonium and Suspended Sediment Transport and Gross Estimates of Plutonium Concentration at E110

Flood Origin	Plutonium transport (mCi)	Sediment transport (tons)	Average Concentration (pu mass/sed mass)
Pueblo and upper LA	34	6331	5.9
upper LA only	0.2	543	0.4
Guaje	0.2	674	0.4

We estimate that 34 mCi plutonium in 7548 tons of sediment was transported beyond E110 into the Rio Grande since 2003. The primary source of the plutonium contamination is Pueblo Canyon. The gross average of plutonium in suspended sediments whose origin is Pueblo Canyon is about 6 pCi/g. The average measured concentration seen in Figure 25 in the Spatial Trend section is 4.6 pCi/g. Flood events that originate in Guaje Canyon provide near background levels of plutonium to transport. We estimate as little as 0.2 mCi plutonium in 674 tons of suspended sediment was transferred past E110 from Guaje Canyon. The gross average plutonium concentration in suspended sediments from Guaje Canyon is 0.4 pCi/g. Floods that originate below the confluence of Pueblo and Los Alamos Canyon do not appear to provide elevated transport levels but deposition of sediments contaminated with LANL legacy materials in this reach has been demonstrated. Without gages in Guaje Canyon these flows cannot be differentiated and transport estimations are speculative.

The slope coefficient for the plutonium/peak discharge correlation for floods originating in Pueblo Canyon is 0.018. That value is similar but less than the 0.037 rating coefficient from E060. It is approximately half of the value and may demonstrate mixing with relatively clean sediment supplies from lower Los Alamos Canyon and Guaje Canyon reducing the overall level of contaminant transport.

The plutonium/peak discharge rating coefficient for runoff events originating from outside the Laboratory property is 0.0001, most similar to baseline stations in mid Los

Alamos and the Pueblo background station E055. Those values range from 0.00003 to 0.001. The sediment transport rating coefficients for E110 range from 0.72 to 3.17. Taking into account events containing large suspended sediment concentrations and not considered for this evaluation we suggest the E110 rating coefficient is more likely 3.17, similar to E060 where values ranged from three to five.

Transport Summary

The following Table 19 is the same as Table 4 presented in the introduction of this section. Comparisons of the plutonium and sediment transport factors demonstrate the relationships between the six gaging stations discussed in the preceding sections. Stations E055, E030, E042, and E050 develop similar sediment load relationships that show upper Pueblo Canyon and upper to mid Los Alamos Canyon deliver limited sediment supplies for transport, while downstream channels contribute much larger loads to E060 and E110. The plutonium transport factors identify relative Laboratory impacts to the watershed system. Station E055 supplies background levels to contaminant transport, while mid Los Alamos Canyon stations E030, E042, and E050 demonstrate Laboratory impacts. Those impacts are small relative to that seen at Pueblo Canyon endpoint E060 and the lower Los Alamos Canyon station at the Rio Grande E110.

Table 19 Plutonium and Sediment Transport Rating-Curve Summary

Station	E030	E042	E050	E055	E060	E110
flow count	16	58	33	31	48	33
max pu inventory (mCi)	0.32	3.21	1.08	0.13	182	34.4
min pu inventory (mCi)					134	
max rating coefficient	0.001	0.0013	0.0008	0.00003	0.037	0.018
min rating coefficient					0.019	0.00005*
max Sediment inventory (tons)	255	4384	755	4182	19348	7548
min Sediment inventory (tons)			576		13848	6119
max rating coefficient	0.80	1.78	0.75	0.98	4.78	3.17
min rating coefficient			0.51		2.71	0.72
Gross calculation of plutonium in sediments based on total tranported sediments and plutonium						
Station	**E030**	**E042**	**E050**	**E055**	**E060**	**E110**
pCi/g	1.38	0.81	1.20	0.03	8.01	5.02 0.28*

*based on projected plutonium and sediment transport from Guaje Canyon

Stations E030 and E055 are baseline and contribute little to contaminant transport. Baseline stations E030 in upper Los Alamos Canyon and E055 in upper Pueblo Canyon transported 0.32 mCi and 0.13 mCi plutonium in 255 and 4182 tons sediment respectively. E055 is also classified as a background station in that LANL contaminant impacts are not recognized above this location. Fourteen storm events passed E030 while twice that many, 28, passed E055. Upper Los Alamos contains some legacy contaminants and the gross plutonium average at E030 demonstrates the relative impact. The upper valley channels are heavily armored with rock and a reservoir is located at the top of the Los Alamos valley that controls discharge. These factors provide a more stable channel system and appear to control sediment availability. The rating coefficients 0.001 and 0.00003 for plutonium transport and 0.80 and 0.98 for sediment at E030 and E055, respectively, develop comparative values demonstrating small contaminant and sediment availability. At E030 contaminants exist but limited sediment supplies are available, while only background levels exist at E055 but greater sediment supplies are available for transport.

Stations E042 and E050 are located above and below a low-head weir impoundment in mid Los Alamos Canyon just above the Pueblo Canyon confluence. They are about 2.5 miles below E030 and demonstrate similar channel conditions and LANL impacts. The transport masses and rating coefficients also demonstrate a reduction in transport rates through the impoundment between E042 and E050. Plutonium transport is reduced from 3.2 mCi in 4384 tons of sediment to 1.08 mCi in up to 755 tons of sediment.

The plutonium rating coefficients derived for the upper to mid Los Alamos stations, E030, E042, and E050 are similar, around 0.001. These coefficients are two orders of magnitude greater than the E055 background station in upper Pueblo Canyon and demonstrate LANL impacts. The sediment slope factor at E050 is similar to the E055 and E030 stations we refer to as baseline. They approximate one. A slightly larger value at E042, 1.78, may demonstrate greater sediment availability that is reduced as flow progresses through the impoundment above E050.

While these reductions at E050 are partly explained by the number of flows retained within the impoundment, the rating coefficients and gross plutonium estimates provide additional information. Fifty eight events passed E042 while 33 passed E050, resulting in 25 flows being impounded by the weir and infiltrating to the alluvial aquifer. The rating coefficients for plutonium are similar at 0.0013 and 0.0008 and identify similar contaminant transport rates. The sediment coefficients reduce from 1.78 at E042 to a range of 0.51 to 0.75 at E050. The gross concentration of plutonium in sediments demonstrates a small increase from 0.81 pCi/g at E042 to 1.2 pCi/g at E050. These comparisons suggest a component of coarse grained sediments drop out in the impoundment during flow thereby reducing sediment load while increasing the plutonium concentration in the remaining fine grained sediments passing E050. While the concentrations may increase, a net loss of plutonium transported downstream occurs.

This phenomenon is also demonstrated between E030 and E042 that develop similar rating coefficients for both plutonium and sediment, yet plutonium and sediment flux are quite different. Plutonium transport of 0.32 mCi in 255 tons of sediment was transported at E030, while 3.21 mCi of plutonium in 4384 tons of sediment was transported at E042. Although both stations developed similar rating coefficients the numbers of runoff events were largely different. Sixteen runoff events were measured at E030 while 58 were measured at E042. The higher number of runoff events at E042 are due to contributions from DP canyon whose confluence is located just downstream from E030.

E060 is near the Pueblo Canyon endpoint, the confluence with Los Alamos Canyon and the eastern LANL boundary. Pueblo Canyon drains contaminated sediments that originate from historic industrial discharges into Acid Canyon at Pueblo's upper reach. The gross plutonium concentration in transported sediments is 8 pCi/g, two orders of magnitude greater than the 0.03 pCi/g background value at E055 and five to ten times greater than generated at Los Alamos Canyon stations.

Plutonium rating coefficients at E060 range from 0.02 to 0.04 and are similar to 0.022 developed from our evaluation of 2000 to 2002 stormwater (Englert et al., 2004). These coefficients are one to three orders of magnitude greater than the mid Los Alamos gage stations E030, E042, and E050 0.001 value, and the background E055 Pueblo Canyon station 0.00003 value.

The E060 sediment rating coefficients range from 2.7 to 4.8. We estimated a 5.6 slope factor from previous monitoring at E060 during 2000 to 2002. Based on this evaluation three to five times more sediment is available at E060 than E030 and E055 baseline stations for relative sized flows. E042 in Los Alamos Canyon begins to approach the sediment availability as E060, but becomes reduced below the low head weir at E050.

At E060 we identified a substantial amount of variability in the data as well as potential overly influential data from the August 8th, 2006 flood. To compensate, we report a range of possible sediment and contaminant transport inventories during 2003 to 2008, as well as a more probable piecewise approximation of transport since the 2000 Cerro Grande fire. The largest plutonium inventory was transported beyond this station than any other station evaluated during the time period of this report, ranging from 134 to 182 mCi in 13848 to 19348 tons of sediment. Using a piecewise approximation we estimate that 246 mCi of plutonium in 35543 tons of sediment was transported beyond E060 since the fire.

E110 is in lower Los Alamos Canyon 0.7 mile above the Rio Grande. The plutonium and sediment transport inventories passing this station reach the Rio Grande, and the difference between them and that measured at E050 and E060 become residual contaminants deposited on Pueblo de San Ildefonso property in the lower Los Alamos Canyon reach. We identified 33 flows measured at this station from 2003 to 2008. The data includes substantial variability but we believe it develops from the origin of the flows, whether they develop within the LANL perimeter or from Guaje Canyon. E110 was not operational until November of 2002 and gages in Guaje have operated intermittently during this time period. Our evaluation indicates a reduction of plutonium and sediment inventories passing the station as well as contaminant concentrations and availability within the channel system.

We developed two plutonium rating coefficients for E110, 0.02 and 0.00005. The 0.02 coefficient is similar to the 0.02 to 0.04 range established at E060 reflecting the same contaminant availability for transport. The remaining coefficient 0.00005 reflects background Guaje Canyon conditions similar to the 0.00003 value at E055 above Acid Canyon. The sediment slope factors demonstrate the same conditions in that a 3.2 value at E110 reflects similar sediment availability conditions as seen from E060.

Over 34 mCi of plutonium in up to 7548 tons of sediment was transported into the Rio Grande from 2003 to 2008. The difference between the inventories passing E060 and E110 suggests that 100 to 148 mCi of plutonium may have been deposited within the lower Los Alamos Canyon reach. Gross plutonium concentrations in sediments transported from Pueblo Canyon are reduced from 8 pCi/g to 6 pCi/g at E110 and approach baseline levels near 0.4 pCi/g when flows originate from Guaje Canyon.

Table 20 identifies the p values and correlation significance of the peak flow/plutonium and sediment inventory correlations. N expresses the number of storm events that were evaluated for transport inventory, and the degrees of freedom for a two tailed test then becomes two less than N. The coefficient of determination (R^2) expresses the amount of the variation in y that is explained by the regression line, and its square root r, the linear correlation coefficient, measures the strength or significance of the relationship. The letter p (probability) expresses whether the relationship is strong enough to be statistically significant. By our criteria, p values less than 0.05 are considered significant, 0.01 very significant and 0.001 extremely significant, 95%, 99%, and 99.9% probabilities. Except for the station E042 all other peak flow/inventory relationships are considered significant to extremely significant.

Table 20. Peak Flow correlation to Inventory Statistics

Peak Flow / Inventory correlation statistics

	Plutonium 239/240					Sediment			
Station	N	R^2	r	p	note	R^2	r	p	note
E055	4	0.9273	0.9630	0.0370	significant	0.8854	0.9410	0.0590	not quite significant
E030	4	0.9577	0.9786	0.0214	significant	0.7971	0.8928	0.1072	not quite significant
E042	2	12.1160	3.4808	NA	not significant	11.7640	3.4299	NA	not significant
E050	7	0.9225	0.9605	0.0006	extremely significant[a]	0.9698	0.9848	0.0001	extremely significant[a]
E060	19	0.9507	0.9750	0.0001	extremely significant[a]	0.8161	0.9034	0.0001	extremely significant[a]
E060[b]	18	0.7942	0.8912	0.0001	extremely significant[a]	0.8290	0.9105	0.0001	extremely significant[a]
E110	9	0.9964	0.9982	0.0001	extremely significant[a]	0.9976	0.9988	0.0001	extremely significant[a]

[a]By conventional criteria this difference is considered to be extremely statistically significant
[b]Does not include extraordinary 1926 cfs event August 8th, 2006

Flow Evaluation Introduction

Flow in the Los Alamos watershed is evaluated by inspection of data generated at 13 stream-gage stations operated by the LANL Water Stewardship Program (EP-WSP) and our ISCO Flow Meter equipment. LANL produces annual reports (Surface Water at Los Alamos National Laboratory for each water year) that include descriptions of the stations, mean daily discharges, descriptive statistics for those discharges, and period of record and annual maximum instantaneous discharges. Each report covers a 12 month water year beginning October 1rst and ending September 30th. The report and data recordings generally become available by November of the following year, 25 months after the beginning of the water year.

DOE OB monitoring locations are equipped with bubbler type flow meters and provide continuous stage measurements but are recorded in 15 minute intervals. Daily and weekly maximum, average, and minimum stages are recorded on strip charts, as well as storm hydrographs. LANL uses more than one type flow metering device, bubbler transducer or sonic types, and stage and discharge are measured in open channels at 5 minute intervals. LANL recordings are made on Mountain Standard Time and do not adjust for Daylight Saving Time. During the summer from the second Sunday in March to the first Sunday in November we record our data in Daylight Savings Time and one hour adjustments are required when correlating our sample times.

We generated hydrographs for all 13 stations but present only those for the endpoint stations in Pueblo and Los Alamos Canyons above their confluence and at the station in Los Alamos Canyon above the Rio Grande; E050, E060, and E110. These hydrographs as well as individual maximum annual peak flows at each station are presented in Appendix D. The hydrographs are generated from LANL five minute discharge records extending over the entire period of this report. Individual hydrographs are also generated for periods during runoff events of special interest. Flow evaluations include magnitude and frequency of storm events greater than 10 cfs, flow duration, and time to peak discharge. The magnitude and frequency of storm events is a major component of the transport evaluations generated here. Time to peak discharge and duration evaluations guide our sampling protocol, such that our first sample is collected near the peak of a storm event, and the following samples are collected during evenly spaced intervals throughout the event.

Comparisons of hydrographs between stations are made to identify progression rates of the floods and transmission losses or gains. Storm event flows are wavelike in their progression downstream, dependant on storm intensities, durations and drainage basin characteristics. They may diminish downstream from transmission losses due to channel storage properties, or gain due to tributary contributions or movement of storm cells over the watersheds. On the Pajarito Plateau, precipitation may occur from local, short, high intensity rainfall during the summer monsoonal season to broad, long, low intensity rainfall from large fall frontal systems.

The rainfalls, as well as the resulting runoff are random and unpredictable. Flood frequency analysis and flood routing computer programs might be used to identify potential flood frequencies and magnitudes but are beyond the scope of this report and may not have been effective due to the largely changing watershed conditions after the Cerro Grande fire. LANL has reported that the Pueblo Canyon drainage has been slower to recover due to the severity of the burn there and new construction activities have exacerbated runoff conditions, but as it recovers flood frequency and flood routing predictions could become more feasible.

Runoff – Hydrograph Evaluation

Following the 2000 Cerro Grande fire and six years of drought conditions ending in 2004, hydrologic conditions were greatly changed on the Sierra de los Valles and in the canyons that drain the Pajarito Plateau. From the 1970s to just before the fire, discharge rarely exceeded 10 cfs in lower Los Alamos or Pueblo Canyons. After the fire, flows two orders of magnitude greater than previously recognized were recorded. By 2003, LANL began reporting there were indications stormwater runoff and sediment transport from most of the burned watersheds recovered to near pre-fire levels, except Pueblo Canyon due to urbanization since the fire (LANL ESR, 2003).

We show highly variable flow conditions in Pueblo Canyon and more modulated flows in Los Alamos Canyon. Flows greater than 10 cfs were common in both canyons prior to

2006. During that year stream flow on the Pajarito Plateau was record setting and dominated by large rainfall events in August (LANL ESR, 2006). Since then, 2007 and 2008, there has been minimal to no stormwater flow in lower Pueblo or Los Alamos Canyons. We suspect the potential of large flows will always exist while flood frequencies will diminish. The following narrative describes discharges at LANL stream-gage stations in the Los Alamos watershed. In this section we list all of the discharges greater than 10cfs, their flow dates and summary statistics.

The following list provides the LANL identification of each station, its location and watershed drainage area. The stations are listed in Pueblo Canyon and then the Los Alamos Canyon reach above the Pueblo/Los Alamos confluence, from the upper watershed area to downstream reaches. Stations located at the outflow of each canyon are identified as endpoints. The E110 station, listed as the Los Alamos watershed endpoint, is at the most downstream location before the Rio Grande and listed last.

E055	Upper Pueblo Canyon,	35° 52' 20", 106°18' 14"	3.42 mi^2
E055.5	South Fork of Acid Canyon,	35° 53' 10", 106°18' 26"	0.08 mi^2
E056	Endpoint of Acid Canyon,	35° 53' 19", 106°18' 14"	0.45 mi^2
E060	Endpoint of Pueblo Canyon,	35° 52' 15", 106°13' 1.0"	8.21 mi^2
E089	Upper Guaje Canyon,	35° 54' 41", 106°13' 47"	14.6 mi^2
E026	Upper Los Alamos Canyon,	35° 52' 49", 106°19' 30"	7.07 mi^2
E030	Los Alamos Canyon above DP Canyon,	35° 52' 21" 106°15" 36"	8.57 mi^2
E038	Upper DP Canyon,	35° 52' 49", 106°16' 58"	0.22 mi^2
E039	mid DP Canyon,	35° 52' 41", 106°15' 28"	0.32 mi^2
E040	DP Canyon endpoint,	35° 52' 24", 106°15' 34"	0.60 mi^2
E042	Los Alamos Canyon above low head weir,	35° 52' 01", 106°13' 25"	10.11 mi^2
E050	Los Alamos Canyon endpoint above Pueblo confluence,	35° 52' 71", 106°13' 0.03"	10.42 mi^2
E110	Endpoint Los Alamos watershed,	35° 52' 53", 106° 08' 55"	57.7 mi^2

Table 21 lists the date for each flow greater than 10 cfs, its maximum instantaneous discharge, and then summary statistics for the annual and total period of this report at each station. During water years a station is shut down, "No Data" is listed in the column. We did not identify periods during which the stations were not functioning. For the most part, this report does not attempt to evaluate the operation of the stream-gage stations, but occasional discrepancies are discussed. Addition charts provide hydrographs and graphical presentations relating the sequence and conditions of the storm flows. The following narrative describes stream flows at E050, E060, and E110.

Since the Cerro Grande fire, from 2000 through 2008, E060 has seen 101 stream flows that exceeded 10 cfs, of which 61 occurred during the period of this report. The number of stream flows greater than 10 cfs include six in 2000, 17 in 2001, 17 in 2002, 11 in 2003, 32 in 2004, five in 2005, eight in 2006, five in 2007, and none in 2008. Peak discharges for each year were 148 cfs in 2000, 1440 cfs in 2001, 583 cfs in 2002, 749 cfs in 2003, 504 cfs in 2004, 130 cfs in 2005, 1926 cfs in 2006, 37 cfs in 2007, and less than 10 cfs in 2008.

During 2003 to 2008 at E050, which is just below a low head weir in mid Los Alamos Canyon, 33 runoff events occurred of which 11 flowed during 2005. Peak discharge ranged up to 252 cfs, a flood that occurred in 2006. They appear less varied than events

Table 21 Individual Runoff Events Recorded at Each Station

	Pueblo E055	cfs	Acid E055.5	cfs	E056	cfs	Pueblo E060	cfs	Guaje E089	cfs	LA E110	cfs
2008 up to 10/1/2008	1/28	68	no data		1/28	26	0	0	no data		1/28	40
					8/10	19					7/22	69
					8/31	12					8/17	19
annual total >10 cfs		1				3		0				3
annual max		68				26		0				69
annual mean		68				19		0				43
annual median		68				19		0				40
2007	7/26	21	no data		5/13	26	4/29	19	no data		3/28	12
					5/20	18	4/30	18			7/30	26
					6/11	12	4/30	31				
					6/16	75	5/5	10				
					7/14	24	12/1	37				
					7/26	216						
					7/30	14						
					8/4	32						
					8/29	24						
					9/1	58						
					9/2	55						
					9/6	66						
					9/20	23						
					9/29	16						
					12/1	61						
annual total >10 cfs		1				15		5				2
annual max		21				216		37				26
annual mean		21				51		23				19
annual median		21				26		19				19
2006	8/1	16	8/1	88	no data		7/5	117	no data		7/5	67
	8/7	15	8/7	38			7/9	41			7/6	11
	8/7	14	8/8	91			8/7	127			8/2	14
	8/8	1780	8/25	18			8/8	1926			8/6	49
	8/19	12	9/11	12			8/25	220			8/7	45
	8/25	45					9/8	11			8/8	1749
							9/22	12			8/19	16
							10/1	11			8/25	89
annual total >10 cfs		6		5				8				8
annual max		1780		91				1926				1749
annual mean		314		49				308				255
annual median		15.5		38				79				47
2005	1/3	14	8/24	17	no data		1/1	47	no data		1/4	18
	2/9	13					8/14	116			2/12	11
	2/10	18					8/24	85			4/16	11
	2/12	11					9/29	40			4/24	16
	4/16	11					10/30	130			5/3	10
	7/15	30									6/25	10
	8/12	14									8/12	18
	8/13	123									8/13	36
	8/24	53									8/24	16
	9/28	10									8/25	11
	9/29	16									9/7	21
											9/28	36
											10/19	10
annual total >10 cfs		11		1				5				13
annual max		123		17				130				36
annual mean		28		17				84				17
annual median		14		17				85				16
2004	9/27	11	no data		no data		1/2	13	7/23	43	10/5	49
	10/5	28					1/5	13	7/24	69	10/11	11
	12/18	10					1/9	11				
							1/14	11				
							1/30	17				
							2/6	24				
							2/9	20				
							2/20	15				
							2/27	19				
							3/5	19				
							3/9	19				
							3/10	16				
							3/12	14				
							3/19	17				
							4/20	10				
							7/23	21				
							7/24	504				
							7/27	262				
							8/18	21				
							8/20	40				
							8/23	12				
							9/12	14				
							9/20	18				
							9/21	16				
							9/22	25				
							9/25	29				
							9/26	21				
							9/28	18				
							9/30	27				
							10/4	13				
							10/5	77				
							10/11	30				
annual total >10 cfs		3						32		2		2
annual max		28						504		69		49
annual mean		16						43		56		30
annual median		11						18.5		56		30
2003	8/11	26	no data		no data		5/25	62	8/23	360	8/3	30
	8/23	1179					5/26	17			8/11	17
	8/26	61					5/31	20			8/22	10
	8/30	19					6/18	14			8/23	55
	9/3	14					8/12	60				
	9/6	651					8/21	13				
							8/22	90				
							8/23	749				
							8/26	38				
							9/6	243				
							9/11	10				
annual total >10 cfs		6						11		1		4
annual max		1179						749		360		55
annual mean		325						120		360		28
annual median		44						38		360		24
total flows > 10cfs		28		6		18		62		3		32
Max		1780		91		216		1926		360		1749
mean		153		44		46		92		157		81
median		17		28		25		20		69		18

Table 21 Individual Runoff Events Recorded at Each Station - Continued

	LA				DP						LA			
	E028	cfs	E030	cfs	E038	cfs	E039	cfs	E040	cfs	E042	cfs	E050	cfs
2008 up to 10/1/2008	0	0	9/4	17	6/15	16	6/15	23	8/9	45	no data		1/28	16
					6/28	120	6/28	62	8/10	77			2/4	23
					7/1	22	7/21	14	8/12	67			8/10	18
					7/7	13	8/4	14	8/16	14				
					7/16	15	8/9	29	8/31	169				
					7/21	80	8/9	78						
					8/4	27	8/10	118						
					8/9	83	8/16	23						
					8/9	105	8/23	67						
					8/10	186	8/24	33						
					8/12	22	8/26	11						
					8/14	15	8/29	18						
					8/15	82	8/31	67						
					8/23	58	9/1	32						
					8/24	44	9/2	17						
					8/25	14								
					8/26	15								
					8/31	96								
					9/1	13								
					9/22	35								
annual total >10 cfs		0		1		20		15		5				3
annual max		0		17		186		118		169				23
annual mean		0		17		53		39		74				19
annual median		0		17		31		29		67				18
2007	0	0	9/2	17	3/21	20	3/21	11	8/29	11	3/23	24	3/23	11
			9/8	24	3/23	55	3/23	44			3/24	16	8/29	16
			12/1	13	3/24	14	3/24	14			6/2	20	9/2	30
					3/29	13	5/2	25			6/8	13	9/8	22
					4/9	16	5/8	26			6/13	13	12/1	35
					4/13	11	5/14	23			6/12	13		
					5/2	23	5/18	16			6/16	41		
					5/8	36	5/20	21			7/30	15		
					6/13	19	6/11	24			8/8	10		
					6/14	44	6/18	73			8/29	62		
					6/17	17	8/4	40			9/1	10		
					6/18	23	8/16	27			9/2	60		
					6/21	41	8/29	83			9/8	64		
					6/3	13	9/1	47			9/23	10		
					6/11	28	9/2	128			9/23	16		
					6/16	88	9/8	42			9/29	10		
					6/22	22	9/20	26						
					7/14	44	9/23	17						
					8/4	88	9/28	19						
					8/8	12	9/29	21						
					8/16	78	12/1	42						
					8/24	39								
					8/26	33								
					8/29	149								
					9/1	96								
					9/2	148								
					9/4	24								
					9/8	59								
					9/20	59								
					9/23	40								
					9/28	58								
					9/29	51								
					10/1	10								
					11/23	14								
					12/1	42								
annual total >10 cfs		0		3		35		21		1		16		5
annual max		0		24		149		128		11		60		35
annual mean		0		18		44		36		11		26		23
annual median		0		17		35		26		11		15		22
2006	8/8	83	8/8	90	no data		no data		7/8	19	7/3	31	6/29	26
			8/25	40					7/9	51	7/8	194	7/8	148
									7/18	115	7/9	43	7/9	17
									7/20	118	8/1	36	8/1	14
									8/1	60	8/7	43	8/7	24
									8/8	452	8/8	240	8/8	252
											8/25	221	8/25	72
											10/2	17		
annual total >10 cfs		1		2						6		8		7
annual max		83		90						452		240		252
annual mean		83		65						136		103		79
annual median		83		65						87.5		43		26
2005	4/9	14	7/16	12	3/10	42	7/8	12	1/3	15	1/4	25	1/4	16
	4/16	19	8/12	11	4/18	54	7/15	36	2/11	12	2/12	13	4/16	20
	4/17	20	8/24	27	4/24	37	7/20	19	4/8	18	3/16	26	4/24	16
	4/19	22			6/1	18	8/4	135	4/24	16	3/17	20	8/3	16
	8/24	11			6/3	39	9/26	59	5/3	14	4/16	37	8/12	22
					7/6	63	9/29	40	8/4	66	4/18	15	8/15	10
					7/7	36	10/9	20	8/11	34	4/19	16	8/22	10
					7/8	62			8/12	70	4/24	40	8/24	51
					7/13	20			8/13	42	4/25	11	8/26	26
					7/15	78			8/22	58	4/26	10	9/26	13
					7/20	51			8/24	92	6/3	31	9/29	21
					7/28	18			8/26	69	6/8	10		
					8/3	38			9/28	54	6/11	10		
					8/4	144			9/29	48	7/15	30		
					8/5	10			10/19	14	8/4	35		
					8/7	13					8/12	75		
					8/8	13					8/13	22		
					8/9	10					8/22	39		
					8/11	86					8/24	138		
					8/12	72					8/25	68		
					8/13	77					9/29	20		
					8/22	93								
					8/24	122								
					8/25	78								
					9/2	235								
					9/22	24								
					9/25	16								
					9/26	104								
					9/29	41								
					10/2	121								
annual total >10 cfs		5		3		30		7		16		21		11
annual max		22		27		235		135		92		138		51
annual mean		17		17		61		46		42		33		20
annual median		19		12		47		36		42		25		16
2004	3/10	27	7/24	14	2/4	11	2/23	10	4/8	24	7/23	18	7/23	11
	3/11	31			2/12	38	2/24	111	7/16	27	7/24	40	7/24	34
	6/29	17			2/16	46	2/25	33	8/20	49	7/27	10	8/20	12
					3/10	27	3/4	116	12/29	18	8/20	16		
					4/2	16	4/2	14			10/5	16		
					4/3	14	4/3	21			10/11	18		
					4/8	10	4/4	14						
					6/25	18	4/8	23						
					7/16	137	4/23	16						
					7/23	126	6/25	12						
					7/24	295	7/16	87						
					7/27	44	7/23	82						
					9/20	16	7/24	201						
					9/25	64	7/27	35						
					9/27	122	8/8	19						
					10/5	99	8/11	41						
					10/11	44	8/16	29						
					10/25	42	8/18	34						
					10/27	30	8/20	62						
							9/4	10						
							9/27	38						
							10/5	46						
							10/11	21						
							10/27	14						
							11/27	17						
annual total >10 cfs		3		1		19		25		4		6		3
annual max		31		14		295		201		49		40		34
annual mean		25		14		64		43		29		20		19
annual median		27		14		42		25		25.5		18		12
2003	5/19	30	6/20	10	4/15	20	1/5	31	6/25	10	6/20	14	5/20	10
	5/20	31	6/21	10	5/24	22	5/26	20	8/2	10	6/21	14	8/22	16
	5/21	37	8/23	15	5/25	34	5/28	21			6/25	18	8/23	43
	8/11	134	9/6	12	5/26	39	8/2	10			6/23	94	9/26	16
	9/6	60			6/13	29					6/26	94		
					6/17	35					9/6	22		
					8/2	38								
					8/7	54								
					8/11	55								
					8/17	53								
					8/18	11								
					8/19	26								
					8/23	209								
					9/3	49								
					9/8	24								
					10/3	22								
					10/4	27								
annual total >10 cfs		5		4		17		4		3		6		4
annual max		134		15		209		31		10		94		43
annual mean		58		12		44		21		10		43		21
annual median		37		11		34		21		10		20		16
total flows > 10cfs		16		14		122		72		33		57		33
Max		134		90		295		201		452		240		252
mean		34		22		53		39		69		40		33
median		25		15		38		25		45		20		18

at E060 in Pueblo Canyon, possibly due to a reservoir in the upper part of the watershed and the low head weir impoundment just above E050. The maximums and frequency of flows are fairly uniform, except for a larger frequency in 2005 and two large flows greater than 100 cfs in 2006. In 2003, four flow events occurred with a maximum 43 cfs discharge, 2004 had 3 events with a maximum discharge of 34 cfs, 2005 had 11 events and a maximum 51 cfs discharge, 2006 had seven events with a maximum 252 cfs discharge, 2007 had 5 events and a maximum 35 cfs discharge, and finally in 2008, 3 events occurred with a maximum 23 cfs discharge.

E110 demonstrates similarly uniform conditions with some exceptions. A total of 32 runoff events were recorded during this period from which four, two, 13, eight, two, and three occurred respectively during 2003 to 2008. The maximum discharges are 55, 49, 36, 1749, 26, and 69 cfs during those same years. Over half of the drainage area originates in Guaje Canyon and we suspect that a significant amount of discharge develops from there. E099 gage exists at the Guaje Canyon endpoint but was not operating during the period of this report.

Similar conclusions are demonstrated by the Flow Frequency and Magnitude charts in Figures 22, 23, and 25 below. They demonstrate all of the flows greater than 10 cfs from 2003 to 2008 at E060, E050, and E110. The vertical scale is logarithmic up to 10000 cfs relative to dates on the horizontal axis from the beginning of 2003 to the end of 2008. Each column represents an individual flow event, and the numbers along the upper part of the chart indicate the number of flows greater than 10 cfs per year. The charts demonstrate a reduction in the flow frequencies and magnitudes at E060 as well as the seasonal conditions. Most flows occur during the summer monsoons but occasional rain-on-snow events are demonstrated.

The charts also show the difference in magnitudes between the stations, where discharge at E060 is highly variable containing multiple flows greater than 100 cfs, and at E050 and E110 discharge is somewhat uniform in comparison. Discharge at E050 is modulated by two impoundments in upper and mid Los Alamos Canyon, the Los Alamos reservoir at the mountain front and the low head weir just above the gage station. While E110 is much further downstream and also receives discharge from Guaje Canyon. The average and median flows at these stations during this period are:

- the E060 average is 92 cfs and the median is 20 cfs compared to and including 0 events during 2008,
- at E050 the average is 33 cfs and the median is 18 cfs compared to the 2008 average 19 and median 18 values,
- and at E110 the average is 81 cfs and median is 18 cfs compared to the 2008 average 43 and median 40 values.

Individual events can greatly influence these values, demonstrated by large a difference between the mean and median.

An August 8, 2006 flood that reached 1926 cfs at E060 and 1749 cfs at E110 was the most extraordinary event during this period. Previous to this, a maximum peak discharge of 1440 cfs occurred July 2, 2001 at E060. Another discharge event at E099, the Guaje endpoint not evaluated in this report, flowed up to 2120 cfs August 11, 2001. Data from the E110 station was not available prior to 2003.

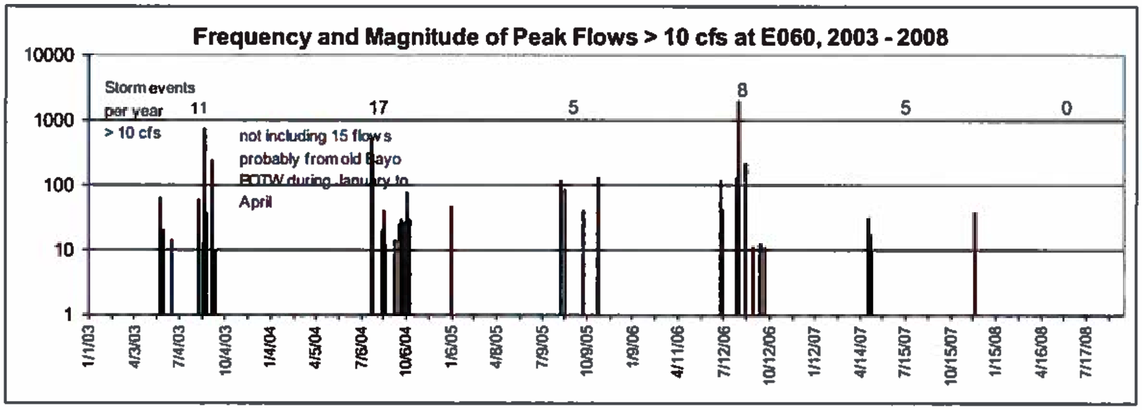


Figure 22 E060 Runoff Frequency and Magnitude

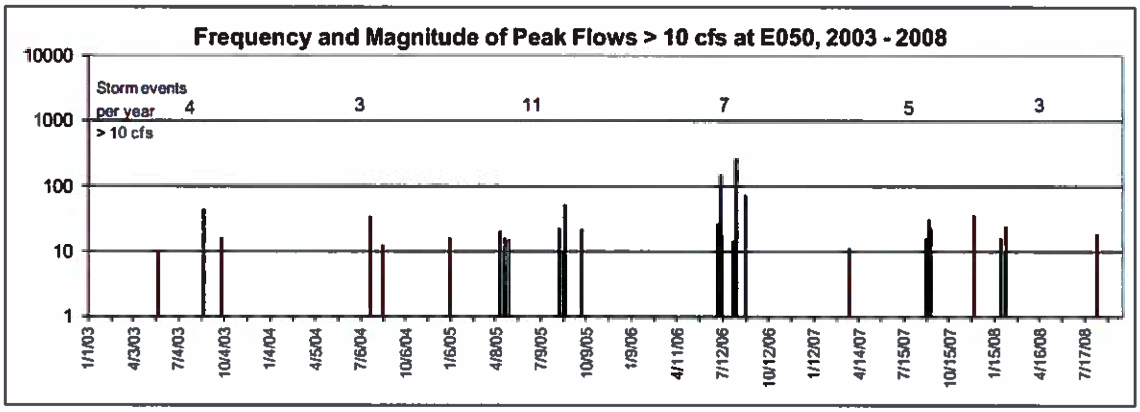


Figure 23 E050 Runoff Frequency and Magnitude

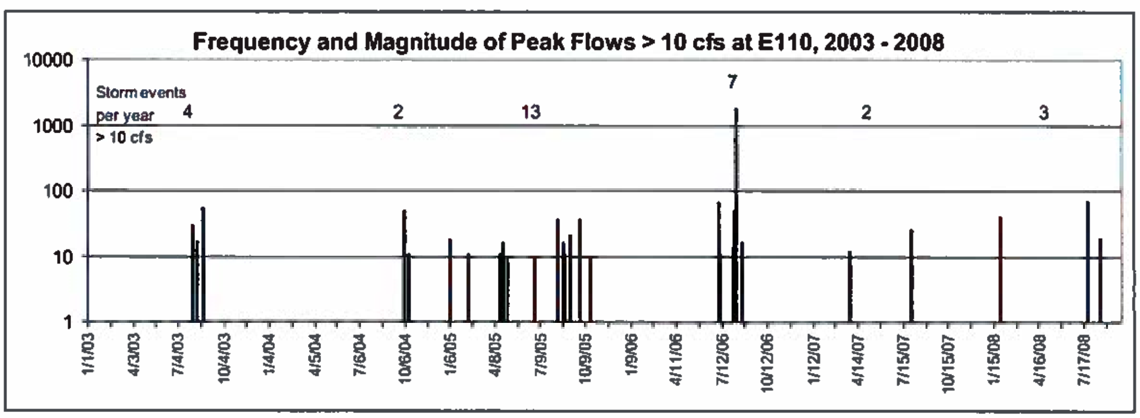


Figure 24 E110 Frequency and Magnitude

Runoff Origin at E110

There are inconsistencies in the discharge data explored in the following table. Table 22 lists peak discharges at E060, E050, and E110 and evaluates them for transmission losses or gains between the upper and lower stations. Flows are arranged so that transmission losses or gains might be evaluated between the upstream E050 and E060 stations and the downstream E110 station. A middle column combines the discharge at E050 and E060, while the last column predicts what may have flowed at E110 based on a 59% transmission loss between the upper and lower stations. The second to last column makes an evaluation of the flows at E110.

Thirty-two flows greater than 10 CFS were measured at the LANL E110 gage from 2003 through 2008. Thirteen flows were identified at E110 that originate from E050, E060 or both. The discharge differences between them demonstrate an average 59% reduction from transmission loss, or channel storage, and range from a 93% to 18% loss. Sixteen of the flows must originate wholly from Guaje Canyon although data is not available from the Guaje gages to confirm this assumption. A 100% transmission loss in lower Los Alamos Canyon, or flows measured at E050 and E060 that did not reach E110 was identified during 62 events, which we find unlikely. The most notable examples of these disparities occur during 2004; particularly the June 24th and 27th events where combined E050 and E060 discharge of 538 cfs and 262 cfs respectively did not produce measureable flow at E110. Applying a 59% transmission loss, our expectation of discharge for those two events would have been 221 cfs and 107 cfs at E110.

We expect that the average transmission loss presented here is inaccurate. Besides incomplete records at E110, other factors such as provenance, flow, alluvial saturation, and other channel conditions contribute to a varied transmission loss factor. We presented the value as a reference for potential flows at E110, although we suspect that a thorough evaluation of transmission losses could be used for monitoring watershed health and should be investigated further.

Table 22 Runoff Events at E050, E060, and E110

Flows less than 10 cfs not recorded	LA E050	cfs	Pueblo E060	cfs	LA E110	cfs	NOTES AND EVALUATIONS: Sampled by NMED - no flows recorded, or recorded less than 10 cfs?	combined 050 and 060 flow	Evaluation of Origin at E110	Potential E110 flow based on 59% transmission loss from upper stations
up to 10/1/2008	1/28	16			1/28	40		16	150% gain (from Guaje?)	
	2/4	23					7/4/08, 8/9/08, 8/23/08 E050	23	00% transmission loss?	9
					7/22	69		0	Originates from Guaje	
	8/10	18						18	00% transmission loss?	7
					8/17	10		0	Originates from Guaje	
2007	3/23	11						11	00% transmission loss?	5
					3/28	12		0	Originates from Guaje	
			4/29	19	7/30	26		19	37% gain (from Guaje?)	
			4/30	18				18	00% transmission loss?	7
			4/30	31				31	00% transmission loss?	13
			5/5	10				10	00% transmission loss?	4
	8/29	16					8/6/2007 E050, E060	16	00% transmission loss?	7
	9/2	30					9/1/07 E050	30	00% transmission loss?	12
	9/6	22						22	00% transmission loss?	9
	12/1	35	12/1	37				72	00% transmission loss?	30
2006	6/29	26						26	00% transmission loss?	11
	7/5	148	7/5	117	7/5	67		265	75% transmission loss	109
					7/6	11		0	Originates from Guaje	
	7/9	17	7/9	41			7/7/06 E110	58	00% transmission loss?	24
	8/1	14						14	00% transmission loss?	6
					8/2	14	7/26/06, 8/5/06 E060	0	Originates from Guaje	
					8/6	49		0	Originates from Guaje	
	8/7	24	8/7	127	8/7	45		151	70% transmission loss	62
	8/8	252	8/8	1926	8/8	1749		2178	20% transmission loss	893
					8/19	16		0	Originates from Guaje	
	8/25	72	8/25	220	8/25	89		292	70% transmission loss	120
			9/8	11	measure by Flowlink			11	00% transmission loss?	5
			9/22	12				12	00% transmission loss?	5
			10/1	11				11	00% transmission loss?	5
2005			1/1	47				47	00% transmission loss?	19
	1/4	16			1/4	18		16	13% gain (from Guaje?)	
					2/12	11		0	Originates from Guaje	
	4/16	20			4/16	11		20	45% transmission loss	8
	4/24	16			4/24	16		16	100% of LANL origin	7
	5/3	15			5/3	10		15	33% transmission loss	6
					6/25	10		0	Originates from Guaje	
	8/12	22			8/12	18		22	18% transmission loss	9
	8/13	10			8/13	36		10	160% gain (from Guaje?)	
			8/14	116				116	00% transmission loss?	48
	8/22	10						10	00% transmission loss?	4
	8/24	51	8/24	85	8/24	16		136	88% transmission loss	56
	8/25	28			8/25	11		28	61% transmission loss	11
					9/7	21		0	Originates from Guaje	
	9/28	13			9/28	36		13	177% gain (from Guaje?)	
	9/29	21	9/29	40				61	00% transmission loss?	25
					10/19	10		0	Originates from Guaje	
			10/30	130				130	00% transmission loss?	53
2004							flows from 1/2 to 3/19 may originate from regular POTW treatment plant discharges			
			1/2	13				13	00% transmission loss?	5
			1/6	13				13	00% transmission loss?	5
			1/9	11				11	00% transmission loss?	5
			1/14	11				11	00% transmission loss?	5
			1/30	17				17	00% transmission loss?	7
			2/6	24				24	00% transmission loss?	10
			2/9	20				20	00% transmission loss?	8
			2/20	16				15	00% transmission loss?	6
			2/27	19				19	00% transmission loss?	8
			3/6	19				19	00% transmission loss?	8
			3/9	19				19	00% transmission loss?	8
			3/10	16				16	00% transmission loss?	7
			3/12	14				14	00% transmission loss?	6
			3/19	17				17	00% transmission loss?	7
			4/20	10				10	00% transmission loss?	4
	7/23	11	7/23	21				32	00% transmission loss?	13
	7/24	34	7/24	504				538	00% transmission loss?	221
			7/27	262				262	00% transmission loss?	107
			8/18	21				21	00% transmission loss?	9
	8/20	12	8/20	40				52	00% transmission loss?	21
			8/23	12				12	00% transmission loss?	5
			9/12	14				14	00% transmission loss?	6
			9/20	18				18	00% transmission loss?	7
			9/21	16				16	00% transmission loss?	7
			9/22	25				25	00% transmission loss?	10
			9/25	29				29	00% transmission loss?	12
			9/26	21				21	00% transmission loss?	9
			9/28	16				16	00% transmission loss?	7
			9/30	27				27	00% transmission loss?	11
			10/4	13				13	00% transmission loss?	5
			10/5	77	10/5	49		77	36% transmission loss	32
			10/11	30	10/11	11		30	63% transmission loss	12
2003	5/20	10						10	00% transmission loss?	4
			5/25	62				62	00% transmission loss?	25
			5/26	17				17	00% transmission loss?	7
			5/31	20				20	00% transmission loss?	8
			6/18	14				14	00% transmission loss?	6
					8/3	30		0	Originates from Guaje	
					8/11	17		0	Originates from Guaje	
			8/12	60				60	00% transmission loss?	25
			8/21	13				13	00% transmission loss?	5
	8/22	15	8/22	90	8/22	10		105	90% transmission loss	43
	8/23	43	8/23	749	8/23	55		792	93% transmission loss	325
			8/26	38				38	00% transmission loss?	16
			9/6	243				243	00% transmission loss?	100
			9/11	10				10	00% transmission loss?	4
	9/26	16						16	00% transmission loss?	7

- 18 flows recorded at E110 originate or gain from Guaje flow substantiated by combined flows at E050 and E060 that were less than recorded at E110 or entirely absent.
- 62 flows originating at LANL (E050 & E060) exhibited a 100% transmission loss and registered no flow at E110. The combined flows from E050 & E060 for those events with 100% transmission loss ranged from 116 to 538 cfs.
- 13 flows recorded at E110 and the LANL eastern boundary (E050 & E060) demonstrate an average 59% reduction from transmission losses ranging from 18% to 93%.

Spatial Changes

The following six box and whisker charts, Figures 25 through 30, demonstrate the spatial changes of plutonium levels in suspended sediment, in water, and the suspended sediment concentrations between stations within upper Pueblo and Los Alamos Canyon reaches downstream to the Rio Grande. The box and whisker plots represent the maximum, minimum, and the 25th and 75th central tendency of the measurements made at each station. Those values, plus the sample counts and averages are listed below each chart. The first three charts represent plutonium in sediments, total plutonium in water, and suspended sediment concentrations measured along Pueblo Canyon to the Rio Grande. The following three charts demonstrate the same measurements along the upper Los Alamos Canyon reach to the Rio Grande. The LA0.7 (E110) station, four miles below the Pueblo/Los Alamos Canyon confluence, and the Buckman-Rio Grande values are duplicated in both reaches.

Based on comparisons between these stations, we can make inferences of plutonium and sediment transport availability. These inferences substantiate the availability assessments developed from the correlation work described in earlier sections of this report. The rating coefficients that describe the correlations between plutonium and sediment transport to peak discharge, reflect the supplies of those materials available for transport.

The changes represented by these plots reflect the ranges of concentration in all samples collected during this study from a variety of discharge magnitudes. Concentration values reflect the instantaneous mass or activity relationships to a volume of water or mass of sediment, while the rating coefficient assessment defines the relationship of plutonium or sediment concentration values to discharge.

We also recognize that some variability in suspended sediment and plutonium measurements may originate from the size assortment of materials within storm discharge. Increasing flow energy may pick up greater amounts as well as coarser sediment. Plutonium, as well as other insoluble contaminants, is primarily attached to finer grained sediments carried by stormwater due to greater surface area and chemical and physical bonding. Although particle size measurements were not made in this report, we believe the greatest majority of suspended sediments in storm discharge are fine grained silt and clay materials.

In 2002 we collected 20 storm water samples at four Pueblo Canyon locations from five storm flow events, http://racerdat.com/. The average content of silt and clay was 94.8% with a 5.9% standard deviation. Total silt and clay content ranged from 81.6% to 99.8%. As well, the regression analysis of SSC and plutonium values for 88 values collected at E060 in Pueblo Canyon during the period of this report indicates that the correlation is considered to be extremely statistically significant. $P = 0.0001$, $r = 0.694$, $df = 86$. This suggests a strong relationship of SSC to plutonium concentration in water.

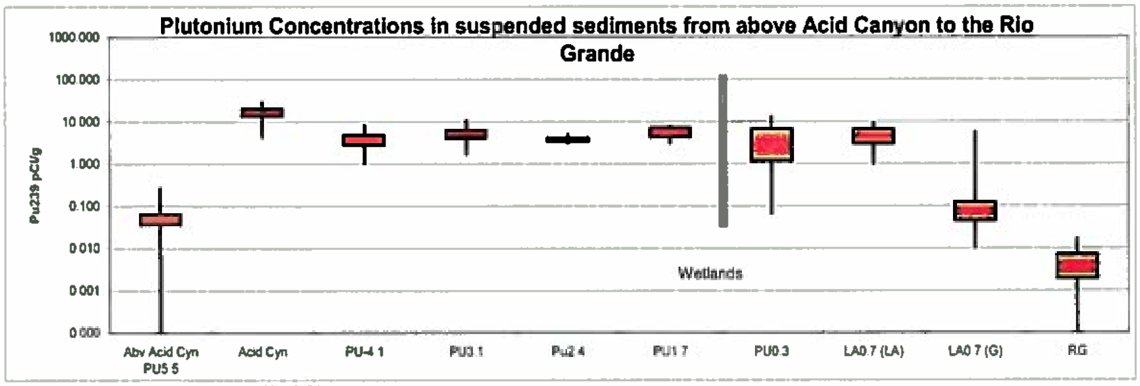
Although we believe sediment size distribution does contribute to the variability in plutonium concentrations in water, it may be that the magnitude of differences in plutonium measurements in sediments related to source terms overwhelms this variability. For example plutonium concentrations measured in stormwater suspended sediments from background stations are fractions of a pico Curie, while values below source terms are tens of pico Curies.

Comparisons of the three charts representing each reach demonstrate the relationships of plutonium concentration in water to suspended sediments and plutonium in sediments. Based on an assertion that if plutonium levels in sediments are consistent, are fairly insoluble and mostly associated with sediments, then plutonium concentrations in water are directly related to suspended sediments; if suspended sediment concentrations increase or decrease so do the plutonium concentrations in water.

In the context of this section, we demonstrate the relation between suspended sediment, plutonium measurements in sediment, and plutonium measurements in water. Of particular significance are the magnitudes of plutonium values in sediment and the relation it bears on plutonium measurements in water. For example, stormwater from Acid Canyon typically contains suspended sediment that has large values of plutonium measured in it; the average of 17 pCi/g was calculated from samples taken for this report. Yet because Acid Canyon contributes relatively small amounts of suspended sediment to storm water, an average of 2000 mg/L, a relatively small downstream contribution of contaminants is made. The average plutonium concentration in water from Acid Canyon is 29 pCi/L, while other stations just downstream in Pueblo Canyon with smaller plutonium and larger sediment content, commonly contain total plutonium values in water that exceed 100 pCi/L.

Pueblo Canyon to the Rio Grande

Figure 25 represents the plutonium concentrations in stormwater suspended sediments sampled in Pueblo Canyon, from a station in Acid Canyon and a background station above Acid Canyon downstream to the Rio Grande. Pueblo Canyon has discharged the largest component of LANL legacy contaminants originating from Acid Canyon into lower Los Alamos Canyon through Pueblo de San Ildefonso property. Note that each plot along the x axis represents individual stations and the y axis represents the plutonium concentrations in pCi/g units and is in logarithmic scale. The station identification reflects its distance from the downstream Pueblo confluence with Los Alamos Canyon, for example PU5.5 (E055) is in Pueblo Canyon 5.5 miles above the Los Alamos confluence.



	Abv Acid Cyn PU5.5	Acid Cyn	PU-4.1	PU3.1	Pu2.4	PU1.7	PU0.3	LA0.7 (LA)	LA0.7 (G)	RG
25th	0.036	13.25	2.73	4.00	3.34	4.22	1.15	2.95	0.04	0.002
Max	0.281	30	8.60	11.00	5.35	8.30	13.50	9.20	5.77	0.017
Min	0.000	4.2	0.99	1.60	2.93	2.86	0.06	0.92	0.01	0.000
75th	0.063	19.75	4.63	6.20	4.08	6.94	6.48	6.44	0.12	0.007
count	20	14	25	9	19	2	78	20	33	9
ave	0.06	16.77	3.72	5.50	3.79	5.58	4.46	4.64	0.27	0.006

Figure 25 Spatial Difference of Plutonium Concentrations in Suspended Sediments through Pueblo Canyon to the Rio Grande

The station above Acid Canyon, PU5.5 (E055), is intended to reflect background levels of plutonium in the environment. The PU5.5 plot is at the far left side of the chart and plutonium values in suspended sediment range from 0.3 to 0.00 pCi/g and average 0.06 pCi/g. Background levels of plutonium on the Pajarito Plateau are 0.068 pCi/g for channel sediments and 0.054 pCi/g for soils (Ryti et al., 1998). Many plutonium values are slightly greater than background in upper Pueblo Canyon, although plutonium transport availability is relatively small. E055 developed the lowest plutonium transport rating coefficient, 0.00003, and a gross estimate concentration of 0.03 pCi/g. The Ryti background levels are provided for reference only and are not directly comparable to suspended sediments.

Plutonium measurements in sediment from Acid Canyon produce values that range from 4 to 30 pCi/g and average 17 pCi/g. Plutonium concentrations are relatively large, but as we'll see later the suspended sediment concentrations are an order of magnitude less than other Pueblo stations. This implies that the plutonium transport availability is moderated by reduced sediment supplies. This reduction may be due to the relative shortness of the tributary canyon, multiple cleanups there, and stabilized rock-armored channels. The channels are also often incised and contained within bedrock through the reach. Accurate discharge measurements are not available from this location downstream to E060 and transport assessments cannot be produced.

The following stations through the next four miles of the canyon are represented by stations PU4.1 downstream to PU1.7. PU1.7 is just above the wetlands artificially created from the public waste water treatment system discharge and will become a LANL supported gage station, E059, in 2010. The plutonium concentrations in suspended sediments through this reach range from 1 to 11 pCi/g and consistently average around 5 pCi/g. This demonstrates that a relatively large consistent supply of plutonium is available for transport throughout this part of the canyon.

The next 1.5 miles of canyon contain wetlands heavily overgrown with marsh grasses (canary reed grass), and have recently been planted with willows by the Laboratory. These plants can be effective in stabilizing the valley channels, modulating storm flows and reducing the sediment load. PU0.3 (E060) is located at the downstream extent of the wetlands and approximately 0.3 mile above the Los Alamos confluence as well as near the eastern Laboratory boundary. The plutonium concentrations in suspended sediments there range from less than 1 pCi/g to about 14 pCi/g and average 4.5 pCi/g, similar if not slightly less than the measurements from above the wetlands. As demonstrated in the following charts, a substantial reduction of sediments, about five times less than measured at stations above the wetlands, reduces the plutonium availability for transport.

The transport rating coefficient at E060, ranging from 0.02 to 0.04, demonstrates the largest transport supply than at any other LANL gage station. We estimate up to 182 mCi of plutonium was transported beyond this location and that the gross plutonium average in suspended sediments, based on plutonium transport divided by tons of sediment transported, was 8 pCi/g. During 2006 the overall gross estimate was greater than 13 pCi/g and between 4 and 4.5 during the remaining four years.

The LA0.7 station most distant downstream in the Los Alamos watershed, approximately 0.7 mile above the Rio Grande, is represented by two box and whisker plots. LA0.7 is also referred to as E110, a LANL operated gage station four miles below the Pueblo/Los Alamos Canyon confluence on Pueblo de San Ildefonso property. The two plots reflect the origin of flows that pass the E110 gage. Water flowing from within the Laboratory perimeter, particularly Pueblo Canyon; contain higher plutonium levels than water originating from other watershed areas, Guaje Canyon, Bayo Canyon, and sheet-flow or road discharge into lower Los Alamos Canyon. Guaje gage data is not available and flows from the canyon cannot be confirmed, yet it is only three quarters of a mile upstream of E110, comprises over 25% of the entire watershed area, and may contribute a large portion of flow into the Los Alamos Watershed.

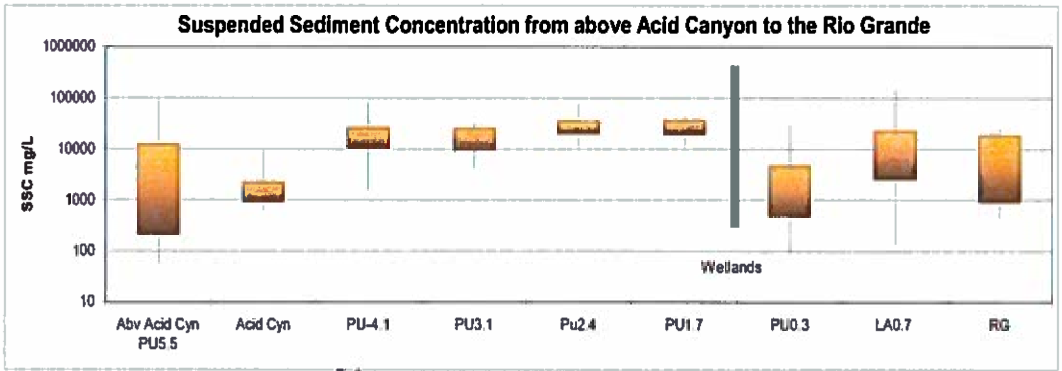
Data from flows recognized at Pueblo E060 and later at E110 were compiled into a population represented by box plot LA0.7(LA). Data from flows not recognized in Pueblo but observed at E110 are presumed to be from the other sources and are compiled into and represented by box plot LA0.7(G). Plutonium concentrations in the LA0.7(LA) population are similar to that discharging from Pueblo Canyon. The concentrations range from about 1 to over 9 pCi/g and average 5 pCi/g. The LA0.7(G) data population reflects near background conditions similar to the PU5.5 station. The values range from 0.01 to 6 pCi/g and average 0.28 pCi/g. The maximum value, 6 pCi/g, is unusual for background but may have been from Pueblo residual flood deposits in lower Los Alamos Canyon or the flood source is misidentified. One of three samples from a July 6th, 2006 event contained 5.77 pCi/g plutonium, a much greater concentration relative to the remaining two samples both measured at 0.15 pCi/g. Discharge into the Rio Grande demonstrates much greater Laboratory impacts when runoff events originate from Pueblo Canyon.

The plutonium/peak discharge rating coefficients at E110, 0.018 for runoff that developed within the Laboratory boundaries and 0.00005 for Guaje runoff, demonstrate similar transport rates as the Pueblo endpoint E060 (0.02 to 0.04) and the background station E055 (0.00003). We estimate up to 34 mCi of plutonium was transported beyond this location and that the gross plutonium average in suspended sediments was 5 pCi/g from runoff originating from the Laboratory and 0.27 pCi/g from other runoff sources.

The Rio Grande station is located at the Buckman Landing three miles downstream of the Los Alamos confluence. It is just above the Buckman Direct Diversion, site of the new Santa Fe community water resource. The station was deployed in 2008 and collected nine samples initiated by four stage increases in the river. The stage increases reflected regional storm events, however runoff originating from the Los Alamos watershed were not concurrent with these events. The average plutonium value from these events, 0.006 pCi/g, is less than the PU5.5 background station values and regional background soil or reservoir sediments references. The suspended sediments in the Rio Grande samples represent transport of sediments from northern New Mexico. Plutonium in these sediments reflects concentrations derived from worldwide atmospheric testing of nuclear weapons.

Figures 26 and 27 represent the suspended sediment and total plutonium measurements in stormwater sampled from the upper reaches of Pueblo Canyon downstream to the Rio Grande. If the plutonium distribution within a canyon reach is in some near equilibrium state, then concentrations in the transported sediments will be fairly consistent. A direct relationship develops in total recoverable plutonium measurements and suspended sediment concentrations, if the sediment load increases or decreases so does the plutonium, as well as other insoluble contaminants. That relationship is represented by the equation: pCi/g x mg/L x 0.001 = pCi/L, the concentration of plutonium in sediments multiplied by the suspended sediment concentration and a milligram to gram conversion factor is equal to the plutonium concentration in water. Figure 26 demonstrates the suspended sediment concentrations locations along Pueblo Canyon to the Rio Grande followed by Figure 28 representing the associated plutonium concentrations in stormwater.

These measurements reflect multiple samples per event collected from a broad spectrum of runoff discharges. They represent a range of concentrations that could be expected in the watershed and in conjunction with the earlier transport assessments provide a clearer perception of transport rates and channel conditions. At least six events (8/20/2008, 8/21/2008, 7/6/2006, 7/17/2005, 8/20/2004, and 8/19/2004) were sampled at LA0.7 but concurrent discharge measurements were not available and therefore not included in the transport evaluation. Almost all of those events contained large suspended sediment concentrations of 10000 mg/L to greater than 100000 mg/L indicative of substantial transport and runoff rates.



	Abv Acid Cyn PU5.5	Acid Cyn	PU-4.1	PU3.1	Pu2.4	PU1.7	PU0.3	LA0.7	RG
25th	209	909	10679	9401	19824	19167	478	2545	910
Max	110000	9290	81128	31613	79245	46078	31000	147147	25000
Min	57	616	1559	4167	9705	10196	89	135	450
75th	12450	2261	26200	25502	35456	37108	4814	23092	19000
count	20	14	23	8	17	2	80	57	9
ave	17752	2101	21524	16401	29842	28137	4023	18596	8493

Figure 26 Spatial Difference of Suspended Sediment Concentrations through Pueblo Canyon to the Rio Grande

The first plot on the left of the chart is the background reference station PU5.5 in upper Pueblo Canyon. The suspended sediment concentrations are more variable but average less than most stations in the upper canyon reach. The concentration values range from 57 mg/L to 110000 mg/L and average 17752 mg/L. The average is greatly influenced by one event during August 11th, 2003. It was the largest discharge of the year at E055, 1179 cfs, and included SSC values greater than 100000 mg/L. By excluding this event the SSC average would be near 4000 mg/L. Referring to Figure 25, plutonium measurements in sediments, we see the concentrations to be small and the associated plutonium in water values represented in the Figure 27 are likewise relatively low. Acid Canyon demonstrates even lower SSC values containing less variability, ranging from 616 to 9290 mg/L and averages 2101 mg/L. This may be indicative of a shorter, more stable reach that supplies less sediment than the other locations we have monitored. Although the plutonium concentrations in sediment are largest from Acid Canyon the plutonium availability for transport in water is reduced relative to the reaches downstream. The contaminant availability from Acid Canyon is greater than the PU5.5 background station with its larger sediment supply containing far less plutonium.

The transport rating coefficient for sediment at E055 is 0.98, and demonstrates similar transport availability to stations E030, E042, and E050. They develop coefficients less than downstream stations E060 and E110 that range up to 4.8. We estimate up to 4182 tons of sediment was transported beyond this location relative to 19348 tons at E060. Although relevant, the above concentrations describe only conditions of stormwater samples, while the rating coefficient assessments also identify transport associated with the number of runoff events.

The two and one half mile reach downstream appears to demonstrate a slightly increasing sediment-supply trend as distance increases. The valley is narrow, has a fairly steep gradient, and the channel bottom is mostly comprised of sand, gravel and cobbles. The suspended sediment concentration averages are fairly consistent and range from 16401 mg/L at PU3.1 to 29842 mg/L at PU2.4. We noted from the previous chart the plutonium concentrations in sediments are fairly stable and consequently the plutonium concentrations in water reflect similar slight upward-trending plutonium rates as distance increases downstream.

The largest change within the canyon reach appears within the wetlands section of Pueblo Canyon. At PU0.3 (E060), below the wetlands, the suspended concentrations reduce by a factor of at least five. Along this reach the valley floor broadens as well as the associated floodplain, and the gradient decreases. Within this reach the largest supply of Laboratory contaminants are stored in recent post-Laboratory era deposits (Reneau et al., 1998). This area is referred to as reach P4-W by the Laboratory. Shortly after the Cerro Grande fire, a braided stream system in this reach went through a series of dramatic changes. Large floods sequentially deposited large volumes of sediments aggrading the floodplain and then began a period of incising. Floods cut through the alluvium, creating deep single thread channels, and had the potential to supply increasing amounts of sediments as the channel banks sloughed and widened. This is partially caused by the water table following the incised channel depth, drying the banks and abandoning the wetland vegetation. The channel banks had become more destabilized and were producing greater sediment supplies. It appears from this evaluation the system has been improving. The suspended sediment concentration averages of stations upstream of the wetlands reduced from 20000 mg/L to 4000 mg/L. The plutonium in sediments is fairly constant from upstream stations to PU0.3 and reduction in plutonium in water concentrations and transport rates occur.

LA0.7 (E110) appears to demonstrate increasing sediment supplies with distance downstream. The station is approximately four miles downstream of PU0.3 and the average suspended sediment concentration increases from 4000 mg/L at PU0.3 to over 18000 mg/L at LA0.7. Both the plutonium concentration in sediment, around 4.5 pCi/g, and the concentration in water, around 17 pCi/L, appear fairly constant. This does not follow the expectation of increasing total concentrations in water. We believe this demonstrates Guaje Canyon supplies a larger component of sediment transport at E110 than previously estimated.

The assessment at E110 suggests the sediment concentrations in stormwater originating from Pueblo average 9300 mg/L relative to 23600 mg/L from Guaje Canyon runoff. Plutonium concentrations in sediment from Pueblo Canyon runoff average 4.6 pCi/g and 0.27 pCi/g from Guaje Canyon floods. While the sediment supply is larger in Guaje Canyon, the plutonium concentrations in sediment are near background and are largely demonstrated by the plutonium concentrations in water. The average total plutonium concentration in stormwater that originates in Pueblo Canyon is about 50 pCi/L, much greater than from Guaje Canyon stormwater that averages about 3 pCi/L.

Contributing to this contradiction is that multiple samples from at least six events (8/20/2008, 8/21/2008, 7/6/2006, 7/17/2005, 8/20/2004, and 8/19/2004) were included in this spatial evaluation but not the transport evaluation. Samples were collected from runoff events not successfully recorded by the gage station. Almost all of those events contained large suspended sediment concentrations of 10000 mg/L to greater than

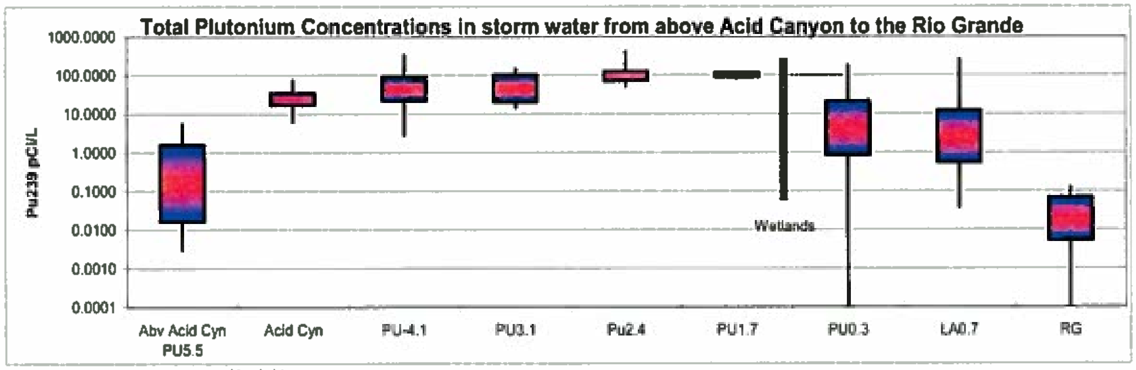
100000 mg/L and low plutonium concentrations, indicative of substantial runoff rates from Guaje Canyon.

The sediment transport rating coefficient of 3.17 at E110 demonstrates similar transport rates as the Pueblo endpoint E060. The Pueblo plutonium transport rating coefficients at E060 ranged from 2.71 to 4.78. We estimate up to 7548 tons of sediment was transported beyond this location. Of this amount, 674 tons of sediment originated from Guaje Canyon although this may be underestimated. At least six runoff events were not included in the evaluation of the transport correlations or inventory estimates.

The regional stormwater samples in the Rio Grande contain smaller concentrations of suspended sediments than the mostly ephemeral Los Alamos watershed. The average sediment concentration in four Rio Grande storm events is 8500 mg/L while the Los Alamos Canyon watershed input average, measured at LA0.7 is almost 19000 mg/L. Relatively low suspended sediment concentrations and regional background levels of plutonium (0.006 pCi/g average) produce low plutonium concentrations in the Rio Grande floods. They are two orders of magnitude less than developed at the E055 baseline station and three to four orders of magnitude less than seen at any other Los Alamos watershed location.

An important perception to recognize in relation to contaminant transport downstream is the relative abundance of background sediment transported in the Rio Grande. While stormwater runoff from the Los Alamos watershed might temporarily impact Rio Grande water, the impact is short term. During the August 8th, 2006 runoff event, we estimate a plutonium concentration of 287 pCi/L may have been present in Rio Grande water. Within ten hours from the beginning of the Los Alamos Canyon runoff, Rio Grande waters would have recovered to baseline levels. Alternatively, the annual suspended sediment yield at the Otowi gage in the Rio Grande is over two million tons (2×10^6 Mg as presented by W. Graff, 1993). Other information for the Rio Grande presented by Graff includes an annual water yield of 1293×10^6 m^3 (46 million cubic feet), an annual maximum flood rate of 8440 cfs, and based on these values an average suspended sediment concentration of 1547 mg/L. We found an average 1258 tons of sediment per year was transported into the Rio Grande from the Los Alamos watershed during the period of this report. Almost 32 mCi in 6000 tons of sediment was transported to the Rio Grande during 2006 of which most was transported in the August 8th flood. About 80% of the total suspended sediment and contaminant inventories transported to the Rio Grande since 2003 occurred in this event.

The following chart demonstrates the plutonium concentration measurements in water that has been discussed above.



	Abv Acid Cyn PU5.5	Acid Cyn	PU-4.1	PU3.1	Pu2.4	PU1.7	PU0.3	LA0.7	RG
25th	0.0160	17	21.50	20.25	71.17	89.20	0.83	0.527	0.005
Max	5.8300	78	359.06	155.79	423.96	131.78	187.00	273.000	0.130
Min	0.0027	6	2.62	14.00	48.04	75.00	0.00	0.035	0.000
75th	1.6000	35	90.55	102.50	128.00	117.59	21.00	11.960	0.066
count	21	14	23	8	17	2	77	57	9
ave	1.02	28.96	73.71	63.60	118.84	103.39	15.38	18.90	0.041

Figure 27 Spatial Difference of Plutonium Concentrations in Water through Pueblo Canyon to the Rio Grande; Identifies SSC and Plutonium Concentration in Sediments Relationship

The most important relationships to notice in Figure 27 are:

- the background conditions at PU5.5 and within the Rio Grande,
- Acid Canyon stormwater containing large plutonium values in sediments but low SSC and relative low plutonium transport rates in water,
- consistent if not increasing plutonium transport rates in water through the canyon reach above the wetlands,
- diminishing plutonium transport rates through the wetlands to PU0.3,
- and consistent if not decreasing plutonium transport rates to LA0.7.

Mid Los Alamos Canyon to the Rio Grande

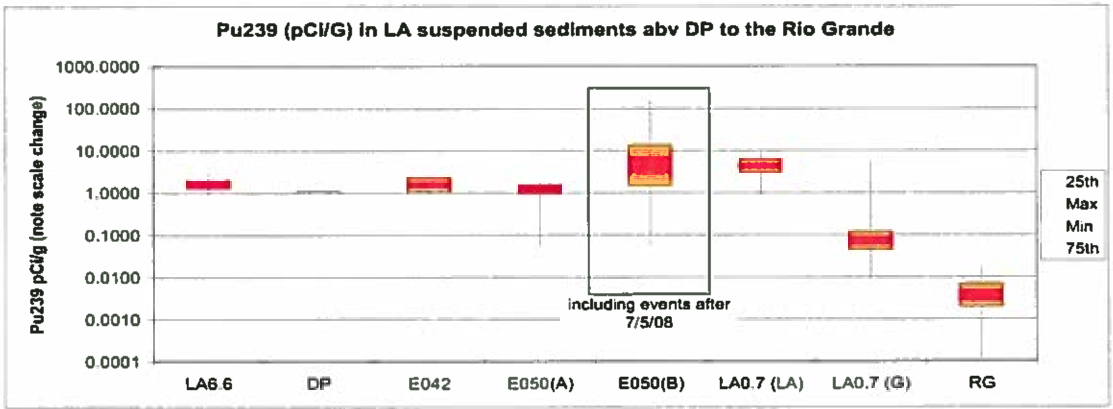
The next three charts in Figures 28 to 30 represent plutonium in sediments, plutonium in water, and suspended sediment concentrations measured along upper Los Alamos Canyon to the Rio Grande. The LA0.7 (E110) station and the Buckman-Rio Grande values are duplicated in both the Pueblo and the upper Los Alamos Canyon reaches. Besides their location at the watershed endpoint, inspection of these plots provides a reference between the two upper reaches. The observations to note between the reaches are plutonium concentrations and SSC are less in the mid Los Alamos reach than the Pueblo Canyon reach and that the contaminant availability is greater than the near background conditions of station E055 in upper Pueblo Canyon and in the Rio Grande.

Four upstream stations are represented. LA6.6 was considered baseline but reflects upstream Laboratory impacts. The DP Canyon station is below a large contaminant inventory from TA-21 plutonium processing operations. Station E042, two miles below DP Canyon, is above the Los Alamos low head weir impoundment. Station E050, below the weir, is above the Pueblo Canyon confluence.

The first chart in Figure 28 represents the plutonium concentrations in stormwater sediments sampled in mid Los Alamos Canyon. Two plots are presented for the E050 station to demonstrate changing conditions that developed after an upstream waterline break at TA-21. The waterline break in 2008 discharged over a SWMU and eroded contaminated sediments into the canyon. Like the two plots developed for LA0.7 (E110), they demonstrate dissimilar source terms of contaminants transported in the watershed. The E050 plot excluding the July 5th, 2008 waterline break at TA-21 runoff event and after is considered to be the most representative of conditions in the mid Los Alamos canyon after the Cerro Grande fire. The increased flux from the waterline break appears to be quickly attenuating. Four events were sampled, the maximum plutonium measurement, 160 pCi/g, was measured in flow from the July 5th event. Each succeeding flow contained smaller concentrations; the maximum concentration was 47 pCi/g collected during an event on August 9th, on August 23rd a sample was measured at 6.1 pCi/g and finally a sample from an October 11 event was measured at 4.5 pCi/g. Since then the Laboratory has excavated the impoundment area above the low head weir. E042 may reflect similar contaminant levels but was not sampled during this period.

Average plutonium concentrations in suspended sediments from LA6.6 to E050 before the line break were fairly consistent; the average ranges from 1.3 to 1.7 pCi/g. Only one sample was acquired from DP Canyon containing a similar measurement of 1.1 pCi/g. Until the waterline break the plutonium availability in the canyon was in equilibrium contributing nearly constant contaminant concentrations to the sediment load in stormwater. Plutonium levels available in the lower Los Alamos canyon from the upper reach was less than that from Pueblo Canyon. The average concentration from the upper reach was 1.3 pCi/g relative to the near 4.5 pCi/g concentrations seen at Pueblo Canyon E060 (previous discussion) and then at LA0.7(LA). Alternatively, plutonium levels are almost five times greater than that available from Guaje Canyon, demonstrated at LA0.7(G), and two orders of magnitude greater than that demonstrated in regional Rio Grande stormwater. Since the line break the average concentrations have increased to 23 pCi/g. The following suspended sediment and plutonium measurements in water charts will demonstrate that although large plutonium concentrations existed, small sediment loads in stormwater limited contaminant transport downstream.

The rating coefficients for plutonium transport at E030, E042, and E050 are all similar at 0.001 relative to 0.04 developed at E060 and E110. The coefficients developed for background conditions at E055 and runoff from Guaje Canyon are two orders of magnitude less, near 0.00004.



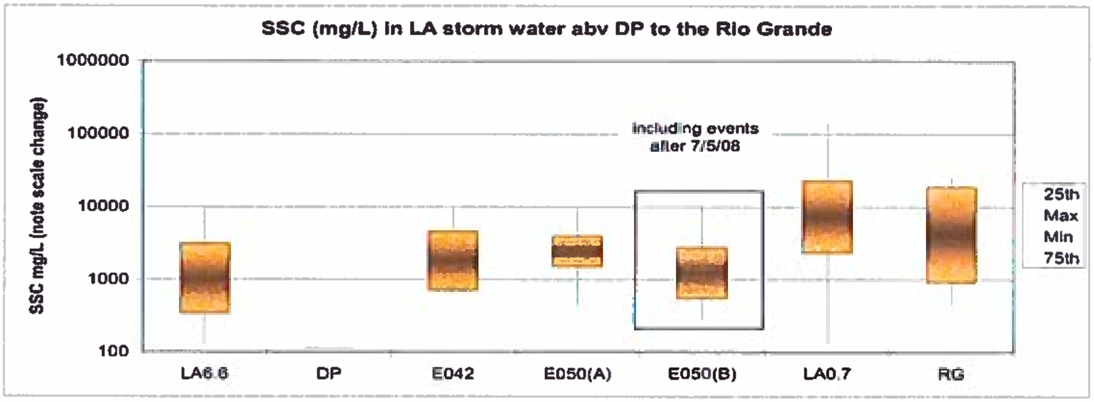
	LA6.6	DP	E042	E050(A) exc samples after 7/5/08	E050(B) incl 7/5/08+ samples	LA0.7 (LA)	LA0.7 (G)	RG
25th	1.25	1.10	1.07	0.97	1.43	2.95	0.04	0.002
Max	3.10	1.10	2.70	2.03	160.00	9.20	5.77	0.017
Min	0.79	1.10	0.96	0.05	0.05	0.92	0.01	0.000
75th	2.05	1.10	2.33	1.60	14.00	6.44	0.12	0.007
count	11	1	4	13	30	20	33	9
ave	1.70	1.10	1.74	1.28	22.71	4.64	0.27	0.006

Figure 28 Spatial Difference of Plutonium Concentrations in Suspended Sediments through Mid Los Alamos Canyon to the Rio Grande

Figure 29 demonstrates suspended sediment concentrations in the upper Los Alamos canyon reach down to the Rio Grande. The concentrations of suspended sediment in upper Los Alamos Canyon reflect stable conditions similar to E055, upstream from Acid Canyon (baseline conditions in Pueblo Canyon). They demonstrate small sediment availability, are fairly consistent through the upper canyon, and originate from relatively well armored channels.

The average SSC range from levels as low as 111 mg/L (one sample at DP) to less than 4000 mg/L, similar to that measured in the upper Pueblo reach stations E055 and Acid Canyon. The concentrations appear to demonstrate a slight increasing trend to E042 until the flows reach the low head weir above E050. There the average suspended sediment concentrations at E042 and E050 are almost equal around 3600 to 3900 mg/L. The events after the July 5th event contain even smaller sediment concentrations associated with low flow events. As runoff proceeds off Laboratory property beyond the Pueblo Canyon confluence sediment concentrations increase to 19000 mg/L at LA0.7 (E110) and reflect an increased availability of sediments in the lower canyon.

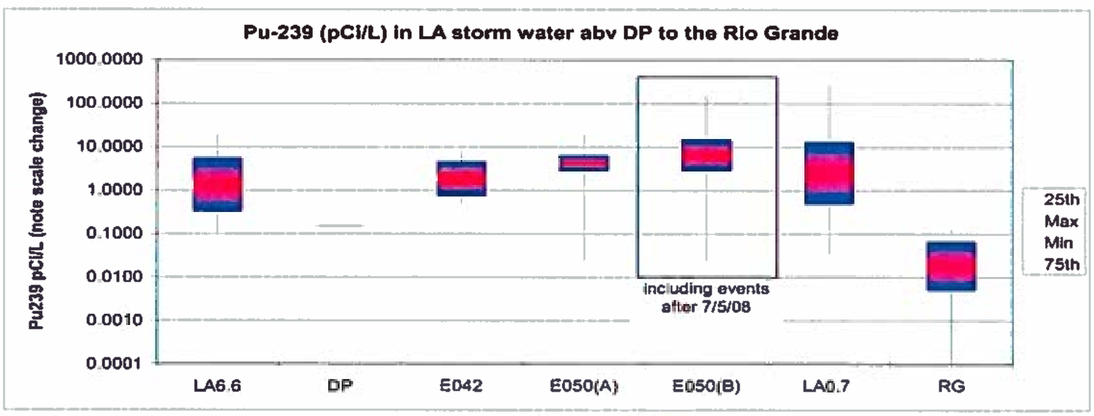
The Rio Grande samples contain larger average sediment levels, 8900 mg/L, than the upper Los Alamos reach, 3300 mg/L and reflect regional stormwater runoff. Nine Rio Grande samples were collected upon rapid stage increases and the concentration values range from 450 mg/L to 25000 mg/L. Concentrations are normally around 1000 mg/L during baseline flow conditions.



	LA6.6	DP	E042	E050(A) exc samples after 7/5/08	E050(B) incl 7/5/08+ samples	LA0.7	RG
25th	336	111	695	1494	535	2310	910
Max	9530	111	10429	10000	10000	147147	25000
Min	132	111	623	450	280	135	450
75th	3150	111	4643	4000	2794	23094	19000
count	11	1	4	13	30	52	9
ave	2493	111	3621	3856	2202	18874	6493

Figure 29 Spatial Difference of Suspended Sediment Concentrations through Mid Los Alamos Canyon to the Rio Grande

Plutonium concentrations in water reflect transport rates that combine contaminant and sediment availability in the canyons. The following chart in Figure 30 demonstrates the plutonium concentrations in stormwater from the upper Los Alamos watershed to the Rio Grande.



	LA6.6	DP	E042	E050(A) exc samples after 7/5/08	E050(B) incl 7/5/08+ samples	LA0.7	RG
25th	0.33	0.15	0.75	2.84	2.86	0.49	0.01
Max	19.06	0.15	10.01	19.30	150.00	273.00	0.13
Min	0.10	0.15	0.51	0.02	0.02	0.04	0.00
75th	5.43	0.15	4.66	6.38	15.15	13.12	0.07
count	12	1	4	14	31	52	9
ave	4.48	0.15	3.56	4.97	18.59	20.55	0.04

Figure 30. Spatial Difference of Plutonium Concentrations in Water through Mid Los Alamos Canyon to the Rio Grande; Identifies SSC and Plutonium Concentration in Sediments Relationship

Plutonium measurements in water average around 4 pCi/L from LA6.6 to E042, demonstrating fairly consistent contaminant and sediment supplies. Average plutonium measurements in sediments are 1.7 pCi/g and SSC averages range from 2500 to 3600 mg/L through the mid Los Alamos reach. Although the supplies appear constant the numbers of runoff events are largely different. Sixteen events were recorded at LA6.6

and 58 were seen at E042 contributing to a plutonium inventory increase from 0.32 mCi to 3.21mCi. The contaminant inventory was transported in 255 tons of sediment in the upper station and 4384 tons at E042. Contaminant loads also decreased through the low head weir to E050. Approximately 1.08 mCi of plutonium in 755 tons of sediment was estimated to pass E050 in 33 flow events.

The measurement at DP is an example of the transport availability between stations where the contaminant levels in sediments are similar but the suspended sediment concentrations are quite different. The suspended sediment concentration, 111 mg/L at DP is a magnitude smaller than the average 2000 to 3800 mg/L values measured at the other stations, while the plutonium concentration is similar to other LA stations, 1.1 pCi/g. The plutonium measurement in water is 0.15 pCi/L, likewise an order of magnitude less than the other upper watershed stations. The DP sample is a single grab sample and likely does not represent the canyon conditions. Additional monitoring is planned at this station. It stands below a large urban runoff source and contributes a substantial proportion of stormwater to the mid Los Alamos Canyon.

The relationship that develops between E042 and E050 above and below the low head weir requires discussion at this point. The hypothesis we tested is that coarse grained sediments would drop out of storm flows within the impoundment at the weir, reducing suspended sediment concentrations but increasing total plutonium concentrations in water, and thereby produce an overall reduction in the stormwater contaminant load. We found that the average plutonium in water concentrations at E050(A) appear slightly higher than at E042, 5 pCi/L relative to 4 pCi/L, reflecting an increase of suspended sediment concentrations at E050. Average suspended sediment concentrations increased from 3600 mg/L at E042 to 3900 mg/L at E050. Only four samples from two storm events in 2005 were collected at E042 and 14 samples from eight storm events during 2007 and 2008 at E050 (not including events after the waterline break at TA-21). Although E042 values appear in good agreement with the overall assessment of the upper watershed it is underrepresented. To test our hypothesis additional sampling at E042 and E050, especially concurrent samples during individual storm events would be required.

Plutonium concentrations in sediments from samples at E050 collected after the TA-21 waterline break increased by over an order of magnitude, the average increased from 1.3 pCi/g to 23 pCi/g. Although the plutonium availability increased to a large degree, the sediment load was almost half of that seen before, 2200 relative to 3900 mg/L. The plutonium concentrations in water increased from around 5 pCi/L to 19 pCi/L and have demonstrated a fairly rapid attenuation of contaminant availability in the canyon since the waterline break.

Prior to the TA-21 excursion, the average plutonium concentration in water at E050 was approximately 5 pCi/L, about 30% of the average 15 pCi/L concentration passing PU0.3 (E060). E050 is the upper Los Alamos watershed endpoint before flows leave the Laboratory and E060 represents the Pueblo Canyon endpoint at the Laboratory boundary. After the excursion, plutonium concentrations leaving the Laboratory are similar at both endpoints, 15 pCi/L at E060 and 19 pCi/L at E050. Sediment load increases from both endpoints to the Rio Grande and the associated plutonium concentrations in stormwater from the Laboratory increase to almost 50 pCi/L. Including the Guaje 2.7 pCi/L contribution the average becomes 19 pCi/L. The main contaminant source term originates from Pueblo but E050 monitoring should continue in the future to confirm our assessment that a quick attenuation of contaminants is occurring.

The spatial trend discussion above outlined contaminant transport through the Los Alamos watershed to the Rio Grande based on comparisons of plutonium concentrations in sediment, suspended sediment concentrations, and plutonium concentrations in water measured between multiple stations within the watershed. The data originated from measurements of samples collected from multiple storm events of variable size and is intended to represent a range of conditions. Unlike the assessments in the preceding sections this assessment does not include sediment and contaminant inventories and their relation to flow dynamics. The conclusions that the primary source terms of contaminants are from Pueblo Canyon, a smaller source term exists in mid Los Alamos Canyon, and that potential contaminant transport rates increase at E110 are based on concentration relationships between stations.

Temporal Changes

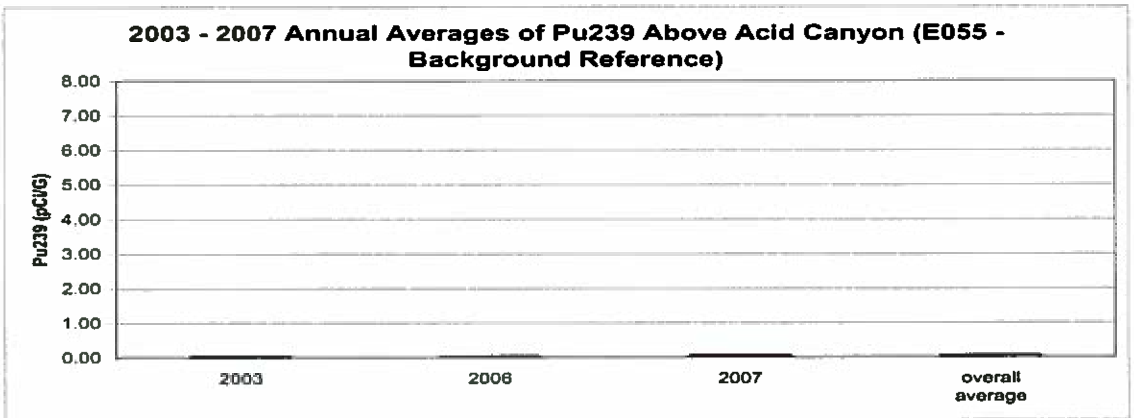
The following discussion regards plutonium concentration changes in suspended sediment over the time period of this report. These values reflect the availability of the contaminant for transport in stormwater. They represent the annual averages from the samples collected during the time period of this report and reflect multiple events of variable sizes at four stations, and a combination of stations through the upper Pueblo Canyon reach. The stations include E055, E060, E050, and E110, and the upper Pueblo Canyon reach includes a combination of stations below Acid Canyon to the wetlands; stations PU4.1, PU3.1, PU2.4, and PU1.7. The following list identifies the reaches they represent:

- Station E055 represents upper Pueblo Canyon assumed to be a baseline or background station
- Station E060 represents the Pueblo Canyon endpoint
- The combination of mid Pueblo Canyon stations represents the conditions below Acid Canyon to the wetlands above E060
- Station E050 represents the mid Los Alamos Canyon reach, and
- E110 represents the Los Alamos watershed endpoint as stormwater flows to the Rio Grande

Charts were constructed that reflect the annual averages at each station and are presented in the following figures. The x-axis identifies the years the samples represent. The y-axis represents the plutonium values, in pCi/g units measured in suspended sediments and maintains the same scale between charts to establish a reference. The associated table presents the annual averages, the maximum, and the plutonium and sediment inventory estimate derived in the Transport section. The bottom line of the table presents the overall average for all samples collected.

E055 Time Series

Figure 31 demonstrates plutonium values in sediments from samples collected at the baseline station E055 in upper Pueblo Canyon during 2003, 2006 and 2007. It demonstrates little temporal changes in plutonium availability from the head of the Pueblo watershed.



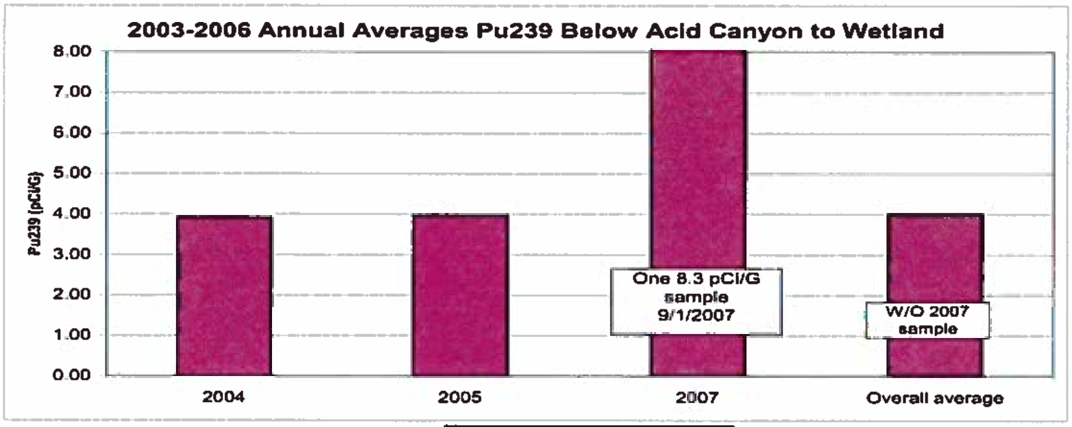
year	average Pu 239 pCi/G	Max value	Pu Transport	Sediment Transport
2003	0.04	0.07	0.062	1907
2006	0.03	0.03	0.057	1846
2007	0.07	0.28	0.0004	9
overall average	0.06			

Figure 31 Temporal Plutonium Concentrations in Suspended Sediments at Baseline E055

The plutonium concentrations in sediments are all similar around 0.06 pCi/g. The plutonium values demonstrate little variability from year to year and reflect Pajarito Plateau background conditions. The sediment mass transport variability is relative to the stormwater runoff from the upper Pueblo watershed and is too variable to identify recovery trends. Refer to the E055 Transport section for additional discussion.

Mid Pueblo Time Series

Figure 32 demonstrates plutonium values in sediments from samples collected at a combination of mid Pueblo Canyon stations PU1.7, PU2.4, PU3.1, and PU4.1 during 2003, 2006 and 2007. It represents little temporal changes in plutonium availability from the mid Pueblo Canyon below the Acid Canyon confluence to the wetlands above E060. Discharge measurements are not available at these sites and transport inventories could not be estimated for temporal assessments.



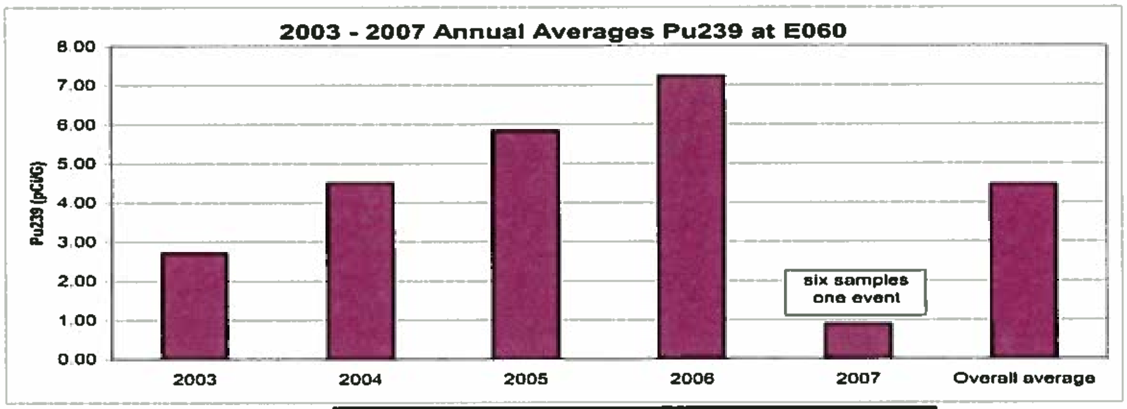
year	average Pu 239 pCi/G	Max value
2004	3.93	6.7
2005	3.97	11
2007	8.30	8.3
Overall average	4.02	

Figure 32 Temporal Plutonium Concentrations in Suspended Sediments in Mid Pueblo Canyon, Includes Stations PU1.7, PU2.4, PU3.1 and PU4.1

Only one sample was collected during 2007 and potentially misrepresents the plutonium availability in mid Pueblo Canyon. The plutonium concentrations range as high as 11 pCi/g through this reach but generally average 4 pCi/g. Acid Canyon is above this reach and is the primary contaminant source. Plutonium measurements have been measured there as high as 30 pCi/g during the period of this report. Based on this assessment it appears the plutonium availability is fairly consistent and reflects equilibrium between contaminants in channel sediments and those carried in stormwater.

E060 Time Series

Figure 33 demonstrates plutonium values in sediments from stormwater samples collected at the Pueblo Canyon endpoint station E060 during 2003 through 2007. No flows were recorded at this station or samples collected during 2008. The chart reflects an upward trending change in contaminant availability over time at E060 although preceding discussion shows that the annual transport masses of plutonium and sediment are diminishing. The estimates from 2003 through 2007 indicate diminishing transport inventories except for 2006. Stream flow in 2006 on the Pajarito Plateau was extraordinary and included a 1926 cfs flood that contributed over 84 mCi of plutonium, 95% of the total annual transport inventory in approximately 6000 tons sediment. The remaining estimates steadily decrease from 22.2 mCi plutonium in 6018 tons of sediment in 2003 to 0.9 mCi in 229 tons during 2007.



year	average Pu 239 pCi/G	Max value pCi/G	Pu Transport mCi	Sediment Transport tons
2003	2.71	5.22	22.2	6018
2004	4.51	9.6	16.4	4034
2005	5.84	8.2	6.6	1800
2006	7.24	13.5	88.4	7265
2007	0.89	1.1	0.9	229
Overall average	4.46			

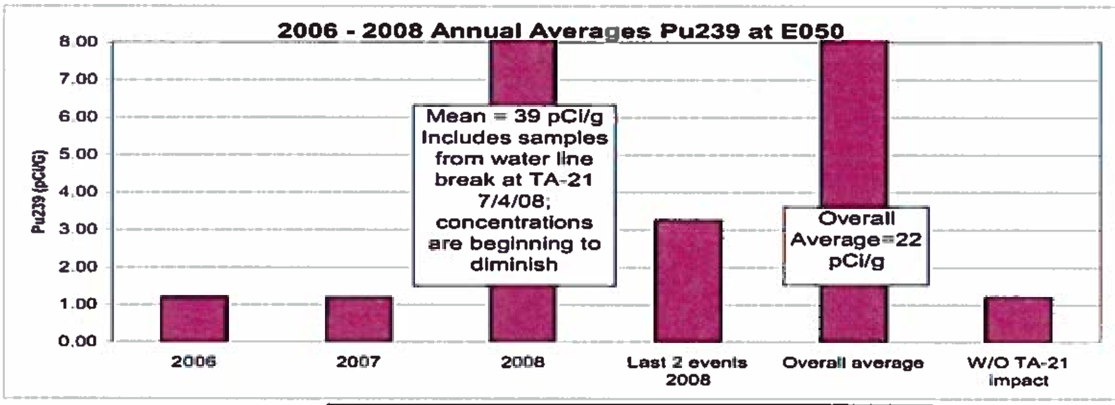
Figure 33 Temporal Plutonium Concentrations in Suspended Sediments at E060

The overall average of plutonium concentrations in sediment is 4.46 pCi/g. The annual averages range from 2.7 in 2003 to 7.24 in 2006 representing a 20% to 40% increase each year until 2006. Only six samples were collected from one event during 2007 and may not be representative of conditions during the year. Only five events flowed greater than 10 cfs during 2007 and the samples we collected originate from a single August 6th event with a maximum flow of just under 5 cfs.

Increasing availability of plutonium originates in the wetland reach below the public wastewater treatment plant. The increase may come from either improving efficiencies of the wetland vegetation in reducing sediment load through the reach or channel bank failure contribution of new contaminant sources. Soon after the Cerro Grande fire and significant aggradations in the area, the channels incised throughout the wetlands forming relatively deep single-thread channels. Stream adjustments to impacts that cause incision include channel widening and reformation of floodplains. The widening of the channels may be contributing sediments containing increasing contaminant levels. The alternative may be that as storm-event flows progress through the wetland area, the sediment load comprised of the coarsest materials is reduced, producing increasing concentrations of contaminants associated with the finer grained component of the load. Although contaminant concentrations increase in water, the overall transport decreases. Data presented in the spatial evaluation identified a dramatic decrease in the sediment load through the wetlands which suggests the later theory is likely. The Laboratory is continuing work to improve channel stability and functionality of the wetlands and continued monitoring is planned.

E050 Time Series

Figure 34 demonstrates plutonium values in sediments from samples collected at the mid Los Alamos Canyon endpoint station E050 during 2006 through 2008. It demonstrates little temporal changes in plutonium availability before the TA-21 excursion, and since then a large increase of contaminant concentrations has been seen.



year	average Pu 239 pCi/G	Max value pCi/G	Pu Transport mCi	Sediment Transport tons
2006	1.20	2.03	0.44	344
2007	1.19	2	0.09	93
2008	39.11	160	0.27	47
Last 2 events 2008	3.26			
Overall average	21.99			
W/O TA-21 impact	1.19			

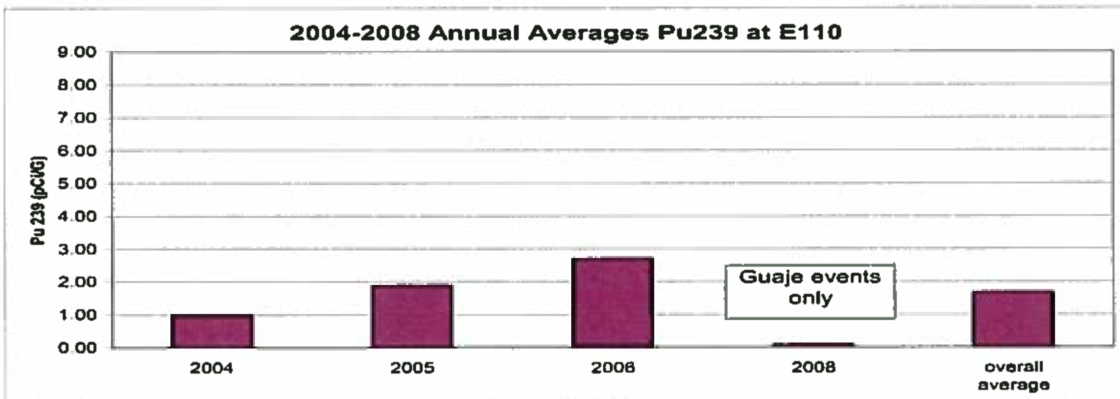
Figure 34 Temporal Plutonium Concentrations in Suspended Sediments at E050

The values recorded during 2006 and 2007 average just over 1 pCi/g containing a maximum value just over 2 pCi/g. The assessments discussed in previous sections have identified fairly uniform transport conditions in mid Los Alamos Canyon except for 2005, 2006, and 2008. Sediment and contaminant yields increased due to increased stormwater runoff frequencies in 2005 and unusually large events in 2006. During 2008 a TA-21 waterline break discharged almost 4 million gallons of potable water over a Solid Waste Management Unit on July 4th introducing new contaminant levels to the mid reach of Los Alamos Canyon.

Combining measurements of samples from the July 4th excursion and subsequent storm events the average concentration of plutonium in sediments increased to 39 pCi/g, over 30 times greater than the previous averages and off the scale of this chart. The maximum value measured during the event exceeded 160 pCi/g. The plutonium measurements in subsequent storm events demonstrate attenuation in contaminant levels. The average of values measured in the last two events of 2008 is 3.3 pCi/g including a maximum value of 4.7 pCi/g. At the end of 2008, impounded sediments above the low head weir were excavated and disposed of and further reduction of contaminant levels can be expected. An assessment of the sediment reduction efficiency of the low head weir impoundment based on this data is not possible but continued monitoring of E042 and E050, particularly of paired sample groups from flows that progress through the weir, should continue.

E110 Time Series

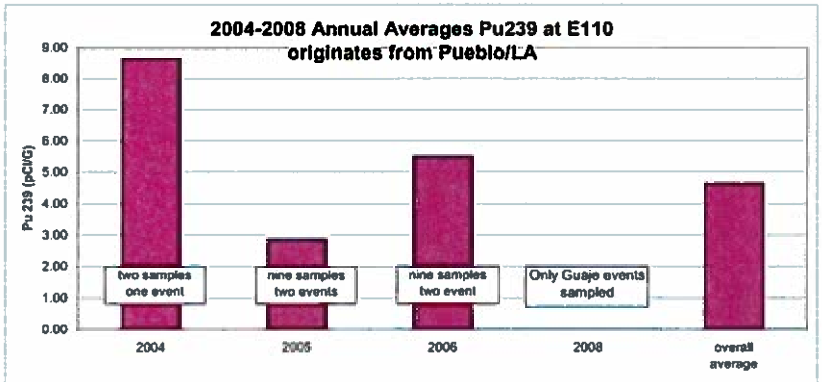
Figures 35 and 36 demonstrate plutonium values in sediments from samples collected at the lower Los Alamos Canyon endpoint station E110 during 2004, 2005, 2006, and 2008. Two flows greater than 10 cfs were recorded at this station during 2007 but we failed to collect samples here. The chart appears to reflect an upward trending change in contaminant availability over time at E110 similar to that at E060, an average 39% increase each year to 2008. Further investigation identifies major transport differences in runoff sources, those originating from Pueblo and mid Los Alamos Canyons and those from Guaje Canyon.



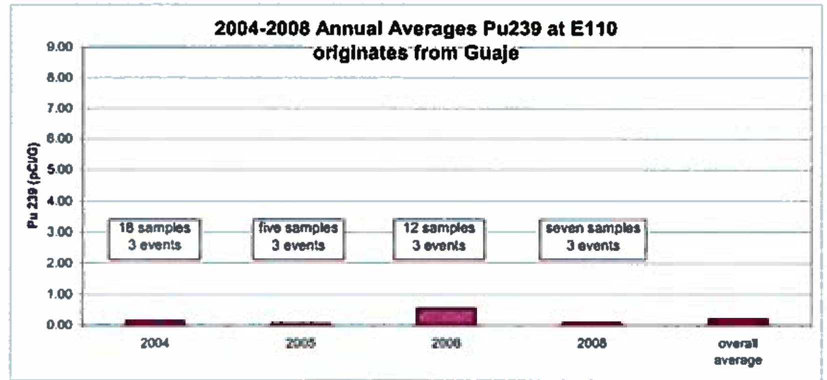
year	average Pu 239 pCi/G	Max value pCi/G	Pu Transport mCi	Sediment Transport tons
2004	1.00	9.20	1.1	190
2005	1.88	7.10	0.2	583
2006	2.69	7.00	31.9	6047
2008	0.08	0.20	0.05	251
overall average	1.67			

Figure 35 Temporal Plutonium Concentrations in Suspended Sediments at E110

All plutonium values derived from storm events at E110 are combined to build this chart. Clearly, an upward trend appears to be developing containing an overall average-plutonium concentration in sediment of 1.67 pCi/g. From earlier evaluations, we identified flows at E110 from multiple sources that contribute largely different levels of contaminants. Flow that originates from the Laboratory contains legacy contaminants at elevated levels, those that originate from outside the Laboratory exhibit background or residual contaminants at low levels. This data set expresses conditions from the combined flows from each scenario. Except for a series of large runoff events during August of 2006 that yielded most of the contaminant loads that year, it appears contaminant transport to the Rio Grande has diminished. The following charts in Figure 36 demonstrate the conditions from each scenario, flows that originate from Pueblo Canyon and those that originate from Guaje Canyon or elsewhere.



year	average Pu 239 pCi/G	Max value	samples / events
2004	8.65	9.2	2/1
2005	2.88	7.1	9/2
2006	5.51	7	9/2
2008	0	0	0
overall average	4.64	9.2	



year	average Pu 239 pCi/G	Max value	samples / events
2004	0.14	1.0	18/3
2005	0.07	0.1	5/1
2006	0.57	5.8	12/3
2008	0.08	0.2	7/2
overall average	0.22	5.8	

Figure 36 Temporal Plutonium Concentrations in Suspended Sediments at E110, from Runoff of Different Origin

The chart on the left demonstrates plutonium in sediment concentrations from a limited number of events at E110 that have been identified as originating from Pueblo and mid Los Alamos Canyon. The chart on the right represents flows at E110 originating from Guaje Canyon. The average plutonium concentrations are 4.6 pCi/g from Pueblo Canyon and 0.2 pCi/g from elsewhere. The annual averages for samples collected from Pueblo Canyon flows are too variable to demonstrate a trend in time but do demonstrate consistently elevated contaminate levels available for transport. Those from Guaje Canyon are fairly consistent and demonstrate conditions similar to the baseline station E055, although the levels are in some cases two orders of magnitude greater and suggest mixing with residual contaminants along lower Los Alamos Canyon. Over 33 mCi of plutonium in approximately 7000 tons of sediment originate from Laboratory property while 0.2 mCi in 700 tons are transported during Guaje Canyon runoff.

Other RAD Discussion

Gross alpha, gross beta, $uranium^{234}$, $uranium^{235}$, $uranium^{238}$, $americium^{241}$, $strontium^{90}$, and $cesium^{137}$ measurements were also completed on an assortment of stormwater samples collected during the period of this report. Plutonium evaluations were presented in the previous discussion as the primary contaminant associated with the canyons within the LANL perimeter and serve as an indicator or tracer parameter for other contaminants. Periodically, when funding was available, subsets of the other analyses were included to expand the breadth and to investigate specific questions beyond the original concept of this report.

Two reference values were established for contaminants in both water and sediments. Baseline upper tolerance values and outlier limits were developed. The following discussion identifies radiochemical contaminants that exceed an upper tolerance level (UTL) established for those areas considered to be background or baseline areas; upper Pueblo Canyon station E055, upper Los Alamos Canyon station E030, and the Buckman Landing Rio Grande station. An approximate 95^{th} percent confidence level based on the mean plus two times the standard deviation of the baseline population was derived for the UTLs. We also established outlier values based on the entire sample population for individual contaminants. The outlier definition for this sample group is based on the mean plus 1.5 times the difference between the 75^{th} and 25^{th} percentile.

For most of the contaminants in water, if measurable, there exists a close relationship between discharge, suspended sediments, and the contaminant concentration. Generally, the variance of this relationship reflects the difference in the flow magnitudes and portrays the availability of a contaminant for transport. The concentration in sediment variances identifies potential Laboratory impacts. This relationship was discussed for plutonium in the preceding discussions. Contaminant concentrations in sediments are calculated based on suspended sediment concentration and contaminant concentration in water.

Gross alpha measurements in stormwater range from 1 pCi/L to 2320 pCi/L in 113 samples. Where multiple samples from individual storm events were measured for gross alpha, they showed linear relationships of concentration to discharge similar to the discussion made for plutonium. The sample containing the largest level originated from the background station PU6.4 during an August 23^{rd}, 2003 1179 cfs event, the second largest discharge recorded at the site. It contained a large 95000 mg/L concentration of suspended sediments.

The UTL value calculated for gross alpha in sediments from the baseline stations is 42 pCi/g. The PU6.4 sample described above contained a relatively small 24 pCi/g measurement for sediment.

Twenty seven measurements that exceed their respective UTLs may identify Laboratory impacts. A sample was collected at the baseline station PU5.5 that returned a value of 48pCi/g, above the 42 pCi/g UTL. Four measurements originate from PU0.3, collected during August and September events in 2003. The values range from 43 pCi/g to 71 pCi/g. Two samples collected from LA0.7 during an August 24th, 2005 event exceed the UTL, the measurements are 48pCi/g and 51 pCi/g. A single sample collected August 25th, 2005 at E042 in Los Alamos Canyon is reported above the UTL at 43 pCi/g. Four measurements from Acid Canyon collected during August and September of 2007 are above the UTL, ranging from 44 pCi/g to 142 pCi/g. After the July 5th, 2008 waterline break at TA-21, the gross alpha values in sediments increased in the canyon. Fifteen samples collected at LA5.0 exceed the UTL. Four of them originate from 2007 samples and range from 48 pCi/g to 62 pCi/g. Following the waterline break, eleven samples from four events exceed the UTL. The values appear to diminish with time, starting at more than 200 pCi/g and declining to measurements near 50 pCi/g.

One measurement collected at LA5.0 on August 9th is reported at 228 pCi/g. This value, as well as other radionuclide values in sediments for this sample, may be an error developed from the analytical processes. Review of the linear relationship between SSC and discharge described in an earlier section indicates the sediment measurement could be too small. The recorded value is 208 mg/L and based on the equation that describes the linear relationship of SSC and discharge, we estimate a more realistic value would be around 900 mg/L. A 900 mg/L SSC value would also produce a gross alpha measurement in sediments near 70 pCi/g, more similar to the other 60 pCi/g values measured during the event. This error follows through for each radiochemical value we derived using the 208 mg/L value, and although using a more reasonable SSC produces consistently high values, further references to this sample will not be made.

Gross beta measurements demonstrate similar conditions. The values range from 5 pCi/L to 3630 pCi/L. All gross alpha and beta measurements are closely related, and demonstrate the same increasing concentrations with increasing discharge.

The UTL value calculated for gross beta in sediments from the baseline stations is 100 pCi/g. Three values exceeded the UTL reference value, including one from the E050 event that contained a low SSC value. As described in the preceding paragraphs, this value is probably in error. The other samples originate from an August 29th, 2007 event at Acid Canyon, AC0.2 and a September 1st, 2007 event at the baseline PU5.5 station. The values are 119 pCi/g and 138 pCi/g, respectively. No other radiochemical measurements were made at these stations and a determination of why they may be elevated cannot be made.

Uranium measurements are presented for 68 samples. The $uranium^{234}$ UTL for water is 73 pCi/L and was exceeded in three samples. These values reflect high SSC values ranging from 48000 mg/L to 99000 mg/L in samples collected from large flood events.

The sediment values are more useful in identifying those areas with potential LANL impacts. Eight $uranium^{234}$ values appear elevated above a 2.5 pCi/g UTL. Two samples originate from baseline and background stations LA6.6 and the Rio Grande and are near 2.6 pCi/g. The remaining values that demonstrate elevated levels originate from samples collected on or after the July 5th waterline event at LA5.0. $Uranium^{234}$ values for five samples collected on July 5th range from 5.8 pCi/g to 6.7 pCi/g. Another sample collected on August 9th, 2008 was 2.8 pCi/g.

Uranium^{235} measurements in water are similar to the high uranium^{234} levels and reflect the large SSC found in water from large flood events.

Six values calculated from measurements in water and their associated suspended sediment concentration, and considered detections exceed the 0.18 pCi/g UTL for uranium^{235} in sediment. One 0.22 pCi/g value was derived from a non-detect in a sample collected at PU0.3 on August 22, 2003. One elevated value originated from the baseline station PU6.4 collected on September 3rd, 2003. Its value is 0.19 pCi/g. The remaining five measurements that exceed the reference UTL originate from the TA-21 waterline break and range from 0.22 pCi/g to 0.33 pCi/g.

Like the other uranium measurements, uranium^{238} also demonstrates elevated measurements in water when large SSC levels are present.

The sediment UTL for uranium^{238} is 2.3 pCi/g. One measurement from a baseline station LA6.6 contained a 2.8 pCi/g value. The five samples collected during the TA-21 waterline event contain uranium^{238} at concentrations greater than the reference values. They range from 2.6 pCi/g to 3.5pCi/g. The remaining July 5th sample was just under the references at 2.6 pCi/g.

Only 37 americium^{241} alpha spectroscopy measurements were made of which five originate from baseline conditions. Although the conclusions based on references developed from such a small population of data are limited in value, they do reflect similar assessments as those made from other radiochemical data sets. Twelve samples contain elevated americium^{241} measurements above a 0.39 pCi/g sediment UTL. Nine originate from samples collected at LA5.0 during and after the TA-21 waterline break. All nine samples were collected from two flows, July 5th and August 9th. The values range from 0.9 pCi/g to 18 pCi/g. Three additional samples from Pueblo Canyon at stations PU0.3 and PU3.1 contain elevated americium^{241}. Two samples collected during a September 6th event at PU0.3 contained 0.4 pCi/g values. The remaining PU3.1 sample collected July 15th, 2005 is also measured at 0.4 pCi/g.

Sixty strontium^{90} measurements were made of which 18 are from baseline stations. Eleven strontium values in water appear elevated, not all of which are due to high SSC values. In some cases the elevated strontium in sediments are enough to elevate low SSC samples above the water UTL. Except for a sample collected at DP-0.1/DPS-4 that was not measured for SSC, the sediment evaluation captures those samples likely impacted by the Laboratory. The value measured in water at DP0.1 is 18 pCi/L, well over the 3.6 pCi/L water UTL.

The sediment UTL for strontium^{90} is 1.90 pCi/g. Eighteen samples exceed this level. The baseline station LA6.6 produced a sample that appears elevated. A sample collected August 24th, 2005 at this station was measured at 2 pCi/g. The remaining elevated samples originate from Los Alamos Canyon stations. Three samples from E042 samples collected from two August 2005 events contained levels that ranged from 2.9 pCi/g to 10.6 pCi/g. Eleven samples with elevated strontium levels were collected from LA5.0, eight of which were collected after the waterline break at TA-21. The values range from 2 pCi/g to 9.7 pCi/g. Three additional samples are from the LA0.7 station just above the Rio Grande. From two events in 2005, August 12th and August 24th, strontium was measured between 2.5 pCi/g to 4.4 pCi/g.

Sixty samples were also measured for $cesium^{137}$, of which only four contained detectable levels. The detection limits range from 1.4 pCi/g to 180 pCi/g and average 12 pCi/g. The four samples that contained measureable $cesium^{137}$ include three samples at LA0.7 collected from two events in 2005, August 12 and August 24th. The values range from 0.6 pCi/g to 1.8 pCi/g. The remaining sample was collected at E042 on August 25th, 2005. Its value is 0.7 pCi/g.

Table 22 contains the measurements discussed above. Those stations that are shaded green represent areas we consider baseline, PU6.4, PU5.5, and LA6.6. They are nearest to the heads of their respective watersheds, but in one case has demonstrated some impacts from Laboratory operations. The Rio Grande station, also shaded green, is considered background and impacted only by atmospheric contaminants. Upper tolerance values are developed for this baseline/background data population of contaminants in stormwater and the associated sediments. They reflect the highest measurement for this population at a 95% probability. It is not intended to represent a background reference level for stormwater samples or the associated suspended sediments. It does identify what we define as extraordinary measurements for this data population. The columns shaded tan represents contaminant concentrations in sediments. The concentrations are calculated based on the suspended sediment concentration and contaminant concentration in water. Values that exceed the UTLs for water and sediments are preceded by an X and represent extraordinary measurements. Values that are not preceded by an X do not preclude them as potentially impacted by Laboratory operations. Descriptive statistics for each contaminant data set are listed at the bottom of the table. The Baseline UTL is developed from only the stations identified as baseline or background. Generally, extraordinary values in water reflect samples collected from large storm events that carried high levels of suspended sediments. Extraordinary values in sediments identify some environmental excursion, for example the July 5th, 2008 waterline break at TA-21 that made increasing amounts of contaminants available for transport. Another example includes the August 9th sample at LA5.0 that we suspect contains a suspended sediment measurement error. The row that includes those values is shaded in yellow.

Table 23 Additional Radiochemical Measurements

LOCATION	DATE / TIME	Gross A RESULT pCi/L	Gross A UNCERT	Gross A MDA	Gross A RESULT pCi/G	Gross A QUAL	Gross B RESULT pCi/L	Gross B UNCERT	Gross B MDA	Gross B RESULT pCi/G	Gross B QUAL	Sr-90 RESULT pCi/L	Sr-90 UNCERT	Sr-90 MDA	Sr-90 RESULT pCi/G	Sr-90 QUAL	Cs-137 RESULT pCi/L	Cs-137 UNCERT	Cs-137 MDA	Cs-137 QUAL	Cs-137 RESULT pCi/G
PU-6.4	8/11/03 18:06	1230	300	130			1880	340	150												
PU-6.4	8/11/03 18:27	800	200	70	23		1425	260	50	41											
PU-0.3	8/11/03 23:44	436	88	14			460	84	11												
PU-0.3	8/11/03 23:52	292	60	9	37		396	76	9	51											
PU-0.3	8/12/03 0:44	237	48	9	48		264	48	7	54											
PU-0.3	8/12/03 1:44	126	26	4	42		184	36	5	61											
PU-0.3	8/22/03 13:48	395	90	24	16		625	120	25	26											
PU-0.3	8/22/03 14:26	184	36	6	44		227	42	7	54											
PU-0.3	8/22/03 15:11	253	52	7	45		294	58	8	53											
PU-6.4	8/23/03 14:45	2320	560	200	24		3630	640	150	38											
PU-6.4	8/30/03 0:52	909	200	60	38		1150	110	37	48											
PU-6.4	9/3/03 16:58	815	200	67	17		1900	340	75	40											
PU-6.4	9/6/03 16:54	890	190	55			1650	300	55												
PU-0.3	9/6/03 19:53	1010	220	55	33		1060	200	35	35											
PU-0.3	9/6/03 19:53	670	140	35			1125	208	35												
PU-0.3	9/6/03 20:38	602	124	30	26		810	160	25	35											
PU-0.3	9/6/03 22:38	486	100	13	71		370	70	11	54											
DP-0.1/DPS-4	8/12/05 15:00	9.8	1.7	0.45			46	7.5	1			18.00	4.4	0.71			0.85	2.7	4.7	U	
LA-0.7	7/17/05 17:56	480	91	46	15	M3	730	130	80	22	M3	3.90	5.8	9.5	0.12	U,M	3.90	23	39	U,M	
LA-0.7	7/17/05 19:56	56	11	6.3	8	M3	91	17	12	13	M3	1.40	1.2	1.9	0.19	U,M	2.50	6	10	U,M	
LA-0.7	7/17/05 21:56	70	13	5.2	20	M3	110	19	11	31	M3	0.78	0.52	0.79	0.22	U	0.56	2.9	4.9	U	
LA-0.7	7/17/05 23:56	16	3	1.3	7		36	6.1	2.8	16		0.48	0.32	0.49	0.21	U	-1.00	1.6	2.7	U	
LA-0.7	8/12/05 14:21	75	14	5	39	M3	120	21	11	62	M3	1.00	0.38	0.56	0.52		5.80	3.5	5.2	M3	1.81
LA-0.7	8/12/05 16:21	38	6.8	2.4	28		59	10	4.8	43	M3	1.40	0.39	0.37	1.03		3.90	2.8	4.3	U	
LA-0.7	8/12/05 18:21	25	4.6	2	36		61	10	3.6	88		2.90	0.78	0.53	4.20		2.00	2	3.2	U	
LA-0.7	8/12/05 20:21	13	2.3	0.89	23		40	6.6	2.1	71		2.50	0.75	0.78	4.45		-0.71	1.9	3.3	U	
LA-0.7	8/24/05 18:37	250	43	9.1	33	M3	300	51	22	40	M3	0.98	0.42	0.55	0.13	LT	17.00	10	16	M3	1.33
LA-0.7	8/24/05 20:37	130	22	4.8	51	M3	170	29	11	67	M3	3.00	0.81	0.59	1.18		6.20	1.4	1.8		0.55
LA-0.7	8/24/05 22:37	66	11	2.4	48		87	14	5.1	64	M3	3.90	1	0.56	2.86		0.57	2.8	4.8	U	
LA-0.7	8/25/05 18:20	110	19	5.7	28	M3	160	27	11	41	M3	1.90	0.61	0.63	0.48		2.40	4	6.7	U,M	
LA-6.6	8/12/05 14:50	8.8	1.7	0.92	39		21	3.5	1.7	94		0.23	0.31	0.51	1.03	Y2,U	-0.42	1.7	2.9	U	
LA-6.6	8/12/05 22:34	49	8.6	2.4	19		79	13	5.1	31	M3	0.81	0.38	0.65	0.32	Y1,LT	0.83	0.87	1.4	U	
LA-6.6	8/13/05 0:04	14	2.6	1.2	18		29	5	2.2	36		0.87	0.9	1.4	1.09	U,M	2.20	2	3.1	U	
LA-6.6	8/13/05 1:36	7.6	1.4	0.61	28		16	2.7	1.2	60		0.08	0.83	1.4	0.22	U,M	-0.11	2.2	3.8	U	
LA-6.6	8/13/05 3:36	5.5	1.1	0.61	42		13	2.2	1.2	99		0.05	1.3	2.1	0.36	U,M	0.79	1.8	2.7	U	
LA-6.6	8/22/05 13:39	240	41	9.6	26	M3	330	56	23	39	M3	2.40	0.92	1.2	0.28	M3	4.00	7.7	13	U,M	
LA-6.6	8/22/05 15:09	17	2.9	0.92	42		29	4.9	1.8	72		0.56	0.77	1.2	1.38	U,M	1.40	2.8	4.3	U	
LA-6.6	8/24/05 15:42	220	38	9.1	23	M3	250	44	22	26	M3	6.30	1.5	0.52	0.66		0.93	9.3	16	U,M	
LA-6.6	8/24/05 16:32	98	17	5.1	26	M3	140	24	11	37	M3	2.40	0.71	0.66	0.63		2.20	2.9	4.7	U	
LA-6.6	8/24/05 18:02	22	3.9	1.1	27		37	6.2	2.7	45		0.86	0.41	0.58	1.05	LT	0.81	2.7	4.6	U	
LA-6.6	8/24/05 19:32	12	2.2	0.99	29		23	4	1.8	55		0.83	0.39	0.56	1.99	LT	1.00	2.6	4.5	U	
E042	8/12/05 14:26	27	4.7	1.3	43		60	9.9	2.3	96		6.60	1.6	0.67	10.59		3.30	2.7	4.2	U	
E042	8/25/05 17:16	82	14	4	30	M3	140	23	7.3	52	M3	8.00	2	0.8	2.95		6.50	1.8	2.4		0.86
E042	8/25/05 18:47	17	2.9	0.95	24		45	7.4	1.8	63		7.40	1.9	0.86	10.29		2.70	3	4.9	U	
PU-3.1	7/15/05 17:56	250	44	12	8	M3	290	50	24	9	M3	8.40	5.5	8.3	0.27	M3	11.00	8.7	14	U,M	
PU-3.1	7/15/05 19:06	26	4.6	1.3	2		42	7	2.7	4		2.50	2.9	4.7	0.23	Y2,U,M	-0.41	9.4	16	U,M	
PU-4.1	7/15/05 17:28	180	32	11	5	M3	210	38	23	6	M3	8.00	4.6	6.7	0.24	M3	-2.20	26	48	U,M	
PU-4.1	7/15/05 18:18	26	4.9	2.4	2		38	7.1	5.1	3	M3	2.60	1.9	2.9	0.21	U,M	4.80	11	18	U,M	
PU-4.1	7/15/05 19:58	71	13	5.2	19	M3	91	17	11	24	M3	1.50	0.62	0.8	0.40		0.50	3.5	5.9	U,M	
LA-5.0	8/6/07 19:31	530	90	18	48	M3	510	83	23	46	M3										
LA-5.0	8/29/07 16:49											4.50	1.1	0.6	0.59		7.80	5.8	9.2	U	
LA-5.0	8/29/07 19:45	51	8.7	1.7	62		78	13	3.9	94		3.50	0.9	0.46	4.24		5.50	5.9	9.6	U	
LA-5.0	9/1/07 16:10	180	31	9.1	46	M3	210	38	24	53	M3	3.60	0.97	0.72	0.92		-1.90	5.5	9.8	U	
LA-5.0	9/1/07 17:36	84	15	3.9	30	M3	110	19	8.4	40	M3	1.80	0.53	0.55	0.65		4.00	4.6	7.6	U	
LA-5.0	9/1/07 19:06	60	14	4.1	54	M3	130	22	6.2	87	M3	3.20	0.6	0.43	2.14		0.39	4.5	7.8	U	
LA-5.0	9/2/07 16:45	220	40	15	23	M3	370	63	24	39	M3										
LA-5.0	9/2/07 18:15											3.50	1	1.1		M3	0.47	5.7	10	U	
LA-5.0	9/2/07 19:45											3.80	1	0.73	3.18		0.66	5.7	9.9	U	

Table 22 Additional Radiochemical Measurements - Continued

LOCATION	DATE / TIME		Gross A RESULT pCi/L	Gross A UNCERT	Gross A MDA		Gross A RESULT pCi/G	Gross A QUAL		Gross B RESULT pCi/L	Gross B UNCERT	Gross B MDA		Gross B RESULT pCi/G	Gross B QUAL		Sr-90 RESULT pCi/L	Sr-90 UNCERT	Sr-90 MDA		Sr-90 RESULT pCi/G	Sr-90 QUAL	Cs-137 RESULT pCi/L	Cs-137 UNCERT	Cs-137 MDA	Cs-137 QUAL	Cs-137 RESULT pCi/G
PU-5.5	7/14/07 18:02		22	4.1	1.2		28			28	4.8	2.4		35													
PU-5.5	7/14/07 19:02		63	9.7	3.7		26	M3		93	16	7.5		45	M3												
PU-5.5	7/14/07 20:02		33	5.8	1.6		34			36	6.2	3.2		37													
PU-5.5	7/26/07 14:16		250	45	14		19	M3		360	61	24		27	M3												
PU-5.5	7/26/07 15:15		110	20	6.1		31	M3		160	27	13		48	M3												
PU-5.5	7/26/07 16:15		38	6.4	1.9		30			60	10	4.1		50	M3												
PU-5.5	7/26/07 17:15		11	2.5	1.3		28			25	4.5	3.1		60													
PU-5.5	7/26/07 18:15		5.1	2	2.1		28			16	3.5	3.4		87													
PU-5.5	8/4/07 14:16		35	6.7	3.1		18	M3		68	12	5.6		35	M3												
PU-5.5	8/4/07 15:15		9.9	2.4	1.4		19			20	3.7	2.7		38													
PU-5.5	8/4/07 16:15		4.2	1.3	1.1		25			11	2.3	2.2		65													
PU-5.5	8/4/07 17:15		2.7	1.1	1.4		31	LT		7.9	1.9	2.2		90													
PU-5.5	8/4/07 18:15		1	0.97	1.8			U		7.5	2	2.9															
PU-5.5	9/1/07 14:38		120	21	6		25	M3		160	27	10		33	M3												
PU-5.5	9/1/07 15:37		47	8.6	3.5			M3		77	13	6.9			M3												
PU-5.5	9/1/07 16:37		14	3.1	1.6		26			24	4.4	2.5		45													
PU-5.5	9/1/07 17:37		5.6	1.7	1.4		26			17	3.2	2.3		78													
PU-5.5	9/1/07 18:37		4.2	1.7	1.9	x	48			12	2.8	3.2	x	138													
AC-0.2	7/14/07 17:47		110	19	4		18	M3		100	17	7.2		17	M3												
AC-0.2	7/30/07 13:24		46	8	1.9		37			57	9.5	3.7		45													
AC-0.2	8/4/07 14:02		87	16	5.7			M3		75	14	11		37	M3												
AC-0.2	8/4/07 14:22		79	13	2.7	x	89			54	9.2	4.2		61	M3												
AC-0.2	8/18/07 13:16		31	5.5	1.7		12			34	6	3.2		13													
AC-0.2	8/18/07 13:34		41	7	1.7		39			44	7.5	3.3		42													
AC-0.2	8/29/07 15:02		220	37	5.1		24	M3		170	28	12		18	M3												
AC-0.2	8/29/07 15:20		83	14	2.3		28			66	11	4.1		20	M3												
AC-0.2	8/29/07 15:40		49	8.4	1.6		26			44	7.5	3.5		24													
AC-0.2	8/29/07 16:00		21	4.2	1.4		24			29	3.9	3.2		23													
AC-0.2	8/29/07 16:20		88	15	4.5	x	143	M3		73	13	6.1	x	119	M3												
AC-0.2	9/1/07 14:28		75	13	3		32	M3		76	13	5.8		32	M3												
AC-0.2	9/1/07 14:46		41	7.1	1.6		42			38	6.4	2.7		39													
AC-0.2	9/1/07 15:06		33	6.2	1.8	x	44			26	4.7	2.8		35													
AC-0.2	9/1/07 16:19		450	76	12	x	44	M3		370	61	21		36	M3												
PU-0.3	8/6/07 20:01		240	43	12		24	M3		230	41	23		23	M3												
PU-0.3	8/6/07 20:46																										
PU-0.3	8/6/07 21:31		6.5	2.2	1.9		13			34	5.8	3		52													
PU-0.3	8/6/07 22:16		2.8	1.3	2		6	LT			4.4	2.7															
PU-0.3	8/6/07 23:01		2.5	1.1	1.5		8	LT		18	3.4	2.3		56													
LA-5.0	7/5/08 16:02		150	25	1.8	x	208			36	6.4	4		50			1.30	0.46	0.56		1.81		0.24	3.2	5.5	U,M	
LA-5.0	7/5/08 16:47		120	19	1.7	x	231			27	5	3.5		52			1.30	0.44	0.52	x	2.50		-3.30	3.1	5.4	U,M	
LA-5.0	7/5/08 17:37		82	14	1.7	x	155			29	5.2	3.1		55			1.40	0.49	0.66	x	2.84		-0.19	2.4	4.1	U	
LA-5.0	7/5/08 18:17		77	13	1.8	x	167			25	4.7	3.4		54			1.10	0.44	0.67	x	2.39		0.12	3.9	6.6	U,M	
LA-5.0	7/5/08 19:17		44	7.6	1.1	x	107			17	3.3	2.7		41			1.20	0.42	0.53	x	2.93		-3.20	3.2	5.6	U,M	
LA-0.7	7/22/08 15:47	x	1900	350	130		19	M3	x	2900	490	190		29	M3		1.60	3.5	5.7		0.02	U,M	57.00	110	180	U,M	
BM @ Rio Grande	7/26/08 22:03		23	4.5	2.2		19	M3		35	6.2	3.8		29	M3		0.04	0.29	0.86		0.04	U	-3.00	2.8	5	U	
LA-5.0	8/9/08 15:49		180	31	5.4	x	82	M3		190	31	7.7		66	M3		2.60	0.79	0.75		0.90		2.80	2.9	4.6	U	
LA-5.0	8/9/08 16:34		110	19	3	x	61	M3		120	20	6.1		67	M3		3.20	0.86	0.56		1.78		1.30	2.8	4.7	U	
LA-5.0	8/9/08 17:19		64	11	1.7	x	229			61	10	3.1	x	218			2.90	0.77	0.46	x	10.38		2.30	2.9	4.8	U	
LA-5.0	8/9/08 18:04		29	5.8	2.2	x	49			44	7.6	3.5		75			3.60	0.92	0.44	x	6.10		1.90	2.8	4.6	U	
LA-5.0	8/9/08 19:04		13	2.8	1.7		38			30	5.2	2.4		88			3.30	0.87	0.45	x	9.71		-4.80	3.3	5.8	U,M	
LA-0.7	8/20/08 16:40		4.1	1.9	2.8		0			5.4	1.8	2.9		0			-0.01	0.49	0.83		0.00	U	6.10	14	23	U,M	
LA-5.0	8/23/08 7:40		140	24	6.7	x	54	M3		180	30	11		69	M3	x	5.20	1.3	0.35	x	2.00		2.50	2.3	3.7	U	
BM @ Rio Grande	8/24/08 19:59		12	2.6	2		10			21	3.9	2.8		18			0.02	0.18	0.4		0.01	U	-1.50	3	5.2	U,M	
BM @ Rio Grande	8/24/08 21:57		90	17	8		24	M3		100	18	10		26	M3		0.32	0.24	0.46		0.08	U	-0.23	4	6.7	U,M	
BM @ Rio Grande	9/9/08 22:28		16	3.1	2.1		17			22	4.2	3.3		25			-0.09	0.19	0.41		-0.10	U	-2.20	2.5	4.3	U	
BM @ Rio Grande	9/9/08 23:26		8.8	2.6	2.5		19			13	3	3.4		28			0.14	0.17	0.34		0.31	U	0.16	2.6	4.4	U	
BM @ Rio Grande	10/11/08 19:47		420	77	32		22	M3		500	89	53		26	M3		-0.17	0.82	1.4		-0.01	U,M	-3.90	17	29	U,M	
BM @ Rio Grande	10/11/08 21:44		610	110	44		25	M3		720	130	74		30	M3		-0.09	0.98	1.8		0.00	U,M	-7.80	18	32	U,M	
LA-5.0	10/11/08 18:08		74	13	3.2	x	49	M3		96	18	4.4		65	M3		3.60	0.87	0.32	x	2.33		2.20	2.9	4.7	U	
Descriptive stats for whole data set																											
mean			196				40			272				48			2.65				1.85		2.45				
max			2320				231			3630				218			18.00				10.59		57.00				
min			1				0			5				0			-0.17				-0.10		-7.80				
count			113				105			112				105			60.00				58.00		60.00				
75th			220				43			228				61			3.50				2.38		2.93				
25th			22				20			33				30			0.83				0.22		-0.20				
outlier			493				75			564				95			6.66				5.08		7.14				
UTL from Baseline data set																											
standard dev			511				8			895				26			1.40				0.57						
Baseline UTL mean+2SD			1342				42			2325				100			3.63				1.90						

Table 22 Additional Radiochemical Measurements - Continued

LOCATION	DATE / TIME	U-234 RESULT pCi/L	U-234 UNCERT	U-234 MDA	U-234 RESULT pCi/G	U-234 QUAL	U-235 RESULT pCi/L	U-235 UNCERT	U-235 MDA	U-235 RESULT pCi/G	U-235 QUAL	U-238 RESULT pCi/L	U-238 UNCERT	U-238 MDA	U-238 RESULT pCi/G	U-238 QUAL	Am-241 RESULT pCi/L	Am-241 UNCERT	Am-241 MDA	Am-241 RESULT pCi/G	Am-241 QUAL	SSC mg/L
PU-6.4	8/11/03 18:00	61.5	10	7			3.50	2.8	7		U	74.0	10	4			0.60	3.8	10		U	
PU-6.4	8/11/03 18:27	28.1	4.4	4	0.8		1.00	1.4	3.2	0.0285714	U	32.2	4.8	1.8	0.9		1.25	1.8	4	0.04	U	35000
PU-0.3	8/11/03 23:44	15.2	2.6	2.2			1.50	1	1.8		U	14.4	2.4	1.2			6.60	2.8	5			
PU-0.3	8/11/03 23:52	8.3	2.2	3.7	1.1		-0.50	1.2	3.3	-0.0641026	U	9.1	2	1.8	1.2		2.20	2	4	0.28	U	7800
PU-0.3	8/12/03 0:44	7.2	1.4	1.4	1.5		-0.32	0.42	1.3	-0.0653061	U	8.2	1.4	0.7	1.7		0.80	1	2	0.16	U	4900
PU-0.3	8/12/03 1:44	5	1	0.9	1.7		0.20	0.32	0.8	0.0666667	U	4.9	1	0.5	1.6		1.80	1	1.9	0.60	U	3000
PU-0.3	8/22/03 13:46	29.6	4.4	2.3	1.2		1.80	1	2	0.075	U	32.3	4.6	1.3	1.3		3.50	2.4	5	0.15	U	24000
PU-0.3	8/22/03 14:26	9	1.6	1.1	2.1		0.91	0.5	1	0.2166667	U	7.8	1.4	0.7	1.9		1.80	1.4	2.8	0.43	U	4200
PU-0.3	8/22/03 15:11	7.6	1.6	1.5	1.4		0.47	0.56	1.4	0.0839286	U	7.4	1.4	0.9	1.3		2.40	1.6	3.7	0.43	U	5600
PU-6.4	8/23/03 14:45	107	18	15	1.1		10.00	6	13	0.1052632	U	118.0	18	8	1.2		17.00	8	16	0.18		95000
PU-6.4	8/30/03 0:52	30.4	5.4	4.4	1.3		2.10	1.8	3.9	0.0875	U	32.3	5.4	2.5	1.3		3.90	4	10	0.16	U	24000
PU-6.4	9/3/03 16:58	84	12	5	1.8		9.00	3	4	0.1875		85.0	12	3	1.8		14.00	5	10	0.29		48000
PU-6.4	9/6/03 16:54	58	8	4.4			5.30	2.4	3.8			55.5	8	2.8			8.30	6	14		U	
PU-0.3	9/6/03 19:53	39	6.4	5	1.3		2.30	1.8	4	0.0741935	U	36.9	6	3	1.2		11.70	5.8	11	0.38		31000
PU-0.3	9/6/03 19:53																					
PU-0.3	9/6/03 20:38	15.5	4.4	7	0.7		-1.60	2.2	7	-0.0695652	U	17.2	3.8	4	0.7		3.20	3.4	8	0.14	U	23000
PU-0.3	9/6/03 22:38	10.2	2	2.4	1.5		-0.20	0.8	2.1	-0.0294118	U	12.0	2	1.2	1.8		3.00	1.6	3	0.44		6800
DP-0.1/DPS-4	8/12/05 15:00	0.37	0.074	0.016			0.01	0.01	0.013		U	0.2	0.048	0.014								
LA-0.7	7/17/05 17:56	27	5.4	0.56	0.8	M3	1.10	0.78	0.34	0.0334944	M3	28.0	5.6	0.68	0.9	M3	-0.07	0.65	0.98	0.00	U,M	32841.33
LA-0.7	7/17/05 19:56	6.6	1.3	0.12	0.9		0.39	0.22	0.075	0.05382		6.7	1.3	0.15	0.9		0.08	0.1	0.076	0.01	LT	7246.38
LA-0.7	7/17/05 21:56	3.9	0.74	0.13	1.1		0.23	0.12	0.087	0.085		3.6	0.7	0.098	1.0		0.08	0.083	0.065	0.02	Y2,LT	3538.46
LA-0.7	7/17/05 23:56	1.6	0.33	0.037	0.7		0.07	0.051	0.022	0.0326083	LT	1.2	0.26	0.037	0.5		0.02	0.027	0.042	0.01	U	2269.5
LA-0.7	8/12/05 14:21	2	0.33	0.005	1.0		0.12	0.037	0.016	0.0621176	LT	1.8	0.3	0.02	0.9							1931.82
LA-0.7	8/12/05 16:21	1.2	0.21	0.013	0.9		0.08	0.026	0.0043	0.0601332	LT	1.1	0.18	0.0099	0.8							1363.64
LA-0.7	8/12/05 18:21	0.76	0.13	0.021	1.1		0.04	0.019	0.013	0.0606906	LT	0.6	0.11	0.02	0.9							689.66
LA-0.7	8/12/05 20:21	0.65	0.12	0.014	1.2		0.04	0.017	0.013	0.0622998	LT	0.5	0.099	0.004	0.9							561.8
LA-0.7	8/24/05 18:37	5.2	0.87	0.05	0.7		0.22	0.092	0.059	0.0293333		4.5	0.76	0.05	0.6							7500
LA-0.7	8/24/05 20:37	2.2	0.36	0.025	0.9		0.11	0.04	0.02	0.0432144	LT	2.0	0.33	0.025	0.8							2545.45
LA-0.7	8/24/05 22:37	1.3	0.22	0.024	1.0		0.06	0.023	0.015	0.0454665	LT	1.3	0.21	0.016	1.0							1363.64
LA-0.7	8/25/05 18:20	2.6	0.44	0.049	0.7		0.15	0.054	0.028	0.038603	LT	2.4	0.41	0.043	0.6							3885.71
LA-6.6	8/12/05 14:50	0.45	0.086	0.019	2.0		0.03	0.016	0.013	0.1301616	LT	0.4	0.077	0.017	1.8							222.8
LA-6.6	8/12/05 22:34	1.8	0.3	0.043	0.7		0.14	0.043	0.024	0.0556315	LT	1.8	0.29	0.014	0.7							2516.56
LA-6.6	8/13/05 0:04	0.67	0.12	0.017	0.8		0.03	0.016	0.015	0.03875	LT	0.6	0.11	0.013	0.8							800
LA-6.6	8/13/05 1:36	0.43	0.081	0.012	1.6		0.03	0.016	0.012	0.1237485	LT	0.5	0.086	0.012	1.7							266.67
LA-6.6	8/13/05 3:36	0.35	0.069	0.017	2.7		0.02	0.013	0.011	0.1747986	LT	0.4	0.072	0.018	2.8							131.58
LA-6.6	8/22/05 13:39	16	2.5	0.072	1.9		1.20	0.28	0.11	0.1406557		14.0	2.3	0.057	1.6							8531.47
LA-6.6	8/22/05 15:09	0.58	0.1	0.019	1.4		0.05	0.019	0.0042	0.1208653	LT	0.6	0.1	0.021	1.4							405.41
LA-6.6	8/24/05 15:42	6.9	1.2	0.17	0.7		0.34	0.14	0.13	0.0356761		8.9	1.2	0.13	0.7							9530.2
LA-6.6	8/24/05 16:32	2.9	0.49	0.047	0.8		0.19	0.064	0.031	0.0502143	LT	3.1	0.51	0.043	0.8							3783.78
LA-6.6	8/24/05 18:02	0.82	0.14	0.019	1.0		0.04	0.016	0.011	0.0453248	LT	0.8	0.13	0.016	1.0							816.33
LA-6.6	8/24/05 19:32	0.55	0.089	0.016	1.3		0.04	0.018	0.017	0.0863993	LT	0.5	0.096	0.021	1.2							416.67
E042	8/12/05 14:26	0.53	0.096	0.012	0.9		0.03	0.017	0.017	0.0529695	LT	0.5	0.09	0.019	0.8							623
E042	8/25/05 17:16	1.6	0.27	0.02	0.6		0.07	0.027	0.016	0.025421	LT	1.3	0.23	0.017	0.5							2714.29
E042	8/25/05 18:47	0.58	0.11	0.018	0.8		0.04	0.02	0.017	0.0597704	LT	0.5	0.089	0.02	0.7							719.42
PU-3.1	7/15/05 17:56	32	6.4	0.83	1.0	M3	1.70	0.99	0.37	0.0537755	M3	31.0	6.2	0.32	1.0	M3	6.40	1.9	0.53	0.20	M3	31612.9
PU-3.1	7/15/05 19:06	10	2	0.22	0.9	M3	0.57	0.32	0.11	0.0533462		11.0	2.1	0.27	1.0	M3	4.10	1.2	0.32	0.38	M3	10684.93
PU-4.1	7/15/05 17:28	20	4.3	0.95	0.8	M3	0.47	0.58	0.97	0.0140145	U,M	19.0	4.2	0.75	0.8	M3	4.10	1.5	0.29	0.12	M3	33536.59
PU-4.1	7/15/05 18:18	8.5	1.8	0.34	0.7	M3	0.51	0.33	0.25	0.04131	M3	8.7	1.8	0.26	0.7	M3	1.10	0.4	0.19	0.09	M3	12345.68
PU-4.1	7/15/05 19:58	3.5	0.68	0.13	0.9		0.20	0.11	0.089	0.0533333		3.5	0.68	0.1	0.9		0.57	0.23	0.11	0.15	M3	3750
LA-5.0	8/6/07 19:31																					11043
LA-5.0	8/29/07 16:49																					7659
LA-5.0	8/29/07 19:45																					826
LA-5.0	9/1/07 16:10																					3930
LA-5.0	9/1/07 17:36																					2774
LA-5.0	9/1/07 19:06																					1494
LA-5.0	9/2/07 16:45																					9397
LA-5.0	9/2/07 18:15																					
LA-5.0	9/2/07 19:45																					1196

Table 22 Additional Radiochemical Measurements - Continued

LOCATION	DATE / TIME	U-234 RESULT pCi/L	U-234 UNCERT	U-234 MDA		U-234 RESULT pCi/G	U-234 QUAL	U-235 RESULT pCi/L	U-235 UNCERT	U-235 MDA		U-235 RESULT pCi/G	U-235 QUAL	U-238 RESULT pCi/L	U-238 UNCERT	U-238 MDA		U-238 RESULT pCi/G	U-238 QUAL	Am-241 RESULT pCi/L	Am-241 UNCERT	Am-241 MDA		Am-241 RESULT pCi/G	Am-241 QUAL	SSC mg/L
PU-5.5	7/14/07 18:02																									793
PU-5.5	7/14/07 19:02																									2068
PU-5.5	7/14/07 20:02																									966
PU-5.5	7/26/07 14:15																									13440
PU-5.5	7/26/07 15:15																									3500
PU-5.5	7/26/07 16:15																									1193
PU-5.5	7/26/07 17:15																									416
PU-5.5	7/26/07 18:15																									184
PU-5.5	8/4/07 14:16																									1959
PU-5.5	8/4/07 15:15																									521
PU-5.5	8/4/07 16:15																									169
PU-5.5	8/4/07 17:15																									88
PU-5.5	8/4/07 18:15																									
PU-5.5	9/1/07 14:38																									4882
PU-5.5	9/1/07 15:37																									
PU-5.5	9/1/07 16:37																									534
PU-5.5	9/1/07 17:37																									217
PU-5.5	9/1/07 18:37																									87
AC-0.2	7/14/07 17.47																									6057
AC-0.2	7/30/07 13.24																									1258
AC-0.2	8/4/07 14.02																									2013
AC-0.2	8/4/07 14.22																									885
AC-0.2	8/18/07 13.16																									2646
AC-0.2	8/18/07 13.34																									1048
AC-0.2	8/29/07 15.02																									9290
AC-0.2	8/29/07 15.20																									3253
AC-0.2	8/29/07 15.40																									1856
AC-0.2	8/29/07 16.00																									877
AC-0.2	8/29/07 16.20																									816
AC-0.2	9/1/07 14.28																									2343
AC-0.2	9/1/07 14.46																									980
AC-0.2	9/1/07 15.06																									750
AC-0.2	9/1/07 16.19																									10198
PU-0.3	8/6/07 20.01																									9965
PU-0.3	8/6/07 20.46																									
PU-0.3	8/6/07 21.31																									652
PU-0.3	8/6/07 22.16																									475
PU-0.3	8/6/07 23.01																									321
LA-5.0	7/5/08 16.02	4.5	0.83	0.053	x	6.3		0.20	0.074	0.015	x	0.28	LT	2.3	0.44	0.041	x	3.2		13.00	2	0.015	x	18.06		720
LA-5.0	7/5/08 16.47	3.5	0.62	0.0091	x	6.7		0.13	0.05	0.011	x	0.25	LT	1.8	0.34	0.028	x	3.5		8.10	1.3	0.018	x	15.58		520
LA-5.0	7/5/08 17:37	3.1	0.58	0.041	x	5.8		0.14	0.054	0.026	x	0.26	LT	1.4	0.28	0.032	x	2.6		6.30	1	0.0058	x	11.89		530
LA-5.0	7/5/08 18:17	3.1	0.58	0.084	x	6.7		0.15	0.066	0.053	x	0.33	LT	1.5	0.3	0.061	x	3.3		5.60	0.92	0.0066	x	12.17		460
LA-5.0	7/5/08 19:17	2.5	0.47	0.032	x	6.1		0.09	0.045	0.013	x	0.22	LT	1.3	0.27	0.026	x	3.2		4.50	0.74	0.018	x	10.96		410
LA-0.7	7/22/08 15.47	x 93	17	1.1		0.9	M3	5.50	2	1.3		0.06	M3	x 97.0	17	1		1.0	M3	0.65	0.61	0.67		0.01	U,M	99000
BM @ Rio Grande	7/28/08 22:03																			0.00	0.018	0.037		0.00	U	1200
LA-5.0	8/9/08 15:49	7.1	1.2	0.028		2.4		0.37	0.099	0.011		0.13		5.2	0.9	0.032		1.8		2.60	0.44	0.019	x	0.90		2900
LA-5.0	8/9/08 16:34	5	0.88	0.03	x	2.8		0.25	0.079	0.012		0.14		3.4	0.61	0.01		1.9		2.50	0.42	0.016	x	1.39		1800
LA-5.0	8/9/08 17:19	2.1	0.39	0.04	x	7.5		0.11	0.051	0.048	x	0.39	LT	1.8	0.34	0.047	x	6.4		1.30	0.24	0.018	x	4.64		280
LA-5.0	8/9/08 18.04	1.3	0.26	0.029		2.2		0.05	0.033	0.028		0.09	LT	1.0	0.21	0.01		1.7		0.87	0.15	0.0056	x	1.47		590
LA-5.0	8/9/08 19.04	0.82	0.18	0.029		2.4		0.03	0.024	0.027		0.08	LT	0.6	0.14	0.023		1.8		0.58	0.12	0.025	x	1.71		340
LA-0.7	8/20/08 18.40	12	2	0.084		0.9		0.51	0.17	0.11		0.04		11.0	1.8	0.084		0.8								13000
LA-5.0	8/23/08 7:40	4.4	0.66	0.069		1.7		0.21	0.1	0.031		0.08		3.6	0.72	0.045		1.4								2600
BM @ Rio Grande	8/24/08 19:59	1.8	0.41	0.078		1.5		0.12	0.08	0.075		0.10	LT	1.5	0.36	0.09		1.3								1200
BM @ Rio Grande	8/24/08 21:57	4	0.64	0.079		1.1		0.1	0.082	0.083		0.03	LT	3.8	0.79	0.071		1								3800
BM @ Rio Grande	9/9/08 22:28	1.4	0.33	0.061		1.6		0.029	0.042	0.072		0.03	U	1.1	0.28	0.067		1.3								880
BM @ Rio Grande	9/9/08 23:28	1.2	0.31	0.12	x	2.6		0.0082	0.045	0.07		0.02	U	0.68	0.21	0.067		1.5								458
BM @ Rio Grande	10/11/08 19:47	26	5.2	0.38		1.4	M3	0.92	0.55	0.4		0.05	M3	26	5.1	0.41		1.4	M3							19000
BM @ Rio Grande	10/11/08 21:44	12	2	0.12		0.5		0.77	0.25	0.042		0.03		12	2	0.098		0.5								24000
LA-5.0	10/11/08 18:08	2.5	0.54	0.055		1.7		0.081	0.064	0.056		0.05	LT	2.1	0.47	0.055		1.4								1500
Descriptive stats for whole data set																										
mean		12.8				1.8		0.79				0.08		13.0				1.4		3.90				2.45		
max		107.0				7.5		10.00				0.39		116.0				6.4		17.00				18.06		
min		0.4				0.5		-1.60				-0.07		0.2				0.5		-0.07				0.00		
count		68.0				64.0		68.00				64.00		68.0				64.0		37.00				34.00		
75th		12.0				1.7		0.53				0.10		12.0				1.7		5.60				1.27		
25th		1.4				0.9		0.04				0.04		1.2				0.8		0.80				0.13		
outlier		28.7				3.0		1.51				0.18		29.2				2.7		11.10				4.16		
UTL from Baseline data set																										
standard dev		28.0				0.6		2.65				0.05		30.2				0.5		6.84				0.12		
Baseline UTL mean+2SD		73.4				2.5		6.63				0.18		78.6				2.3		20.13				0.37		

Metals evaluation

Fifty-three stormwater samples collected from Pajarito Plateau during 2005, 2006, and 2008 were submitted to analytical laboratories for dissolved metal analysis, and 73 samples during 2003, 2005, 2007, and 2008 were submitted for total metal analysis. Stormwater samples were also collected in the Rio Grande at Buckman Landing in 2008 and measured for dissolved metals. Calcium, magnesium, silver, aluminum, arsenic, barium beryllium, cadmium cobalt chromium copper iron, mercury, manganese, nickel, lead, antimony, selenium, thallium, uranium vanadium zinc, potassium, sodium are included in most analysis and boron, molybdenum, silica, tin, and strontium were also included in 2003 total metal measurements.

The following assessment includes comparison of the metal analytical values to applicable New Mexico 20.6.4 NMAC Standards for Interstate and Intrastate Surface Waters. Numeric criteria exist for livestock watering, wildlife habitat, and acute aquatic life uses in ephemeral and intermittent portions of watercourses within lands managed by the U.S. Department of Energy. Additional criteria for irrigation exist for the main stem of the Rio Grande at Buckman.

Where applicable criteria do not exist summary statistics will be presented in table format followed by a brief narrative.

Acute aquatic life criteria for dissolved silver, cadmium, chromium, copper, nickel, lead, and zinc are individually calculated for each sample based on water hardness derived from dissolved calcium and magnesium measurements. There are also wildlife habitat criteria for total mercury and selenium. The derived chronic aquatic life criteria normally associated with these acute criteria do not apply to the ephemeral Pajarito Plateau canyon reaches.

There are no dissolved silver, chromium, mercury, or nickel measurements that exceed acute aquatic life criteria. All detection levels are below the criteria, and almost all reported measurements are less than detection levels.

All cadmium measurements are reported less than the average 0.0003 mg/L detection levels. Those levels were adequate to determine that there was not an exceedance of the acute aquatic life criterion.

Most of the reported lead measurements are less than their detection levels (0.0005 mg/L for the watershed samples and 0.000045 mg/L for samples collected in the Rio Grande); although a number of samples are measured above their detections limits only a single measurement collected at LA0.7 on 8/24/2005 (0.06 mg/L) exceeds the lead acute aquatic life criterion (0.04 mg/L).

Most copper measurements are reported above their individual detection levels (0.002 mg/L), and four exceed the acute aquatic life criterion. The samples that exceed the acute criterion were collected at SA6.1 on 8/12/2005 (0.0049mg/L relative to the 0.0038 criterion), LA6.6 on 8/13/2005 (0.0043 mg/L relative to the 0.0032 criterion), and two samples collected in Los Alamos Canyon at Gage E042 on 8/25/2005 (0.0041 mg/L and 0.0058 mg/L relative to their 0.0038 and 0.0048 mg/L derived criteria). Interestingly, the largest copper measurement was at LA0.7 on 8/12/2005. The 0.0079 mg/L measurement is less than its derived 0.0118 mg/L criterion. There are multiple measurements larger than those levels presented above as exceeding a criterion, although their associated hardness levels were relatively larger and because of that difference the individually derived criteria were higher.

Almost all zinc values are reported above their detection levels (0.005 mg/L) and several exceed the acute aquatic life criterion. Acute exceedance measurements are found in samples collected on 7/15/2005 at PU4.1, DP0.1/DPS4, La0.7, on 8/12/2005 at LA6.6, on 8/22/2005 at LA6.6, on 8/23/2008 and 10/11/2008 at LA5.0, and in Los Alamos Canyon at Gage E042 on 8/25/2005.

The zinc value at PU4.1 is 0.068 and greater than its derived 0.064 mg/L criterion, at DP0.1/DPS4 the measured value is 0.045mg/L relative to its criterion of 0.044 mg/L. The samples collected on 8/12/ 2005 at LA0.7 and La6.6 are 0.17 mg/L and 0.077 mg/L relative to the respective 0.104 mg/L and 0.034 mg/L criteria. Another LA6.6 sample collected later in 2005 on 8/22 was measured at 0.049 mg/L and greater than its derived criterion of 0.034 mg/L. Two samples collected at La5.5 in 2008 on 8/23 and 10/11 had zinc values of 0.094 mg/L and 0.19 mg/L and greater than their respective 0.039 mg/L and 0.049 mg/L criteria. The remaining zinc exceedance was from a sample collected during 2005 in Los Alamos Canyon at Gage E042, the value is 0.038 mg/L slightly above a derived 0.037 mg/L criterion.

Most total selenium measurements are reported as non-detects, and of the few values reported above the 0.001 mg/L detection level, none exceeded the 0.005 mg/L wildlife habitat criterion.

Stormwater sample analysis are also compared to livestock watering criteria that exist for dissolved lead, selenium, and vanadium, as well as for total mercury, and wildlife habitat criteria that exist for total mercury and selenium.

Most of the dissolved lead and vanadium measurements are reported as less than 0.0005 mg/L detection limits, and none of the levels exceeded the 0.1 mg/L livestock watering criterion. The detection levels and standards were identical for both elements. As well, almost all dissolved selenium and total selenium measurements are reported as below the 0.001 mg/L detection limits; and all dissolved values are below the 0.05 mg/L livestock watering criterion, and all total values are below the 0.005 mg/L wildlife habitat criterion.

Most total mercury measurements are reported as non-detects below the 0.0001 mg/L detection limit, although five samples contained detectable mercury at levels that exceeded the 0.00077 mg/L wildlife habitat criterion. Two samples collected 30 minutes apart (15:02 and 16:32) on 8/24/2005 at LA6.6 were measured at 0.00088 mg/L and 0.00085 mg/L. Three more samples collected at LA0.7 in 2006 on 7/6, 8/8, and 8/25 exceed the wildlife criterion. The measurements are 0.0019 mg/L, 0.0021 mg/L, and 0.0017 mg/L respectively.

Applicable standards do not exist for the remaining dissolved and total metal analysis. A brief narration of the averages and outliers measurements will be made and tables presented that include summary statistics for the sum of all the measurements as well as for each individual year. Outlier levels were determined based on addition of the mean plus the difference between the 75^{th} and 25^{th} percentiles for each analyte. The assessment includes 14 dissolved metal measurements made for 53 samples, and 27 total metal measurements made for 73 samples.

The following narrative describes the number of detections, averages, outliers, and number of measurements that exceed the outlier lever for the dissolved measurements made in 53 samples during 2005, 2006, and 2008.

Fifty two detections were made for calcium. The average for all measurements was 23 mg/L, and averages ranged from 18 mg/L during 2005 to 38 mg/L during 2006. Five measurements exceeded the outlier level of 44 mg/L.

Fifty three detections were made for potassium. The average for all measurements was 5 mg/L, and averages ranged from 3 mg/L during 2008 to 7 mg/L during 2006. Three measurements exceeded the outlier level of 8 mg/L.

Fifty three detections were made for magnesium. The average for all measurements was 3 mg/L, and averages ranged from 2 mg/L during 2005 to 5 mg/L during 2006. Four measurements exceeded the outlier level of 5 mg/L.

Fifty two detections were made for sodium. The average for all measurements was 17 mg/L, and averages ranged from 16 mg/L during 2008 to 19 mg/L during 2006. Six measurements exceeded the outlier level of 26 mg/L.

Nine detections were made for aluminum. The average for all measurements was 0.97 mg/L, and averages ranged from 0.14 mg/L during 2005 to 1.8 mg/L during 2008. One measurement exceeded the outlier level of 2.03 mg/L.

Thirteen detections were made for arsenic. The average for all measurements was 0.0025 mg/L, and averages ranged from 0.0021 mg/L during 2008 to 0.0027 mg/L during 2005. One measurement exceeded the outlier level of 0.0031 mg/L.

Fifty three detections were made for barium. The average for all measurements was 0.14 mg/L, and averages ranged from 0.23 mg/L during 2008 to 0.10 mg/L during 2005. Three measurements exceeded the outlier level of 0.35 mg/L.

There were no detections of beryllium.

Two detections were made for cobalt. The average was 0.003 mg/L, one sample in 2005 was 0.002 and another in 2006 was 0.004 mg/L.

Twenty four detections were made for iron. The average for all measurements was 0.26 mg/L, and averages ranged from 0.09 mg/L during 2005 to 0.73 mg/L during 2008. Four measurements exceeded the outlier level of 0.32 mg/L.

Twenty detections were made for manganese. The average for all measurements was 0.36 mg/L, and averages ranged from 0.10 mg/L during 2008 to 0.78 mg/L during 2006. Three measurements exceeded the outlier level of 0.56 mg/L.

Thirty eight detections were made for antimony. The average for all measurements was 0.0009 mg/L, and averages ranged from 0.0008 mg/L during 2005 to 0.0009 mg/L during 2008. Five measurements exceeded the outlier level of 0.0014 mg/L, all during 2006 from La0.7.

There were no detections of thallium.

Thirty nine detections were made for uranium. The average for all measurements was 0.00099 mg/L, and averages ranged from 0.00035 mg/L during 2005 to 0.00265 mg/L during 2008. Three measurements exceeded the outlier level of 0.00202 mg/L.

Table 24 contains all the summary statistics for the dissolved metals measured for this project, including those that have numeric standards.

Table 24 Dissolved Metals Summary Statistics

		Ca	K	Mg	Na	Ag	Al	As	Ba	Be	Cd	Co	Cr
2005 measurements	count	37	38	38	37	0	1	8	38	0	0	1	0
	average	18	6	2	17		0.14	0.0027	0.10			0.002	
	minimum	6	2	1	1		0.14	0.0021	0.02			0.002	
	maximum	50	17	5	41		0.14	0.0043	0.39			0.002	
	25th percentile	9	4	1	11		0.14	0.0023	0.03			0.002	
	75th percentile	21	6	3	21		0.14	0.0028	0.10			0.002	
	outlier level	30	8	4	27		0.14	0.0032	0.17			0.002	
2006 measurements	count	6	6	6	6	0	5	2	6	0	0	1	0
	average	38	7	5	19		0.66	0.0027	0.26			0.004	
	minimum	22	3	3	10		0.12	0.0022	0.09			0.004	
	maximum	72	13	12	40		1.70	0.0031	0.34			0.004	
	25th percentile	28	5	4	13		0.14	0.0024	0.22			0.004	
	75th percentile	43	9	5	18		1.20	0.0029	0.33			0.004	
	outlier level	53	12	7	24		1.72	0.0031	0.37			0.004	
2008 measurements	count	9	9	9	9	0	3	3	9	0	0	0	0
	average	33	3	4	16		1.77	0.0021	0.23				
	minimum	9	2	2	10		0.12	0.0021	0.09				
	maximum	53	6	6	31		4.00	0.0021	0.57				
	25th percentile	34	2	4	13		0.66	0.0021	0.09				
	75th percentile	41	5	6	17		2.60	0.0021	0.27				
	outlier level	40	6	6	20		3.71	0.0021	0.41				
all measurements	count	52	53	53	52	0	9	13	53	0	0	2	0
	average	23	5	3	17		0.97	0.0025	0.14			0.003	
	minimum	6	2	1	1		0.12	0.0021	0.02			0.002	
	maximum	72	17	12	41		4.00	0.0043	0.57			0.004	
	25th percentile	10	3	2	11		0.14	0.0021	0.03			0.003	
	75th percentile	31	6	4	20		1.20	0.0027	0.24			0.003	
	outlier level	44	8	5	26		2.03	0.0031	0.35			0.004	

Table 24 Dissolved Metals Summary Statistics (continued)

		Cu	Fe	Hg	Mn	Ni	Pb	Sb	Se	Tl	U	V	Zn
2005 measurements	count	30	15	0	12	0	13	26	0	0	25	7	36
	average	0.0039	0.09		0.31		0.0062	0.0005			0.00035	0.0061	0.037
	minimum	0.0022	0.06		0.00		0.0005	0.0003			0.00010	0.0054	0.008
	maximum	0.0079	0.13		1.90		0.0600	0.0010			0.00140	0.0077	0.170
	25th percentile	0.0031	0.07		0.00		0.0007	0.0004			0.00016	0.0056	0.013
	75th percentile	0.0044	0.11		0.19		0.0029	0.0005			0.00026	0.0064	0.047
	outlier level	0.0052	0.13		0.50		0.0084	0.0007			0.00045	0.0069	0.071
2006 measurements	count	4	5	0	4	2	3	6	0	0	6	4	6
	average	0.0047	0.39		0.78	0.0055	0.0009	0.0027			0.00142	0.0066	0.043
	minimum	0.0038	0.06		0.00	0.0051	0.0005	0.0010			0.00036	0.0054	0.018
	maximum	0.0055	1.00		2.80	0.0059	0.0012	0.0039			0.00350	0.0085	0.074
	25th percentile	0.0045	0.06		0.01	0.0053	0.0008	0.0018			0.00076	0.0055	0.033
	75th percentile	0.0050	0.75		0.92	0.0057	0.0012	0.0036			0.00178	0.0074	0.054
	outlier level	0.0052	1.08		1.68	0.0059	0.0013	0.0045			0.00243	0.0085	0.064
2008 measurements	count	2	4	0	4	0	2	6	0	0	8	4	9
	average	0.0034	0.73		0.10		0.0006	0.0009			0.00265	0.0056	0.071
	minimum	0.0027	0.06		0.02		0.0017	0.0003			0.00016	0.0051	0.017
	maximum	0.0040	2.00		0.23		0.0030	0.0025			0.00810	0.0063	0.190
	25th percentile	0.0030	0.06		0.02		0.0020	0.0005			0.00138	0.0052	0.029
	75th percentile	0.0037	1.09		0.16		0.0027	0.0009			0.00290	0.0058	0.094
	outlier level	0.0040	1.76		0.23		0.0012	0.0014			0.00417	0.0062	0.136
all measurements	count	36	24	0	20	2	18	38	0	0	39	15	51
	average	0.0039	0.26		0.36	0.0055	0.0049	0.0009			0.00099	0.0061	0.044
	minimum	0.0022	0.06		0.00	0.0051	0.0005	0.0003			0.00010	0.0051	0.008
	maximum	0.0079	2.00		2.80	0.0059	0.0600	0.0039			0.00810	0.0085	0.190
	25th percentile	0.0031	0.06		0.01	0.0053	0.0007	0.0004			0.00017	0.0055	0.017
	75th percentile	0.0047	0.12		0.21	0.0057	0.0027	0.0008			0.00120	0.0064	0.053
	outlier level	0.0056	0.32		0.56	0.0059	0.0069	0.0014			0.00202	0.0070	0.079

The following narrative describes the number of detections, averages, outliers, and number of measurements that exceed the outlier lever for the total measurements made in 73 samples during 2003, 2005, 2007, and 2008. During 2003 additional total measurements for boron, molybdenum, silica, tin, and strontium were made, and potassium and sodium measurements were not made.

Seventy three detections were made for calcium. The average for all measurements was 89 mg/L, and the averages ranged from 57 mg/L during 2005 to 136 mg/L during 2003. Nine measurements exceeded the outlier level of 148 mg/L.

Fifty nine detections were made for potassium. The average for all measurements was 27 mg/L, and averages ranged from 19 mg/L during 2005 to 52 mg/L during 2007. Six measurements exceeded the outlier level of 40 mg/L.

Seventy three detections were made for magnesium. The average for all measurements was 32 mg/L, and averages ranged from 21 mg/L during 2005 to 22 mg/L during 2007 and 2008. Eight measurements exceeded the outlier level of 52 mg/L.

Sixty detections were made for sodium. The average for all measurements was 20 mg/L, and averages ranged from 19 mg/L during 2008 to 19 mg/L during 2006. Eight measurements exceeded the outlier level of 28 mg/L.

Seventy three detections were made for aluminum. The average for all measurements was 129 mg/L, and averages ranged from 82 mg/L during 2005 to 247 mg/L during 2007. Ten measurements exceeded the outlier level of 225 mg/L.

Sixty five detections were made for arsenic. The average for all measurements was 0.02 mg/L, and averages ranged from 0.02 mg/L during 2003, 2005, and 2008 to 0.04 mg/L during 2007. Four measurements exceeded the outlier level of 0.03 mg/L.

Seventy three detections were made for barium. The average for all measurements was 1.54 mg/L, and averages ranged from 0.88 mg/L during 2005 to 2.8 mg/L during 2003. Nine measurements exceeded the outlier level of 2.60 mg/L.

Sixty nine detections were made for beryllium. The average for all measurements was 0.14 mg/L, and averages ranged from 0.008 mg/L during 2005 to 0.020 mg/L during 2007. Eleven measurements exceeded the outlier level of 0.23 mg/L.

Seventy one detections were made for cobalt. The average was 0.046 mg/L, and averages ranged from 0.028 mg/L during 2005 to 0.074 mg/L during 2003. Seven measurements exceeded the outlier level of 0.079 mg/L.

Seventy three detections were made for iron. The average for all measurements was 129 mg/L, and averages ranged from 86 mg/L during 2005 to 249 mg/L during 2007. Eleven measurements exceeded the outlier level of 237 mg/L.

Seventy three detections were made for manganese. The average for all measurements was 6.1 mg/L, and averages ranged from 2.8 mg/L during 2005 to 17.1 mg/L during 2003. Ten measurements exceeded the outlier level of 10.1 mg/L.

Fifty six detections were made for antimony. The average for all measurements was 0.0011 mg/L, and averages ranged from 0.0011 mg/L during 2005 and 2008 to 0.0013 mg/L during 2007. There were no measurements exceeding the outlier level of 0.0041 mg/L.

Fifty four detections were made for thallium. The average for all measurements was 0.002 mg/L, and averages ranged from 0.0013 mg/L during 2005 to 0.003 mg/L during 2007. Three measurements exceeded the outlier level of 0.007 mg/L.

Sixty eight detections were made for uranium. The average for all measurements was 0.014 mg/L, and averages ranged from 0.0084 mg/L during 2005 to 0.0322 mg/L during 2003. Twelve measurements exceeded the outlier level of 0.025 mg/L.

Seventy three detections were made for vanadium. The average for all measurements was 0.163 mg/L, and averages ranged from 0.113 mg/L during 2005 to 0.188 mg/L during 2008. Seven measurements exceeded the outlier level of 0.279 mg/L.

Seventy three detections were made for zinc. The average for all measurements was 0.622 mg/L, and averages ranged from 0.488 mg/L during 2005 to 0.877 mg/L during 2003. Ten measurements exceeded the outlier level of 1.2 mg/L.

Thirteen detections from 13 samples were made for boron during 2003. The average was 0.15 mg/L, ranging from 0.10 mg/L to 0.20 mg/L. There were no outliers.

Two detections from 13 samples were made for molybdenum during 2003; both values were 0.01 mg/L.

Thirteen detections from 13 samples were made for silica during 2003. The average was 152 mg/L, ranging from 100 mg/L to 280 mg/L. One value (280 mg/L) exceeded the outlier level of 212 mg/L.

Four detections from 13 samples were made for tin during 2003. The average was 0.7 mg/L, ranging from 0.2 mg/L to 0.9 mg/L. One value (0.9 mg/L) exceeded the outlier level of 0.8 mg/L.

Thirteen detections from 13 samples were made for strontium during 2003. The average was 0.7 mg/L, ranging from 0.2 mg/L to 1.8 mg/L. Three measurements exceeded the outlier level of 1.2 mg/L.

Table 25 contains all the summary statistics for the total metals measured for this project, including mercury and selenium which have numeric standards.

Table 25 Total Metals Summary Statistics

		Na	K	Mg	Na	Ag	Al	As	Ba	Be	Cd	Co	Cr
2003 measurements	count	13	0	13	0	0	13	8 00	13	13	0	12	12
	average	136		35			149	0 02	2 8	0 028		0 074	0.067
	minimum	39		16			52	0.01	0.7	0 006		0.020	0.020
	maximum	390		89			400	0 05	8	0.100		0 200	0.200
	25th percentile	56		19			72	0 01	1	0.010		0.030	0.038
	75th percentile	130		35			180	0.02	3.6	0 040		0.105	0.093
	outlier level	210		51			257	0 03	5.4	0 058		0.149	0.122
2005 measurements	count	37	37	37	37	37	37	34.00	37	33	37	36	37
	average	57	19	21	19	0.0027	82	0.02	0 88	0.008	0.011	0.028	0.063
	minimum	10	5	2	2	0.0001	6	0.00	0.07	0.001	0.001	0.002	0.007
	maximum	650	120	240	44	0 0190	670	0.06	8.30	0.037	0.076	0.220	0.330
	25th percentile	15	8	6	15	0.0004	19	0.01	0.23	0.002	0.002	0.006	0.015
	75th percentile	55	20	19	24	0.0033	100	0 02	1.10	0 011	0.015	0.036	0.083
	outlier level	97	31	34	28	0.0056	163	0 03	1.75	0.016	0.024	0.057	0.131
2007 measurements	count	11	10	11	11	10	11	11.00	11	11	11	11	11
	average	131	52	57	22	0 0053	247	0 04	2.41	0.020	0.003	0.073	0.137
	minimum	17	8	6	8	0.0006	24	0.01	0.19	0.002	0.000	0.006	0.016
	maximum	520	180	190	42	0 0220	990	0.12	7.90	0.086	0.011	0.260	0.430
	25th percentile	20	10	10	15	0.0011	49	0.01	0.43	0.004	0.001	0.014	0.038
	75th percentile	160	81	70	28	0.0081	370	0.05	3.65	0.025	0.004	0.120	0.210
	outlier level	271	123	116	35	0.0122	568	0.07	5.63	0.040	0.006	0.179	0.310
2008 measurements	count	12	12	12	12	12	12	12.00	12	12	7	12	12
	average	94	31	40	22	0.0018	142	0 02	1.40	0.010	0.004	0 047	0.166
	minimum	17	6	5	16	0.0001	10	0.00	0.12	0.001	0.001	0.002	0 021
	maximum	810	270	390	40	0.0120	1400	0.19	14 00	0.087	0.021	0.500	0.760
	25th percentile	21	7	7	18	0.0006	14	0.00	0.15	0.001	0.001	0.003	0.051
	75th percentile	28	10	11	22	0.0013	38	0.01	0 41	0.004	0.002	0.010	0.170
	outlier level	100	34	45	26	0 0026	166	0.03	1.66	0.012	0.005	0.055	0.286
all measurements	count	73	59	73	60	59	73	65	73	69	55	71	72
	average	89	27	32	20	0 0030	129	0.020	1 54	0.014	0 009	0.046	0.092
	minimum	10	5	2	2	0 0001	6	0 002	0 07	0.001	0.000	0.002	0.007
	maximum	810	270	390	44	0 0220	1400	0.19	14.00	0 100	0 076	0 500	0.760
	25th percentile	20	8	7	16	0 0006	24	0.006	0.24	0.003	0 002	0 006	0.026
	75th percentile	79	21	27	23	0 0029	120	0 021	1.30	0.012	0 010	0 040	0.100
	outlier level	148	40	52	28	0.0185	225	0.03	2.60	0.023	0.028	0.079	0.166

Table 25 Total Metals Summary Statistics (continued)

		Cu	Fe	Hg	Mn	Ni	Pb	Sb	Se	Tl	U	V	Zn
2003 measurements	count	9	13	0	13	6	13	0	0	0	9	13	13
	average	0.212	146		17.1	0.18	0.497				0.0322	0.144	0.877
	minimum	0.100	37		2.0	0.10	0.130				0.0060	0.050	0.300
	maximum	0.500	410		58.0	0.40	1.300				0.0800	0.400	2.500
	25th percentile	0.100	63		4.1	0.10	0.250				0.0140	0.070	0.400
	75th percentile	0.300	180		22.0	0.20	0.650				0.0500	0.200	1.100
	outlier level	0.412	263		35.0	0.28	0.897				0.0682	0.274	1.577
2005 measurements	count	37	37	18	37	36	36	35	3	32	37	37	37
	average	0.088	86	0.0004	2.8	0.05	0.164	0.0011	0.002	0.0013	0.0084	0.113	0.488
	minimum	0.008	5	0.0001	0.2	0.01	0.016	0.0003	0.001	0.0002	0.0004	0.010	0.058
	maximum	0.540	610	0.0011	17.0	0.37	0.970	0.0033	0.002	0.0069	0.0510	0.790	2.300
	25th percentile	0.023	17	0.0002	0.5	0.01	0.046	0.0007	0.001	0.0005	0.0015	0.031	0.160
	75th percentile	0.105	120	0.0005	3.7	0.07	0.208	0.0012	0.002	0.0017	0.0099	0.150	0.690
	outlier level	0.170	189	0.0007	6.0	0.11	0.326	0.0016	0.002	0.0025	0.0168	0.232	1.018
2007 measurements	count	11	11	8	11	11	10	10	3	11	10	11	11
	average	0.229	249	0.0010	7.5	0.14	0.414	0.0013	0.002	0.003	0.022	0.324	0.871
	minimum	0.019	24	0.0003	0.9	0.01	0.040	0.0004	0.001	0.000	0.002	0.031	0.150
	maximum	0.810	910	0.0021	27.0	0.53	1.300	0.0023	0.003	0.014	0.063	1.000	2.200
	25th percentile	0.057	44	0.0004	1.4	0.03	0.138	0.0008	0.002	0.001	0.004	0.067	0.350
	75th percentile	0.345	380	0.0018	10.9	0.23	0.473	0.0019	0.003	0.004	0.040	0.565	1.150
	outlier level	0.518	585	0.0024	17.0	0.34	0.749	0.0024	0.003	0.007	0.058	0.823	1.671
2008 measurements	count	12	12	4	12	12	12	11	1	11	12	12	12
	average	0.136	130	0.0004	3.1	0.09	0.157	0.0011	0.006	0.002	0.009	0.188	0.528
	minimum	0.011	9	0.0001	0.3	0.01	0.017	0.0004	0.006	0.000	0.001	0.020	0.074
	maximum	1.300	1300	0.0009	29.0	0.85	1.300	0.0025	0.006	0.016	0.081	1.800	3.100
	25th percentile	0.018	12	0.0002	0.4	0.01	0.024	0.0007	0.006	0.000	0.002	0.029	0.213
	75th percentile	0.039	32	0.0004	0.9	0.03	0.080	0.0013	0.006	0.001	0.004	0.050	0.355
	outlier level	0.159	149	0.0006	3.7	0.10	0.213	0.0017	0.006	0.002	0.011	0.209	0.670
all measurements	count	69	73	30	73	65	71	56	7	54	68	73	73
	average	0.135	129	0.0005	6.1	0.09	0.259	0.0011	0.002	0.002	0.014	0.163	0.622
	minimum	0.008	5	0.0001	0.2	0.01	0.016	0.0003	0.001	0.000	0.000	0.010	0.058
	maximum	1.300	1300	0.0021	58.0	0.85	1.300	0.0033	0.006	0.016	0.081	1.800	3.100
	25th percentile	0.023	22	0.0002	0.8	0.01	0.046	0.0007	0.001	0.000	0.002	0.039	0.200
	75th percentile	0.140	130	0.0006	4.8	0.09	0.305	0.0013	0.003	0.002	0.015	0.155	0.800
	outlier level	0.240	237	0.0008	10.1	0.17	0.522	0.0041	0.002	0.007	0.025	0.279	1.222

Table 25 Total Metals Summary Statistics (continued)

		B	Mo	Si	Sn	Sr
2003 measurements	count	13	2	13	4	13
	average	0.15	0.1	152	0.7	0.7
	minimum	0.10	0.1	100	0.5	0.2
	maximum	0.20	0.1	280	0.9	1.8
	25th percentile	0.10	0.1	110	0.7	0.3
	75th percentile	0.20	0.1	170	0.8	0.8
	outlier level	0.25	0.1	212	0.8	1.2

Summary

This report evaluates the chemical and hydrological data to determine mass transport of sediments and Los Alamos National Laboratory legacy plutonium$^{239/240}$ in stormwater runoff, describe spatial and temporal trends in suspended sediment loads and contaminant levels, and determine exceedance of applicable water quality criteria. We estimated plutonium and sediment transport inventory at LANL gage stations E030, E042, E050, E055, E060, and E110 in the Los Alamos watershed using correlations between discharge (Q), suspended sediment concentration (SSC), and total plutonium$^{239/240}$ in stormwater.

In summary we estimate:

- that up to 182 mCi of plutonium$^{239/240}$ has been transported out of Pueblo Canyon into lower Los Alamos Canyon on Pueblo de San Ildefonso lands during the 2003 to 2008 period of this report
- that 1 mCi has been transported out of mid Los Alamos Canyon into lower Los Alamos Canyon

- that 34 mCi of plutonium$^{239/240}$ has been transported to the Rio Grande during the period of this report
- that 149 mCi or 82% of plutonium$^{239/240}$ transported beyond the Laboratory boundaries during the time frame of this report remains on Pueblo de San Ildefonso lands in lower Los Alamos Canyon.
- Laboratory contaminants were carried off site in 19000 tons of suspended sediments, of which 7500 tons entered the Rio Grande
- that approximately 246 mCi of plutonium$^{239/240}$ in 35543 tons of suspended sediment have been transported out of Pueblo Canyon into lower Los Alamos Canyon since the 2000 Cerro Grande fire
- rating coefficients that describe the relationships between peak discharge and inventory estimates of suspended sediments and plutonium$^{239/240}$ can be used to identify contaminant and sediment transport availability, and thereby temporal and spatial condition changes in the watershed channels. For example lower Pueblo Canyon followed by lower Los Alamos Canyon stations develop the largest coefficients and contribute the largest amount of sediment for transport. Upper Pueblo and upper to mid Los Alamos stations contribute the smallest levels.
- plutonium$^{239/240}$ concentrations in suspended sediments throughout Pueblo Canyon average about 5 pCi/g, the levels are similar in lower Los Alamos Canyon above the Rio Grande when floods originate from Laboratory property, averaging 4.6 pCi/g. The average from Guaje Canyon, a baseline tributary to lower Los Alamos Canyon, is 0.4 pCi/g.
- until a July 2008 waterline break at TA-21 in upper Los Alamos Canyon, the average plutonium$^{239/240}$ concentration in the canyon suspended sediments was 1 pCi/g, after the excursion it increased to almost 40 pCi/g. The concentrations have steadily declined since the waterline break. Acid Canyon, a main source term to Pueblo Canyon, contributes an average 17 pCi/g in suspended sediments
- The average concentrations of total plutonium$^{239/240}$ in all storm samples from upper Los Alamos Canyon is 5 pCi/L, the average concentration in mid Pueblo Canyon above a wetland is 90 pCi/L. Beyond the wetlands the concentrations decline to an average 15 pCi/L measured at the Pueblo Canyon endpoint and then 19 pCi/L downstream to the Rio Grande confluence
- it appears that an 85% reduction of sediment transport rates occur through the Pueblo Canyon wetlands, identified by suspended sediment concentrations.
- an 80% reduction of sediment transport rates occurs through the Los Alamos Canyon low head weir, up to 86% when flows completely impounded by the structure are included in the evaluation. Approximately 3700 tons of sediment was retained within the impoundment.
- a subset of gross alpha, uranium, americium, strontium, and cesium measurements also identified Laboratory impacts in the Los Alamos watershed
- few metals analysis exceed New Mexico 20.6.4 NMAC Standards for Interstate and Intrastate Surface Waters, although some measurements of dissolved lead, copper, and zinc did exceed acute aquatic life standards and some total mercury measurements did exceed wildlife habitat standards

- the frequency and magnitude of floods in the Los Alamos watershed are decreasing, but urban and residential stormwater discharges will continue to contribute to future flood magnitudes and probabilities.

Sediment and plutonium$^{239/240}$ transport estimates for the period of 2003 through 2008 were reported at six stations within the Los Alamos watershed. Rating coefficients were also developed and presented that identify stream function, relative channel stability, and sediment and contaminant availability at stations monitored during this period. These factors demonstrate near-background conditions in upstream Pueblo and downstream Guaje Canyons, and moderate LANL impacts within the mid Los Alamos Canyon reach relative to large impacts in Pueblo and lower Los Alamos Canyons. Use of these coefficients in future storm water assessments may identify changes in the watershed. These changes may reflect potential destabilization of the water courses or watershed improvements made by LANL to reduce off-site contaminant migration.

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Appendix A
Analytical Descriptions

The following descriptions are of the major classes of radionuclide analysis normally requested by this bureau.

Alpha Emitting Radionuclides measured by alpha spectroscopy

Commercial laboratories use alpha spectrometry to accurately identify and quantify alpha-emitting radionuclides in soil, water, air filters, and other sample matrix. Alpha spectrometry can identify and quantify uranium 234, 235, and 238, thorium 228, 230, and 232, plutonium 238, 239, and 240, polonium^{210}, neptunium^{237}, and americium^{241} by counting their alpha emissions at specific energies. Each radionuclide emits alpha particles at distinct energies. A spectrum is constructed that includes the rate of emissions at those energies. The laboratory uses this spectrum to identify and quantify each analyte.

Laboratory sample preparation involves drying a sample and grinding the remaining matrix to a fine-grain, homogeneous aliquot. This aliquot could be heated to high temperatures in a furnace or treated with strong oxidizers to eliminate organic materials. A small portion of the homogenized sample is usually all that is required for the individual analysis.

Once the sample has been prepared, a 2 to 10 gram aliquot is dissolved or leached to provide a clear solution containing the radionuclide of interest. Often the sample is completely dissolved using combinations of nitric, hydrochloric, and hydrofluoric acids. In some cases, leaching with strong acids can consistently provide greater than 80% recovery of a radionuclide and may be acceptable for certain applications. Tracers of known activity and of similar chemical properties to the radionuclides of interest are added before separation. The laboratories measure the tracers to calibrate the instruments and determine the overall analyte recovery during the chemical procedures. Plutonium^{242}, uranium^{232}, and americium^{243} are examples of tracers that could be used.

After dissolution, the sample is purified using a variety of chemical reactions to remove bulk chemical and radionuclide impurities. Ferric-hydroxide co-precipitation is commonly performed to remove constituents that do not form insoluble hydroxides. The precipitate containing the analytes of interest is re-dissolved and the solution is passed through multiple ion exchange columns. These columns are used to sequentially retain the analytes of interest. The columns are eluted with acid washes, re-dried, re-dissolved, and the solutions co-precipitated with lanthanum fluoride. These steps provide a chemically and radiologically pure sample having very little mass. Other examples of purification techniques include liquid-liquid extraction, distillation, and electro-deposition.

After the sample is purified, it is prepared for counting by analyte deposition onto a small planchet. Because of the limited penetrating power of alpha particles, the preparation for counting is often a critical step. Most methods require that sample aliquots be prepared as a virtually weightless mount in vacuum chambers at fixed distances from the alpha detectors. Although electro-deposition onto a stainless steel planchet is the traditional method for preparing samples for counting, precipitation of the radionuclide of interest onto the surface of a filter planchet is often used to prepare samples for alpha spectroscopy. While this technique generally produces a spectrum with lower resolution, the preparation time is relatively short compared to electro-deposition.

The radionuclides on these planchets are then measured by alpha spectroscopy using detectors housed in a light-tight vacuum chamber. The alpha detectors consist of high-resolution ion implanted silicon diodes. Alpha particle emissions that strike the diodes create voltage pulses proportional to specific energies. Alpha spectroscopy produces a spectrum of alpha particles detected at different energies and displayed by a histogram of the number of counts versus the alpha energy. Peaks associated with specific alpha energies are used to identify the radionuclides, and the activities of the sample are quantified by the disintegration rates. Because the sample is purified prior to counting, all of the alpha particles come from radionuclides of a single element simplifying the process of associating each peak with a specific radionuclide.

Energy levels of alpha particles emitted by radionuclides commonly monitored by our bureau include Am^{241} at a 5485 keV (kilo electron volt) energy level, Pu^{238} at 5499 keV, Pu^{239} at 5155 keV, U^{234} at 4775 keV, U^{235} at 4396 keV, and U^{238} particle emissions at a 4196 keV energy level. $Plutonium^{239}$ and $plutonium^{240}$ emissions are at similar energies and are indistinguishable using alpha spectroscopy.

Two system calibrations are necessary to characterize the analysis performance. A source with at least two known alpha energies is counted to correlate the voltage pulses with alpha energy. A standard source of known activity is analyzed to determine the system efficiency for detecting alphas. Since the sample and detector are in a vacuum, most commonly encountered alpha energies will be detected with approximately the same efficiency

For environmental detection levels, typically below 0.004 Bq/g or 0.1 pCi/g, samples are counted for 1000 minutes or more. To achieve lower detection limits, laboratories may count larger sample aliquots for longer periods. In addition to the reported concentration value, the laboratories must document performance characteristics of the analysis, such as the analyte and tracer net counts and count time, background counts and background count time, detector efficiencies, and total uncertainty.

These commercial laboratory methods for alpha spectroscopy meet or exceed the requirements referenced by DOE/EML 4.5.2.1.

Beta Emitting Radionuclides (Strontium^{90})

Commercial laboratories use low-background gas flow proportional counters to count beta emissions from yttrium^{90} (Y^{90}), the daughter product of Sr^{90} decay. Although, this method accurately identifies and quantifies Sr^{89} and Sr^{90} radionuclides in soil, water, air filters, and other sample matrices, it does not resolve the individual isotope's emission energies. Rigorous separation of the yttrium isotope is required from which the strontium isotopes can be quantified.

Laboratory sample preparation, dissolution, and purification procedures for beta emitting radionuclide analysis are similar to that for alpha emitting radionuclides. Heterogeneous samples are ground, mixed, and sieved to produce a fine-grained homogeneous aliquot. Two to 10 gram sample aliquots are spiked with a stable strontium carrier, dissolved with concentrated acids, and then physical and chemical treatments separate and purify the sample for measurement. Portions of the pre- and post-separation solutes are measured by inductively coupled plasma - atomic emission spectroscopy, ICP- AES, for non-radioactive strontium and gas flow proportional beta counts of blank spike samples to monitor chemical yields of the separation technique.

After dissolution, the sample undergoes a preliminary count that represents the total Sr^{89} and Sr^{90} activity plus a small fraction of Y^{90} that has grown in by radioactive decay. The strontium sample is allowed to reach secular equilibrium with its Y^{90} progeny, a period of approximately 14 days. The sample is then purified using a variety of chemical reactions to remove bulk chemical and radionuclide impurities. The aliquot solute is passed through an extraction column to separate yttrium from the sample solute. The radioisotope yttrium is then eluted from the column with diluted acids, evaporated or fixed onto a stainless steel planchet, and beta counted in a gas-flow proportional counter. Other examples of purification techniques include liquid-liquid extraction, distillation, electro-deposition, and filtration through specially prepared filters.

After the purified yttrium is fixed onto a planchet, the sample undergoes a final 3 to 8 hour beta count on a gas flow proportional counter. Beta particle emissions from the Y^{90} progeny produce ionization in a gas-filled chamber, generating a small electronic pulse for each interaction. The pulse height is dependent upon the incident energy of the particle. The Sr^{90} concentration is determined from the yttrium activity and the Sr^{89} concentration by computing the difference between preliminary and final counts. Data reduction for beta emitting radionuclides is less complicated than that for photon emitting radionuclides. Since the beta detectors report total beta activity, the calculation to determine the concentration for the radionuclide of interest is straightforward. The counter provides raw counting information to computer and spreadsheet-based analysis programs, generating results in units of radioactivity per unit sample volume.

These procedures used to measure Sr^{90} meet the calibration, data collection, and analysis requirements of EPA method 900.0.

Photon Emitting Radionuclides (Gamma Spectroscopy)

Commercial laboratories use gamma spectrometry to accurately identify and quantify multiple gamma-emitting radionuclides in soil, water, air filters, and other sample matrices. Gamma spectrometry methods, using high-resolution germanium or sodium iodide detectors, can measure mixed isotopes by counting their gamma emissions or photons at specific energies. Laboratories use a spectrum, constructed from the rate of emissions at specific energies, to identify and quantify each analyte

There is no special sample preparation required for gamma spectroscopy measurements beyond placing a sample in a known geometry around the detector. Efficiency calibration curves are developed for different geometries since the counting efficiency depends on the distance from the sample to the detector. Generally, dried, ground materials, sieved to produce homogeneous samples are used. Large volumes, 500 mL, are place into Marinelli beakers that fit around the detector and provide exceptional counting efficiencies. Small volumes can be placed into Petri dishes and placed on top of a detector for counting.

The samples in these geometries are typically counted for 1000 seconds to 1000 minutes on instruments using high-resolution germanium or sodium iodide semiconductors. Germanium detectors have better resolution and can identify radionuclides at lower concentrations, although sodium iodide semiconductors are more efficient. Gamma emissions from radionuclides detected by a semiconductor germanium crystal, provides a small electronic pulse for each gamma interaction that is proportional to the gamma incident energy. The intensity or count rate /energy spectrum is collected and displayed on a multi channel analyzer (MCA). Computers, generating results in units of radioactivity per unit sample volume, subsequently interprets the data collected by the MCA.

Data reduction is usually the critical step in measuring photon-emitting radionuclides. There are often several hundred individual gamma ray energies detected within a single sample. Computer software is usually used to identify the peaks, associate them with the proper energy, associate the energy with one or more radionuclides, correct for the efficiency of the detector and the geometry of the sample, and provide results in terms of concentrations with the associated uncertainty. It is important that the software be either a well-documented commercial package or thoroughly evaluated and documented before use. The counts in each peak or energy band, the sample weight, the efficiency calibration curve, and the isotope's decay scheme are factored together to give the sample concentration.

Although several hundred individual gamma ray energies can be detected by gamma spectroscopy, our bureau is commonly interested in Cs^{137}. The energy level of gamma photons emitted by Cs^{137} is 661.7 keV. Additional radionuclides and their energy levels that are measured by gamma spectroscopy include Pb^{210} (45.6keV), Am^{241} (59.5keV), Co^{60} (1173.2 and 1332.5keV), and K^{40} (1460.8keV).

This gamma spectroscopy procedure is equivalent or exceeds EPA Procedure 901.1 and DOE/EML Procedure 4.5.2.3.

Table B
Analytical Data Tables

Table B1. Analysis Suite per Station

Location	Isotopic Plutonium (water)	Isotopic Plutonium (suspended sediment)	Isotopic Uranium (water)	Am-241 (water)	Cs-237 (water)	Sr-90 (water)	Gross alpha/beta (water)	Total Metals (unfiltered)	Total Metals (filtered)	SSC
E056 (AC 0.2)	15	15					15	1		15
PU 6.4	7	7	6	6			12			6
E055 (PU-5.5)	21	1		1	1	1	18			22
PU 4.1	6	24	3	6	3	3	3	6		23
PU 3.1	7	8	2	4	2	2	2	4	2	8
PU 2.4		17								17
PU 1.7		1								1
E060 (PU-0.3)	25	74	10	10			24	9		80
E059	1	1								1
E050	30	21	12	31	21	20	18	13	2	29
E042	4	4	4	4	4	4	4	4	4	4
E030 (LA-6.6)	14	11	14	11	14	11	11	14	12	15
E110 (LA-0.7)	38	39	14	25	20	20	20	19	16	57
E040 (DP 0.1)	1		1	1	1	6	6	1	1	6
Rio Grande at Buckman	9		6	1	7	7	7	1	6	10
Sum samples	**178**	**223**	**72**	**100**	**73**	**74**	**140**	**72**	**43**	**294**

Table 1. Radiochemical Analysis of Storm Water for 2003 (pCi/L unfiltered)

			Gross A				Gross B				U-234				U-235				U-238			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
PU-6.4	8/11/03 18:00	CS	1230	300	130		1680	340	150		61.5	10	7		3.5	2.8	7	U	74	10	4	
PU-6.4	8/11/03 18:00	DUP	981	230	100		1700	340	150													
PU-6.4	8/11/03 18:27	CS	800	200	70		1425	260	50		28.1	4.4	4		1	1.4	3.2	U	32.2	4.6	1.8	
PU-6.4	8/11/03 18:27	DUP	545	130	50		1370	260	50													
PU-0.3	8/11/03 23:44	CS	436	88	14		460	84	11		15.2	2.6	2.2		1.5	1	1.8	U	14.4	2.4	1.2	
PU-0.3	8/11/03 23:44	DUP	294	60	10		437	80	11													
PU-0.3	8/11/03 23:52	CS	292	60	9		396	76	9		8.3	2.2	3.7		-0.5	1.2	3.3	U	9.1	2	1.8	
PU-0.3	8/11/03 23:52	DUP	447	92	13		420	80	10													
PU-0.3	8/12/03 0:44	CS	237	48	9		264	48	7		7.2	1.4	1.4		-0.32	0.42	1.3	U	8.22	1.4	0.7	
PU-0.3	8/12/03 0:44	DUP	162	34	6		277	50	8													
PU-0.3	8/12/03 1:44	CS	126	26	4		184	36	5		5	1	0.9		0.2	0.32	0.8	U	4.9	1	0.5	
PU-0.3	8/12/03 1:44	DUP	191	40	6		174	36	5													
PU-0.3	8/22/03 13:46	CS	395	90	24		625	120	25		29.6	4.4	2.3		1.8	1	2	U	32.3	4.6	1.3	
PU-0.3	8/22/03 13:46	DUP	595	130	40		650	120	25													
PU-0.3	8/22/03 14:26	CS	184	36	6		227	42	7		9	1.6	1.1		0.91	0.5	1	U	7.8	1.4	0.7	
PU-0.3	8/22/03 14:26	DUP	266	52	9		237	44	8													
PU-0.3	8/22/03 15:11	CS	253	52	7		294	58	8		7.6	1.6	1.5		0.47	0.56	1.4	U	7.4	1.4	0.9	
PU-0.3	8/22/03 15:11	DUP	390	80	11		278	56	7													
PU-6.4	8/23/03 14:45	CS	2320	560	200		3630	640	150		107	18	15		10	6	13	U	116	18	8	
PU-6.4	8/23/03 14:45	DUP	1640	380	150		3750	660	150													
PU-6.4	8/30/03 0:52	CS	909	200	60		1150	110	37		30.4	5.4	4.4		2.1	1.8	3.9	U	32.3	5.4	2.5	
PU-6.4	8/30/03 0:52	DUP	605	134	40		1200	220	38													
PU-6.4	9/3/03 16:58	CS	815	200	67		1900	340	75		64	12	5		9	3	4		85	12	3	
PU-6.4	9/3/03 16:58	DUP	1150	260	95		1960	340	75													
PU-6.4	9/6/03 16:54	CS	890	190	55		1650	300	55		56	8	4.4		5.3	2.4	3.8		55.5	8	2.6	
PU-6.4	9/6/03 16:54	DUP	1290	280	80		1600	300	55													
PU-0.3	9/6/03 19:53	CS	1010	220	55		1080	200	35		39	6.4	5		2.3	1.8	4	U	36.9	6	3	
PU-0.3	9/6/03 19:53	DUP	670	140	35		1125	208	35													
PU-0.3	9/6/03 20:38	CS	602	124	30		810	160	25		15.5	4.4	7		-1.6	2.2	7	U	17.2	3.8	4	
PU-0.3	9/6/03 20:38	DUP	911	190	40		850	160	25													
PU-0.3	9/6/03 22:38	CS	486	100	13		370	70	11		10.2	2	2.4		-0.2	0.8	2.1	U	12	2	1.2	
PU-0.3	9/6/03 22:38	DUP	333	64	9		388	74	11													

Table 1. Radiochemical Analysis of Storm Water for 2003 (pCi/L unfiltered) Continued

			Am-241				Pu-238				Pu-239/240				Sr-90				Cs-137			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
PU-6.4	8/11/03 18:00	CS	0.6	3.8	10	U	1.4	1.8	4	U	4.9	2.8	2.4									
PU-6.4	8/11/03 18:00	DUP																				
PU-6.4	8/11/03 18:27	CS	1.25	1.8	4	U	0.4	1	2.8	U	2.3	1	1.5									
PU-6.4	8/11/03 18:27	DUP																				
PU-0.3	8/11/03 23:44	CS	6.6	2.8	5		-0.2	0.8	2.2	U	33.6	5	1.1									
PU-0.3	8/11/03 23:44	DUP																				
PU-0.3	8/11/03 23:52	CS	2.2	2	4	U	0.4	1	2.5	U	21	10	1.3									
PU-0.3	8/11/03 23:52	DUP																				
PU-0.3	8/12/03 0:44	CS	0.8	1	2	U	0.57	0.42	0.9	U	18.8	2.8	0.5									
PU-0.3	8/12/03 0:44	DUP																				
PU-0.3	8/12/03 1:44	CS	1.8	1	1.9	U	-0.18	0.32	1	U	10.4	1.8	0.6									
PU-0.3	8/12/03 1:44	DUP																				
PU-0.3	8/22/03 13:46	CS	3.5	2.4	5	U	-0.8	1	3	U	1.7	1	1.5									
PU-0.3	8/22/03 13:46	DUP																				
PU-0.3	8/22/03 14:26	CS	1.8	1.4	2.8	U	0.28	0.56	1.5	U	1.62	0.66	0.9									
PU-0.3	8/22/03 14:26	DUP																				
PU-0.3	8/22/03 15:11	CS	2.4	1.8	3.7	U	-0.04	0.8	2.2	U	2.6	1	1									
PU-0.3	8/22/03 15:11	DUP																				
PU-6.4	8/23/03 14:45	CS	17	8	16		-0.7	306	10	U	3.4	206	6	U								
PU-6.4	8/23/03 14:45	DUP																				
PU-6.4	8/30/03 0:52	CS	3.9	4	10	U	-0.4	1.8	5	U	1.6	1.2	2.4	U								
PU-6.4	8/30/03 0:52	DUP																				
PU-6.4	9/3/03 16:58	CS	14	5	10		-1.6	1.8	6	U	1.8	1.4	2.6	U								
PU-6.4	9/3/03 16:58	DUP																				
PU-6.4	9/6/03 16:54	CS	8.3	6	14	U	0.07	2.2	6	U	1	1.2	2.9	U								
PU-6.4	9/6/03 16:54	DUP																				
PU-0.3	9/6/03 19:53	CS	11.7	5.8	11		1	2.6	7	U	123	20	4									
PU-0.3	9/6/03 19:53	DUP																				
PU-0.3	9/6/03 20:38	CS	3.2	3.4	8	U	-0.4	1.8	5	U	49.7	8.2	2.8									
PU-0.3	9/6/03 20:38	DUP																				
PU-0.3	9/6/03 22:38	CS	3	1.6	3		0	0.64	1.9	U	43.6	6.6	1.2									
PU-0.3	9/6/03 22:38	DUP																				

Table 2. Radiochemical Analysis of Storm Water for 2005 (pCi/L unfiltered)

LOCATION	DATE / TIME	TYPE	Gross A RESULT	Gross A UNCERT	Gross A MDA	Gross A QUAL	Gross B RESULT	Gross B UNCERT	Gross B MDA	Gross B QUAL	U-234 RESULT	U-234 UNCERT	U-234 MDA	U-234 QUAL	U-235 RESULT	U-235 UNCERT	U-235 MDA	U-235 QUAL	U-238 RESULT	U-238 UNCERT	U-238 MDA	U-238 QUAL
CDB-2.0	8/12/05 10:40	CS	110	21	9.9	M3	160	30	21	M3	1.2	0.23	0.069		0.049	0.04	0.054	U	1.2	0.23	0.054	
DP-0.1/DPS-4	8/12/05 15:00	CS	9.8	1.7	0.45		46	7.5	1		0.37	0.074	0.016		0.011	0.01	0.013	U	0.21	0.048	0.014	
DP-0.1/DPS-4	8/12/05 15:00	DUP	9.3	1.7	0.57		46	7.5	1													
LA-0.7	7/17/05 17:56	CS	480	91	46	M3	730	130	80	M3	27	5.4	0.56	M3	1.1	0.78	0.34	M3	28	5.6	0.68	M3
LA-0.7	7/17/05 17:56	DUP									35	6.6	0.91	M3	1.9	1	0.67	M3NC	36	6.9	0.68	M3
LA-0.7	7/17/05 19:56	CS	56	11	6.3	M3	91	17	12	M3	6.6	1.3	0.12		0.39	0.22	0.075		6.7	1.3	0.15	
LA-0.7	7/17/05 21:56	CS	70	13	5.2	M3	110	19	11	M3	3.9	0.74	0.13		0.23	0.12	0.087		3.6	0.7	0.098	
LA-0.7	7/17/05 23:56	CS	16	3	1.3		36	6.1	2.8		1.6	0.33	0.037		0.074	0.051	0.022	LT	1.2	0.26	0.037	
LA-0.7	8/12/05 14:21	CS	75	14	5	M3	120	21	11	M3	2	0.33	0.005		0.12	0.037	0.016	LT	1.8	0.3	0.02	
LA-0.7	8/12/05 16:21	CS	38	6.8	2.4		59	10	4.8	M3	1.2	0.21	0.013		0.082	0.026	0.0043	LT	1.1	0.18	0.0099	
LA-0.7	8/12/05 18:21	CS	25	4.6	2		61	10	3.6		0.78	0.13	0.021		0.042	0.019	0.013	LT	0.63	0.11	0.02	
LA-0.7	8/12/05 20:21	CS	13	2.3	0.89		40	6.6	2.1		0.65	0.12	0.014		0.035	0.017	0.013	LT	0.53	0.099	0.004	
LA-0.7	8/24/05 18:37	CS	250	43	9.1	M3	300	51	22	M3	5.2	0.87	0.05		0.22	0.092	0.059		4.5	0.76	0.05	
LA-0.7	8/24/05 20:37	CS	130	22	4.8	M3	170	29	11	M3	2.2	0.36	0.025		0.11	0.04	0.02	LT	2	0.33	0.025	
LA-0.7	8/24/05 22:37	CS	66	11	2.4		87	14	5.1	M3	1.3	0.22	0.024		0.062	0.023	0.015	LT	1.3	0.21	0.016	
LA-0.7	8/25/05 18:20	CS	110	19	5.7	M3	160	27	11	M3	2.6	0.44	0.049		0.15	0.054	0.028	LT	2.4	0.41	0.043	
LA-0.7	8/25/05 18:20	DUP									1.8	0.32	0.04	W	0.035	0.033	0.047	U,WNC	1.5	0.27	0.053	W
LA-6.6	8/12/05 14:50	CS	8.8	1.7	0.92		21	3.5	1.7		0.45	0.086	0.019		0.029	0.016	0.013	LT	0.39	0.077	0.017	
LA-6.6	8/12/05 22:34	CS	49	8.6	2.4		79	13	5.1	M3	1.8	0.3	0.043		0.14	0.043	0.024	LT	1.8	0.29	0.014	
LA-6.6	8/13/05 0:04	CS	14	2.6	1.2		29	5	2.2		0.67	0.12	0.017		0.031	0.016	0.015	LT	0.6	0.11	0.013	
LA-6.6	8/13/05 1:36	CS	7.6	1.4	0.61		16	2.7	1.2		0.43	0.081	0.012		0.033	0.016	0.012	LT	0.46	0.086	0.012	
LA-6.6	8/13/05 3:36	CS	5.5	1.1	0.61		13	2.2	1.2		0.35	0.069	0.017		0.023	0.013	0.011	LT	0.37	0.072	0.018	
LA-6.6	8/22/05 13:39	CS	240	41	9.6	M3	330	56	23	M3	16	2.5	0.072		1.2	0.28	0.11		14	2.3	0.057	
LA-6.6	8/22/05 13:39	DUP									15	2.3	0.1		0.76	0.2	0.11		14	2.2	0.13	
LA-6.6	8/22/05 15:09	CS	17	2.9	0.92		29	4.9	1.8		0.58	0.1	0.019		0.049	0.019	0.0042	LT	0.57	0.1	0.021	
LA-6.6	8/24/05 15:42	CS	220	38	9.1	M3	250	44	22	M3	6.9	1.2	0.17		0.34	0.14	0.13		6.9	1.2	0.13	
LA-6.6	8/24/05 15:42	DUP									7.4	1.2	0.11		0.35	0.13	0.076	NC	7.1	1.2	0.024	
LA-6.6	8/24/05 16:32	CS	98	17	5.1	M3	140	24	11	M3	2.9	0.49	0.047		0.19	0.064	0.031	LT	3.1	0.51	0.043	
LA-6.6	8/24/05 18:02	CS	22	3.9	1.1		37	6.2	2.7		0.82	0.14	0.019		0.037	0.016	0.011	LT	0.79	0.13	0.016	
LA-6.6	8/24/05 19:32	CS	12	2.2	0.99		23	4	1.8		0.55	0.099	0.016		0.036	0.018	0.017	LT	0.52	0.096	0.021	
LA-6.6	8/24/05 19:32	DUP	10	1.9	0.96		22	3.8	1.7													
Los Alamos at Gage E042	8/12/05 14:26	CS	27	4.7	1.3		60	9.9	2.3		0.53	0.096	0.012		0.033	0.017	0.017	LT	0.48	0.09	0.019	
Los Alamos at Gage E042	8/25/05 15:45	CS																				
Los Alamos at Gage E042	8/25/05 17:16	CS	82	14	4	M3	140	23	7.3	M3	1.6	0.27	0.02		0.069	0.027	0.016	LT	1.3	0.23	0.017	
Los Alamos at Gage E042	8/25/05 18:47	CS	17	2.9	0.95		45	7.4	1.8		0.58	0.11	0.016		0.043	0.02	0.017	LT	0.47	0.089	0.02	
PU-0.3	8/24/05 18:15	CS																				
PU-0.3	8/24/05 20:15	CS																				
PU-0.3	8/24/05 20:15	DUP																				
PU-0.3	8/24/05 22:15	CS																				
PU-0.3	8/25/05 0:15	CS																				
PU-3.1	7/15/05 17:56	CS	250	44	12	M3	290	50	24	M3	32	6.4	0.83	M3	1.7	0.99	0.37	M3	31	6.2	0.32	M3
PU-3.1	7/15/05 19:06	CS	26	4.6	1.3		42	7	2.7		10	2	0.22	M3	0.57	0.32	0.11		11	2.1	0.27	M3
PU-3.1	8/12/05 9:48	CS																				
PU-3.1	8/12/05 13:18	CS																				
PU-3.1	8/24/05 15:26	CS																				
PU-3.1	8/24/05 15:26	DUP																				
PU-3.1	8/24/05 17:46	CS																				
PU-3.1	8/24/05 18:56	CS																				
PU-4.1	7/15/05 17:28	CS	180	32	11	M3	210	38	23	M3	20	4.3	0.95	M3	0.47	0.58	0.97	U,M	19	4.2	0.75	M3
PU-4.1	7/15/05 18:18	CS	26	4.9	2.4		38	7.1	5.1	M3	8.5	1.8	0.34	M3	0.51	0.33	0.25	M3	8.7	1.8	0.26	M3
PU-4.1	7/15/05 19:58	CS	71	13	5.2	M3	91	17	11	M3	3.5	0.68	0.13		0.2	0.11	0.089		3.5	0.68	0.1	
PU-4.1	8/12/05 9:12	CS																				
PU-4.1	8/12/05 10:02	CS																				
PU-4.1	8/12/05 10:52	CS																				
PU-4.1	8/12/05 11:42	CS																				

Table 2. Radiochemical Analysis of Storm Water for 2005 (pCi/L unfiltered) Continued

LOCATION	DATE / TIME	TYPE	Am-241 RESULT	Am-241 UNCERT	Am-241 MDA	Am-241 QUAL	Pu-238 RESULT	Pu-238 UNCERT	Pu-238 MDA	Pu-238 QUAL	Pu-239/240 RESULT	Pu-239/240 UNCERT	Pu-239/240 MDA	Pu-239/240 QUAL	Sr-90 RESULT	Sr-90 UNCERT	Sr-90 MDA	Sr-90 QUAL	Cs-137 RESULT	Cs-137 UNCERT	Cs-137 MDA	Cs-137 QUAL
CDB-2.0	8/12/05 10:40	CS					0.0041	0.02	0.03	U	0.044	0.028	0.011	LT	0.54	0.42	0.65	U	1.8	3.6	6	U,M
DP-0.1/DPS-4	8/12/05 15:00	CS					0.022	0.012	0.004	LT	0.15	0.037	0.004		18	4.4	0.71		0.85	2.7	4.7	U
DP-0.1/DPS-4	8/12/05 15:00	DUP																				
LA-0.7	7/17/05 17:56	CS	-0.072	0.65	0.98	U,M	-0.039	0.47	0.68	U,M	1.3	0.85	0.35	M3	3.9	5.8	9.5	U,M	3.9	23	39	U,M
LA-0.7	7/17/05 17:56	DUP	0.57	0.58	0.39	M3NC	0	0.44	0.33	U,MNC	1.7	0.95	0.64	M3NC	3.7	5.2	8.4	U,MNC	-6.2	14	23	U,MNC
LA-0.7	7/17/05 19:56	CS	0.084	0.1	0.076	LT	0	0.1	0.077	U	0.23	0.16	0.076		1.4	1.2	1.9	U,M	2.5	6	10	U,M
LA-0.7	7/17/05 21:56	CS	0.082	0.083	0.055	Y2,LT	-0.0038	0.046	0.067	U	0.37	0.15	0.034		0.78	0.52	0.79	U	0.56	2.9	4.9	U
LA-0.7	7/17/05 23:56	CS	0.022	0.027	0.042	U	-0.0076	0.031	0.06	U	0.12	0.071	0.071		0.48	0.32	0.48	U	-1	1.6	2.7	U
LA-0.7	8/12/05 14:21	CS					0.13	0.038	0.0054		2.1	0.35	0.021		1	0.38	0.56		5.8	3.5	5.2	M3
LA-0.7	8/12/05 16:21	CS					0.079	0.026	0.014	LT	1.4	0.23	0.0041		1.4	0.39	0.37		3.9	2.8	4.3	U
LA-0.7	8/12/05 18:21	CS					0.025	0.014	0.012	LT	2.1	0.33	0.0043		2.9	0.76	0.53		2	2	3.2	U
LA-0.7	8/12/05 20:21	CS					0.011	0.0094	0.011	U	2.2	0.35	0.016		2.5	0.75	0.78		-0.71	1.9	3.3	U
LA-0.7	8/24/05 18:37	CS					0.41	0.12	0.061		11	1.8	0.048		0.98	0.42	0.55	LT	17	10	16	M3
LA-0.7	8/24/05 20:37	CS					0.16	0.046	0.0062		3.2	0.52	0.017		3	0.81	0.59		6.2	1.4	1.8	
LA-0.7	8/24/05 22:37	CS					0.076	0.023	0.0037	LT	9.7	1.5	0.01		3.9	1	0.56		0.57	2.8	4.8	U
LA-0.7	8/25/05 18:20	CS					0.13	0.049	0.033		9.2	1.4	0.033		1.9	0.61	0.63		2.4	4	6.7	U,M
LA-0.7	8/25/05 18:20	DUP					0.13	0.051	0.034	NC	7.6	1.2	0.0098		1.7	0.57	0.6	NC	2.3	1.5	2.4	UNC
LA-6.6	8/12/05 14:50	CS					-0.0029	0.025	0.04	U	0.34	0.11	0.019		0.23	0.31	0.51	Y2,U	-0.42	1.7	2.9	U
LA-6.6	8/12/05 22:34	CS					0.021	0.021	0.031	U	3.9	0.62	0.025		0.81	0.38	0.65	Y1,LT	0.83	0.87	1.4	U
LA-6.6	8/13/05 0:04	CS					0	0.0067	0.0037	U	0.66	0.12	0.0037		0.87	0.9	1.4	U,M	2.2	2	3.1	U
LA-6.6	8/13/05 1:36	CS					0	0.0082	0.017	U	0.3	0.062	0.017		0.059	0.83	1.4	U,M	-0.11	2.2	3.8	U
LA-6.6	8/13/05 3:36	CS					0.0064	0.0091	0.015	U	0.098	0.031	0.023	LT	0.048	1.3	2.1	U,M	0.79	1.6	2.7	U
LA-6.6	8/22/05 13:39	CS					0.17	0.091	0.097		10	1.7	0.022		2.4	0.92	1.2	M3	4	7.7	13	U,M
LA-6.6	8/22/05 13:39	DUP					0.2	0.089	0.059	NC	10	1.6	0.096		0.77	0.76	1.2	U,MNC	13	7.9	12	M,TINC
LA-6.6	8/22/05 15:09	CS					0.0044	0.0072	0.004	LT	0.49	0.092	0.016		0.56	0.77	1.2	U,M	1.4	2.6	4.3	U
LA-6.6	8/24/05 15:42	CS					0.066	0.058	0.077	U	14	2.2	0.077		6.3	1.5	0.52		0.93	9.3	16	U,M
LA-6.6	8/24/05 15:42	DUP					0.13	0.081	0.083	NC	13	2.1	0.024		0.8	0.4	0.56	LT,DNC	2.3	7.1	12	U,MNC
LA-6.6	8/24/05 16:32	CS					0.017	0.017	0.0091	LT	3.8	0.61	0.025		2.4	0.71	0.66		2.2	2.9	4.7	U
LA-6.6	8/24/05 18:02	CS					-0.0027	0.0076	0.018	U	0.86	0.15	0.019		0.86	0.41	0.58	LT	0.61	2.7	4.6	U
LA-6.6	8/24/05 19:32	CS					0	0.0072	0.014	U	0.31	0.063	0.011		0.83	0.39	0.55	LT	1	2.6	4.5	U
LA-6.6	8/24/05 19:32	DUP																				
Los Alamos at Gage E042	8/12/05 14:26	CS					0.042	0.017	0.01	LT	0.51	0.093	0.01		6.6	1.6	0.67		3.3	2.7	4.2	U
Los Alamos at Gage E042	8/25/05 15:45	CS					0.28	0.12	0.088													
Los Alamos at Gage E042	8/25/05 17:16	CS					0.15	0.04	0.016		2.9	0.47	0.021		8	2	0.8		6.5	1.8	2.4	
Los Alamos at Gage E042	8/25/05 18:47	CS					0.031	0.016	0.017	LT	0.83	0.14	0.017		7.4	1.9	0.86		2.7	3	4.9	U
PU-0.3	8/24/05 18:15	CS					0.12	0.038	0.019		27	4.2	0.015									
PU-0.3	8/24/05 20:15	CS					0.037	0.065	0.11	U,M	7.4	1.3	0.15	M3								
PU-0.3	8/24/05 20:15	DUP					0	0.074	0.16	U,MNC	7.8	1.4	0.16	M3								
PU-0.3	8/24/05 22:15	CS					0.008	0.014	0.024	U	2	0.33	0.0054									
PU-0.3	8/25/05 0:15	CS					0.0021	0.01	0.016	U	0.53	0.11	0.026									
PU-3.1	7/15/05 17:56	CS	6.4	1.9	0.53	M3	0.28	0.43	0.74	U,M	110	19	0.61	M3	8.4	5.5	8.3	M3	11	8.7	14	U,M
PU-3.1	7/15/05 19:06	CS	4.1	1.2	0.32	M3	0.18	0.17	0.2	U,M	33	6	0.24	M3	2.5	2.9	4.7	Y2,U,M	-0.41	9.4	16	U,M
PU-3.1	8/12/05 9:48	CS					0.29	0.12	0.074		57	8.8	0.074									
PU-3.1	8/12/05 13:18	CS					0.1	0.037	0.0074		21	3.1	0.0074									
PU-3.1	8/24/05 15:26	CS					0.32	0.16	0.13	M3	100	16	0.046									
PU-3.1	8/24/05 15:26	DUP					0.54	0.21	0.12	M3NC	92	14	0.18	M3								
PU-3.1	8/24/05 17:46	CS					0.057	0.049	0.068	U	14	2.2	0.056									
PU-3.1	8/24/05 18:56	CS					0.13	0.06	0.017		18	2.8	0.017									
PU-4.1	7/15/05 17:28	CS	4.1	1.5	0.29	M3	0.5	0.5	0.34	M3	88	16	0.65	M3	8	4.6	6.7	M3	-2.2	28	48	U,M
PU-4.1	7/15/05 18:18	CS	1.1	0.4	0.19	M3	0.21	0.2	0.23	U,M	23	4.4	0.28	M3	2.6	1.9	2.9	U,M	4.8	11	18	U,M
PU-4.1	7/15/05 19:58	CS	0.57	0.23	0.11	M3	0.083	0.084	0.14	U,M	10	1.8	0.083		1.5	0.62	0.8		0.5	3.5	5.9	U,M
PU-4.1	8/12/05 9:12	CS					0.19	0.13	0.15	M3	36	5.6	0.12	M3								
PU-4.1	8/12/05 10:02	CS					0.13	0.091	0.1	M3	27	4.3	0.082									
PU-4.1	8/12/05 10:52	CS					0.068	0.03	0.008	LT	20	3.1	0.022									
PU-4.1	8/12/05 11:42	CS					0.076	0.028	0.0057	LT	16	2.5	0.016									

Table 3. Radiochemical Analysis of Storm Water for 2006 (pCi/L unfiltered)

			Am-241				Pu-238				Pu-239/240				Sr-90				Cs-137			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
AC-0.2	9/11/06 13:36	CS					0.174	0.047	0.026		33.7	5.1	0									
LA-0.7	7/6/06 6:42	CS					0.022	0.033	0.057	U	1.11	0.28	0.06									
LA-0.7	7/6/06 7:42	CS					-0.002	0.016	0.032	U	0.33	0.072	0.021									
LA-0.7	7/6/06 8:42	CS					0.0037	0.0092	0.0173	U	0.169	0.044	0.005									
LA-0.7	7/6/06 21:22	CS					-0.002	0.027	0.039	U	0.111	0.06	0.02									
LA-0.7	7/6/06 21:22	DUP																				
LA-0.7	7/6/06 23:22	CS					0.025	0.03	0.045	U	0.22	0.081	0.017									
LA-0.7	7/6/06 23:22	DUP					0.009	0.024	0.038	UNC	0.182	0.07	0.052	NC								
LA-0.7	7/7/06 1:22	CS					0.003	0.013	0.007	U	0.035	0.021	0.02	LT								
LA-0.7	8/6/06 2:09	CS					0.126	0.097	0.049		1.69	0.44	0.22	M3								
LA-0.7	8/6/06 4:14	CS					0.026	0.025	0.034	U	1.04	0.2	0.01									
LA-0.7	8/6/06 4:14	DUP					0	0.026	0.02	U	0.28	0.1	0.04									
LA-0.7	8/6/06 6:14	CS					-0.002	0.011	0.025	U	0.117	0.038	0.006									
LA-0.7	8/8/06 16:25	CS					0.067	0.048	0.041	LT	11	1.9	0									
LA-0.7	8/8/06 17:25	CS					0.65	0.22	0.04		103	16	0	M3								
LA-0.7	8/8/06 17:25	DUP					0.47	0.2	0.16	M3NC	100	15	0	M3								
LA-0.7	8/8/06 18:25	CS					0.48	0.15	0.07		84	13	0									
LA-0.7	8/8/06 19:25	CS					0.281	0.093	0.043		53.2	8.1	0									
LA-0.7	8/8/06 20:26	CS					0.192	0.059	0.009		37.5	5.7	0									
LA-0.7	8/8/06 21:25	CS					0.233	0.064	0.031		29.2	4.5	0									
LA-0.7	8/19/06 15:47	CS					0.015	0.031	0.045	U	0.39	0.14	0.07									
LA-0.7	8/19/06 15:47	DUP																				
LA-0.7	8/25/06 16:41	CS					0.152	0.079	0.055		11.6	2.1	0.1									
LA-0.7	8/25/06 17:41	CS					0.272	0.09	0.056		42.1	6.4	0									
LA-0.7	8/25/06 18:41	CS					0.57	0.22	0.13	M3	128	20	0	M3								
LA-5.0	8/1/06 17:09	CS					0.339	0.074	0.025		3.4	0.54	0.01									
LA-5.0	8/1/06 17:09	DUP					0.207	0.092	0.05	NC	2.61	0.75	0.06									
LA-5.0	8/1/06 17:09	DUP					0.226	0.089	0.021		3.95	0.52	0.05	W								
LA-5.0	8/5/06 1:50	CS					0	0.0097	0.0146	U	0.024	0.014	0.005	LT								
LA-5.0	8/7/06 14:29	CS					0.284	0.067	0.016		3.02	0.48	0.02									
LA-5.0	8/7/06 14:29	DUP					0.362	0.078	0.006		7.6	1.2	0	D								
LA-5.0	8/7/06 14:29	DUP					0.37	0.12	0.05		4.63	0.79	0.01									
LA-5.0	8/7/06 14:29	DUP					0.235	0.099	0.024		4.8	0.86	0.05									
LA-5.0	8/7/06 14:29	DUP					0.267	0.087	0.014		3.92	0.76	0.05									
LA-5.0	8/8/06 14:40	CS					1.36	0.28	0.05		19.3	3	0									
PU-0.3	7/26/06 15:13	CS					0	0.026	0.056	U	0.47	0.12	0.06									
PU-0.3	7/26/06 19:13	CS					0.003	0.013	0.024	U	0.64	0.13	0.02									
PU-0.3	8/5/06 9:52	CS																				
PU-0.3	8/5/06 11:22	CS					0	0.012	0.019	U	1.34	0.23	0.01									
PU-0.3	8/8/06 15:47	CS																				
PU-0.3	8/8/06 16:47	CS																				
PU-0.3	8/8/06 17:47	CS																				
PU-0.3	8/8/06 18:47	CS																				
PU-0.3	8/8/06 19:47	CS																				
PU-0.3	8/8/06 20:47	CS																				
PU-0.3	8/25/06 14:21	CS					0.01	0.024	0.036	U	3.12	0.54	0.05									
PU-0.3	8/25/06 15:21	CS					0.52	0.16	0.03		163	25	0									
PU-0.3	8/25/06 16:21	CS					0.185	0.066	0.045		62	9.4	0.1									
PU-5.5	8/8/06 14:20	CS																				
PU-5.5	8/25/06 13:23	CS					-0.0019	0.0094	0.0179	U	0.06	0.023	0.005	LT								
PU-5.5	8/25/06 13:23	DUP					0.0019	0.0093	0.0176	UNC	0.14	0.039	0.014	W								
PU-5.5	8/25/06 15:48	CS					0.31	0.12	0.04		4.78	0.9	0.04									
PU-5.5	8/25/06 16:48	CS					0.235	0.056	0.014		2.82	0.45	0.01									

Table 4. Radiochemical Analysis of Storm Water for 2007 (pCi/L unfiltered)

			Gross A				Gross B				U-234				U-235				U-238			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
LA-5.0	8/6/07 19:31	CS	530	90	18	M3	510	83	23	M3												
LA-5.0	8/29/07 16:49	CS																				
LA-5.0	8/29/07 19:45	CS	51	8.7	1.7		78	13	3.9													
LA-5.0	9/1/07 16:10	CS	180	31	9.1	M3	210	38	24	M3												
LA-5.0	9/1/07 17:36	CS	84	15	3.9	M3	110	19	8.4	M3												
LA-5.0	9/1/07 19:06	CS	80	14	4.1	M3	130	22	6.2	M3												
LA-5.0	9/2/07 16:45	CS	220	40	15	M3	370	63	24	M3												
LA-5.0	9/2/07 18:15	CS																				
LA-5.0	9/2/07 19:45	CS																				
PU-5.5	7/14/07 18:02	CS	22	4.1	1.2		28	4.8	2.4													
PU-5.5	7/14/07 19:02	CS	53	9.7	3.7	M3	93	16	7.5	M3												
PU-5.5	7/14/07 20:02	CS	33	5.8	1.6		36	6.2	3.2													
PU-5.5	7/26/07 14:16	CS	250	45	14	M3	360	61	24	M3												
PU-5.5	7/26/07 15:15	CS	110	20	6.1	M3	160	27	13	M3												
PU-5.5	7/26/07 16:15	CS	36	6.4	1.9		60	10	4.1	M3												
PU-5.5	7/26/07 17:15	CS	11	2.5	1.3		25	4.5	3.1													
PU-5.5	7/26/07 18:15	CS	5.1	2	2.1		16	3.5	3.4													
PU-5.5	8/4/07 14:16	CS	35	6.7	3.1	M3	68	12	5.6	M3												
PU-5.5	8/4/07 15:15	CS	9.9	2.4	1.4		20	3.7	2.7													
PU-5.5	8/4/07 16:15	CS	4.2	1.3	1.1		11	2.3	2.2													
PU-5.5	8/4/07 17:15	CS	2.7	1.1	1.4	LT	7.9	1.9	2.2													
PU-5.5	8/4/07 18:15	CS	1	0.97	1.8	U	7.5	2	2.9													
PU-5.5	9/1/07 14:38	CS	120	21	6	M3	160	27	10	M3												
PU-5.5	9/1/07 15:37	CS	47	8.6	3.5	M3	77	13	6.9	M3												
PU-5.5	9/1/07 16:37	CS	14	3.1	1.6		24	4.4	2.5													
PU-5.5	9/1/07 17:37	CS	5.6	1.7	1.4		17	3.2	2.3													
PU-5.5	9/1/07 18:37	CS	4.2	1.7	1.9		12	2.8	3.2													
AC-0.2	7/14/07 17:47	CS	110	19	4	M3	100	17	7.2	M3												
AC-0.2	7/30/07 13:24	CS	46	8	1.9		57	9.5	3.7													
AC-0.2	8/4/07 14:02	CS	87	16	5.7	M3	75	14	11	M3												
AC-0.2	8/4/07 14:22	CS	79	13	2.7		54	9.2	4.2	M3												
AC-0.2	8/18/07 13:16	CS	31	5.5	1.7		34	6	3.2													
AC-0.2	8/18/07 13:34	CS	41	7	1.7		44	7.5	3.3													
AC-0.2	8/29/07 15:02	CS	220	37	5.1	M3	170	28	12	M3												
AC-0.2	8/29/07 15:20	CS	83	14	2.3		66	11	4.1	M3												
AC-0.2	8/29/07 15:40	CS	49	8.4	1.6		44	7.5	3.5													
AC-0.2	8/29/07 16:00	CS	21	4.2	1.4		20	3.9	3.2													
AC-0.2	8/29/07 16:20	CS	88	15	4.5	M3	73	13	8.1	M3												
AC-0.2	9/1/07 14:28	CS	75	13	3	M3	76	13	5.8	M3												
AC-0.2	9/1/07 14:46	CS	41	7.1	1.6		38	6.4	2.7													
AC-0.2	9/1/07 15:06	CS	33	6.2	1.8		26	4.7	2.8													
AC-0.2	9/1/07 16:19	CS	450	76	12	M3	370	61	21	M3												
PU-0.3	8/6/07 20:01	CS	240	43	12	M3	230	41	23	M3												
PU-0.3	8/6/07 20:46	CS																				
PU-0.3	8/6/07 21:31	CS	8.5	2.2	1.9		34	5.8	3													
PU-0.3	8/6/07 22:16	CS	2.8	1.3	2	LT		4.4	2.7													
PU-0.3	8/6/07 23:01	CS	2.5	1.1	1.5	LT	18	3.4	2.3													

Table 4. Radiochemical Analysis of Storm Water for 2007 (pCi/L unfiltered) Continued

			Am-241				Pu-238				Pu-239/240				Sr-90				Cs-137			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
LA-5.0	8/6/07 19:31	CS					0.13	0.12	0.13	M3	1.1	0.37	0.2	M3								
LA-5.0	8/29/07 16:49	CS					0.59	0.17	0.072		6.9	1.2	0.072		4.5	1.1	0.6		7.8	5.8	9.2	U
LA-5.0	8/29/07 19:45	CS					0.041	0.02	0.0061	LT	1.1	0.19	0.017		3.5	0.9	0.46		5.5	5.9	9.6	U
LA-5.0	9/1/07 16:10	CS					0.23	0.063	0.022		7.6	1.2	0.027		3.6	0.97	0.72		-1.9	5.5	9.8	U
LA-5.0	9/1/07 17:36	CS					0.12	0.039	0.022		4.8	0.76	0.017		1.8	0.53	0.55		4	4.6	7.6	U
LA-5.0	9/1/07 19:06	CS					0.047	0.026	0.024	LT	2.9	0.48	0.024		3.2	0.8	0.43		0.39	4.5	7.8	U
LA-5.0	9/2/07 16:45	CS					0.62	0.26	0.2	M3	7.7	1.5	0.17	M3								
LA-5.0	9/2/07 18:15	CS					0.19	0.088	0.048		3.6	0.7	0.058		3.5	1	1.1	M3	0.47	5.7	10	U
LA-5.0	9/2/07 19:45	CS					0.061	0.047	0.023	LT	1.7	0.37	0.063		3.8	1	0.73		0.66	5.7	9.9	U
PU-5.5	7/14/07 18:02	CS					-0.0097	0.014	0.034	U	0.039	0.022	0.022	LT								
PU-5.5	7/14/07 19:02	CS					0	0.01	0.019	U	0.081	0.029	0.0056	LT								
PU-5.5	7/14/07 20:02	CS					-0.0019	0.0094	0.021	U	0.017	0.013	0.014	LT								
PU-5.5	7/26/07 14:16	CS					0.019	0.047	0.026	U	0.65	0.19	0.026									
PU-5.5	7/26/07 15:15	CS					0.0084	0.014	0.0076	LT	0.17	0.052	0.03									
PU-5.5	7/26/07 16:15	CS					0.0039	0.0095	0.018	U	0.052	0.023	0.016	LT								
PU-5.5	7/26/07 17:15	CS					-0.0086	0.011	0.028	U	0.047	0.022	0.016	LT								
PU-5.5	7/26/07 18:15	CS					0	0.0097	0.018	U	0.0079	0.0097	0.014	U								
PU-5.5	8/4/07 14:16	CS					0.0065	0.024	0.018	U	0.071	0.047	0.047	LT								
PU-5.5	8/4/07 15:15	CS					-0.0023	0.025	0.037	U	0.089	0.052	0.019	LT								
PU-5.5	8/4/07 16:15	CS					0	0.023	0.017	U	0.012	0.023	0.017	U								
PU-5.5	8/4/07 17:15	CS					0.0044	0.024	0.036	U	0.0044	0.024	0.035	U								
PU-5.5	8/4/07 18:15	CS					-0.01	0.029	0.063	U	0.016	0.029	0.021	U								
PU-5.5	9/1/07 14:38	CS					0.007	0.017	0.032	U	0.14	0.049	0.026									
PU-5.5	9/1/07 15:37	CS					-0.0059	0.015	0.028	U	0.05	0.028	0.028	LT								
PU-5.5	9/1/07 16:37	CS					0	0.011	0.02	U	0.032	0.019	0.02	LT								
PU-5.5	9/1/07 17:37	CS					-0.0021	0.01	0.02	U	0.013	0.016	0.026	U								
PU-5.5	9/1/07 18:37	CS					0.0082	0.013	0.02	U	0.0027	0.013	0.025	U								
AC-0.2	7/14/07 17:47	CS					0.11	0.044	0.011		23	3.6	0.01									
AC-0.2	7/30/07 13:24	CS					0.029	0.019	0.02	LT	5.7	0.9	0.024									
AC-0.2	8/4/07 14:02	CS					0.18	0.079	0.056		35	5.9	0.045									
AC-0.2	8/4/07 14:22	CS					0.094	0.051	0.017	LT	34	5.7	0.046									
AC-0.2	8/18/07 13:16	CS					0.15	0.044	0.0063		38	5.8	0.017									
AC-0.2	8/18/07 13:34	CS					0.081	0.03	0.0061	LT	16	2.4	0.0061									
AC-0.2	8/29/07 15:02	CS					0.25	0.093	0.06		78	12	0.069									
AC-0.2	8/29/07 15:20	CS					0.21	0.052	0.019		45	6.9	0.019									
AC-0.2	8/29/07 15:40	CS					0.1	0.035	0.026		24	3.7	0.015									
AC-0.2	8/29/07 16:00	CS					0.094	0.032	0.019	LT	21	3.2	0.015									
AC-0.2	8/29/07 16:20	CS					0.046	0.024	0.022	LT	16	2.5	0.022									
AC-0.2	9/1/07 14:28	CS					0.13	0.045	0.022		27	4.2	0.022									
AC-0.2	9/1/07 14:46	CS					0.083	0.03	0.019	LT	19	2.9	0.015									
AC-0.2	9/1/07 15:06	CS					0.099	0.045	0.037	LT	13	2.1	0.029									
AC-0.2	9/1/07 16:19	CS					0.38	0.19	0.06	Y2	75	13	0.06	Y2								
PU-0.3	8/6/07 20:01	CS					-0.0074	0.05	0.078	U	2.5	0.53	0.096									
PU-0.3	8/6/07 20:46	CS					0.035	0.04	0.052	U	1.3	0.31	0.026									
PU-0.3	8/6/07 21:31	CS					0.0048	0.026	0.038	U	0.34	0.11	0.046									
PU-0.3	8/6/07 22:16	CS					0.0046	0.025	0.037	U	0.29	0.1	0.037									
PU-0.3	8/6/07 23:01	CS					-0.0024	0.026	0.039	U	0.23	0.09	0.02									

Table 5. Radiochemical Analysis of Storm Water for 2008 (pCi/L unfiltered)

			Gross A				Gross B				U-234				U-235				U-238			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
LA-5.0	7/5/08 16:02	CS	150	25	1.8		36	6.4	4		4.5	0.83	0.053		0.2	0.074	0.015	LT	2.3	0.44	0.041	
LA-5.0	7/5/08 16:47	CS	120	19	1.7		27	5	3.5		3.5	0.62	0.0091		0.13	0.05	0.011	LT	1.8	0.34	0.026	
LA-5.0	7/5/08 17:37	CS	82	14	1.7		29	5.2	3.1		3.1	0.56	0.041		0.14	0.054	0.026	LT	1.4	0.28	0.032	
LA-5.0	7/5/08 18:17	CS	77	13	1.6		25	4.7	3.4		3.1	0.58	0.064		0.15	0.066	0.053	LT	1.5	0.3	0.061	
LA-5.0	7/5/08 19:17	CS	44	7.6	1.1		17	3.3	2.7		2.5	0.47	0.032		0.092	0.045	0.013	LT	1.3	0.27	0.026	
LA-0.7	7/22/08 15:47	CS	1900	350	130	M3	2900	490	190	M3	93	17	1.1	M3	5.5	2	1.3	M3	97	17	1	M3
Buckman @ Rio Grande	7/26/08 22:03	CS	23	4.5	2.2	M3	35	6.2	3.8	M3	NA				NA				NA			
LA-5.0	8/9/08 15:49	CS	180	31	5.4	M3	190	31	7.7	M3	7.1	1.2	0.028		0.37	0.099	0.011		5.2	0.9	0.032	
LA-5.0	8/9/08 16:34	CS	110	19	3	M3	120	20	6.1	M3	5	0.88	0.03		0.25	0.079	0.012		3.4	0.61	0.01	
LA-5.0	8/9/08 17:19	CS	64	11	1.7		61	10	3.1		2.1	0.39	0.04		0.11	0.051	0.048	LT	1.8	0.34	0.047	
LA-5.0	8/9/08 18:04	CS	29	5.8	2.2		44	7.6	3.5		1.3	0.26	0.029		0.054	0.033	0.028	LT	1	0.21	0.01	
LA-5.0	8/9/08 19:04	CS	13	2.8	1.7		30	5.2	2.4		0.82	0.18	0.029		0.028	0.024	0.027	LT	0.62	0.14	0.023	
LA-0.7	8/20/08 16:40	CS	4.1	1.9	2.8		5.4	1.8	2.9		12	2	0.084		0.51	0.17	0.11		11	1.8	0.084	
LA-0.7	8/20/08 17:25	CS																				
LA-0.7	8/20/08 18:10	CS																				
LA-0.7	8/20/08 18:55	CS																				
LA-0.7	8/20/08 20:40	CS																				
LA-0.7	8/20/08 20:40	DUP																				
LA-0.7	8/21/08 1:10	CS																				
LA-5.0	8/23/08 7:40	CS	140	24	6.7	M3	180	30	11	M3	4.4	0.88	0.069		0.21	0.1	0.031		3.6	0.72	0.045	
LA-5.0	8/23/08 8:25	CS																				
LA-5.0	8/23/08 9:10	CS																				
Buckman @ Rio Grande	8/24/08 19:59	CS	12	2.6	2		21	3.9	2.8		1.8	0.41	0.078		0.12	0.08	0.075	LT	1.5	0.36	0.09	
Buckman @ Rio Grande	8/24/08 20:57	CS																				
Buckman @ Rio Grande	8/24/08 21:57	CS	90	17	8	M3	100	18	10	M3	4	0.84	0.079		0.1	0.082	0.083	LT	3.8	0.79	0.071	
Buckman @ Rio Grande	9/9/08 22:28	CS	15	3.1	2.1		22	4.2	3.3		1.4	0.33	0.061		0.029	0.042	0.072	U	1.1	0.28	0.067	
Buckman @ Rio Grande	9/9/08 23:26	CS	8.6	2.6	2.5		13	3	3.4		1.2	0.31	0.12		0.0082	0.045	0.07	U	0.68	0.21	0.067	
Buckman @ Rio Grande	9/9/08 23:26	DUP																				
Buckman @ Rio Grande	10/11/08 19:47	CS	420	77	32	M3	500	89	53	M3	26	5.2	0.38	M3	0.92	0.55	0.4	M3	26	5.1	0.41	M3
Buckman @ Rio Grande	10/11/08 20:44	CS																				
Buckman @ Rio Grande	10/11/08 20:44	DUP																				
Buckman @ Rio Grande	10/11/08 21:44	CS	610	110	44	M3	720	130	74	M3	12	2	0.12		0.77	0.25	0.042		12	2	0.098	
LA-5.0	10/11/08 18:08	CS	74	13	3.2	M3	98	16	4.4	M3	2.5	0.54	0.055		0.081	0.064	0.056	LT	2.1	0.47	0.055	
LA-5.0	10/11/08 18:53	CS																				
LA-5.0	10/11/08 19:53	CS																				
LA-5.0	10/11/08 20:23	CS																				

Table 5. Radiochemical Analysis of Storm Water for 2008 (pCi/L unfiltered) Continued

			Am-241				Pu-238				Pu-239/240				Sr-90				Cs-137			
LOCATION	DATE / TIME	TYPE	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL
LA-5.0	7/5/08 16:02	CS	13	2	0.015		3.9	1	0.23	M3	150	25	0.28	M3	1.3	0.46	0.56		0.24	3.2	5.5	U,M
LA-5.0	7/5/08 16:47	CS	8.1	1.3	0.018		1.5	0.55	0.18	M3	86	14	0.18	M3	1.3	0.44	0.52		-3.3	3.1	5.4	U,M
LA-5.0	7/5/08 17:37	CS	6.3	1	0.0058		2.4	0.73	0.31	M3	68	11	0.28	M3	1.4	0.49	0.66		-0.19	2.4	4.1	U
LA-5.0	7/5/08 18:17	CS	5.6	0.92	0.0066		1.2	0.21	0.018		41	6.2	0.014		1.1	0.44	0.67		0.12	3.9	6.6	U,M
LA-5.0	7/5/08 19:17	CS	4.5	0.74	0.018		1.7	0.6	0.19	M3	40	7	0.25	M3	1.2	0.42	0.53		-3.2	3.2	5.6	U,M
LA-0.7	7/22/08 15:47	CS	0.65	0.61	0.87	U,M	0.057	0.28	0.53	U,M	7.8	1.8	0.42	M3	1.6	3.5	5.7	U,M	57	110	180	U,M
Buckman @ Rio Grande	7/26/08 22:03	CS	-0.0022	0.018	0.037	U	0.0	0.0097	0.015	U	0.0079	0.011	0.018	U	0.043	0.29	0.66	U	-3	2.8	5	U
LA-5.0	8/9/08 15:49	CS	2.6	0.44	0.019		2.8	0.81	0.22	M3	47	8	0.22	M3	2.6	0.79	0.75		2.8	2.9	4.6	U
LA-5.0	8/9/08 16:34	CS	2.5	0.42	0.016		1.8	0.64	0.24	M3	32	5.7	0.24	M3	3.2	0.86	0.56		1.3	2.8	4.7	U
LA-5.0	8/9/08 17:19	CS	1.3	0.24	0.016		0.71	0.13	0.016		11	1.6	0.0045		2.9	0.77	0.46		2.3	2.9	4.8	U
LA-5.0	8/9/08 18:04	CS	0.87	0.16	0.0056		0.35	0.072	0.013		6.8	1	0.016		3.6	0.92	0.44		1.9	2.8	4.6	U
LA-5.0	8/9/08 19:04	CS	0.58	0.12	0.025		0.21	0.05	0.0046		3.4	0.54	0.013		3.3	0.87	0.45		-4.8	3.3	5.8	U,M
LA-0.7	8/20/08 16:40	CS					0.0075	0.037	0.069	U	1.4	0.29	0.055		-0.0086	0.49	0.83	U	6.1	14	23	U,M
LA-0.7	8/20/08 17:25	CS					0.0031	0.015	0.0083	U	0.16	0.051	0.028									
LA-0.7	8/20/08 18:10	CS					0.0022	0.011	0.016	U	0.29	0.066	0.02									
LA-0.7	8/20/08 18:55	CS					0.015	0.076	0.042	U	3.9	0.77	0.2	M3								
LA-0.7	8/20/08 20:40	CS					0.012	0.056	0.031	U	1.1	0.29	0.11	M3								
LA-0.7	8/20/08 20:40	DUP					0.035	0.057	0.031	LT	1.9	0.44	0.26	M3,W								
LA-0.7	8/21/08 1:10	CS					0.079	0.19	0.11	U,M	4.2	1	0.42	M3								
LA-5.0	8/23/08 7:40	CS					0.5	0.094	0.013		6.1	0.93	0.013		5.2	1.3	0.35		2.5	2.3	3.7	U
LA-5.0	8/23/08 8:25	CS					0.28	0.063	0.017		4.2	0.65	0.02									
LA-5.0	8/23/08 9:10	CS					0.13	0.045	0.022		1.5	0.26	0.022									
Buckman @ Rio Grande	8/24/08 19:59	CS					0	0.0093	0.018	U	-0.0019	0.0093	0.02	U	0.015	0.19	0.4	U	-1.5	3	5.2	U,M
Buckman @ Rio Grande	8/24/08 20:57	CS					0	0.005	0.0095	U	0.0051	0.005	0.0028	LT								
Buckman @ Rio Grande	8/24/08 21:57	CS					0.0041	0.01	0.015	U	0.066	0.027	0.019		0.32	0.24	0.46	U	-0.23	4	6.7	U,M
Buckman @ Rio Grande	9/9/08 22:28	CS					0.0016	0.008	0.0044	U	-0.0016	0.008	0.018	U	-0.086	0.19	0.41	U	-2.2	2.5	4.3	U
Buckman @ Rio Grande	9/9/08 23:26	CS					0.0035	0.01	0.019	U	0.0053	0.0086	0.013	U	0.14	0.17	0.34	U	0.16	2.6	4.4	U
Buckman @ Rio Grande	9/9/08 23:26	DUP																	-0.17	2.4	4.1	U
Buckman @ Rio Grande	10/11/08 19:47	CS					0.01	0.049	0.093	U,M	0.13	0.074	0.027		-0.17	0.82	1.4	U,M	-3.9	17	29	U,M
Buckman @ Rio Grande	10/11/08 20:44	CS					0.015	0.074	0.11	U,M	0.11	0.1	0.14	U,M								
Buckman @ Rio Grande	10/11/08 20:44	DUP					0	0.085	0.16	U,M	0.1	0.12	0.19	U,M								
Buckman @ Rio Grande	10/11/08 21:44	CS					0.075	0.074	0.041	M3	0.045	0.074	0.11	U,M	-0.093	0.98	1.6	U,M	-7.8	18	32	U,M
LA-5.0	10/11/08 18:08	CS					0.41	0.083	0.041		4.5	0.7	0.016		3.5	0.87	0.32		2.2	2.9	4.7	U
LA-5.0	10/11/08 18:53	CS					0.22	0.051	0.013		2.7	0.43	0.021									
LA-5.0	10/11/08 19:53	CS					0.086	0.028	0.018	LT	1.3	0.22	0.0044									
LA-5.0	10/11/08 20:23	CS					0.1	0.026	0.012	LT	1.2	0.2	0.02									

Table 6. Radiochemical Analysis of Storm Water for 2003 (pCi/g unfiltered)

			Pu-238					Pu-239/240					SSC (mg/L)
LOCATION	DATE / TIME	TYPE		RESULT	UNCERT	MDA	QUAL		RESULT	UNCERT	MDA	QUAL	RESULT
PU-0.3	8/11/03 23:44	CS	<	0.018	0.02	0.031	U		3.9	0.72	0.01		
PU-0.3	8/11/03 23:52	CS		0.012	0.014	0.011	LT		3.52	0.64	0.02		7800
PU-0.3	8/12/03 0:44	CS		0.032	0.024	0.022	LT		4.03	0.73	0.03		4900
PU-0.3	8/12/03 1:44	CS	<	0.024	0.023	0.032	U		3.83	0.69	0.02		3000
PU-0.3	8/22/03 13:41	CS	<	0.011	0.015	0.022	U		0.083	0.04	0.026		24000
PU-0.3	8/22/03 13:46	CS		0.01	0.06	0.03			0.06	0.04	0.02		
PU-0.3	8/22/03 14:26	CS	<	0.003	0.015	0.022	U		0.316	0.09	0.011		4200
PU-0.3	8/22/03 15:11	CS	<	0.012	0.016	0.023	U		0.28	0.085	0.012		5600
PU-0.3	9/6/03 19:08	CS		0.01	0.02	0.06			4.08	0.52	0.03		
PU-0.3	9/6/03 19:53	CS	<	0.015	0.016	0.021	U		3.92	0.71	0.02		31000
PU-0.3	9/6/03 20:38	CS	<	0.021	0.021	0.024	U		4.68	0.85	0.02		23000
PU-0.3	9/6/03 22:38	CS		0.028	0.022	0.024	LT		5.22	0.92	0.01		6800
PU-6.4	8/11/03 17:42	CS	<	0.011	0.015	0.022	U		0.053	0.031	0.022		110000
PU-6.4	8/11/03 17:42	DUP	<	0	0.016	0.012	U		0.052	0.034	0.035		
PU-6.4	8/11/03 18:00	CS		-0.02	0.02	0.06			0.05	0.02	0.03		
PU-6.4	8/11/03 18:00	DUP		0	0.02	0.05			0.04	0.02	0.03		
PU-6.4	8/11/03 18:27	CS	<	0.011	0.015	0.021	U		0.071	0.036	0.021		35000
PU-6.4	8/23/03 14:50	CS		0	0.02	0.04			0.00	0.02	0.02		95000
PU-6.4	8/23/03 14:50	CS	<	-0.001	0.014	0.02	U	<	0.007	0.014	0.02	U	
PU-6.4	8/30/03 0:52	CS	<	0.001	0.019	0.038	U		0.057	0.037	0.028		24000
PU-6.4	9/3/03 16:58	CS	<	-0.001	0.015	0.022	U	<	0.004	0.015	0.012	U	69000
PU-6.4	9/3/03 16:58	DUP	<	0.003	0.015	0.022	U	<	0.011	0.015	0.022	U	
PU-6.4	9/6/03 16:54	CS	<	-0.003	0.017	0.03	U	<	0.005	0.017	0.013	U	48000

Table 7. Radiochemical Analysis of Storm Water for 2004 (pCi/g unfiltered)

				Pu-238				Pu-239/240				SSC (mg/L)
LOCATION	DATE / TIME	TYPE		RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT
LA-0.7	7/27/04 18:51	CS	<	0.018	0.024	0.043	U	9.2	1.6	0		2323.33
LA-0.7	7/27/04 19:01	CS		0.048	0.027	0.009	LT	8.1	1.4	0		2123.55
LA-0.7	8/19/04 15:15	CS	<	0	0.013	0.01	U	0.112	0.045	0.023		147146.9
LA-0.7	8/19/04 15:23	CS	<	0.004	0.013	0.01	U	0.144	0.052	0.023		83055.56
LA-0.7	8/19/04 15:32	CS	<	-0.002	0.012	0.022	U	0.064	0.031	0.018		55242.72
LA-0.7	8/19/04 16:00	CS	<	0	0.013	0.01	U	0.087	0.038	0.01		36569.27
LA-0.7	8/19/04 16:00	DUP	<	-0.001	0.013	0.019	UNC	0.067	0.034	0.023	NC	
LA-0.7	8/19/04 16:49	CS	<	-0.003	0.013	0.026	U	0.1	0.041	0.01		23091.98
LA-0.7	8/19/04 17:21	CS	<	-0.001	0.012	0.017	U	0.096	0.04	0.023		15316.21
LA-0.7	8/20/04 0:00	CS	<	0.012	0.015	0.022	U	0.95	0.2	0.01		3181.82
LA-0.7	8/20/04 17:28	CS	<	0	0.014	0.01	U	0.04	0.026	0.02	LT	17002.01
LA-0.7	8/20/04 17:35	CS	<	-0.002	0.013	0.023	U	0.059	0.031	0.01		10400
LA-0.7	8/20/04 17:48	CS	<	0.002	0.013	0.019	U	0.033	0.023	0.022	LT	23098.33
LA-0.7	8/20/04 17:58	CS	<	-0.002	0.013	0.023	U	0.043	0.026	0.01	LT	12254.9
LA-0.7	8/20/04 18:15	CS	<	0.004	0.02	0.048	U	0.034	0.026	0.023	LT	13056.38
LA-0.7	8/20/04 18:15	DUP	<	-0.002	0.011	0.02	UNC	0.093	0.038	0.016	NC	
LA-0.7	8/20/04 19:36	CS	<	0	0.013	0.01	U	0.206	0.065	0.019		16932.27
LA-0.7	8/20/04 20:05	CS	<	0.004	0.015	0.011	U	0.037	0.025	0.011	LT	7507.82
LA-0.7	8/21/04 2:27	CS	<	0.014	0.025	0.018	U	0.07	0.047	0.043		1473.8
LA-0.7	8/21/04 9:49	CS	<	-0.04	0.13	0.31	U,M	0.37	0.22	0.08	M3	134.97
PU-0.3	7/23/04 21:52	CS	<	0.023	0.026	0.033	U	5.19	0.92	0.03		1043.01
PU-0.3	7/23/04 21:54	CS	<	0.017	0.026	0.048	U	5.41	0.96	0.02		1022.04
PU-0.3	7/23/04 21:56	CS		0.061	0.041	0.033		5.3	0.94	0.04		1018.13
PU-0.3	7/23/04 21:58	CS		0.042	0.037	0.039	LT	6.1	1.1	0		909.31
PU-0.3	7/23/04 22:00	CS	<	0.003	0.036	0.096	U,M	6.1	1.1	0		865.82
PU-0.3	7/23/04 22:02	CS	<	0.012	0.031	0.055	U,M	5.8	1.1	0		827.03
PU-0.3	7/23/04 22:07	CS	<	0.058	0.052	0.067	U,M	5.9	1.1	0.1	M3	748.11
PU-0.3	7/23/04 22:12	CS	<	0.047	0.054	0.082	U,M	6	1.1	0.1	M3	636.78
PU-0.3	7/23/04 22:17	CS	<	0.013	0.048	0.036	U	5.9	1.1	0.1	M3	507.74
PU-0.3	7/27/04 18:06	CS	<	0.026	0.021	0.026	U	6.4	1.1	0		3875.97
PU-0.3	7/27/04 18:09	CS		0.034	0.022	0.009	LT	7.6	1.3	0		3488.37
PU-0.3	7/27/04 18:16	CS		0.029	0.021	0.023	LT	8.1	1.4	0		3541.67
PU-0.3	7/27/04 18:23	CS	<	0.02	0.024	0.044	U	8.9	1.5	0		2838.22
PU-0.3	7/27/04 18:30	CS	<	0.018	0.017	0.021	U	8.7	1.5	0		2687.14
PU-0.3	7/27/04 18:32	CS		0.036	0.024	0.02	LT	9	1.6	0		2568.98
PU-0.3	7/27/04 18:34	CS		0.043	0.026	0.01	LT	8.7	1.5	0		2641.88
PU-0.3	7/27/04 18:39	CS		0.034	0.024	0.023	LT	8.9	1.5	0		2541.54
PU-0.3	7/27/04 18:41	CS		0.035	0.023	0.01	LT	9.1	1.6	0		2626.26
PU-0.3	7/27/04 18:47	CS		0.035	0.025	0.031	LT	9.6	1.6	0		2394.64

Table 7. Radiochemical Analysis of Storm Water for 2004 (pCi/g unfiltered) Continued

			Pu-238					Pu-239/240				SSC (mg/L)
LOCATION	DATE / TIME	TYPE		RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT
PU-0.3	8/18/04 18:56	CS		0.067	0.051	0.059	M3	4.1	0.77	0.02		1264.25
PU-0.3	8/18/04 18:59	CS	<	0.017	0.036	0.053	U,M	4.74	0.89	0.07	M3	860.48
PU-0.3	8/18/04 19:02	CS	<	0.048	0.047	0.069	U,M	5.75	0.99	0.06	M3	703.68
PU-0.3	8/18/04 19:08	CS	<	0.032	0.048	0.09	U,M	6.5	1.2	0.1	M3	697.62
PU-0.3	8/18/04 19:16	CS	<	0.062	0.065	0.09	U,M	6.6	1.3	0.1	M3	635.44
PU-0.3	8/18/04 19:26	CS	<	0.039	0.045	0.069	U,M	5.16	0.96	0.03		664.65
PU-0.3	8/18/04 19:38	CS	<	0.012	0.04	0.078	U,M	5.4	1	0.1	M3	558.44
PU-0.3	8/18/04 19:55											478.76
PU-0.3	8/18/04 20:17	CS	<	0.008	0.041	0.079	U,M	6	1.1	0.1	M3	342.23
PU-0.3	8/18/04 20:44	CS	<	0.097	0.085	0.111	U,M	5.8	1.1	0.1	M3	278.81
PU-0.3	8/18/04 21:16	CS	<	0.021	0.07	0.137	U,M	3.58	0.79	0.1	M3	346.88
PU-0.3	8/19/04 0:29	CS	<	0	0.23	0.17	U,M	3.2	1	0.3	M3	109.35
PU-0.3	8/19/04 4:35	CS	<	-0.03	0.18	0.31	U,M	2.09	0.73	0.26	M3	157.02
PU-0.3	8/19/04 6:17	CS	<	-0.05	0.23	0.56	U,M	2.35	0.86	0.33	M3	105.33
PU-0.3	8/19/04 8:39	CS	<	-0.01	0.18	0.39	U,M	1.92	0.71	0.32	M3	158.26
PU-0.3	8/20/04 18:27	CS	<	0	0.012	0.024	U	2.69	0.48	0.02		4784.69
PU-0.3	8/20/04 18:33	CS	<	0.021	0.019	0.024	U	1.28	0.26	0.02		5899.14
PU-0.3	8/20/04 18:33	DUP		0.01	0.013	0.009	LTNC	1.1	0.22	0.02		
PU-0.3	8/20/04 18:39	CS	<	0.008	0.016	0.034	U	0.91	0.19	0.01		5438.93
PU-0.3	8/20/04 18:45	CS	<	0.009	0.014	0.025	U	0.62	0.14	0.03		5355.4
PU-0.3	8/20/04 18:57	CS	<	-0.002	0.012	0.021	U	0.316	0.083	0.009		4453.05
PU-0.3	8/20/04 18:57	DUP	<	-0.001	0.013	0.019	UNC	0.319	0.087	0.023		
PU-0.3	8/20/04 19:09	CS	<	0.003	0.016	0.022	U	0.308	0.09	0.012		3204.52
PU-0.3	8/20/04 19:26	CS	<	0.003	0.016	0.024	U	0.54	0.13	0.02		1502.35
PU-0.3	8/20/04 19:48	CS	<	-0.007	0.042	0.074	U,M	0.88	0.25	0.06	M3	569.27
PU-0.3	8/20/04 20:15	CS	<	0.075	0.091	0.14	U,M	1.32	0.41	0.21	M3	336.89
PU-0.3	8/20/04 20:47	CS	<	0.011	0.097	0.169	U,M	1.66	0.5	0.17	M3	250.58
PU-0.3	8/20/04 21:24	CS	<	0.03	0.11	0.21	U,M	1.96	0.58	0.23	M3	259.6
PU-0.3	8/20/04 22:06	CS	<	0.01	0.11	0.2	U,M	2.51	0.7	0.19	M3	252.3
PU-0.3	8/20/04 22:58	CS	<	-0.04	0.12	0.26	U,M	2.15	0.64	0.09	M3	245.84
PU-0.3	8/21/04 0:01	CS	<	-0.008	0.097	0.141	U,M	3.15	0.78	0.17	M3	264.61
PU-0.3	8/21/04 2:34	CS	<	0.15	0.2	0.29	U,M	4	1.2	0.3	M3	131.89
PU-1.7	8/18/04 14:35	CS	<	0.011	0.015	0.026	U	2.86	0.52	0.02		46078.43
PU-2.4	7/23/04 15:41	CS		0.033	0.024	0.026	LT	5.35	0.93	0.02		79245.28
PU-2.4	7/23/04 15:49	CS	<	0.012	0.015	0.023	U	4.11	0.73	0.02		47238.1
PU-2.4	7/23/04 15:52	CS		0.025	0.02	0.01	LT	4.49	0.79	0.02		42747.36
PU-2.4	7/23/04 16:00	CS	<	0.008	0.015	0.032	U	3.61	0.64	0.01		35456.27
PU-2.4	7/23/04 16:10	CS	<	0.009	0.013	0.018	U	3.27	0.58	0.02		32313.58
PU-2.4	7/23/04 16:22	CS	<	0.013	0.016	0.025	U	3.22	0.58	0.01		27246.65
PU-2.4	7/23/04 16:22	DUP	<	0.007	0.014	0.02	UNC	3.09	0.56	0.02		
PU-2.4	7/23/04 16:29	CS		0.044	0.026	0.01	LT	2.93	0.53	0.02		24337.12
PU-2.4	7/23/04 16:51	CS	<	0.013	0.016	0.025	U	3.68	0.66	0.02		18261.72
PU-2.4	7/23/04 17:18	CS	<	0.019	0.018	0.022	U	4.05	0.72	0.02		12630.58

Table 7. Radiochemical Analysis of Storm Water for 2004 (pCi/g unfiltered) Continued

LOCATION	DATE / TIME	TYPE		Pu-238 RESULT	Pu-238 UNCERT	Pu-238 MDA	Pu-238 QUAL	Pu-239/240 RESULT	Pu-239/240 UNCERT	Pu-239/240 MDA	Pu-239/240 QUAL	SSC (mg/L) RESULT
PU-2.4	7/27/04 15:19	CS	<	0.012	0.014	0.021	U	3.7	0.65	0.03		38229.38
PU-2.4	7/27/04 15:31	CS	<	0.018	0.016	0.021	U	3.9	0.68	0.01		29482.55
PU-2.4	7/27/04 15:33	CS	<	0.009	0.013	0.023	U	3.39	0.61	0.02		30308.7
PU-2.4	7/27/04 15:49	CS		0.024	0.018	0.008	LT	3.34	0.58	0.02		26305.79
PU-2.4	7/27/04 15:49	DUP	<	0	0.013	0.025	UNC	3.33	0.59	0.02		
PU-2.4	7/27/04 16:01	CS	<	0.013	0.014	0.018	U	3.59	0.64	0.01		21981.13
PU-2.4	7/27/04 16:08	CS		0.023	0.019	0.01	LT	3.59	0.64	0.02		19824.22
PU-2.4	7/27/04 16:30	CS	<	0.003	0.017	0.043	U	4.5	0.79	0.03		12000
PU-2.4	7/27/04 16:57	CS		0.013	0.013	0.009	LT	4.95	0.86	0.02		9705.04
PU-3.1	8/18/04 13:56	CS	<	0.021	0.02	0.028	U	6.2	1.1	0		25127.68
PU-3.1	8/18/04 13:56	DUP		0.026	0.019	0.009	LTNC	5.8	1	0		
PU-4.1	7/23/04 15:12	CS		0.031	0.021	0.009	LT	4.78	0.83	0.02		75117.37
PU-4.1	7/23/04 15:12	DUP	<	-0.006	0.013	0.032	U,WNC	4.63	0.81	0.02		
PU-4.1	7/23/04 15:16	CS	<	0.019	0.021	0.031	U	3.56	0.65	0.01		32551.72
PU-4.1	7/27/04 14:53	CS	<	0.01	0.013	0.019	U	3.3	0.59	0.01		81127.73
PU-4.1	7/27/04 14:59	CS		0.022	0.019	0.01	LT	2.48	0.46	0.02		37809.65
PU-4.1	7/27/04 15:05	CS	<	-0.005	0.016	0.047	U	3.2	0.58	0.04		26209.22
PU-4.1	7/27/04 15:13	CS		0.011	0.013	0.01	LT	2.73	0.5	0.02		22072.07
PU-4.1	7/27/04 15:13	DUP	<	0.009	0.014	0.025	UNC	2.67	0.49	0.02		
PU-4.1	7/27/04 15:23	CS		0.013	0.014	0.009	LT	3.42	0.61	0.01		18510.16
PU-4.1	7/27/04 15:35	CS		0.017	0.016	0.009	LT	3.89	0.69	0.02		14058.96
PU-4.1	8/18/04 13:36	CS		0.051	0.028	0.025		6.7	1.1	0		19358.41
PU-4.1	8/18/04 13:42	CS		0.025	0.02	0.021	LT	5.58	0.96	0.03		16684.61
PU-4.1	8/18/04 13:48	CS	<	0.018	0.018	0.025	U	4.63	0.81	0.01		13260.87
PU-4.1	8/18/04 13:56	CS	<	0.02	0.018	0.023	U	3.22	0.57	0.03		10991.38
PU-4.1	8/18/04 14:06	CS	<	0.012	0.014	0.018	U	3.69	0.65	0.02		10366.62

Table 8. Radiochemical Analysis of Storm Water for 2005 (pCi/g unfiltered)

LOCATION	DATE / TIME	TYPE	Pu-238 RESULT	Pu-238 UNCERT	Pu-238 MDA	Pu-238 QUAL	Pu-239/240 RESULT	Pu-239/240 UNCERT	Pu-239/240 MDA	Pu-239/240 QUAL	SSC (mg/L) RESULT
CDB-2.0	8/12/05 10:40	CS	< 0.0072	0.026	0.019	U	< 0.024	0.029	0.045	U	4280.2
DP-0.1/DPS-4	8/12/05 15:00	CS	0.16	0.11	0.14	M3	1.1	0.33	0.12	M3	111.2
LA-0.7	7/17/05 17:56	CS	< 0.0024	0.012	0.018	U	0.054	0.029	0.0092		32841.33
LA-0.7	7/17/05 17:56	DUP	< 0.0051	0.011	0.016	UNC	0.047	0.025	0.016	LTNC	
LA-0.7	7/17/05 19:56	CS	< 0	0.012	0.009	U	0.04	0.024	0.009	LT	7246.38
LA-0.7	7/17/05 21:56	CS	< 0.0044	0.01	0.006	U	0.11	0.035	0.006		3538.46
LA-0.7	7/17/05 23:56	CS	< 0.0047	0.0099	0.015	U	0.12	0.036	0.0059		2269.5
LA-0.7	8/12/05 14:21	CS	0.041	0.022	0.02	LT	0.92	0.17	0.0059		1931.82
LA-0.7	8/12/05 16:21	CS	0.05	0.022	0.015	LT	1	0.18	0.015		1363.64
LA-0.7	8/12/05 18:21	CS	0.025	0.015	0.0053	LT	1.7	0.28	0.014		689.66
LA-0.7	8/12/05 20:21	CS	0.053	0.024	0.0063		3.3	0.53	0.0063		561.8
LA-0.7	8/24/05 18:37	CS	0.07	0.043	0.031		1.6	0.33	0.031		7500
LA-0.7	8/24/05 20:37	CS	0.066	0.043	0.032		2.2	0.43	0.039		2545.45
LA-0.7	8/24/05 22:37	CS	0.062	0.041	0.017		7.1	1.3	0.039		1363.64
LA-0.7	8/25/05 18:20	CS	0.036	0.032	0.019	LT	4.9	0.91	0.019		3885.71
LA-0.7	8/25/05 20:20	CS	0.11	0.07	0.064	M3	3.2	0.66	0.027		1219.51
LA-6.6	8/12/05 14:50	CS	< -0.0018	0.032	0.069	U,M	1.3	0.3	0.056	M3	222.8
LA-6.6	8/12/05 22:34	CS	< 0.0099	0.014	0.023	U	1.9	0.33	0.0067		2516.56
LA-6.6	8/13/05 0:04	CS	< 0.0071	0.01	0.017	U	2.3	0.37	0.021		800
LA-6.6	8/13/05 1:36	CS	< 0.025	0.031	0.046	U	1.3	0.26	0.045		266.67
LA-6.6	8/13/05 3:36	CS	< -0.019	0.065	0.14	U,M	3.1	0.59	0.087	M3	131.58
LA-6.6	8/22/05 13:39	CS	0.019	0.013	0.0056	LT	2.1	0.35	0.0056		8531.47
LA-6.6	8/22/05 15:09	CS	< 0.004	0.02	0.038	U	1.1	0.21	0.011		405.41
LA-6.6	8/24/05 15:02	CS	< 0	0.021	0.016	U	2	0.4	0.016		9530.2
LA-6.6	8/24/05 16:32	CS	< 0.023	0.027	0.042	U	1.6	0.33	0.018		3783.78
LA-6.6	8/24/05 18:02	CS	< -0.0022	0.027	0.039	U	1.2	0.27	0.039		816.33
LA-6.6	8/24/05 19:32	CS	< 0.018	0.067	0.05	U,M	0.79	0.28	0.13	M3	416.67
Los Alamos at Gage E042	8/12/05 14:26	CS	0.13	0.061	0.018		1.1	0.25	0.018		623
Los Alamos at Gage E042	8/25/05 15:45	CS	0.073	0.047	0.041		0.96	0.22	0.017		10428.57
Los Alamos at Gage E042	8/25/05 15:45	DUP	0.096	0.055	0.037	NC	0.62	0.17	0.037		
Los Alamos at Gage E042	8/25/05 17:16	CS	0.13	0.063	0.018		2.2	0.44	0.048		2714.29
Los Alamos at Gage E042	8/25/05 18:47	CS	0.2	0.097	0.053	M3	2.7	0.55	0.027		719.42
MO-2.53	8/12/05 10:46	CS	< 0	0.024	0.018	U	< 0.013	0.024	0.018	U	2854.1
PU-0.3	8/24/05 18:15	CS	0.041	0.033	0.032	LT	8.2	1.4	0.016		2857.14
PU-0.3	8/24/05 20:15	CS	< 0.011	0.023	0.033	U	0.46	0.13	0.017		19259.96
PU-0.3	8/24/05 20:15	DUP	< -0.0097	0.023	0.054	U,MNC	0.66	0.17	0.041		
PU-0.3	8/24/05 22:15	CS	< 0.024	0.037	0.064	U,M	7.9	1.4	0.027		183.49
PU-0.3	8/25/05 0:15	CS	< 0.032	0.069	0.1	U,M	6.8	1.3	0.099	M3	89.29

Table 8. Radiochemical Analysis of Storm Water for 2005 (pCi/g unfiltered) Continued

			Pu-238					Pu-239/240				SSC (mg/L)
LOCATION	DATE / TIME	TYPE		RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT
PU-3.1	7/15/05 17:56	CS		0.013	0.013	0.009	LT	5.6	0.97	0.024		31612.9
PU-3.1	7/15/05 19:06	CS		0.022	0.017	0.0086	LT	3.8	0.67	0.0086		10684.93
PU-3.1	8/12/05 9:48	CS	<	0.013	0.012	0.017	U	4	0.63	0.017		16185.57
PU-3.1	8/12/05 9:48	DUP		0.015	0.012	0.014	LTNC	3.6	0.58	0.014		
PU-3.1	8/12/05 13:18	CS		0.062	0.027	0.027		11	1.7	0.016		4166.67
PU-3.1	8/24/05 15:26	CS	<	0.012	0.031	0.054	U,M	4.8	0.92	0.023		26623.38
PU-3.1	8/24/05 15:26	DUP	<	0.021	0.025	0.038	UNC	4.7	0.84	0.038		
PU-3.1	8/24/05 17:46	CS	<	0.024	0.026	0.034	U	6.7	1.2	0.034		6404.49
PU-3.1	8/24/05 18:56	CS	<	-0.00067	0.024	0.063	U,M	1.6	0.34	0.042		10400
PU-4.1	7/15/05 17:28	CS		0.03	0.021	0.009	LT	3.6	0.64	0.026		33536.59
PU-4.1	7/15/05 18:18	CS	<	0.0043	0.011	0.02	U	2.6	0.47	0.019		12345.68
PU-4.1	7/15/05 19:58	CS	<	0.0075	0.011	0.02	U	3	0.54	0.022		3750
PU-4.1	8/12/05 9:12	CS	<	0.0058	0.012	0.021	U	2	0.34	0.021		26190.48
PU-4.1	8/12/05 9:12	DUP	<	0.004	0.011	0.021	UNC	2.3	0.38	0.021		
PU-4.1	8/12/05 10:02	CS	<	0.015	0.014	0.02	U	2.9	0.47	0.0057		18024.69
PU-4.1	8/12/05 10:52	CS		0.038	0.019	0.014	LT	8.6	1.3	0.014		4588.24
PU-4.1	8/12/05 11:42	CS		0.018	0.012	0.005	LT	6.3	0.98	0.014		3292.68
PU-4.1	8/25/05 15:08	CS	<	0.00073	0.027	0.052	U,M	1.6	0.34	0.052	M3	1639.34
PU-4.1	8/25/05 16:08	CS	<	0.0028	0.025	0.043	U	2.9	0.56	0.019		1558.7
PU-4.1	8/25/05 17:08	CS	<	0.0053	0.028	0.04	U	0.99	0.24	0.04		12012.9
PU-4.1	8/25/05 17:08	DUP	<	0	0.024	0.018	UNC	0.85	0.21	0.042		

Table 9. Radiochemical Analysis of Storm Water for 2006 (pCi/g unfiltered)

LOCATION	DATE / TIME	TYPE		Pu-238 RESULT	Pu-238 UNCERT	Pu-238 MDA	Pu-238 QUAL	Pu-239/240 RESULT	Pu-239/240 UNCERT	Pu-239/240 MDA	Pu-239/240 QUAL	SSC (mg/L) RESULT
AC-0.2	9/11/06 13:36	CS		0.078	0.028	0.006		18.6	2.9	0		1600
LA-0.7	7/6/06 6:42	CS		0.094	0.032	0.014		5.77	0.92	0.01		1900
LA-0.7	7/6/06 7:42	CS										2200
LA-0.7	7/6/06 8:42	CS										1100
LA-0.7	7/6/06 21:22	CS	<	0.009	0.01	0.016	U	0.037	0.017	0.01	LT	45000
LA-0.7	7/6/06 21:22	DUP	<	-0.0028	0.0063	0.014	UNC	0.062	0.022	0.012	NC	
LA-0.7	7/6/06 23:22	CS										7700
LA-0.7	7/6/06 23:22	DUP										
LA-0.7	7/7/06 1:22	CS										3700
LA-0.7	8/6/06 2:09	CS										30000
LA-0.7	8/6/06 4:14	CS	<	0.003	0.01	0.02	U	0.105	0.031	0.016		5600
LA-0.7	8/6/06 4:14	DUP										
LA-0.7	8/6/06 6:14	CS										2600
LA-0.7	8/8/06 16:25	CS		0.031	0.016	0.011	LT	7	1.1	0		39000
LA-0.7	8/8/06 17:25	CS										26000
LA-0.7	8/8/06 17:25	DUP										
LA-0.7	8/8/06 18:25	CS										15000
LA-0.7	8/8/06 19:25	CS										10000
LA-0.7	8/8/06 20:26	CS										6000
LA-0.7	8/8/06 21:25	CS										5000
LA-0.7	8/19/06 15:47	CS	<	-0.0021	0.006	0.0147	U	0.283	0.06	0.012		35000
LA-0.7	8/19/06 15:47	DUP		0.0049	0.0067	0.0045	LTNC	0.189	0.046	0.013		
LA-0.7	8/25/06 16:41	CS		0.058	0.021	0.01		7	1.1	0		19000
LA-0.7	8/25/06 17:41	CS										9400
LA-0.7	8/25/06 18:41	CS										31000
LA-5.0	8/1/06 17:09	CS		0.122	0.034	0.004		1.04	0.18	0.01		2800
LA-5.0	8/1/06 17:09	DUP										
LA-5.0	8/1/06 17:09	DUP										
LA-5.0	8/5/06 1:50	CS										450
LA-5.0	8/7/06 14:29	CS										4000
LA-5.0	8/7/06 14:29	DUP										
LA-5.0	8/7/06 14:29	DUP										
LA-5.0	8/7/06 14:29	DUP										
LA-5.0	8/7/06 14:29	DUP										
LA-5.0	8/8/06 14:40	CS										10000
PU-0.3	7/26/06 15:13	CS	<	0.0003	0.0066	0.0146	U	0.093	0.029	0.004		5600
PU-0.3	7/26/06 19:13	CS										740
PU-0.3	8/5/06 9:52	CS		0.056	0.092	0.051	M3	7.2	1.3	0.2	M3	150
PU-0.3	8/5/06 11:22	CS										120

Table 9. Radiochemical Analysis of Storm Water for 2006 (pCi/g unfiltered) Continued

LOCATION	DATE / TIME	TYPE		Pu-238				Pu-239/240				SSC (mg/L)
				RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT
PU-0.3	8/8/06 15:47	CS		0.028	0.014	0.012	LT	11	1.7	0		17000
PU-0.3	8/8/06 16:47	CS										11000
PU-0.3	8/8/06 17:47	CS										7000
PU-0.3	8/8/06 18:47	CS		0.049	0.019	0.009	LT	13.5	2.1	0		4400
PU-0.3	8/8/06 19:47	CS										2800
PU-0.3	8/8/06 20:47	CS										1700
PU-0.3	8/25/06 14:21	CS	<	-0.0003	0.0064	0.0123	U	0.69	0.13	0.02		5200
PU-0.3	8/25/06 15:21	CS										14000
PU-0.3	8/25/06 16:21	CS										6900
PU-5.5	8/8/06 14:20	CS										8600
PU-5.5	8/25/06 13:23	CS										1800
PU-5.5	8/25/06 13:23	DUP										
PU-5.5	8/25/06 15:48	CS		0.097	0.029	0.01		2.03	0.33	0.01		3600
PU-5.5	8/25/06 16:48	CS										2000

Table 10. Radiochemical Analysis of Storm Water for 2007 (pCi/g unfiltered)

LOCATION	DATE / TIME	TYPE	Pu-238 RESULT	Pu-238 UNCERT	Pu-238 MDA	Pu-238 QUAL	Pu-239/240 RESULT	Pu-239/240 UNCERT	Pu-239/240 MDA	Pu-239/240 QUAL	SSC (mg/L) RESULT
LA-5.0	8/6/07 19:31	CS	0.0011	0.011	0.02	U	0.12	0.044	0.02		11043
LA-5.0	8/29/07 16:49	CS	0.11	0.041	0.017		0.9	0.18	0.017		7659
LA-5.0	8/29/07 19:45	CS	0.077	0.058	0.053	M3	1.2	0.29	0.027		826
LA-5.0	9/1/07 16:10	CS	0.044	0.024	0.0084	LT	1.5	0.28	0.017		3930
LA-5.0	9/1/07 17:36	CS	0.039	0.024	0.018	LT	2	0.37	0.0089		2774
LA-5.0	9/1/07 19:06	CS	0.054	0.036	0.034		1.6	0.33	0.028		1494
LA-5.0	9/2/07 16:45	CS	0.1	0.043	0.023		1.2	0.24	0.023		9397
LA-5.0	9/2/07 19:45	CS	0.044	0.033	0.034	LT	0.97	0.21	0.028		1196
AC-0.2	7/14/07 17:47	CS	0.016	0.015	0.0088	LT	7.1	1.2	0.0088		6057
AC-0.2	7/30/07 13:24	CS	0.0073	0.02	0.035	U	4.2	0.76	0.015		1258
AC-0.2	8/4/07 14:02	CS	0.099	0.044	0.026		22	3.6	0.011		2013
AC-0.2	8/4/07 14:22	CS	0.14	0.069	0.02		30	4.9	0.038		885
AC-0.2	8/18/07 13:16	CS	0.046	0.023	0.007	LT	12	1.9	0.014		2646
AC-0.2	8/18/07 13:34	CS	0.072	0.044	0.043		15	2.5	0.035		1048
AC-0.2	8/29/07 15:02	CS	0.083	0.033	0.0072		20	3.2	0.014		9290
AC-0.2	8/29/07 15:20	CS	0.088	0.035	0.008		14	2.4	0.0079		3253
AC-0.2	8/29/07 15:40	CS	0.068	0.032	0.0092		13	2.2	0.0091		1856
AC-0.2	8/29/07 16:00	CS	0.07	0.036	0.031		21	3.3	0.01		877
AC-0.2	8/29/07 16:20	CS	0.096	0.048	0.034		19	3	0.042		616
AC-0.2	9/1/07 14:28	CS	0.05	0.025	0.0079	LT	11	1.8	0.016		2343
AC-0.2	9/1/07 14:46	CS	0.075	0.048	0.051	M3	19	3.2	0.041		980
AC-0.2	9/1/07 15:06	CS	0.056	0.14	0.26	U,M	16	2.8	0.2	M3	750
AC-0.2	9/1/07 16:19	CS	0.027	0.019	0.0082	LT	8.3	1.4	0.024		10196
PU-0.3	8/6/07 20:01	CS	0.0059	0.011	0.008	U	0.36	0.088	0.016		9965
PU-0.3	8/6/07 21:31	CS	0.016	0.023	0.04	U	1	0.21	0.051	M3	652
PU-0.3	8/6/07 22:16	CS	0.018	0.067	0.05	U	1.1	0.34	0.05		475
PU-0.3	8/6/07 23:01	CS	0	0.044	0.066	U,M	1.1	0.27	0.085	M3	321

Table 11. Radiochemical Analysis of Storm Water for 2008 (pCi/g unfiltered)

LOCATION	DATE / TIME	TYPE	Pu-238				Pu-239/240				SSC (mg/L)	Americium-241			
			RESULT	UNCERT	MDA	QUAL	RESULT	UNCERT	MDA	QUAL	RESULT	RESULT	UNCERT	MDA	QUAL
LA-0.7	7/22/08 15:47	CS	0.0068	0.012	0.0092	U	0.12	0.045	0.027		99000				
LA-5.0	7/5/08 16:02	CS	3.3	0.53	0.0061	Y2	160	24	0.017	Y2	720				
LA-5.0	7/5/08 16:47	CS	2.9	0.48	0.0081	Y2	120	18	0.008	Y2	520				
LA-5.0	7/5/08 17:37	CS	2.8	0.47	0.0086	Y1	110	17	0.0086	Y1	530				
LA-5.0	7/5/08 18:17	CS	2.7	0.46	0.026	Y2	93	14	0.026	Y2	460				
LA-5.0	7/5/08 19:17	CS	2.9	0.52	0.075	M3	87	13	0.053	M3	410				
LA-5.0	8/9/08 15:49	CS	0.9	0.15	0.0045	Y1	15	2.3	0.0045	Y1	2900				
LA-5.0	8/9/08 16:34	CS	0.85	0.14	0.007		18	2.9	0.01		1800				
LA-5.0	8/9/08 17:19	CS	0.79	0.19	0.073	M3	18	2.9	0.044		280				
LA-5.0	8/9/08 18:04	CS	0.65	0.14	0.0083		11	1.8	0.033		590				
LA-5.0	8/9/08 19:04	CS	0.5	0.13	0.041		10	1.7	0.051	M3	340				
Buckman @ Rio Grande	7/26/08 22:03	CS	NA				NA				1200	0.014	0.014	0.0076	LT
LA-0.7	8/20/08 16:40	CS	0	0.0082	0.0045	U	0.05	0.028	0.038	(blank)	13000				
LA-0.7	8/20/08 16:40	dup	0.0033	0.0082	0.0045	U	0.067	0.025	0.018	(blank)					
LA-5.0	8/23/08 7.40	CS	0.23	0.051	0.014	(blank)	2.8	0.44	0.016	(blank)	2600				
LA-5.0	10/11/08 18:08	CS	0.3	0.06	0.0093	(blank)	3.8	0.58	0.0093	(blank)	1500				

The following table contains plutonium 239/240 conversions for sediment to water or water to sediments wherever an available suspended sediment measurement exists using the following conversion methods.

To obtain plutonium activity in sediments from a plutonium measurement in water:

$$pCi/L_{(Pu\ water)} \times L/mg_{(SSC\ water)} \times 1000 = pCi/g_{(Pu\ Suspended\ Sediment)}$$

and to obtain a plutonium activity in water from a plutonium measurement in suspended sediment:

$$pCi/g_{(Pu\ Suspended\ Sediment)} \times mg/L_{(SSC\ water)} \times 0.001 = pCi/L_{(Pu\ water)}.$$

Table 12. 2003 Plutonium 239/240 Conversions for Sediment to Water or Water to Sediment wherever an Available Suspended Sediment Measurement Exists

Location	Date/Time	Pu-239/240 pCi/g (dry)	Uncertainty pCi/g (dry)	MDA pCi/g (dry)	Qual	SSC mg/L	Pu-239/240 Calculated in Water pCi/L
E060 (PU-0.3)	8/11/2003 23:44	3.9	0.72	0.01		7300	28.5
E060 (PU-0.3)	8/11/2003 23:52	3.52	0.64	0.02		7800	27.5
E060 (PU-0.3)	8/12/2003 0:44	4.03	0.73	0.03		4900	19.7
E060 (PU-0.3)	8/12/2003 1:44	3.83	0.69	0.02		3000	11.5
E060 (PU-0.3)	8/22/2003 13:41	0.083	0.04	0.026		24000	2.0
E060 (PU-0.3)	8/22/2003 13:46	0.06	0.04	0.02			
E060 (PU-0.3)	8/22/2003 14:26	0.316	0.09	0.011		4200	1.3
E060 (PU-0.3)	8/22/2003 15:11	0.28	0.085	0.012		5600	1.6
E060 (PU-0.3)	9/6/2003 19:08	4.08	0.52	0.03			
E060 (PU-0.3)	9/6/2003 19:53	3.92	0.71	0.02		31000	121.5
E060 (PU-0.3)	9/6/2003 20:38	4.68	0.85	0.02		23000	107.6
E060 (PU-0.3)	9/6/2003 22:38	5.22	0.92	0.01		6800	35.5
PU-6.4	8/11/2003 17:42	0.053	0.031	0.022		110000	5.8
PU-6.4 DUP	8/11/2003 17:42	0.052	0.034	0.035			
PU-6.4	8/11/2003 18:00	0.05	0.02	0.03			
PU-6.4 DUP	8/11/2003 18:00	0.04	0.02	0.03			
PU-6.4	8/11/2003 18:27	0.071	0.036	0.021		35000	2.5
PU-6.4	8/23/2003 14:50	0	0.02	0.02		95000	0
PU-6.4	8/23/2003 14:50	0.007	0.014	0.02	U		
PU-6.4	8/30/2003 0:52	0.057	0.037	0.028		24000	1.4
PU-6.4	9/6/2003 16:54	0.005	0.017	0.013	U	69000	0.3
PU-6.4	9/30/2003 16:58	0.004	0.015	0.012	U	48000	0.2
PU-6.4 DUP	9/30/2003 16:58	0.011	0.015	0.022	U		

Location	Date/Time	Pu-239/240 pg/L	Uncertainty pg/L	MDA pg/L	Qual	SSC mg/L	Pu-239/240 Calculated in Suspended Sediment pCi/g
E030 (LA-6.6)	8/18/2003 0:00	4.6	0.518	0.066	U,M	14191	0.324
E030 (LA-6.6)	8/23/2003 0:00	3.92	0.374	0.038		17907	0.219
E030 (LA-6.6)	9/3/2003 18:47	2.17	0.308	0.075		7446	0.291
E060 (PU-0.3)	8/11/2003 23:44	33.6	5	1.1		7300	4.6
E060 (PU-0.3)	8/11/2003 23:52	21	10	1.3		7800	2.7
E060 (PU-0.3)	8/12/2003 0:44	18.8	2.8	0.5		4900	3.8
E060 (PU-0.3)	8/12/2003 1:44	10.4	1.8	0.6		3000	3.5
E060 (PU-0.3)	8/22/2003 13:46	1.7	1	1.5		24000	0.071
E060 (PU-0.3)	8/22/2003 14:26	1.62	0.66	0.9		4200	0.386
E060 (PU-0.3)	8/22/2003 15:11	2.6	1	1		5600	0.464
E060 (PU-0.3)	9/6/2003 19:53	123	20	4		31000	4.0
E060 (PU-0.3)	9/6/2003 20:38	49.7	8.2	2.8		23000	2.2
E060 (PU-0.3)	9/6/2003 22:38	43.6	6.6	1.2		6800	6.4
PU-6.4	8/11/2003 18:00	4.9	2.8	2.4		110000	0.045
PU-6.4	8/11/2003 18:27	2.3	1	1.5		35000	0.066
PU-6.4	8/23/2003 14:45	3.4	206	6		95000	0.036
PU-6.4	8/30/2003 0:52	1.6	1.2	2.4		24000	0.067
PU-6.4	9/3/2003 16:58	1.8	1.4	2.6		48000	0.038
PU-6.4	9/6/2003 16:54	1	1.2	2.9		69000	0.014

Table 13. 2004 Plutonium 239/240 Conversions for Sediment to Water or Water to Sediment wherever an Available Suspended Sediment Measurement Exists

Location	Date/Time	Pu-239/240 pCi/g (dry)	Uncertainty pCi/g (dry)	MDA pCi/g (dry)	Qual	SSC mg/L	Pu-239/240 Calculated in Water pCi/L
E060 (PU-0.3)	7/23/2004 21:52	5.19	0.92	0.03		1043	5.4
E060 (PU-0.3)	7/23/2004 21:54	5.41	0.96	0.02		1022	5.5
E060 (PU-0.3)	7/23/2004 21:56	5.3	0.94	0.04		1018	5.4
E060 (PU-0.3)	7/23/2004 21:58	6.1	1.1	0		909	5.5
E060 (PU-0.3)	7/23/2004 22:00	6.1	1.1	0		866	5.3
E060 (PU-0.3)	7/23/2004 22:02	5.8	1.1	0		827	4.8
E060 (PU-0.3)	7/23/2004 22:07	5.9	1.1	0.1	M3	748	4.4
E060 (PU-0.3)	7/23/2004 22:12	6	1.1	0.1	M3	637	3.8
E060 (PU-0.3)	7/23/2004 22:17	5.9	1.1	0.1	M3	508	3.0
E060 (PU-0.3)	7/27/2004 18:06	6.4	1.1	0		3876	24.8
E060 (PU-0.3)	7/27/2004 18:09	7.6	1.3	0		3488	26.5
E060 (PU-0.3)	7/27/2004 18:16	8.1	1.4	0		3542	28.7
E060 (PU-0.3)	7/27/2004 18:23	8.9	1.5	0		2838	25.3
E060 (PU-0.3)	7/27/2004 18:30	8.7	1.5	0		2687	23.4
E060 (PU-0.3)	7/27/2004 18:32	9	1.6	0		2569	23.1
E060 (PU-0.3)	7/27/2004 18:34	8.7	1.5	0		2642	23.0
E060 (PU-0.3)	7/27/2004 18:39	8.9	1.5	0		2542	22.6
E060 (PU-0.3)	7/27/2004 18:41	9.1	1.6	0		2626	23.9
E060 (PU-0.3)	7/27/2004 18:47	9.6	1.6	0		2395	23.0
E060 (PU-0.3)	8/18/2004 18:56	4.1	0.77	0.02		1264	5.2
E060 (PU-0.3)	8/18/2004 18:59	4.74	0.89	0.07	M3	860	4.1
E060 (PU-0.3)	8/18/2004 19:02	5.75	0.99	0.06	M3	704	4.0
E060 (PU-0.3)	8/18/2004 19:08	6.5	1.2	0.1	M3	698	4.5
E060 (PU-0.3)	8/18/2004 19:16	6.6	1.3	0.1	M3	635	4.2
E060 (PU-0.3)	8/18/2004 19:26	5.16	0.96	0.03		665	3.4
E060 (PU-0.3)	8/18/2004 19:38	5.4	1	0.1	M3	558	3.0
E060 (PU-0.3)	8/18/2004 19:55	5.7	1.1	0.1	M3	479	2.7
E060 (PU-0.3)	8/18/2004 20:17	6	1.1	0.1	M3	342	2.1
E060 (PU-0.3)	8/18/2004 20:44	5.8	1.1	0.1	M3	279	1.6
E060 (PU-0.3)	8/18/2004 21:16	3.58	0.79	0.1	M3	347	1.2
E060 (PU-0.3)	8/19/2004 0:29	3.2	1	0.3	M3	109	0.350
E060 (PU-0.3)	8/19/2004 4:35	2.09	0.73	0.26	M3	157	0.328
E060 (PU-0.3)	8/19/2004 6:17	2.35	0.86	0.33	M3	105	0.248
E060 (PU-0.3)	8/19/2004 8:39	1.92	0.71	0.32	M3	158	0.304
E060 (PU-0.3)	8/20/2004 18:27	2.69	0.48	0.02		4785	12.9
E060 (PU-0.3)	8/20/2004 18:33	1.28	0.26	0.02		5899	7.6
E060 (PU-0.3) DUP	8/20/2004 18:33	1.1	0.22	0.02			
E060 (PU-0.3)	8/20/2004 18:39	0.91	0.19	0.01		5439	4.9
E060 (PU-0.3)	8/20/2004 18:45	0.62	0.14	0.03		5355	3.3
E060 (PU-0.3)	8/20/2004 18:57	0.316	0.083	0.009		4453	1.4
E060 (PU-0.3) DUP	8/20/2004 18:57	0.319	0.087	0.023			
E060 (PU-0.3)	8/20/2004 19:09	0.308	0.09	0.012		3205	0.987
E060 (PU-0.3)	8/20/2004 19:26	0.54	0.13	0.02		1502	0.811
E060 (PU-0.3)	8/20/2004 19:48	0.88	0.25	0.06	M3	569	0.501
E060 (PU-0.3)	8/20/2004 20:15	1.32	0.41	0.21	M3	337	0.445
E060 (PU-0.3)	8/20/2004 20:47	1.66	0.5	0.17	M3	251	0.416
E060 (PU-0.3)	8/20/2004 21:24	1.96	0.58	0.23	M3	260	0.509
E060 (PU-0.3)	8/20/2004 22:06	2.51	0.7	0.19	M3	252	0.633
E060 (PU-0.3)	8/20/2004 22:58	2.15	0.64	0.09	M3	246	0.529
E060 (PU-0.3)	8/21/2004 0:01	3.15	0.78	0.17	M3	265	0.834
E060 (PU-0.3)	8/21/2004 2:34	4	1.2	0.3	M3	132	0.528
PU-1.7	8/18/2004 14:35	2.86	0.52	0.02		46078	132
PU-2.4	7/23/2004 15:41	5.35	0.93	0.02		79245	424
PU-2.4	7/23/2004 15:49	4.11	0.73	0.02		47236	194
PU-2.4 DUP	7/27/2004 15:49	3.33	0.59	0.02			
PU-2.4	7/23/2004 15:52	4.49	0.79	0.02		42747	192
PU-2.4	7/23/2004 16:00	3.61	0.64	0.01		35456	128
PU-2.4	7/23/2004 16:10	3.27	0.58	0.02		32314	106
PU-2.4	7/23/2004 16:22	3.22	0.58	0.01		27247	88
PU-2.4 DUP	7/23/2004 16:22	3.09	0.56	0.02			
PU-2.4	7/23/2004 16:29	2.93	0.53	0.02		24337	71
PU-2.4	7/23/2004 16:51	3.68	0.66	0.02		18262	67
PU-2.4	7/23/2004 17:18	4.05	0.72	0.02		12631	51
PU-2.4	7/27/2004 15:19	3.7	0.65	0.03		38229	141
PU-2.4	7/27/2004 15:31	3.9	0.68	0.01		29483	115
PU-2.4	7/27/2004 15:33	3.39	0.61	0.02		30309	103
PU-2.4	7/27/2004 15:49	3.34	0.58	0.02		26306	88
PU-2.4	7/27/2004 16:01	3.59	0.64	0.01		21981	79
PU-2.4	7/27/2004 16:08	3.59	0.64	0.02		19824	71
PU-2.4	7/27/2004 16:30	4.5	0.79	0.03		12000	54
PU-2.4	7/27/2004 16:57	4.95	0.86	0.02		9705	48
PU-3.1	8/18/2004 13:56	6.2	1.1	0		25128	156
PU-3.1 DUP	8/18/2004 13:56	5.8	1	0			
PU-4.1	7/23/2004 15:12	4.78	0.83	0.02		75117	359
PU-4.1 DUP	7/23/2004 15:12	4.63	0.81	0.02			
PU-4.1	7/23/2004 15:16	3.56	0.65	0.01		32552	116
PU-4.1	7/27/2004 14:53	3.3	0.59	0.01		81128	268
PU-4.1	7/27/2004 14:59	2.48	0.46	0.02		37810	94
PU-4.1	7/27/2004 15:05	3.2	0.58	0.04		26209	84
PU-4.1	7/27/2004 15:13	2.73	0.5	0.02		22072	60
PU-4.1 DUP	7/27/2004 15:13	2.67	0.49	0.02			
PU-4.1	7/27/2004 15:23	3.42	0.61	0.01		18510	63
PU-4.1	7/27/2004 15:35	3.89	0.69	0.02		14059	55
PU-4.1	8/18/2004 13:36	6.7	1.1	0		19358	130
PU-4.1	8/18/2004 13:42	5.58	0.96	0.03		16685	93
PU-4.1	8/18/2004 13:48	4.63	0.81	0.01		13261	61
PU-4.1	8/18/2004 13:56	3.22	0.57	0.03		10991	35
PU-4.1	8/18/2004 14:06	3.69	0.65	0.02		10367	38

Table 14. 2005 Plutonium 239/240 Conversions for Sediment to Water or Water to Sediment wherever an Available Suspended Sediment Measurement Exists

Location	Date/Time	Pu-239/240 pCi/g (dry)	Uncertainty pCi/g (dry)	MDA pCi/g (dry)	Qual	SSC mg/L	Pu-239/240 Calculated in Water pCi/L
E030 (LA-6.6)	8/12/2005 14:50	1.3	0.3	0.056	M3	223	0.290
E030 (LA-6.6)	8/12/2005 22:34	1.9	0.33	0.0067		2517	4.8
E030 (LA-6.6)	8/13/2005 0:04	2.3	0.37	0.021		800	1.8
E030 (LA-6.6)	8/13/2005 1:36	1.3	0.26	0.045		267	0.347
E030 (LA-6.6)	8/13/2005 3:36	3.1	0.59	0.087	M3	132	0.408
E030 (LA-6.6)	8/22/2005 13:39	2.1	0.35	0.0056		8531	17.9
E030 (LA-6.6)	8/22/2005 15:09	1.1	0.21	0.011		405	0.446
E030 (LA-6.6)	8/24/2005 15:02	2	0.4	0.016		9530	19.1
E030 (LA-6.6)	8/24/2005 16:32	1.6	0.33	0.018		3784	6.1
E030 (LA-6.6)	8/24/2005 18:02	1.2	0.27	0.039		816	0.980
E030 (LA-6.6)	8/24/2005 19:32	0.79	0.28	0.13	M3	417	0.329
E042 (Los Alamos at Gage E042)	8/12/2005 14:26	1.1	0.25	0.018		623	0.685
E042 (Los Alamos at Gage E042)	8/25/2005 15:45	0.96	0.22	0.017		10429	10
E042 (Los Alamos at Gage E042) DUP	8/25/2005 15:45	0.62	0.17	0.037			
E042 (Los Alamos at Gage E042)	8/25/2005 17:16	2.2	0.44	0.048		2714	6.0
E042 (Los Alamos at Gage E042)	8/25/2005 18:47	2.7	0.55	0.027		719	1.9
E060 (PU-0.3)	8/24/2005 18:15	8.2	1.4	0.016		2857	23.4
E060 (PU-0.3)	8/24/2005 20:15	0.46	0.13	0.017		19260	8.9
E060 (PU-0.3) DUP	8/24/2005 20:15	0.66	0.17	0.041			
E060 (PU-0.3)	8/24/2005 22:15	7.9	1.4	0.027		183	1.4
E060 (PU-0.3)	8/25/2005 0:15	6.8	1.3	0.099	M3	89	0.607
PU-3.1	7/15/2005 17:56	5.6	0.97	0.024		31613	177
PU-3.1	7/15/2005 19:06	3.8	0.67	0.0086		10685	41
PU-3.1	8/12/2005 9:48	4	0.63	0.017		16186	65
PU-3.1 DUP	8/12/2005 9:48	3.6	0.58	0.014			
PU-3.1	8/12/2005 13:18	11	1.7	0.016		4167	46
PU-3.1	8/24/2005 15:26	4.8	0.92	0.023		26623	128
PU-3.1 DUP	8/24/2005 15:26	4.7	0.84	0.038			
PU-3.1	8/24/2005 17:46	6.7	1.2	0.034		6404	43
PU-3.1	8/24/2005 18:56	1.6	0.34	0.042		10400	17
PU-4.1	7/15/2005 17:28	3.6	0.64	0.026		33537	121
PU-4.1	7/15/2005 18:18	2.6	0.47	0.019		12346	32
PU-4.1	7/15/2005 19:58	3	0.54	0.022		3750	11
PU-4.1	8/12/2005 9:12	2	0.34	0.021		26190	52
PU-4.1 DUP	8/12/2005 9:12	2.3	0.38	0.021			
PU-4.1	8/12/2005 10:02	2.9	0.47	0.0057		18025	52
PU-4.1	8/12/2005 10:52	8.6	1.3	0.014		4588	39
PU-4.1	8/12/2005 11:42	6.3	0.98	0.014		3293	21
PU-4.1	8/25/2005 15:08	1.6	0.34	0.052	M3	1639	2.6
PU-4.1	8/25/2005 16:08	2.9	0.56	0.019		1559	4.5
PU-4.1	8/25/2005 17:08	0.99	0.24	0.04		12013	12
PU-4.1 DUP	8/25/2005 17:08	0.85	0.21	0.042			

Location	Date/Time	Pu-239/240 pg/L	Uncertainty pg/L	MDA pg/L	Qual	SSC mg/L	Pu-239/240 Calculated in Suspended Sediment pCi/g
E030 (LA-6.6)	8/12/2005 14:50	0.34	0.11	0.019		223	1.5
E030 (LA-6.6)	8/12/2005 22:34	3.9	0.62	0.025		2517	1.5
E030 (LA-6.6)	8/13/2005 0:04	0.66	0.12	0.0037		800	0.825
E030 (LA-6.6)	8/13/2005 1:36	0.3	0.062	0.017		267	1.1
E030 (LA-6.6)	8/13/2005 3:36	0.098	0.031	0.023		132	0.745
E030 (LA-6.6)	8/22/2005 13:39	10	1.7	0.022		8531	1.2
E030 (LA-6.6) DUP	8/22/2005 13:39	10	1.6	0.096	LT		
E030 (LA-6.6)	8/22/2005 15:09	0.49	0.092	0.016		405	1.2
E030 (LA-6.6)	8/24/2005 15:42	14	2.2	0.077	M3	9530	1.5
E030 (LA-6.6) DUP	8/24/2005 15:42	13	2.1	0.024			
E030 (LA-6.6)	8/24/2005 16:32	3.8	0.61	0.025		3784	1.0
E030 (LA-6.6)	8/24/2005 18:02	0.86	0.15	0.019		816	1.1
E030 (LA-6.6)	8/24/2005 19:32	0.31	0.063	0.011		417	0.744
E042 (Los Alamos at Gage E042)	8/12/2005 14:26	0.51	0.093	0.01		623	0.819
E042 (Los Alamos at Gage E042)	8/25/2005 15:45	5.4	0.93	0.07		10429	0.518
E042 (Los Alamos at Gage E042)	8/25/2005 17:16	2.9	0.47	0.021		2714	1.1
E042 (Los Alamos at Gage E042)	8/25/2005 18:47	0.83	0.14	0.017		719	1.2
E060 (PU-0.3)	8/24/2005 18:15	27	4.2	0.015		2857	9.5
E060 (PU-0.3)	8/24/2005 20:15	7.4	1.3	0.15		19260	0.384
E060 (PU-0.3) DUP	8/24/2005 20:15	7.8	1.4	0.16	M3	0	
E060 (PU-0.3)	8/24/2005 22:15	2	0.33	0.0054	M3	183	11
E060 (PU-0.3)	8/25/2005 0:15	0.53	0.11	0.026		89	5.9
PU-3.1	7/15/2005 17:56	110	19	0.61	M3	31613	3.5
PU-3.1	7/15/2005 19:06	33	6	0.24	M3	10685	3.1
PU-3.1	8/12/2005 9:48	57	8.8	0.074	M3	16186	3.5
PU-3.1	8/12/2005 13:18	21	3.1	0.0074		4167	5.0
PU-3.1	8/24/2005 15:26	100	16	0.046		26623	3.8
PU-3.1 DUP	8/24/2005 15:26	92	14	0.18			
PU-3.1	8/24/2005 17:46	14	2.2	0.056		6404	2.2
PU-3.1	8/24/2005 18:56	18	2.8	0.017		10400	1.7
PU-4.1	7/15/2005 17:28	88	16	0.65		33537	2.6
PU-4.1	7/15/2005 18:18	23	4.4	0.28	M3	12346	1.9
PU-4.1	7/15/2005 19:58	10	1.8	0.083	M3	3750	2.7
PU-4.1	8/12/2005 9:12	36	5.6	0.12		26190	1.4
PU-4.1	8/12/2005 10:02	27	4.3	0.082		18025	1.5
PU-4.1	8/12/2005 10:52	20	3.1	0.022		4588	4.4
PU-4.1	8/12/2005 11:42	16	2.5	0.016		3293	4.9

Table 15. 2006 Plutonium 239/240 Conversions for Sediment to Water or Water to Sediment wherever an Available Suspended Sediment Measurement Exists

Location	Date/Time	Pu-239/240 pCi/g (dry)	Uncertainty pCi/g (dry)	MDA pCi/g (dry)	Qual	SSC mg/L	Pu-239/240 Calculated in Water pCi/L
AC-0.2	9/11/2006 13:36	18.6	2.9	0		1600	30
E050 (LA-5.0)	8/1/2006 17:09	1.04	0.18	0.01		2800	2.9
E055 (PU-5.5)	8/25/2006 15:48	2.03	0.33	0.01		3600	7.3
E060 (PU-0.3)	7/26/2006 15:13	0.093	0.029	0.004		5600	0.521
E060 (PU-0.3)	8/5/2006 9:52	7.2	1.3	0.2	M3	150	1.1
E060 (PU-0.3)	8/8/2006 15:47	11	1.7	0		17000	187
E060 (PU-0.3)	8/8/2006 18:47	13.5	2.1	0		4400	59
E060 (PU-0.3)	8/25/2006 14:21	0.69	0.13	0.02		5200	3.6

Location	Date/Time	Pu-239/240 pg/L	Uncertainty pg/L	MDA pg/L	Qual	SSC mg/L	Pu-239/240 Calculated in Suspended Sediment pCi/g
AC-0.2	9/11/2006 13:36	33.7	5.1	0		1600	21
E050 (LA-5.0)	8/1/2006 17:09	3.4	0.54	0.01		2800	1.2
E050 (LA-5.0) RE	8/1/2006 17:09	3.95	0.75	0.05			
E050 (LA-5.0) RE	8/1/2006 17:09	2.61	0.52	0.06			
E050 (LA-5.0)	8/5/2006 1:50	0.024	0.014	0.005	W	450	0.053
E050 (LA-5.0)	8/7/2006 14:29	3.02	0.48	0.02		4000	0.755
E050 (LA-5.0) DUP	8/7/2006 14:29	7.6	1.2	0			
E050 (LA-5.0) RE	8/7/2006 14:29	4.63	0.79	0.01	D		
E050 (LA-5.0) RE	8/7/2006 14:29	4.8	0.86	0.05			
E050 (LA-5.0) RE	8/7/2006 14:29	3.92	0.76	0.05			
E050 (LA-5.0)	8/8/2006 14:40	19.3	3	0		10000	1.9
E055 (PU-5.5)	8/25/2006 13:23	0.06	0.023	0.005		1800	0.033
E055 (PU-5.5) DUP	8/25/2006 13:23	0.14	0.039	0.014	LT		
E055 (PU-5.5)	8/25/2006 15:48	4.78	0.9	0.04		3600	1.3
E055 (PU-5.5)	8/25/2006 16:48	2.82	0.45	0.01		2000	1.4
E060 (PU-0.3)	7/26/2006 15:13	0.47	0.12	0.06		5600	0.084
E060 (PU-0.3)	7/26/2006 19:13	0.64	0.13	0.02		740	0.865
E060 (PU-0.3)	8/5/2006 11:22	1.34	0.23	0.01	LT	120	11
E060 (PU-0.3)	8/25/2006 14:21	3.12	0.54	0.05	W	5200	0.600
E060 (PU-0.3)	8/25/2006 15:21	163	25	0		14000	12
E060 (PU-0.3)	8/25/2006 16:21	62	9.4	0.1		6900	9.0

Table 16. 2007 Plutonium 239/240 Conversions for Sediment to Water or Water to Sediment wherever an Available Suspended Sediment Measurement Exists

Location	Date/Time	Pu-239/240 pCi/g (dry)	Uncertainty pCi/g (dry)	MDA pCi/g (dry)	Qual	SSC mg/L	Pu-239/240 Calculated in Water pCi/L
E050 (LA-5.0)	8/6/2007 19:31	0.12	0.044	0.02		11043	1.3
E050 (LA-5.0)	8/29/2007 16:49	0.9	0.18	0.017		7659	6.9
E050 (LA-5.0) DUP	8/29/2007 16:49	0.84	0.17	0.025			
E050 (LA-5.0)	8/29/2007 19:45	1.2	0.29	0.027		826	0.991
E050 (LA-5.0)	9/1/2007 16:10	1.5	0.28	0.017		3930	5.9
E050 (LA-5.0)	9/1/2007 17:36	2	0.37	0.0089		2774	5.5
E050 (LA-5.0)	9/1/2007 19:06	1.6	0.33	0.028		1494	2.4
E050 (LA-5.0)	9/2/2007 16:45	1.2	0.24	0.023		9397	11.3
E050 (LA-5.0)	9/2/2007 19:45	0.97	0.21	0.028		1196	1.16
E056 (AC-0.01)	7/14/2007 17:47	7.1	1.2	0.0088		6057	43
E056 (AC-0.01) DUP	7/14/2007 17:47	5.9	1	0.0087			
E056 (AC-0.01)	7/30/2007 13:24	4.2	0.76	0.015		1258	5.3
E056 (AC-0.01)	8/4/2007 14:02	22	3.6	0.011		2013	44
E056 (AC-0.01)	8/4/2007 14:22	30	4.9	0.038		885	27
E056 (AC-0.01)	8/18/2007 13:16	12	1.9	0.014		2646	32
E056 (AC-0.01)	8/18/2007 13:34	15	2.5	0.035		1048	16
E056 (AC-0.01)	8/29/2007 15:02	20	3.2	0.014		9290	186
E056 (AC-0.01)	8/29/2007 15:20	14	2.4	0.0079		3253	46
E056 (AC-0.01)	8/29/2007 15:40	13	2.2	0.0091		1856	24
E056 (AC-0.01)	8/29/2007 16:00	21	3.3	0.01		877	18
E056 (AC-0.01)	8/29/2007 16:20	19	3	0.042		616	12
E056 (AC-0.01)	9/1/2007 14:28	11	1.8	0.016		2343	26
E056 (AC-0.01)	9/1/2007 14:46	19	3.2	0.041		980	19
E056 (AC-0.01)	9/1/2007 15:06	16	2.8	0.2	M3	750	12
E060 (PU-0.3)	8/6/2007 20:01	0.36	0.088	0.016		9965	3.6
E060 (PU-0.3) DUP	8/6/2007 20:01	0.44	0.1	0.0085			
E060 (PU-0.3)	8/6/2007 21:31	1	0.21	0.051	M3	652	0.652
E060 (PU-0.3)	8/6/2007 22:16	1.1	0.34	0.05		475	0.523
E060 (PU-0.3)	8/6/2007 23:01	1.1	0.27	0.085	M3	321	0.353
PU-2.53	9/1/2007 16:19	8.3	1.4	0.024		10196	85

Location	Date/Time	Pu-239/240 pg/L	Uncertainty pg/L	MDA pg/L	Qual	SSC mg/L	Pu-239/240 Calculated in Suspended Sediment pCi/g
E050 (LA-5.0)	8/6/2007 19:31	1.10	0.37	0.2	U	11043	0.100
E050 (LA-5.0)	8/29/2007 16:49	6.9	1.2	0.072		7659	0.901
E050 (LA-5.0)	8/29/2007 19:45	1.1	0.19	0.017		826	1.3
E050 (LA-5.0)	9/1/2007 16:10	7.6	1.2	0.027	LT	3930	1.9
E050 (LA-5.0)	9/1/2007 17:36	4.8	0.76	0.017	LT	2774	1.7
E050 (LA-5.0)	9/1/2007 19:06	2.9	0.48	0.024	U	1494	1.9
E050 (LA-5.0)	9/2/2007 16:45	7.7	1.5	0.17		9397	0.819
E050 (LA-5.0)	9/2/2007 18:15	3.6	0.7	0.058	M3	0	
E050 (LA-5.0)	9/2/2007 19:45	1.7	0.37	0.063		1196	1.4
E055 (PU-5.5)	7/14/2007 18:02	0.039	0.022	0.022		793	0.049
E055 (PU-5.5)	7/14/2007 19:02	0.081	0.029	0.0056	LT	2068	0.039
E055 (PU-5.5)	7/14/2007 20:02	0.017	0.013	0.014	LT	966	0.018
E055 (PU-5.5)	7/26/2007 14:16	0.65	0.19	0.026	LT	13440	0.048
E055 (PU-5.5)	7/26/2007 15:15	0.17	0.052	0.03		3500	0.049
E055 (PU-5.5)	7/26/2007 16:15	0.052	0.023	0.018		1193	0.044
E055 (PU-5.5)	7/26/2007 17:15	0.047	0.022	0.016	LT	416	0.113
E055 (PU-5.5)	7/26/2007 18:15	0.0079	0.0097	0.014	LT	184	0.043
E055 (PU-5.5)	8/4/2007 14:16	0.071	0.047	0.047		1959	0.036
E055 (PU-5.5)	8/4/2007 15:15	0.089	0.052	0.019		521	0.171
E055 (PU-5.5)	8/4/2007 16:15	0.012	0.023	0.017	LT	169	0.071
E055 (PU-5.5)	8/4/2007 17:15	0.0044	0.024	0.035	U	88	0.050
E055 (PU-5.5)	8/4/2007 18:15	0.016	0.029	0.021	U	57	0.281
E055 (PU-5.5)	9/1/2007 14:38	0.14	0.049	0.026		4862	0.029
E055 (PU-5.5)	9/1/2007 15:37	0.05	0.028	0.028		1352	0.037
E055 (PU-5.5)	9/1/2007 16:37	0.032	0.019	0.02	Y2	534	0.060
E055 (PU-5.5)	9/1/2007 17:37	0.013	0.016	0.026		217	0.060
E055 (PU-5.5)	9/1/2007 18:37	0.0027	0.013	0.025	U	87	0.031
E056 (AC-0.01)	7/14/2007 17:47	23	3.6	0.01		6057	3.8
E056 (AC-0.01)	7/30/2007 13:24	5.7	0.9	0.024	U	1258	4.5
E056 (AC-0.01)	8/4/2007 14:02	35	5.9	0.045		2013	17
E056 (AC-0.01)	8/4/2007 14:22	34	5.7	0.046	LT	885	38
E056 (AC-0.01)	8/18/2007 13:16	38	5.8	0.017		2646	14
E056 (AC-0.01)	8/18/2007 13:34	16	2.4	0.0061		1048	15
E056 (AC-0.01)	8/29/2007 15:02	78	12	0.069		9290	8.4
E056 (AC-0.01)	8/29/2007 15:20	45	6.9	0.019		3253	14
E056 (AC-0.01)	8/29/2007 15:40	24	3.7	0.015		1856	13
E056 (AC-0.01)	8/29/2007 16:00	21	3.2	0.015		877	24
E056 (AC-0.01)	8/29/2007 16:20	16	2.5	0.022		616	26
E056 (AC-0.01)	9/1/2007 14:28	27	4.2	0.022		2343	12
E056 (AC-0.01)	9/1/2007 14:46	19	2.9	0.015		980	19
E056 (AC-0.01)	9/1/2007 15:06	13	2.1	0.029		750	17
E060 (PU-0.3)	8/6/2007 20:01	2.5	0.53	0.096	M3	9965	0.251
E060 (PU-0.3)	8/6/2007 20:46	1.3	0.31	0.026			
E060 (PU-0.3)	8/6/2007 21:31	0.34	0.11	0.046		652	0.521
E060 (PU-0.3)	8/6/2007 22:16	0.29	0.1	0.037		475	0.611
E060 (PU-0.3)	8/6/2007 23:01	0.23	0.09	0.02		321	0.717
PU-2.53	9/1/2007 16:19	75	13	0.06		10196	7.4

Table 17. 2008 Plutonium $^{239/240}$ Conversions for Sediment to Water or Water to Sediment wherever an Available Suspended Sediment Measurement Exists

Location	Date/Time	Pu-239/240 pCi/g (dry)	Uncertainty pCi/g (dry)	MDA pCi/g (dry)	Qual	SSC mg/L	Pu-239/240 Calculated in Water pCi/L
E050 (LA-5.0)	7/5/2008 16:02	160	24	0.017	Y2	720	115
E050 (LA-5.0)	7/5/2008 16:47	120	18	0.008	Y2	520	62
E050 (LA-5.0)	7/5/2008 17:32	110	17	0.0086	Y1	530	58
E050 (LA-5.0)	7/5/2008 18:17	93	14	0.026	Y2	460	43
E050 (LA-5.0)	7/5/2008 19:17	87	13	0.053	M3	410	36
E050 (LA-5.0)	8/9/2008 15:49	15	2.3	0.0045	Y1	2900	44
E050 (LA-5.0)	8/9/2008 16:34	18	2.9	0.01		1800	32
E050 (LA-5.0)	8/9/2008 17:19	18	2.9	0.044		280	5.0
E050 (LA-5.0)	8/9/2008 18:04	11	1.8	0.033		590	6.5
E050 (LA-5.0)	8/9/2008 19:04	10	1.7	0.051	M3	340	3.4
E050 (LA-5.0)	8/23/2008 7:40	2.8	0.44	0.016		2600	7.3
E050 (LA-5.0)	10/11/2008 18:08	3.8	0.58	0.0093		1500	5.7
Rio Grande at Buckman Landing	7/26/2008 22:03	-0.0028	0.014	0.026	U	1100	-0.003
Rio Grande at Buckman Landing	7/26/2008 22:03	0.014	0.014	0.0076	LT	1200	0.017

Location	Date/Time	Pu-239/240 pg/L	Uncertainty pg/L	MDA pg/L	Qual	SSC mg/L	Pu-239/240 Calculated in Suspended Sediment pCi/g
E050 (LA-5.0)	7/5/2008 16:02	150	25	0.28		720	208
E050 (LA-5.0)	7/5/2008 16:47	86	14	0.18	M3	520	165
E050 (LA-5.0)	7/5/2008 17:32	68	11	0.28	M3	530	128
E050 (LA-5.0)	7/5/2008 18:17	41	6.2	0.014	M3	460	89
E050 (LA-5.0)	7/5/2008 19:17	40	7	0.25		410	98
E050 (LA-5.0)	8/9/2008 15:49	47	8	0.22	U	2900	16
E050 (LA-5.0)	8/9/2008 16:34	32	5.7	0.24	M3	1800	18
E050 (LA-5.0) DUP	8/9/2008 16:34	36	6.3	0.23	M3		
E050 (LA-5.0)	8/9/2008 17:19	11	1.6	0.0045	M3	280	39
E050 (LA-5.0)	8/9/2008 18:04	6.8	1	0.016		590	12
E050 (LA-5.0)	8/9/2008 19:04	3.4	0.54	0.013		340	10
E050 (LA-5.0)	8/23/2008 7:40	6.1	0.93	0.013		2600	2.3
E050 (LA-5.0)	8/23/2008 8:25	4.2	0.65	0.02		900	4.7
E050 (LA-5.0)	8/23/2008 9:10	1.5	0.26	0.022		550	2.7
E050 (LA-5.0)	10/11/2008 18:08	4.5	0.7	0.016	U	1500	3.0
E050 (LA-5.0)	10/11/2008 18:53	2.70	0.43	0.021		930	2.9
E050 (LA-5.0)	10/11/2008 19:53	1.30	0.22	0.0044		560	2.3
E050 (LA-5.0)	10/11/2008 20:23	1.20	0.2	0.02		330	3.6
Rio Grande at Buckman Landing	7/26/2008 22:03	0.0079	0.011	0.018	M3	1200	0.007
Rio Grande at Buckman Landing	8/24/2008 19:59	-0.0019	0.0093	0.02		1200	-0.002
Rio Grande at Buckman Landing	8/24/2008 20:57	0.0051	0.005	0.0028	U	910	0.006
Rio Grande at Buckman Landing	8/24/2008 21:57	0.066	0.027	0.019	LT	3800	0.017
Rio Grande at Buckman Landing	9/9/2008 22:28	-0.0016	0.008	0.018		880	-0.002
Rio Grande at Buckman Landing	9/9/2008 23:26	0.0053	0.0086	0.013	U	450	0.012
Rio Grande at Buckman Landing	10/11/2008 19:47	0.13	0.074	0.027		19000	0.007
Rio Grande at Buckman Landing	10/11/2008 20:44	0.11	0.1	0.14		25000	0.004
Rio Grande at Buckman Landing DUP	10/11/2008 20:44	0.10	0.12	0.19	U,M		
Rio Grande at Buckman Landing	10/11/2008 21:44	0.05	0.074	0.11	U,M	24000	0.002

Table 18. Trace and Heavy Metal Analysis of Storm Water for 2003 (Totals)

All measuring units are mg/L

Location	PU-6.4			PU-6.4			PU-0.3			PU-0.3			PU-0.3			PU-0.3			PU-0.3		
Date / Time	8/11/2003 6:00:00 PM			8/11/2003 6:27:00 PM			8/11/2003 11:52:00 PM			8/12/2003 12:44:00 AM			8/12/2003 1:44:00 AM			8/22/2003 1:46:00 PM			8/22/2003 2:22:00 PM		
TYPE	CS			CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
SSC	110000			35000			7800			4900			3000			24000			4200		
Ca	390		10	110		1	79		1	60		1	54		1	75		1	39		1
Mg	66		1	27		1	24		1	17		1	16		1	30		1	16		1
Ag	< 0.05	U	0.05	< 0.02	U	0.02	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.02	U	0.02	< 0.04	U	0.04
Al	240		5	130		2	72		1	58		1	52		1	100		10	56		1
As	0.05		0.05	0.02		0.005	0.02		0.01	0.01		0.01	0.01		0.01	0.005		0.005	< 0.005	U	0.005
B	< 0.1	U	0.1	< 0.1	U	0.1	0.2		0.1	0.2		0.1	0.2		0.1	0.2		0.1	0.2		0.1
Ba	7		1	2.9		0.1	1		0.1	0.9		0.1	0.7		0.1	1.3		0.1	0.7		0.1
Be	0.04		0.01	0.02		0.01	0.01		0.01	< 0.01	U	0.01	0.006		0.005	0.016		0.01	0.015		0.01
Cd	< 0.05	U	0.05	< 0.02	U	0.02	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.02	U	0.02	< 0.04	U	0.04
Co	0.16		0.05	0.06		0.02	0.03		0.01	0.02		0.01	0.02		0.01	0.04		0.02	< 0.04	U	0.04
Cr	0.09		0.05	0.04		0.02	0.03		0.01	0.02		0.01	0.03		0.01	0.044		0.02	< 0.04	U	0.04
Cu	0.3		0.1	0.1		0.1	0.1		0.1	< 0.1	U	0.1	< 0.1	U	0.1	0.1		0.1	< 0.1	U	0.1
Fe	350		5	150		2	70		1	53		1	48		1	74		1	37		1
Hg	0.0019	I,S,A,K	0.0002	0.0008	A,K	0.0002	0.0006	C,H,A,K	0.0002	0.0004	C,H,A,K	0.0002	0.0003	H,A,K	0.0002	0.0003	A,H,K	0.0002	< 0.0002	U,A,K	0.0002
Mn	58		2.5	22		0.5	10		0.5	6.9		0.5	4		0.1	4.1		0.1	2		0.1
Mo	< 0.05	U	0.05	< 0.02	U	0.02	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.02	U	0.02	< 0.04	U	0.04
Ni	0.2		0.1	0.1		0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
Pb	0.93		0.01	0.44		0.01	0.25		0.01	0.2		0.01	0.13		0.01	0.35		0.01	0.39		0.01
Sb	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.005	U	0.005	< 0.01	U	0.01	< 0.01	U	0.01
Se	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005	< 0.01	U,D,F	0.01	< 0.01	U,D,F	0.01	< 0.005	U,D,F	0.05	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005
Si	170		1	160		1	110		1	110		1	100		10	130		1	110		1
Sn	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
Sr	1.6		0.1	0.6		0.1	0.4		0.1	0.3		0.1	0.3		0.1	0.5		0.1	0.2		0.1
Tl	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.005	U	0.005	< 0.01	U	0.01	< 0.01	U	0.01
U	0.06		0.01	0.02		0.01	0.01		0.01	< 0.01	U	0.01	0.006		0.005	< 0.01	U	0.01	< 0.01	U	0.01
V	0.27		0.05	0.12		0.02	0.09		0.01	0.06		0.01	0.06		0.01	0.1		0.02	0.05		0.04
Zn	1.9		0.1	0.8		0.1	0.5		0.1	0.4		0.1	0.3		0.1	0.6		0.1	0.4		0.1

Table 18. Trace and Heavy Metal Analysis of Storm Water for 2003 (Totals) continued

All measuring units are mg/L

Location	PU-0.3			PU-6.4			PU-6.4			PU-0.3			PU-0.3			PU-0.3			LA-6.6			LA-6.6		
Date / Time	8/22/2003 3:11:00 PM			8/23/2003 2:54:00 PM			9/6/2003 4:54:00 PM			9/6/2003 7:53:00 PM			9/6/2003 8:38:00 PM			9/6/2003 10:38:00 PM			8/18/03 0.00			8/23/03 0:00		
TYPE	CS			CS			CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
SSC	5600			95000			69000			31000			23000			6800			NA			NA		
Ca	52		1	380		10	250		10	130		10	97		1	56		1	NA			NA		
Mg	26		1	89		1	56		1	35		1	30		1	19		1	NA			NA		
Ag	< 0.02	U	0.02	< 0.1	U	0.1	< 0.1	U	0.1	< 0.05	U	0.1	< 0.04	U	0.04	< 0.02	U	0.02	< 0.000835	U	0.00084	< 0.000835	U	0.00084
Al	93		1	400		10	290		10	180		10	160		10	110		1	178		0.015	69.6		0.015
As	< 0.02	U	0.02	0.008		0.005	0.02	C	0.01	0.03	C	0.01	0.021		0.005	< 0.02	U	0.02	0.0344		0.0022	0.0204		0.0022
B	0.1		0.1	< 0.1	U	0.1	0.1		0.1	< 0.1	U	0.1	< 0.1	U	0.1	0.2		0.1	NA			NA		
Ba	1.1		0.1	8		1	5		1	3.6		1	2.8		0.1	1.4		0.1	2.3	N	0.00022	1.72	N	0.00022
Be	0.01		0.01	0.1		0.01	0.06		0.01	0.04		0.01	0.03		0.01	0.013		0.01	0.0192	E	0.0004	0.0139	E	0.00008
Cd	< 0.02	U	0.02	< 0.1	U	0.1	< 0.1	U	0.1	< 0.05	U	0.1	< 0.04	U	0.04	< 0.02	U	0.02	0.00726		0.00004	0.00781		0.00004
Co	0.03		0.02	0.2		0.05	0.12		0.05	0.1		0.05	0.07		0.04	0.04		0.02	0.0631	E	0.00054	0.0488	E	0.00054
Cr	0.04		0.02	0.2		0.1	0.1		0.1	0.1		0.1	0.06		0.04	0.05		0.02	0.109		0.0005	0.0487		0.0005
Cu	< 0.1	U	0.1	0.5		0.1	0.3		0.1	0.2		0.1	0.2		0.1	0.11		0.1	0.163		0.0014	0.119		0.0014
Fe	63		1	410		10	250		10	180		10	130		10	89		0.05	135		0.013	49		0.013
Hg	0.0003	A,H,K	0.0002	0.0017	A,I,K,S	0.0002	0.0013	I,S,A,K	0.0002	0.001385	I,S,A,K	0.0002	0.0012	I,S,A,K	0.0002	0.0007	A,K	0.0002	0.000974		0.000047	0.00351		0.000047
Mn	3.2		0.1	47		0.5	25		0.5	19		0.5	14		0.5	6.9		0.05	12.4		0.0081	8.68		0.0016
Mo	< 0.02	U	0.02	0.1		0.1	< 0.1	U	0.1	< 0.05	U	0.1	< 0.04	U	0.04	< 0.02	U	0.02	NA			NA		
Ni	< 0.1	U	0.1	0.4		0.1	0.2		0.1	0.1		0.1	0.1		0.1	< 0.1	U	0.1	0.102		0.00069	0.0599		0.00069
Pb	0.23		0.01	1.3		0.1	0.83		0.05	0.65		0.05	0.487108		0.04	0.27		0.02	0.285		0.00005	0.274		0.00005
Sb	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.005	U	0.005	0.00193	B	0.00028	0.000468	B	0.00028
Se	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005	< 0.005	U,D,F	0.005	0.0377		0.0028	0.0179		0.0028
Si	170		1	100		1	280		1	180		1	200		1	160		1	NA			NA		
Sn	< 0.1	U	0.1	< 0.1	U	0.1	0.9		0.1	0.7		0.1	0.7		0.1	0.5		0.1	NA			NA		
Sr	0.3		0.1	1.8		0.1	1.3		0.1	0.8		0.1	0.6		0.1	0.4		0.1	NA			NA		
Tl	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.01	U	0.01	< 0.005	U	0.005	0.00224		0.00002	0.000725		0.00002
U	< 0.01	U	0.01	0.08		0.01	0.05		0.01	0.03		0.01	0.02		0.01	0.014		0.005	NA			NA		
V	0.07		0.02	0.4		0.1	0.2		0.1	0.2		0.1	0.15		0.04	0.1		0.02	0.209		0.00061	0.121		0.00061
Zn	0.4		0.2	2.5		0.1	1.3		0.1	1.1		0.1	0.8		0.4	0.4		0.2	1.27		0.00088	1.3		0.00088

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Dissolved)

All measuring units are mg/L

Location	PU-4.1			PU-3.1			PU-4.1			PU-3.1			PU-4.1			LA-0.7			LA-0.7		
Date / Time	7/15/2005 5:28:00 PM			7/15/2005 5:56:00 PM			7/15/2005 6:18:00 PM			7/15/2005 7:06:00 PM			7/15/2005 7:58:00 PM			7/17/2005 5:56:00 PM			7/17/2005 7:56:00 PM		
TYPE	CS			CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	21		0.5	26		0.5	21		0.5	20		0.5	17		0.5	31		0.5	35		0.5
K	3.7		0.5	4.2		0.5	4		0.5	3.7		0.5	3.9		0.5	4.3		0.5	5.9		0.5
Mg	2.4		0.5	2.9		0.5	2		0.5	1.9		0.5	1.7		0.5	3		0.5	3.5		0.5
Na	7.8		0.5	8.3		0.5	9.3		0.5	8		0.5	10		0.5	6.7		0.5	14		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	0.14		0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ba	0.39		0.002	0.31		0.002	0.3		0.002	0.18		0.002	0.29		0.002	0.28		0.002	0.27		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	0.0022		0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.0022		0.002	< 0.002	U	0.002	0.0044		0.002
Fe	0.12		0.05	0.067		0.05	0.063		0.05	0.1		0.05	0.13		0.05	< 0.05	U	0.05	< 0.05	U	0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	1.3		0.002	1.9		0.002	0.2		0.002	0.021		0.002	< 0.002	U	0.002	0.19		0.002	0.01		0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	0.00052		0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	0.0029		0.0005	< 0.0005	U	0.0005	0.0047		0.0005	0.0011		0.0005
Sb	0.00041		0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	0.00044		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	0.00038		0.0001	0.00071		0.0001	0.00026		0.0001	0.00019		0.0001	< 0.0001	U	0.0001	0.0014		0.0001	0.0011		0.0001
V	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	0.0064		0.005
Zn	0.1		0.005	0.076		0.005	0.066		0.005	0.044		0.005	0.068		0.005	0.049		0.005	0.038		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Totals) continued

All measuring units are mg/L

Location	PU-4.1			PU-3.1			PU-4.1			PU-3.1			PU-4.1			LA-0.7			LA-0.7		
Date / Time	7/15/2005 5:28:00 PM			7/15/2005 5:56:00 PM			7/15/2005 6:18:00 PM			7/15/2005 7:06:00 PM			7/15/2005 7:58:00 PM			7/17/2005 5:56:00 PM			7/17/2005 7:56:00 PM		
TYPE	CS			CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	93		0.5	120		0.5	56		0.5	58		0.5	34		0.5	650		2.5	210		0.5
K	34		0.5	44		0.5	20		0.5	21		0.5	13		0.5	120		2.5	44		0.5
Mg	35		0.5	46		0.5	19		0.5	20		0.5	11		0.5	240		0.5	78		0.5
Na	15		0.5	18		0.5	14		0.5	15		0.5	14		0.5	20		0.5	22		0.5
Ag	0.0085		0.0001	0.013		0.0001	0.0031		0.0001	0.0033		0.0001	0.0014		0.0001	0.019		0.0001	0.0024		0.0001
Al	220		0.1	290		0.1	110		0.1	120		0.1	57		0.1	670		0.5	210		0.1
As	0.044		0.002	0.057		0.002	0.024		0.002	0.025		0.002	0.013		0.002	0.062		0.002	0.022		0.002
Ba	2.2		0.002	2.9		0.002	1.1		0.002	1.2		0.002	0.56		0.002	8.3		0.002	2.3		0.002
Be	0.019		0.001	0.026		0.001	0.0092		0.001	0.01		0.001	0.0046		0.001	0.037		0.001	0.012		0.001
Cd	0.041		0.0003	0.059		0.0003	0.019		0.0003	0.02		0.0003	0.0088		0.0003	0.076		0.0003	0.02		0.0003
Co	0.073		0.002	0.1		0.002	0.035		0.002	0.038		0.002	0.017		0.002	0.22		0.002	0.067		0.002
Cr	0.18		0.005	0.22		0.005	0.083		0.005	0.092		0.005	0.044		0.005	0.33		0.005	0.13		0.005
Cu	0.29		0.002	0.37		0.002	0.12		0.002	0.14		0.002	0.06		0.002	0.54		0.002	0.18		0.002
Fe	270		0.1	360		0.1	130		0.05	140		0.05	62		0.05	610		0.25	200		0.05
Hg	0.00016		0.0001	0.0004		0.0001	< 0.0001	U	0.0001	0.00018		0.0001	< 0.0001	U	0.0001	0.00018		0.0001	0.00013		0.0001
Mn	9.3		0.002	15		0.004	4.4		0.002	4.1		0.002	2.1		0.002	17		0.01	4.8		0.002
Ni	0.14		0.005	0.18		0.005	0.07		0.005	0.075		0.005	0.036		0.005	0.37		0.005	0.14		0.005
Pb	0.75		0.0025	0.97		0.005	0.3		0.0005	0.31		0.0005	0.14		0.0005	0.43		0.0005	0.13		0.0005
Sb	0.0029		0.0003	0.0033		0.0003	0.002		0.0003	0.002		0.0003	0.0013		0.0003	0.0032		0.0003	0.00097		0.0003
Se	0.0015		0.001	0.0018		0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	0.0014		0.001	< 0.001	U	0.001
Tl	0.0033		0.0002	0.0048		0.002	0.0017		0.0002	0.0018		0.0002	0.00091		0.0002	0.0069		0.002	0.0018		0.0002
U	0.022		0.0001	0.031		0.0001	0.0095		0.0001	0.0099		0.0001	0.004		0.0001	0.051		0.0001	0.012		0.0001
V	0.32		0.005	0.4		0.005	0.16		0.005	0.17		0.005	0.083		0.005	0.79		0.005	0.28		0.005
Zn	1.9		0.005	2.3		0.005	0.83		0.005	0.88		0.005	0.39		0.005	1.4		0.005	0.53		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Dissolved) continued

All measuring units are mg/L

Location	LA-0.7			LA-0.7			CDB-2.0			MO-2.53		
Date / Time	7/17/2005 9:56:00 PM			7/17/2005 11:56:00 PM			8/12/2005 10:40:00 AM			8/12/2005 10:46:00 AM		
TYPE	CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	45		0.5	50		0.5	21		0.5	5.7		0.5
K	7.8		0.5	8.5		0.5	2.5		0.5	2.3		0.5
Mg	3.7		0.5	4		0.5	1.4		0.5	0.73		0.5
Na	17		0.5	20		0.5	< 0.5	U	0.5	0.59		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	0.0024		0.002	0.0027		0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ba	0.24		0.002	0.24		0.002	0.067		0.002	0.032		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0028		0.002	0.0028		0.002	< 0.002	U	0.002	< 0.002	U	0.002
Fe	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	0.0026		0.002	< 0.002	U	0.002	0.037		0.002	0.002		0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	0.0011		0.0005
Sb	0.00096		0.0003	0.00048		0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	0.00087		0.0001	0.001		0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
V	0.0054		0.005	0.0063		0.005	< 0.005	U	0.005	< 0.005	U	0.005
Zn	0.056		0.005	0.04		0.005	0.042		0.005	< 0.005	U	0.005

Location	SA-6.1			LA-0.7			LA-0.7		
Date / Time	8/12/2005 11:15:00 AM			8/12/2005 2:21:00 PM			8/12/2005 2:21:00 PM		
TYPE	CS			CS			DUP		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	8		0.5	24	E	0.5	24.4		0.5
K	5.2		0.5	7.8		0.5	7.79		0.5
Mg	1.5		0.5	2.2		0.5	2.16		0.5
Na	16		0.5	14	E	0.5	13.5		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	0.0021		0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ba	0.018		0.002	0.058		0.002	0.0583		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0049		0.002	0.0036		0.002	0.00384		0.002
Fe	< 0.05	U	0.05	< 0.05	U	0.05	0.0913		0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001			
Mn	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	< 0.0005	U	0.0005	0.00077		0.0005	0.000735		0.0005
Sb	0.00055		0.0003	0.00047		0.0003	0.000418		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	< 0.0001	U	0.0001	0.00026		0.0001	0.000243		0.0001
V	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Zn	0.02		0.005	0.011		0.005	0.0132		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Totals) continued

All measuring units are mg/L

Location	LA-0.7			LA-0.7			CDB-2.0			SA-6.1			LA-0.7		
Date / Time	7/17/2005 9:56:00 PM			7/17/2005 11:56:00 PM			8/12/2005 10:40:00 AM			8/12/2005 11:15:00 AM			8/12/2005 2:21:00 PM		
TYPE	CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	120		0.5	59		0.5	54		0.5	13		0.5	55		0.5
K	29		0.5	15		0.5	23		0.5	9.5		0.5	20		0.5
Mg	34		0.5	12		0.5	25		0.5	6		0.5	20		0.5
Na	24		0.5	26		0.5	1.7		0.5	17		0.5	16		0.5
Ag	0.0016		0.0001	0.00024		0.0001	0.00097		0.0001	0.0094		0.0001	0.0011		0.0001
Al	110		0.1	26		0.1	130		0.1	30		0.1	69		0.1
As	0.016		0.002	0.0069		0.002	0.021		0.002	0.0076		0.002	0.011		0.002
Ba	1		0.002	0.38		0.002	1.2		0.002	0.25		0.002	0.81		0.002
Be	0.0075		0.001	0.0018		0.001	0.011		0.001	0.0033		0.001	0.0055		0.001
Cd	0.013		0.0003	0.0037		0.0003	0.0098		0.0003	0.006		0.0003	0.0066		0.0003
Co	0.029		0.002	0.0077		0.002	0.04		0.002	0.0076		0.002	0.024		0.002
Cr	0.063		0.005	0.017		0.005	0.078		0.005	0.21		0.005	0.05		0.005
Cu	0.088		0.002	0.026		0.002	0.081		0.002	0.049		0.002	0.067		0.002
Fe	90		0.05	21		0.05	120		0.05	29		0.05	68		0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	0.00028		0.0001	< 0.0001	U	0.0001
Mn	1.9		0.002	0.55		0.002	2.4		0.002	1.1		0.002	2.2		0.002
Ni	0.068		0.005	0.019		0.005	0.08		0.005	0.019		0.005	0.047		0.005
Pb	0.072		0.0005	0.019		0.0005	0.1		0.0005	0.056		0.0005	0.099		0.0005
Sb	0.0011		0.0003	0.00081		0.0003	0.00051		0.0003	0.00088		0.0003	0.0008		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	0.0012		0.0002	0.00025		0.0002	0.0017		0.0002	0.00055		0.0002	0.00087		0.0002
U	0.0055		0.0001	0.0023		0.0001	0.0043		0.0001	0.0022		0.0001	0.0045		0.0001
V	0.14		0.005	0.042		0.005	0.17		0.005	0.042		0.005	0.1		0.005
Zn	0.62		0.005	0.12		0.005	0.3		0.005	0.37		0.005	0.36		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Dissolved) continued

All measuring units are mg/L

Location	Los Alamos at Gage E042			LA-6.6			DP-0.1/DPS-4			LA-0.7			LA-0.7			LA-0.7			LA-6.6		
Date / Time	8/12/2005 2:26:00 PM			8/12/2005 2:50:00 PM			8/12/2005 3:00:00 PM			8/12/2005 4:21:00 PM			8/12/2005 6:21:00 PM			8/12/2005 8:21:00 PM			8/12/2005 10:34:00 PM		
TYPE	CS			CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	7.4		0.5	8.2		0.5	11		0.5	20		0.5	30		0.5	28		0.5	11		0.5
K	3		0.5	3.5		0.5	4		0.5	6.4		0.5	17		0.5	17		0.5	4		0.5
Mg	0.98		0.5	1.4		0.5	0.97		0.5	2		0.5	4.3		0.5	4.1		0.5	1.9		0.5
Na	14		0.5	21		0.5	20		0.5	18		0.5	34		0.5	35		0.5	23		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.0023		0.002	0.003		0.002	< 0.002	U	0.002
Ba	0.022		0.002	0.024		0.002	0.029		0.002	0.11		0.002	0.082		0.002	0.074		0.002	0.033		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0033		0.002	0.0032		0.002	0.0035		0.002	0.0038		0.002	0.007		0.002	0.0079		0.002	0.0029		0.002
Fe	0.077		0.05	< 0.05	U	0.05	0.13		0.05	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.003		0.002	< 0.002	U	0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	0.00058		0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005
Sb	0.00032		0.0003	0.00074		0.0003	0.00041		0.0003	0.00036		0.0003	< 0.0003	U	0.0003	0.0003		0.0003	0.00031		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	< 0.0001	U	0.0001	0.00016		0.0001	< 0.0001	U	0.0001	0.00017		0.0001	0.00011		0.0001	0.00016		0.0001	< 0.0001	U	0.0001
V	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	0.0055		0.005	0.0077		0.005	< 0.005	U	0.005
Zn	0.013		0.005	0.012		0.005	0.045		0.005	0.046		0.005	0.016		0.005	0.17		0.005	0.077		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Totals) continued

All measuring units are mg/L

Location	Los Alamos at Gage E042			LA-6.6			DP-0.1/DPS-4			LA-0.7			LA-0.7			LA-0.7			LA-6.6		
Date / Time	8/12/2005 2:26:00 PM			8/12/2005 2:50:00 PM			8/12/2005 3:00:00 PM			8/12/2005 4:21:00 PM			8/12/2005 6:21:00 PM			8/12/2005 8:21:00 PM			8/12/2005 10:34:00 PM		
TYPE	CS			CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	9.5		0.5	9.5		0.5	12		0.5	31		0.5	34		0.5	31		0.5	18		0.5
K	5.1		0.5	5.2		0.5	5.1		0.5	12		0.5	17		0.5	19		0.5	9.1		0.5
Mg	2.9		0.5	2.8		0.5	1.9		0.5	9.5		0.5	9.1		0.5	7.4		0.5	6.6		0.5
Na	14		0.5	21		0.5	19		0.5	19		0.5	26		0.5	34		0.5	24		0.5
Ag	0.00024		0.0001	0.00018		0.0001	0.00015		0.0001	0.00069		0.0001	0.00078		0.0001	0.00063		0.0001	0.00079		0.0001
Al	13		0.1	9.6		0.1	6.2		0.1	32		0.1	26		0.1	16		0.1	27		0.1
As	0.0037		0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.0064		0.002	0.0059		0.002	0.0057		0.002	0.0061		0.002
Ba	0.13		0.002	0.094		0.002	0.072		0.002	0.38		0.002	0.34		0.002	0.23		0.002	0.32		0.002
Be	0.0014		0.001	< 0.001	U	0.001	< 0.001	U	0.001	0.0028		0.001	0.0024		0.001	0.0015		0.001	0.003		0.001
Cd	0.0021		0.0003	0.0014		0.0003	0.00077		0.0003	0.0031		0.0003	0.003		0.0003	0.0021		0.0003	0.0043		0.0003
Co	0.0038		0.002	0.0026		0.002	< 0.002	U	0.002	0.012		0.002	0.0092		0.002	0.0053		0.002	0.01		0.002
Cr	0.012		0.005	0.014		0.005	0.0072		0.005	0.026		0.005	0.021		0.005	0.012		0.005	0.025		0.005
Cu	0.015		0.002	0.011		0.002	0.0079		0.002	0.034		0.002	0.031		0.002	0.021		0.002	0.045		0.002
Fe	12		0.05	8.1		0.05	5.4		0.05	31		0.05	25		0.05	15		0.05	31		0.05
Hg	0.00011		0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	0.47		0.002	0.26		0.002	0.16		0.002	1.1		0.002	0.92		0.002	0.51		0.002	1.3		0.002
Ni	0.0086		0.005	0.0063		0.005	< 0.005	U	0.005	0.023		0.005	0.019		0.005	0.014		0.005	0.02		0.005
Pb	0.039		0.0005	0.021		0.0005	0.016		0.0005	0.056		0.0005	0.047		0.0005	0.027		0.0005	0.11		0.0005
Sb	0.00084		0.0003	0.00066		0.0003	0.00061		0.0003	0.00071		0.0003	0.00065		0.0003	0.00043		0.0003	0.00097		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	0.00022		0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	0.00048		0.0002	0.00039		0.0002	< 0.0002	U	0.0002	0.00055		0.0002
U	0.00099		0.0001	0.0009		0.0001	0.00039		0.0001	0.0022		0.0001	0.0018		0.0001	0.0011		0.0001	0.0034		0.0001
V	0.019		0.005	0.013		0.005	0.01		0.005	0.051		0.005	0.043		0.005	0.031		0.005	0.044		0.005
Zn	0.12		0.005	0.078		0.005	0.058		0.005	0.2		0.005	0.17		0.005	0.1		0.005	0.28		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Dissolved) continued

All measuring units are mg/L

Location	LA-6.6			LA-6.6			LA-6.6			LA-6.6			LA-6.6		
Date / Time	8/13/2005 12:04:00 AM			8/13/2005 1:36:00 AM			8/13/2005 3:36:00 AM			8/22/2005 1:39:00 PM			8/22/2005 3:09:00 PM		
TYPE	CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	6.8		0.5	8.2		0.5	10		0.5	7.3		0.5	9.1		0.5
K	3.1		0.5	3.4		0.5	3.9		0.5	2.8		0.5	3.6		0.5
Mg	1.1		0.5	1.4		0.5	1.8		0.5	1.2		0.5	1.4		0.5
Na	18		0.5	21		0.5	26		0.5	3.9		0.5	17		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ba	0.021		0.002	0.023		0.002	0.028		0.002	0.025		0.002	0.027		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0043		0.002	0.0034		0.002	0.004		0.002	0.0024		0.002	0.0032		0.002
Fe	< 0.05	U	0.05	0.053		0.05	< 0.05	U	0.05	0.059		0.05	< 0.05	U	0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.021		0.002	< 0.002	U	0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005
Sb	0.00056		0.0003	0.00056		0.0003	0.00036		0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	0.00014		0.0001	0.0002		0.0001	0.00025		0.0001	0.00017		0.0001	< 0.0001	U	0.0001
V	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Zn	0.0087		0.005	0.012		0.005	0.011		0.005	0.049		0.005	0.013		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Totals) continued

All measuring units are mg/L

Location	LA-6.6			LA-6.6			LA-6.6			LA-6.6			LA-6.6			LA-6.6		
Date / Time	8/13/2005 12:04:00 AM			8/13/2005 1:36:00 AM			8/13/2005 3:36:00 AM			8/22/2005 1:39:00 PM			8/22/2005 1:39:00 PM			8/22/2005 3:09:00 PM		
TYPE	CS			CS			CS			CS			DUP			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	9.9		0.5	9.6		0.5	12		0.5	31		0.5	31.8		0.5	11		0.5
K	6		0.5	5		0.5	5.4		0.5	16		0.5	16.3		0.5	5.6		0.5
Mg	4		0.5	3		0.5	3.3		0.5	15		0.5	15.2		0.5	3.4		0.5
Na	18		0.5	20		0.5	25		0.5	6.5		0.5	6.53		0.5	16		0.5
Ag	0.00024		0.0001	0.00016		0.0001	0.00014		0.0001	0.0054		0.0001	0.00593		0.0001	0.0003		0.0001
Al	19		0.1	11		0.1	10		0.1	74		0.1	78.4		0.1	11		0.1
As	0.0044		0.002	0.0023		0.002	< 0.002	U	0.002	0.016		0.002	0.0159		0.002	0.004		0.002
Ba	0.16		0.002	0.096		0.002	0.093		0.002	0.78		0.002	0.798		0.002	0.13		0.002
Be	0.0016		0.001	< 0.001	U	0.001	< 0.001	U	0.001	0.011		0.001	0.0114		0.001	0.0013		0.001
Cd	0.0021		0.0003	0.0014		0.0003	0.0011		0.0003	0.015		0.0003	0.016		0.0003	0.0017		0.0003
Co	0.0057		0.002	0.0027		0.002	0.0021		0.002	0.025		0.002	0.0255		0.002	0.0043		0.002
Cr	0.015		0.005	0.0084		0.005	0.0075		0.005	0.065		0.005	0.0694		0.005	0.011		0.005
Cu	0.02		0.002	0.012		0.002	0.01		0.002	0.1		0.002	0.105		0.002	0.023		0.002
Fe	17		0.05	8.9		0.05	8		0.05	92		0.05	96.3		0.05	10		0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001				< 0.0001	U	0.0001
Mn	0.52		0.002	0.26		0.002	0.22		0.002	3.6		0.002	3.66		0.002	0.4		0.002
Ni	0.011		0.005	0.0064		0.005	0.0059		0.005	0.048		0.005	0.0502		0.005	0.0085		0.005
Pb	0.044		0.0005	0.023		0.0005	0.016		0.0005	0.26		0.0005	0.274		0.0005	0.046		0.0005
Sb	0.00067		0.0003	0.00069		0.0003	0.00048		0.0003	0.0012	N	0.0003	< 0.00127		0.0003	0.00072		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	0.001	U	0.001	< 0.001	U	0.001
Tl	0.00034		0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	0.0016		0.0002	0.00169		0.0002	0.00026		0.0002
U	0.0015		0.0001	0.001		0.0001	0.00085		0.0001	0.029		0.0001	0.0299		0.0001	0.0012		0.0001
V	0.027		0.005	0.014		0.005	0.013		0.005	0.1		0.005	0.108		0.005	0.017		0.005
Zn	0.16		0.005	0.076		0.005	0.065		0.005	0.69		0.005	0.709		0.005	0.13		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Dissolved) continued

All measuring units are mg/L

Location	LA-6.6			LA-6.6			LA-6.6			LA-6.6			LA-0.7			LA-6.6			LA-0.7		
Date / Time	8/24/05 15:02			8/24/05 15:02			8/24/05 16:32			8/24/05 18:02			8/24/05 18:37			8/24/05 19:32			8/24/05 20:37		
TYPE	CS			DUP			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	9.3		0.5	9.34		0.5	8.1		0.5	12		0.5	21		0.5	15		0.5	15		0.5
K	3.7		0.5	3.69		0.5	3.3		0.5	4.1		0.5	7.9		0.5	4.6		0.5	5.7		0.5
Mg	1.6		0.5	1.59		0.5	1.4		0.5	2.1		0.5	2.9		0.5	2.7		0.5	2.1		0.5
Na	11		0.5	10.6		0.5	14		0.5	23		0.5	19		0.5	29		0.5	16		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.0024		0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ba	0.037		0.002	0.0372		0.002	0.027		0.002	0.034		0.002	0.052		0.002	0.041		0.002	0.033		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0022		0.002	< 0.002	U	0.002	0.0031		0.002	0.0025		0.002	0.0049		0.002	0.0031		0.002	0.0033		0.002
Fe	0.087		0.05	< 0.05	U	0.05	0.072		0.05	0.081		0.05	0.061		0.05	0.12		0.05	0.1		0.05
Hg	< 0.0001	U	0.0001				< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.0037		0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	< 0.0005	U	0.0005	< 0.0005	U	0.0005	0.00058		0.0005	0.0021		0.0005	0.06		0.0005	< 0.0005	U	0.0005	0.00092		0.0005
Sb	0.00035		0.0003	0.000375		0.0003	0.00044		0.0003	0.00083		0.0003	0.00084		0.0003	< 0.0003	U	0.0003	0.00033		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	< 0.0001	U	0.0001	< 0.0001	U	0.0001	0.00012		0.0001	0.00013		0.0001	0.00016		0.0001	0.00018		0.0001	< 0.0001	U	0.0001
V	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Zn	< 0.005	U	0.005	0.00833		0.005	0.03		0.005	0.0091		0.005	0.015		0.005	0.024		0.005	0.017		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Totals) continued

All measuring units are mg/L

Location	LA-6.6			LA-6.6			LA-6.6			LA-6.6			LA-0.7			LA-6.6			LA-0.7		
Date / Time	8/24/05 15:02			8/24/05 15:02			8/24/05 16:32			8/24/05 18:02			8/24/05 18:37			8/24/05 19:32			8/24/05 20:37		
TYPE	CS			DUP			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	37		0.5	38.2		0.5	22		0.5	16		0.5	64		0.5	17		0.5	28		0.5
K	18		0.5	19.2		0.5	12		0.5	7.6		0.5	29		0.5	7.2		0.5	14		0.5
Mg	19		0.5	19.3		0.5	11		0.5	5.8		0.5	29		0.5	5.4		0.5	12		0.5
Na	14		0.5	14.3		0.5	16		0.5	23		0.5	24		0.5	28		0.5	18		0.5
Ag	0.0037		0.0001	0.00328		0.0001	0.0013		0.0001	0.00051		0.000099	0.0045		0.0001	0.00022		0.0001	0.0015		0.0001
Al	95		0.1	99.9		0.1	57		0.1	24		0.099	130		0.1	18		0.1	52		0.1
As	0.021		0.002	0.0201		0.002	0.011		0.002	0.005		0.002	0.022		0.002	0.0034		0.002	0.01		0.002
Ba	1.1		0.002	1.11		0.002	0.57		0.002	0.24		0.002	1.3		0.002	0.18		0.002	0.49		0.002
Be	0.011		0.001	0.0114		0.001	0.0057		0.001	0.0024		0.00099	0.012		0.001	0.0016		0.001	0.0052		0.001
Cd	0.016		0.0003	0.0139		0.0003	0.0072		0.0003	0.0029		0.0003	0.015		0.0003	0.0024		0.0003	0.0063		0.0003
Co	0.037		0.002	0.0388		0.002	0.019		0.002	0.0064		0.002	0.045		0.002	0.0046		0.002	0.018		0.002
Cr	0.09		0.005	0.0955		0.005	0.052		0.005	0.018		0.005	0.095		0.005	0.015		0.005	0.041		0.005
Cu	0.14		0.002	0.142		0.002	0.064		0.002	0.023		0.002	0.14		0.002	0.016		0.002	0.055		0.002
Fe	120		0.05	125		0.05	61		0.05	22		0.05	140		0.05	14		0.05	53		0.05
Hg	0.0011	*	0.0001	0.000883	*	0.0001	0.00085		0.0001	0.00022		0.0001	0.00047		0.0001	0.00013		0.0001	0.00048		0.0001
Mn	4.8		0.002	5.02		0.002	2.3		0.002	0.79		0.002	4.8		0.002	0.47		0.002	2		0.002
Ni	0.069		0.005	0.0729		0.005	0.039		0.005	0.015		0.005	0.089		0.005	0.012		0.005	0.036		0.005
Pb	0.35	E	0.0005	0.355		0.0005	0.17		0.0005	0.056		0.0005	0.3		0.0005	0.032		0.0005	0.13		0.0005
Sb	0.0017	N	0.0003	0.00138		0.0003	0.0011		0.0003	0.00062		0.0003	0.0011		0.0003	0.00033		0.0003	0.001		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.00099	U	0.00099	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	0.0018		0.0002	0.00187		0.0002	0.0012		0.0002	0.00054		0.0002	0.0018		0.0002	0.00038		0.0002	0.00094		0.0002
U	0.015		0.0001	0.0165		0.0001	0.0073		0.0001	0.0019		0.000099	0.012		0.0001	0.0012		0.0001	0.0048		0.0001
V	0.15		0.005	0.155		0.005	0.083		0.005	0.032		0.005	0.19		0.005	0.021		0.005	0.077		0.005
Zn	0.91		0.005	0.963		0.005	0.43		0.005	0.16		0.005	0.83		0.005	0.11		0.005	0.35		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Dissolved) continued

All measuring units are mg/L

Location	LA-0.7			Los Alamos at Gage E042			Los Alamos at Gage E042			LA-0.7			Los Alamos at Gage E042		
Date / Time	8/24/05 22:37			8/25/05 15:45			8/25/05 17:16			8/25/05 18:20			8/25/05 18:47		
TYPE	CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	20		0.5	12		0.5	8.6		0.5	31		0.5	11		0.5
K	11		0.5	3.7		0.5	3.2		0.5	13		0.5	3.9		0.5
Mg	3.2		0.5	1.5		0.5	1.1		0.5	5.2		0.5	1.5		0.5
Na	24		0.5	15		0.5	11		0.5	41		0.5	17		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1	< 0.1	U	0.1
As	0.0023		0.002	< 0.002	U	0.002	< 0.002	U	0.002	0.0043		0.002	< 0.002	U	0.002
Ba	0.044		0.002	0.038		0.002	0.029		0.002	0.065		0.002	0.032		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0053		0.002	0.0034		0.002	0.0041		0.002	0.0052		0.002	0.0058		0.002
Fe	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05	< 0.05	U	0.05
Hg	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Mn	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ni	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	0.0047		0.0005
Sb	< 0.0003	U	0.0003	0.00052		0.0003	0.00051		0.0003	0.00035		0.0003	0.00051		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	0.00013		0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	0.00024		0.0001	0.0001		0.0001
V	0.0056		0.005	< 0.005	U	0.005	< 0.005	U	0.005	0.0058		0.005	< 0.005	U	0.005
Zn	0.029		0.005	0.034		0.005	0.038		0.005	0.019		0.005	0.03		0.005

Table 19. Trace and Heavy Metal Analysis of Storm Water for 2005 (Totals) continued

All measuring units are mg/L

Location	LA-0.7			Los Alamos at Gage E042			Los Alamos at Gage E042			LA-0.7			Los Alamos at Gage E042		
Date / Time	8/24/05 22:37			8/25/05 15:45			8/25/05 17:16			8/25/05 18:20			8/25/05 18:47		
TYPE	CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	27		0.5	24		0.5	15		0.5	48		0.5	13		0.5
K	17		0.5	12		0.5	8.2		0.5	22		0.5	6.1		0.5
Mg	9.5		0.5	10		0.5	5.9		0.5	15		0.5	3.5		0.5
Na	24		0.5	17		0.5	12		0.5	44		0.5	17		0.5
Ag	0.0014		0.0001	0.0017		0.0001	0.0014		0.0001	0.0022		0.0001	0.00038		0.0001
Al	36		0.1	52		0.1	29		0.1	48		0.1	13		0.1
As	0.0086		0.002	0.012		0.002	0.0073		0.002	0.012		0.002	0.0036		0.002
Ba	0.35		0.002	0.54		0.002	0.3		0.002	0.55		0.002	0.14		0.002
Be	0.0036		0.001	0.0057		0.001	0.0031		0.001	0.0048		0.001	0.0014		0.001
Cd	0.0037		0.0003	0.008		0.0003	0.0041		0.0003	0.0061		0.0003	0.0022		0.0003
Co	0.011		0.002	0.019		0.002	0.01		0.002	0.018		0.002	0.0041		0.002
Cr	0.026		0.005	0.046		0.005	0.026		0.005	0.037		0.005	0.011		0.005
Cu	0.037		0.002	0.07		0.002	0.039		0.002	0.059		0.002	0.02		0.002
Fe	36		0.05	60		0.05	32		0.05	51		0.05	12		0.05
Hg	0.00021		0.0001	0.00056		0.0001	0.00029		0.0001	0.00019		0.0001	0.00022		0.0001
Mn	1.2		0.002	2.1		0.002	1.1		0.002	2.1		0.002	0.41		0.002
Ni	0.025		0.005	0.037		0.005	0.021		0.005	0.037		0.005	0.01		0.005
Pb	0.074		0.0005	0.19		0.0005	0.099		0.0005	0.11		0.0005	0.046		0.0005
Sb	0.00044		0.0003	0.0012		0.0003	0.00099		0.0003	0.00079		0.0003	0.00084		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	0.0006		0.0002	0.00085		0.0002	0.00054		0.0002	0.00076		0.0002	0.00021		0.0002
U	0.0029		0.0001	0.0063		0.0001	0.003		0.0001	0.0048		0.0001	0.0013		0.0001
V	0.056		0.005	0.084		0.005	0.047		0.005	0.077		0.005	0.02		0.005
Zn	0.21		0.005	0.48		0.005	0.3		0.005	0.32		0.005	0.17		0.005

Table 20. Trace and Heavy Metal Analysis of Storm Water for 2006 (Dissolved)

All measuring units are mg/L

Location	LA-0.7			LA-0.7			LA-0.7			LA-0.7			LA-0.7			LA-0.7		
Date / Time	7/6/06 6:42			7/6/06 21:22			8/6/06 4:14			8/8/06 16:25			8/19/06 15:47			8/25/06 16:41		
TYPE	CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	29		0.5	72		0.5	47		0.5	28		0.5	30		0.5	22		0.5
K	13		0.5	10		0.5	4.5		0.5	6.2		0.5	3.1		0.5	7.1		0.5
Mg	5		0.5	12		0.5	3.7		0.5	4.5		0.5	2.5		0.5	3.5		0.5
Na	40		0.5	18		0.5	12		0.5	14		0.5	9.5		0.5	18		0.5
Ag	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001	< 0.0001	U	0.0001
Al	0.14		0.1	0.12		0.1	< 0.1	U	0.1	1.7		0.1	0.15		0.1	1.2		0.1
As	0.0031		0.002	< 0.002	U	0.002	0.0022		0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Ba	0.093		0.002	0.34		0.002	0.2		0.002	0.34		0.002	0.3		0.002	0.26		0.002
Be	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Cd	0.0003		0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003	< 0.0003	U	0.0003
Co	< 0.002	U	0.002	0.0037		0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002	< 0.002	U	0.002
Cr	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Cu	0.0047		0.002	0.0055		0.002	< 0.002	U	0.002	0.0048		0.002	< 0.002	U	0.002	0.0038		0.002
Fe	0.056		0.05	0.091		0.05	< 0.05	U	0.05	1		0.05	0.063		0.05	0.75		0.05
Hg	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
Mn	< 0.002	U	0.002	2.8		0.002	< 0.002	U	0.002	0.011		0.002	0.0025		0.002	0.29		0.002
Ni	0.0051		0.005	0.0059		0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005	< 0.005	U	0.005
Pb	0.00051		0.0005	< 0.0005	U	0.0005	< 0.0005	U	0.0005	0.0012		0.0005	< 0.0005	U	0.0005	0.0011		0.0005
Sb	0.001		0.0003	0.0036		0.0003	0.0026		0.0003	0.0039		0.0003	0.0015		0.0003	0.0036		0.0003
Se	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001	< 0.001	U	0.001
Tl	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002	< 0.0002	U	0.0002
U	0.00083		0.0001	0.0035		0.0001	0.0011		0.0001	0.00074		0.0001	0.002		0.0001	0.00036		0.0001
V	0.007		0.005	< 0.005	U	0.005	0.0085		0.005	< 0.005	U	0.005	0.0054		0.005	0.0055		0.005
Zn	0.018		0.005	0.034		0.005	0.032		0.005	0.074		0.005	0.037		0.005	0.06		0.005

Table 20. Trace and Heavy Metal Analysis of Storm Water for 2006 (Totals) continued

All measuring units are mg/L

Location	LA-0.7			LA-0.7			LA-0.7			LA-0.7			LA-0.7			LA-0.7		
Date / Time	7/6/06 6:42			7/6/06 21:22			8/6/06 4:14			8/8/06 16:25			8/19/06 15:47			8/25/06 16:41		
TYPE	CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	57		0.46	350		0.48	130		0.46	190		2.3	520		2.3	94		0.49
K	24	E	0.46	180		0.48	39		0.46	91		0.47	100		0.46	52		0.49
Mg	18		0.46	190		0.48	49		0.46	90		0.47	180		0.46	49		0.49
Na	42		0.46	42		0.48	15		0.46	28		0.47	19		0.46	28		0.49
Ag	0.0011	E	0.000093	0.01		0.000096	0.00091		0.000093	0.022		0.000093	0.0014		0.000092	0.012		0.000099
Al	51		0.093	990		0.48	160		0.093	510		0.47	480		0.46	260		0.099
As	0.012		0.0019	0.12		0.0019	0.026		0.0019	0.086		0.0019	0.049		0.0018	0.042		0.002
Ba	0.49		0.0019	7.9		0.0019	1.3		0.0019	4.9		0.0019	7.2		0.0018	2.4		0.002
Be	0.0045		0.00093	0.086		0.00096	0.012		0.00093	0.046		0.00093	0.025		0.00092	0.024		0.00099
Cd	0.00047		0.00028	0.011		0.00029	0.0011		0.00028	0.0082		0.00028	0.002		0.00028	0.0047		0.0003
Co	0.014		0.0019	0.26		0.0019	0.044		0.0019	0.16		0.0019	0.17		0.0018	0.079		0.002
Cr	0.03		0.0046	0.43		0.0048	0.098		0.0046	0.31		0.0047	0.25		0.0046	0.17		0.0049
Cu	0.046		0.0019	0.81		0.0019	0.13		0.0019	0.56		0.0019	0.41		0.0018	0.28		0.002
Fe	44		0.046	910		0.24	160		0.046	590		0.23	490		0.23	270		0.25
Hg	< 0.0002	U	0.0002	0.0019		0.0002	< 0.0002	U	0.0002	0.0021		0.0002	0.00038		0.0002	0.0017		0.0002
Mn	1.4		0.0019	27		0.0096	2.8		0.0019	21		0.0093	13		0.0092	8.7		0.002
Ni	0.034		0.0046	0.53		0.0048	0.1		0.0046	0.31		0.0047	0.29		0.0046	0.16		0.0049
Pb	0.067	E	0.00046	1.3		0.0048	0.12		0.00046	1.1		0.0023	0.33		0.00046	0.52		0.00049
Sb	0.00051	N	0.00028	0.00086		0.00029	0.00043		0.00028	0.0014		0.00028	0.00049		0.00028	0.0017		0.0003
Se	< 0.00093	U	0.00093	0.0029		0.00096	< 0.00093	U	0.00093	0.0026		0.00093	< 0.00092	U	0.00092	< 0.00099	U	0.00099
Tl	0.00053		0.00019	0.014		0.0019	0.0021		0.00019	0.0072		0.00093	0.0043		0.00018	0.0037		0.0002
U	0.0032	E	0.000093	0.063		0.000096	0.0089		0.000093	0.053		0.000093	0.045		0.000092	0.025		0.000099
V	0.071		0.0046	1		0.024	0.24		0.0046	0.75		0.023	0.76		0.023	0.38		0.025
Zn	0.19		0.0046	2.2		0.0048	0.43		0.0046	2.2		0.0047	1.1		0.0046	1.2		0.0049

Table 21. Trace and Heavy Metal Analysis of Storm Water for 2007 (Totals)

All measuring units are mg/L

Location	LA-5.0			LA-5.0			LA-5.0			PU-5.5			AC-0.2		
Date / Time	9/1/07 16:10			9/1/07 17:36			9/1/07 19:06			7/14/07 18:02			7/14/07 17:47		
TYPE	CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	27		0.0062	20	(blank)	0.0062	17	(blank)	0.0062	19	(blank)	0.0062	20	(blank)	0.0062
K	17		0.038	12	(blank)	0.038	9.7	(blank)	0.038	7.5	(blank)	0.038	7.8	(blank)	0.038
Mg	16		0.0058	12	(blank)	0.0058	8.3	(blank)	0.0058	5.6	(blank)	0.0058	7	(blank)	0.0058
Na	19		0.042	14	(blank)	0.042	15	(blank)	0.042	17	(blank)	0.042	8.2	(blank)	0.042
Ag	0.0022		1E-08	0.0017	(blank)	1E-08	0.0011	(blank)	1E-08	0.00059	(blank)	1E-08	0.0012	(blank)	1E-08
Al	93		0.01	68	(blank)	0.01	46	(blank)	0.01	24	(blank)	0.01	33	(blank)	0.01
As	0.021		1.6E-07	0.015	(blank)	1.6E-07	0.01	(blank)	1.6E-07	0.0072	(blank)	1.6E-07	0.011	(blank)	1.6E-07
Ba	0.77		0.00039	0.58	(blank)	0.00039	0.36	(blank)	0.00039	0.19	(blank)	0.00039	0.37	(blank)	0.00039
Be	0.008		0.00012	0.0061	(blank)	0.00012	0.0037	(blank)	0.00012	0.0019	(blank)	0.00012	0.0026	(blank)	0.00012
Cd	0.0025		3.6E-08	0.0019	(blank)	3.6E-08	0.0012	(blank)	3.6E-08	0.00063	(blank)	3.6E-08	0.0022	(blank)	3.6E-08
Co	0.028		0.00066	0.02	(blank)	0.00066	0.012	(blank)	0.00066	0.0059	(blank)	0.00066	0.013	(blank)	0.00066
Cr	0.072		0.00049	0.056	(blank)	0.00049	0.035	(blank)	0.00049	0.016	(blank)	0.00049	0.04	(blank)	0.00049
Cu	0.091		0.0006	0.067	(blank)	0.0006	0.037	(blank)	0.0006	0.019	(blank)	0.0006	0.073	(blank)	0.0006
Fe	98		0.0028	70	(blank)	0.0028	44	(blank)	0.0028	24	(blank)	0.0028	39	(blank)	0.0028
Hg	0.00058		4.9E-06	0.00048	(blank)	4.9E-06	0.00026	(blank)	4.9E-06	0.000091	B	4.9E-06	0.00026	(blank)	4.9E-06
Mn	3.2		0.00033	2.4	(blank)	0.00033	1.3	(blank)	0.00033	0.85	(blank)	0.00033	1.2	(blank)	0.00033
Ni	0.055		0.00098	0.043	(blank)	0.00098	0.026	(blank)	0.00098	0.014	(blank)	0.00098	0.027	(blank)	0.00098
Pb	0.25		1.3E-08	0.19	(blank)	1.3E-08	0.1	(blank)	1.3E-08	0.04	(blank)	1.3E-08	0.19	(blank)	1.3E-08
Sb	0.0022		5.2E-08	0.0019	(blank)	5.2E-08	0.0012	(blank)	5.2E-08	0.00072	(blank)	5.2E-08	0.0023	(blank)	5.2E-08
Se	0.0011		1.6E-07	0.00088	B	1.6E-07	0.00055	B	1.6E-07	0.00032	B	1.6E-07	0.00047	B	1.6E-07
Tl	0.0015		2.7E-08	0.0012	(blank)	2.7E-08	0.00076	(blank)	2.7E-08	0.00038	(blank)	2.7E-08	0.00064	(blank)	2.7E-08
U	0.0081		4.3E-09	0.0064	(blank)	4.3E-09	0.0034	(blank)	4.3E-09	0.0016	(blank)	4.3E-09	0.0035	(blank)	4.3E-09
V	0.12		0.00062	0.091	(blank)	0.00062	0.06	(blank)	0.00062	0.031	(blank)	0.00062	0.062	(blank)	0.00062
Zn	0.64		0.0018	0.47	(blank)	0.0018	0.27	(blank)	0.0018	0.15	(blank)	0.0018	0.73	(blank)	0.0018

Table 22. Trace and Heavy Metal Measurements in 2008 Stormwater (Totals)

All measuring units are mg/L

Location	LA-0.7			Buckman @ RG			LA-5.0			LA-5.0			LA-5.0			LA-5.0		
Date / Time	7/22/2008 15:47			7/26/08 22:03			7/5/08 16:02			7/5/08 16:47			7/5/08 17:37			7/5/08 18:17		
TYPE	CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	810	(blank)	0.0062	79	(blank)	0.0062	29	(blank)	0.0062	27	(blank)	0.0062	26	(blank)	0.0062	25	(blank)	0.0062
K	270	(blank)	0.038	7.5	(blank)	0.038	8	(blank)	0.038	7.1	(blank)	0.038	6.8	(blank)	0.038	6.6	(blank)	0.038
Mg	390	(blank)	0.0058	16	(blank)	0.0058	8.3	(blank)	0.0058	7.2	(blank)	0.0058	7.1	(blank)	0.0058	6.8	(blank)	0.0058
Na	40	(blank)	0.042	16	(blank)	0.042	23	(blank)	0.042	22	(blank)	0.042	22	(blank)	0.042	23	(blank)	0.042
Ag	0.012	(blank)	0.000014	0.00013	(blank)	0.000014	0.00074	(blank)	0.000014	0.00063	(blank)	0.000014	0.0006	(blank)	0.000014	0.0006	(blank)	0.000014
Al	1400	(blank)	0.01	28	(blank)	0.01	21	(blank)	0.01	14	(blank)	0.01	14	(blank)	0.01	12	(blank)	0.01
As	0.19	(blank)	0.00012	0.0084	(blank)	0.00012	0.007	(blank)	0.00012	0.0054	(blank)	0.00012	0.0054	(blank)	0.00012	0.005	(blank)	0.00012
Ba	14	(blank)	0.00039	0.45	(blank)	0.00039	0.2	(blank)	0.00039	0.16	(blank)	0.00039	0.15	(blank)	0.00039	0.14	(blank)	0.00039
Be	0.087	(blank)	0.00012	0.0025	(blank)	0.00012	0.002	(blank)	0.00012	0.0015	(blank)	0.00012	0.0015	(blank)	0.00012	0.0013	(blank)	0.00012
Cd	0.021	(blank)	0.000057	0.00021	B	0.000057	0.00089	B	0.000057	0.00067	(blank)	0.000057	0.00063	(blank)	0.000057	0.00061	(blank)	0.000057
Co	0.5	(blank)	0.00066	0.0099	(blank)	0.00066	0.0039	(blank)	0.00066	0.0026	(blank)	0.00066	0.0023	(blank)	0.00066	0.0021	(blank)	0.00066
Cr	0.76	(blank)	0.00049	0.024	(blank)	0.00049	0.26	(blank)	0.00049	0.17	(blank)	0.00049	0.16	(blank)	0.00049	0.13	(blank)	0.00049
Cu	1.3	(blank)	0.0006	0.022	(blank)	0.0006	0.024	(blank)	0.0006	0.017	(blank)	0.0006	0.016	(blank)	0.0006	0.013	(blank)	0.0006
Fe	1300	(blank)	0.0028	23	(blank)	0.0028	17	(blank)	0.0028	12	(blank)	0.0028	11	(blank)	0.0028	9.8	(blank)	0.0028
Hg	0.00089	(blank)	7.5E-06	0.00002	U	7.5E-06	0.000088	U	7.5E-06	0.000033	B	7.5E-06	0.00005	B	7.5E-06	0.000038	B	7.5E-06
Mn	29	(blank)	0.00033	0.79	(blank)	0.00033	0.49	(blank)	0.00033	0.37	(blank)	0.00033	0.36	(blank)	0.00033	0.33	(blank)	0.00033
Ni	0.85	(blank)	0.00098	0.024	(blank)	0.00098	0.013	(blank)	0.00098	0.01	(blank)	0.00098	0.0089	(blank)	0.00098	0.008	(blank)	0.00098
Pb	1.3	(blank)	0.00016	0.017	(blank)	0.00016	0.036	(blank)	0.00016	0.026	(blank)	0.00016	0.025	(blank)	0.00016	0.022	(blank)	0.00016
Sb	0.00037	U	0.000076	0.00044	(blank)	0.000076	0.001	(blank)	0.000076	0.00082	(blank)	0.000076	0.00076	(blank)	0.000076	0.00064	(blank)	0.000076
Se	0.0055	(blank)	0.00016	0.00026	B	0.00016	0.00062	B	0.00016	0.00047	B	0.00016	0.00047	B	0.00016	0.00035	B	0.00016
Tl	0.016	(blank)	0.00002	0.00025	(blank)	0.00002	0.00039	(blank)	0.00002	0.00028	(blank)	0.00002	0.00028	(blank)	0.00002	0.00025	(blank)	0.00002
U	0.081	(blank)	5.3E-06	0.0037	(blank)	5.3E-06	0.0029	(blank)	5.3E-06	0.0024	(blank)	5.3E-06	0.0023	(blank)	5.3E-06	0.0022	(blank)	5.3E-06
V	1.8	(blank)	0.00062	0.046	(blank)	0.00062	0.039	(blank)	0.00062	0.032	(blank)	0.00062	0.031	(blank)	0.00062	0.029	(blank)	0.00062
Zn	3.1	(blank)	0.0018	0.074	(blank)	0.0018	0.28	(blank)	0.0018	0.24	(blank)	0.0018	0.22	(blank)	0.0018	0.19	(blank)	0.0018

Table 22. Trace and Heavy Metal Measurements in 2008 Stormwater (Totals) continued

All measuring units are mg/L

Location	LA-5.0			LA-5.0			LA-5.0			LA-5.0			LA-5.0			LA-5.0		
Date / Time	7/5/08 19:17			8/9/08 15:49			8/9/08 16:34			8/9/08 17:19			8/9/08 18:04			8/9/08 19:04		
TYPE	CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	25	(blank)	0.0062	27	(blank)	0.0062	22	(blank)	0.0062	18	(blank)	0.0062	17	(blank)	0.0062	19	(blank)	0.0062
K	6.1	(blank)	0.038	18	(blank)	0.038	12	(blank)	0.038	9.4	(blank)	0.038	7.9	(blank)	0.038	7.1	(blank)	0.038
Mg	6.7	(blank)	0.0058	14	(blank)	0.0058	10	(blank)	0.0058	7	(blank)	0.0058	5.6	(blank)	0.0058	5	(blank)	0.0058
Na	22	(blank)	0.042	18	(blank)	0.042	16	(blank)	0.042	18	(blank)	0.042	18	(blank)	0.042	20	(blank)	0.042
Ag	0.00045	(blank)	0.000014	0.0026	(blank)	0.000014	0.0019	(blank)	0.000014	0.0011	(blank)	0.000014	0.00075	(blank)	0.000014	0.00054	(blank)	0.000014
Al	10	(blank)	0.01	75	(blank)	0.01	51	(blank)	0.01	34	(blank)	0.01	24	(blank)	0.01	17	(blank)	0.01
As	0.0045	(blank)	0.00012	0.014	(blank)	0.00012	0.0093	(blank)	0.00012	0.0063	(blank)	0.00012	0.0045	(blank)	0.00012	0.0033	(blank)	0.00012
Ba	0.12	(blank)	0.00039	0.6	(blank)	0.00039	0.4	(blank)	0.00039	0.26	(blank)	0.00039	0.19	(blank)	0.00039	0.15	(blank)	0.00039
Be	0.0011	(blank)	0.00012	0.007	(blank)	0.00012	0.005	(blank)	0.00012	0.003	(blank)	0.00012	0.002	(blank)	0.00012	0.0013	(blank)	0.00012
Cd	0.00027	B	0.000057	0.0023	(blank)	0.000057	0.0016	(blank)	0.000057	0.00088	(blank)	0.000057	0.00065	(blank)	0.000057	0.00027	B	0.000057
Co	0.0021	(blank)	0.00066	0.02	(blank)	0.00066	0.012	(blank)	0.00066	0.0065	(blank)	0.00066	0.0045	(blank)	0.00066	0.0029	(blank)	0.00066
Cr	0.1	(blank)	0.00049	0.17	(blank)	0.00049	0.11	(blank)	0.00049	0.056	(blank)	0.00049	0.034	(blank)	0.00049	0.021	(blank)	0.00049
Cu	0.011	(blank)	0.0006	0.095	(blank)	0.0006	0.058	(blank)	0.0006	0.033	(blank)	0.0006	0.022	(blank)	0.0006	0.015	(blank)	0.0006
Fe	8.9	(blank)	0.0028	72	(blank)	0.0028	45	(blank)	0.0028	27	(blank)	0.0028	18	(blank)	0.0028	12	(blank)	0.0028
Hg	0.000031	B	7.5E-06	0.00023	(blank)	7.5E-06	0.00026	(blank)	7.5E-06	0.00011	(blank)	7.5E-06	0.000071	B	7.5E-06	0.000049	B	7.5E-06
Mn	0.29	(blank)	0.00033	2.1	(blank)	0.00033	1.4	(blank)	0.00033	0.79	(blank)	0.00033	0.53	(blank)	0.00033	0.36	(blank)	0.00033
Ni	0.0073	(blank)	0.00098	0.043	(blank)	0.00098	0.029	(blank)	0.00098	0.019	(blank)	0.00098	0.013	(blank)	0.00098	0.0093	(blank)	0.00098
Pb	0.018	(blank)	0.00016	0.19	(blank)	0.00016	0.11	(blank)	0.00016	0.07	(blank)	0.00016	0.046	(blank)	0.00016	0.029	(blank)	0.00016
Sb	0.00047	(blank)	0.000076	0.0025	(blank)	0.000076	0.0019	(blank)	0.000076	0.0014	(blank)	0.000076	0.0012	(blank)	0.000076	0.00093	(blank)	0.000076
Se	0.00026	B	0.00016	0.00057	B	0.00016	0.0004	B	0.00016	0.00024	U	0.00016	0.00024	U	0.00016	0.00024	U	0.00016
Tl	0.00019	B	0.00002	0.0011	(blank)	0.00002	0.0008	(blank)	0.00002	0.00051	(blank)	0.00002	0.00035	(blank)	0.00002	0.00022	(blank)	0.00002
U	0.0018	(blank)	5.3E-06	0.0054	(blank)	5.3E-06	0.004	(blank)	5.3E-06	0.0022	(blank)	5.3E-06	0.0013	(blank)	5.3E-06	0.00081	(blank)	5.3E-06
V	0.027	(blank)	0.00062	0.099	(blank)	0.00062	0.063	(blank)	0.00062	0.04	(blank)	0.00062	0.028	(blank)	0.00062	0.02	(blank)	0.00062
Zn	0.17	(blank)	0.0018	0.69	(blank)	0.0018	0.43	(blank)	0.0018	0.33	(blank)	0.0018	0.28	(blank)	0.0018	0.33	(blank)	0.0018

Table 22. Trace and Heavy Metal Measurements in 2008 Stormwater (Dissolved) continued

All measuring units are mg/L

Location	Buckman @ RG			Buckman @ RG			Buckman @ RG			Buckman @ RG			Buckman @ RG			Buckman @ RG		
Date / Time	8/24/08 19:59			8/24/08 20:57			9/9/08 21:57			9/9/08 22:28			10/11/08 19:47			10/11/08 20:44		
TYPE	CS			CS			CS			CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	35	(blank)	0.013	42	(blank)	0.013	34	(blank)	0.013	34	(blank)	0.013	41	(blank)	0.013	41	(blank)	0.013
K	2.1	(blank)	0.018	2.3	(blank)	0.018	2.1	(blank)	0.018	2.1	(blank)	0.018	2.8	(blank)	0.018	3	(blank)	0.018
Mg	5.5	(blank)	0.0026	4	(blank)	0.0026	5.6	(blank)	0.0026	5.6	(blank)	0.0026	4.3	(blank)	0.0026	3.8	(blank)	0.0026
Na	13	(blank)	0.03	13	(blank)	0.03	13	(blank)	0.03	13	(blank)	0.03	14	(blank)	0.03	17	(blank)	0.03
Ag	0.000024	B	0.000014	0.000025	B	0.000014	0.000025	B	0.000014	0.00002	B	0.000014	0.000024	B	0.000014	0.000025	B	0.000014
Al	0.036	B	0.031	0.12	(blank)	0.031	0.035	U	0.031	0.036	B	0.031	0.067	B	0.031		(blank)	0.031
As	0.0015	B	0.00011	0.0021	(blank)	0.00011	0.0013	B	0.00011	0.0014	B	0.00011	0.0021	(blank)	0.00011	0.0021	(blank)	0.00011
Ba	0.1	(blank)	0.00032	0.57	(blank)	0.00032	0.087	(blank)	0.00032	0.089	(blank)	0.00032	0.27	(blank)	0.00032	0.55	(blank)	0.00032
Be	0.00013	U	0.00013	0.00013	U	0.00013	0.00013	U	0.00013	0.00013	U	0.00013		U	0.00013	0.00013	U	0.00013
Cd	0.000035	B	0.000042	0.000026	B	0.000042	0.000048	B	0.000042	0.000032	B	0.000042	0.000031	B	0.000042	0.000033	B	0.000042
Co	0.00072	U	0.00056	0.00072	U	0.00056	0.00072	U	0.00056	0.00072	U	0.00056	0.00072	U	0.00056	0.00072	U	0.00056
Cr	0.00043	U	0.00051	0.00043	U	0.00051	0.00043	U	0.00051	0.00049	B	0.00051	0.00043	U	0.00051	0.00043	U	0.00051
Cu	0.00092	U	0.0011	0.00092	U	0.0011	0.00092	U	0.0011	0.00092	U	0.0011	0.00092	U	0.0011	0.00092	U	0.0011
Fe	0.022	U	0.01	0.064	(blank)	0.01	0.022	U	0.01	0.023	B	0.01	0.035	B	0.01	0.064	(blank)	0.01
Hg	0.000019	U	8.1E-06	0.000019	U	8.1E-06	0.000019	U	8.1E-06	0.000019	U	8.1E-06	0.000019	U	8.1E-06	0.000019	U	8.1E-06
Mn		U	0.00015	0.00078	B	0.00015	0.00026	U	0.00015	0.00026	U	0.00015	0.13	(blank)	0.00015	0.23	(blank)	0.00015
Ni	0.00081	U	0.001	0.00081	U	0.001	0.00081	U	0.001	0.00081	U	0.001	0.00081	U	0.001	0.00081	U	0.001
Pb	0.000016	U	0.000045	0.000016	U	0.000045	0.000022	B	0.000045	0.000016	U	0.000045	0.00011	B	0.000045	0.00012	B	0.000045
Sb	0.00026	B	0.000041	0.00052	(blank)	0.000041	0.00014	B	0.000041	0.00031	(blank)	0.000041	0.00049	(blank)	0.000041	0.00082	(blank)	0.000041
Se	0.00014	B	0.00011	0.00015	B	0.00011	0.00016	B	0.00011	0.00021	B	0.00011	0.00013	B	0.00011	0.00011	U	0.00011
Tl	0.000034	U	0.000015	0.000034	U	0.000015	0.000034	U	0.000015	0.000034	U	0.000015	0.000034	U	0.000015	0.000034	U	0.000015
U	0.0014	(blank)	7.4E-06	0.0015	(blank)	7.4E-06	0.0015	(blank)	7.4E-06	0.0013	(blank)	7.4E-06	0.005	(blank)	7.4E-06	0.0081	(blank)	7.4E-06
V	0.0036	B	0.00056	0.0051	(blank)	0.00056	0.0036	B	0.00056	0.003	B	0.00056	0.0049	B	0.00056	0.0063	(blank)	0.00056
Zn	0.042	(blank)	0.0034	0.086	(blank)	0.0034	0.026	(blank)	0.0034	0.029	(blank)	0.0034	0.043	(blank)	0.0034	0.11	(blank)	0.0034

Table 22. Trace and Heavy Metal Measurements in 2008 Stormwater (Dissolved) continued

All measuring units are mg/L

Location	LA-5.0			LA-5.0			LA-0.7		
Date / Time	10/11/08 18:08			8/23/08 7:40			8/20/08 16:40		
TYPE	CS			CS			CS		
Analyte	RESULT	QUAL	MDL	RESULT	QUAL	MDL	RESULT	QUAL	MDL
Ca	8.6	(blank)	0.013	11	(blank)	0.013	53	(blank)	0.013
K	4.8	(blank)	0.018	6	(blank)	0.018	4.5	E	0.018
Mg	1.5	(blank)	0.0026	2.1	(blank)	0.0026	4.8	(blank)	0.0026
Na	10	(blank)	0.03	21	(blank)	0.03	31	(blank)	0.03
Ag	0.00004	B	0.000014	0.000057	B	0.000014	0.000024	B	0.000014
Al	1.2	(blank)	0.031	4	(blank)	0.031	0.035	U	0.031
As	0.00093	B	0.00011	0.0009	B	0.00011	0.0017	B	0.00011
Ba	0.089	(blank)	0.00032	0.18	(blank)	0.00032	0.17	(blank)	0.00032
Be	0.00013	B	0.00013	0.00024	B	0.00013	0.00013	U	0.00013
Cd	0.000062	B	0.000042	0.000062	B	0.000042	0.000039	B	0.000042
Co	0.00072	U	0.00056	0.00072	U	0.00056	0.00072	U	0.00056
Cr	0.0013	B	0.00051	0.0022	B	0.00051	0.00044	B	0.00051
Cu	0.0027	(blank)	0.0011	0.004	(blank)	0.0011	0.00092	U	0.0011
Fe	0.79	(blank)	0.01	2	(blank)	0.01	0.022	U	0.01
Hg	0.000019	B	8.1E-06	0.000019	U	8.1E-06	0.000019	U	8.1E-06
Mn	0.024	(blank)	0.00015	0.015	(blank)	0.00015	0.00026	U	0.00015
Ni	0.0033	B	0.001	0.0019	B	0.001	0.00081	U	0.001
Pb	0.0017	(blank)	0.000045	0.003	(blank)	0.000045	0.000016	U	0.000045
Sb	0.00096	(blank)	0.000041	0.0025	(blank)	0.000041	0.00007	U	0.000041
Se	0.0002	B	0.00011	0.00017	B	0.00011	0.00031	B	0.00011
Tl	0.000034	U	0.000015	0.000034	U	0.000015	0.000034	U	0.000015
U	0.000071	B	7.4E-06	0.00016	(blank)	7.4E-06	0.0022	(blank)	7.4E-06
V	0.0028	B	0.00056	0.0052	(blank)	0.00056	0.0056	(blank)	0.00056
Zn	0.094	(blank)	0.0034	0.19	(blank)	0.0034	0.017	(blank)	0.0034

MDL = Minimum Ectectable Limit
B = the reported value was obtained from a reading that was less than the Practical Quantitation Limit but greater than or equal to the Instrument Detection Limit (IDL).
U = The analyte was analyzed for but not detected

Abbreviations

UNCERT	Propagated uncertainty at two times the standard deviation
MDA	Minimum detectable activity
QUAL	Qualifier
CS	Customer Sample
DUP	Duplicate
NA	Not Applicable

Qualifiers

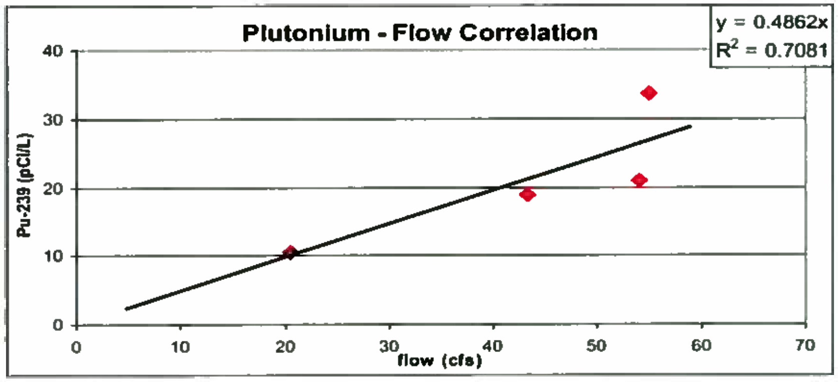
Radiochemicals

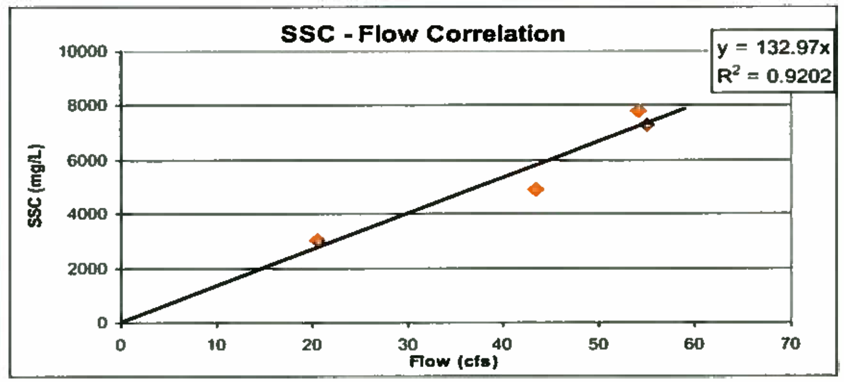
U	Result is less than the sample specific minimum detection concentration
M3	The requested minimum detection concentration was not met, but the reported activity is greater that the reported minimum detection concentration
N	Spiked sample recovery not within control limits
NC	Relative Percent Difference Not Calculated
LT	Result is less than the requested minimum detection concentration, greater than sample specific minimum detection concentration
M	The requested minimum detection concentration was not met
Y2	Chemical Yield outside default limits
TI	Nuclide identification is tentative
D	The result for this analyte was reported from a dilution
Y1	Chemical Yield is in control at 100-110%. Quantitative Yield is assumed.

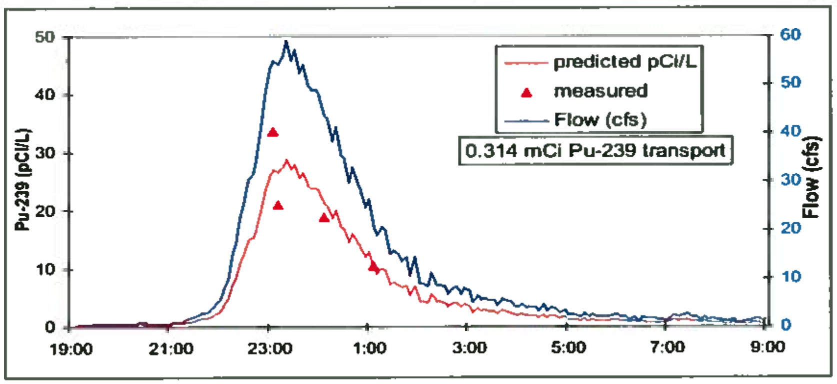
Metals

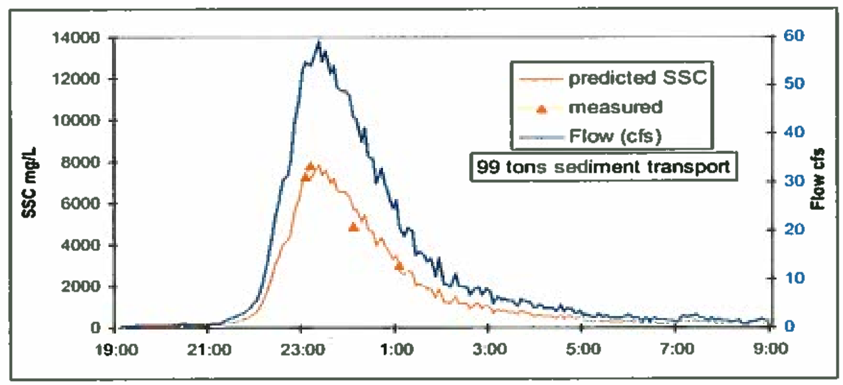
H	The required extraction or analysis holding time for this result was exceeded
D	The result for this analyte was reported from a dilution
E	The reported value is estimated because of the presence of interference.
N	Spiked sample recovery not within control limits
*	Duplicate analysis (relative percent difference) not within control limits

Event on 8/12/2003 at Station E060



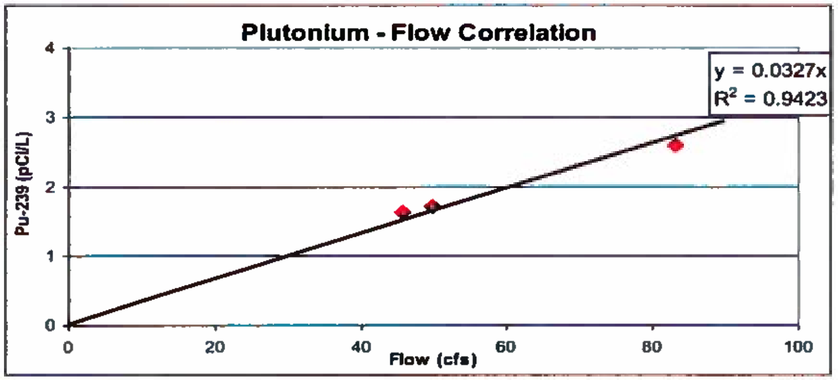


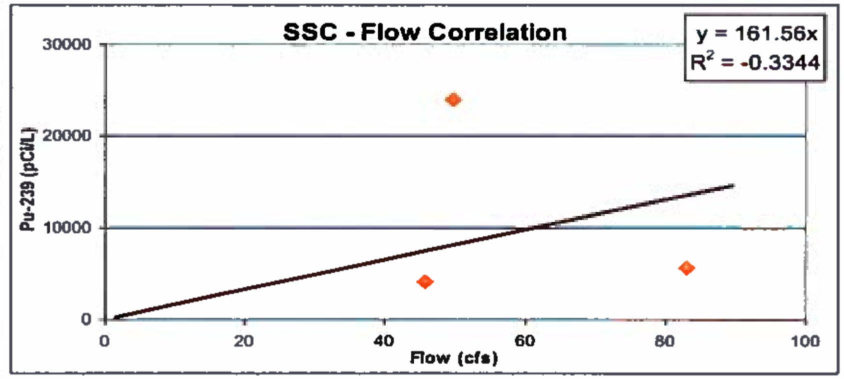


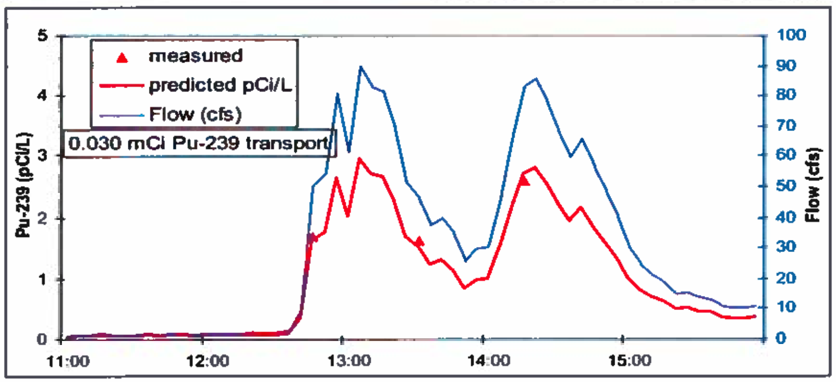


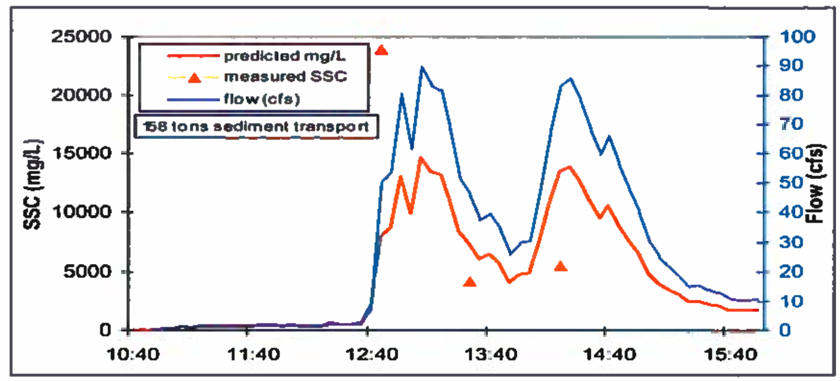
Four samples were collected from a 60 cfs event on August 12th, 2003. Flow duration is approximately seven hours. The first two samples were collected on the rising leg of the hydrograph near the peak followed by two more samples collected at near one hour intervals along the falling leg of the hydrograph. The correlations are good; p for plutonium equals 0.08 while SSC is 0.02. We estimate 0.314 mCi of plutonium$^{239/240}$ was carried beyond this station in 99 tons of sediment. These estimates appear reasonable.

Event on 8/22/2003 at Station E060



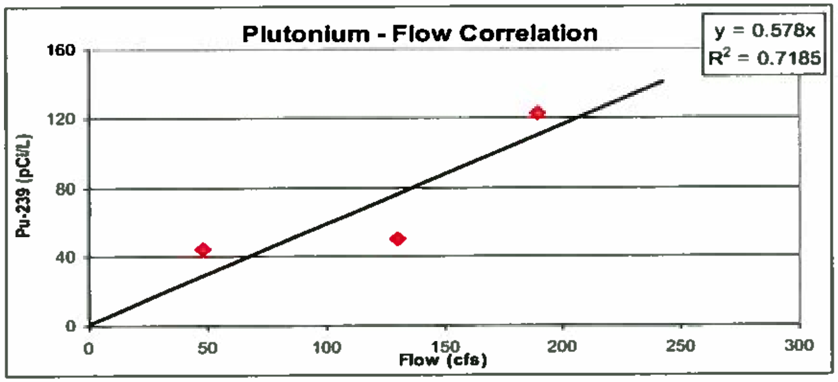


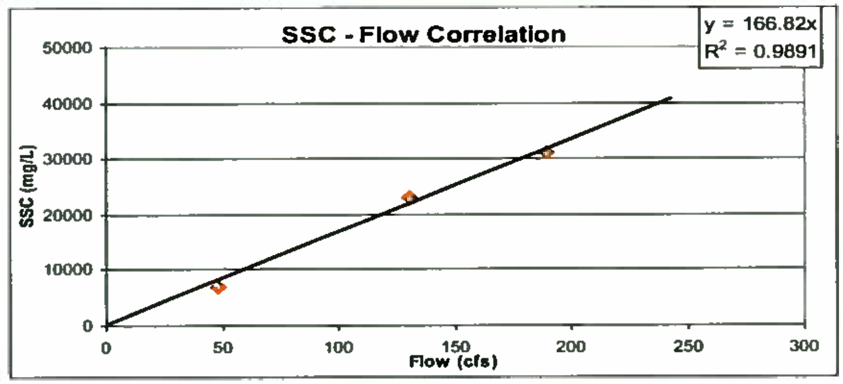


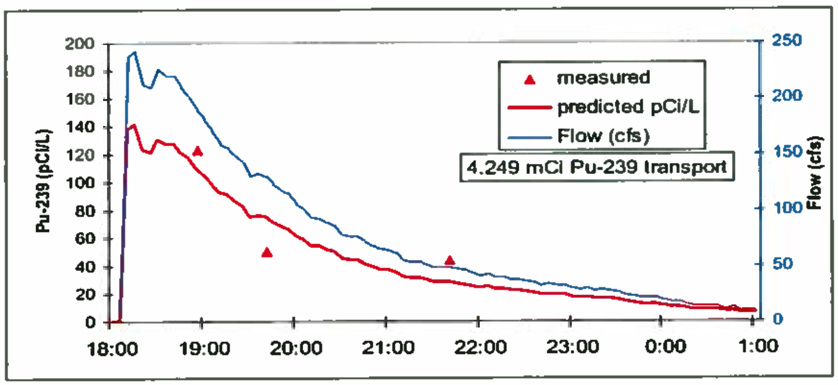


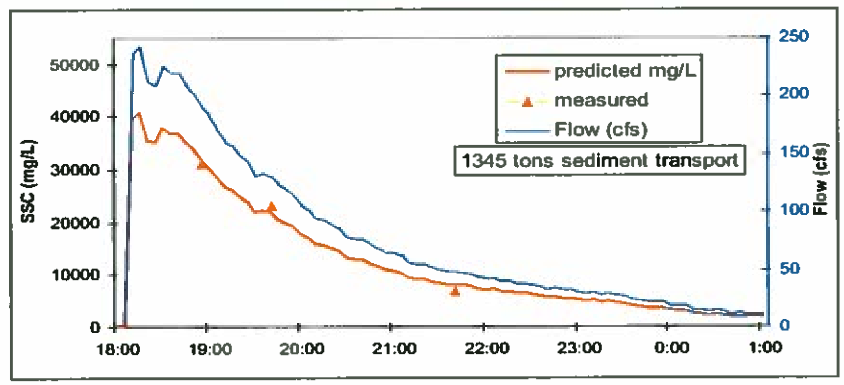
Three samples were collected from a 90 cfs event on August 22nd, 2003. The flow duration is approximately three hours. The first sample was collected on the rising leg of the hydrograph near the peak followed by two more samples collected at near 45 minute intervals along the falling and rising legs of a hydrograph with multiple peaks. The correlation is good for the plutonium correlation, but the first suspended sediment measurement, near 25000 mg/L, may be overvalued. Although a single influential measurement is included in the correlation, the transport estimate looks reasonable. We estimate 0.030 mCi of plutonium$^{239/240}$ was carried beyond this station in 158 tons of sediment. These estimates appear low but reasonable.

Event on 9/6/2003 at Station E060



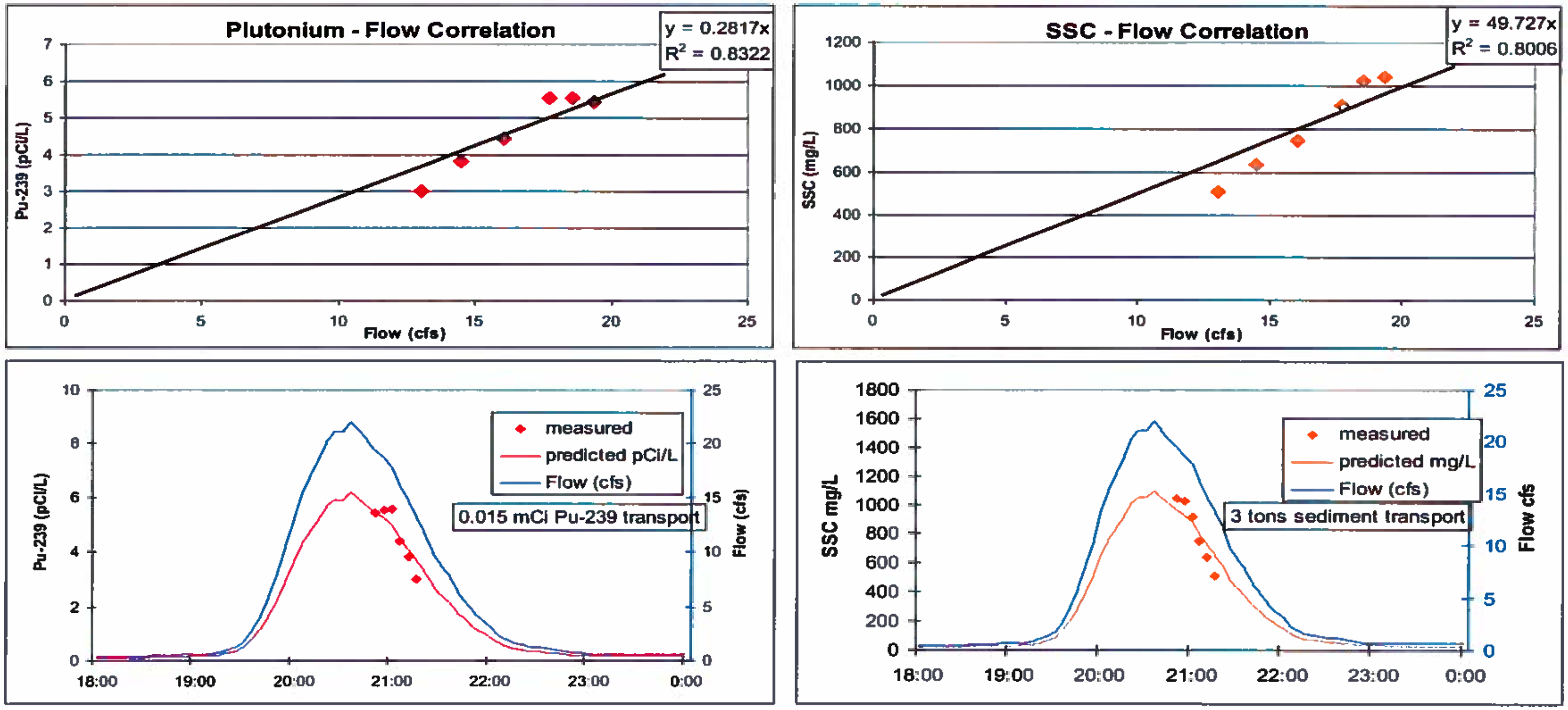






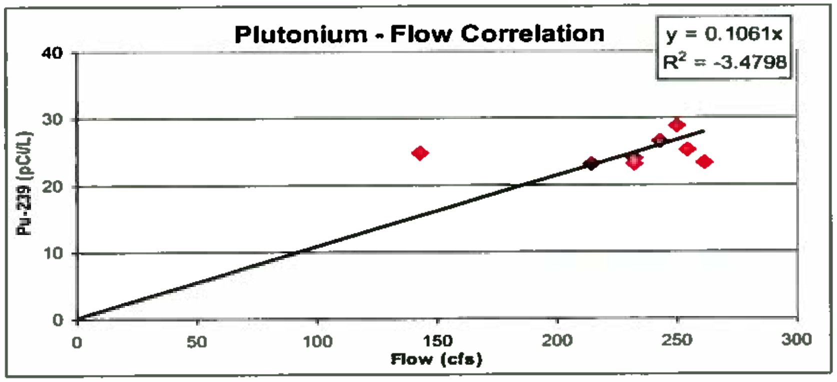
Three samples were collected from a 243 cfs event on September 9th, 2003. Flow duration is more than nine hours. The first sample is collected more than an hour after the peak of the hydrograph followed by two more samples collected along the falling leg of the hydrograph. The interval schedule had been 45 minutes but failure to sample occurred between the second and third sample. The correlations are good. We estimate 4.249 mCi of plutonium$^{239/240}$ was carried beyond this station in 1345 tons of sediment. These estimates appear reasonable. Based on LANL's time-weighted measurement of 88 pCi/L and 54609569 liters water during the event, a 4.8 mCi flux is estimated.

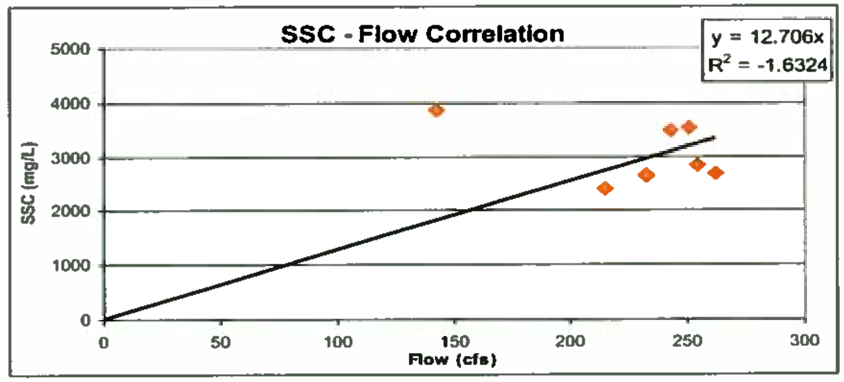
Event on 7/23/2004 at Station E060

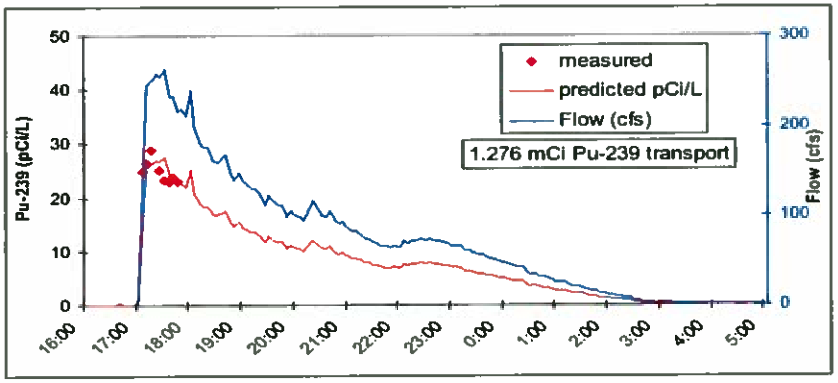


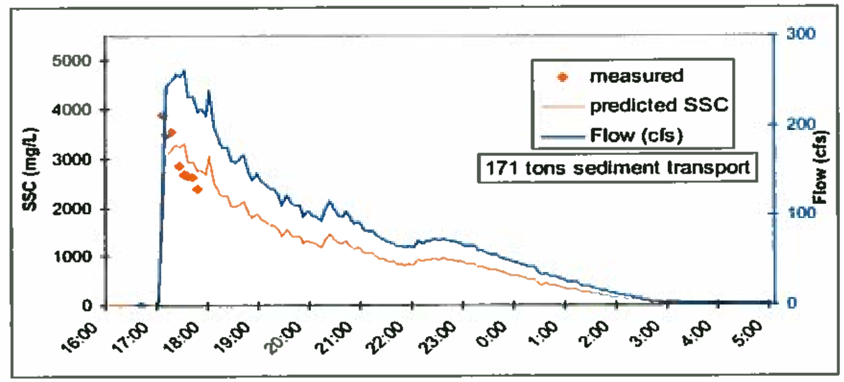
Six samples were collected from a 21 cfs event on July 23rd, 2004. Flow duration is more than three hours. The first sample is collected near the peak of the hydrograph followed by five more samples collected along the falling leg of the hydrograph. The rising and falling leg of the hydrograph appear symmetrical. A large event occurred shortly after this, 504 cfs on the 24th. The sampler was unable to sample, it was still locked from this event. The correlations are good. We estimate 0.015 mCi of plutonium$^{239/240}$ was carried beyond this station in 3 tons of sediment. These estimates appear reasonable, although sediment transport may be underestimated.

Event on 7/27/2004 at Station E060

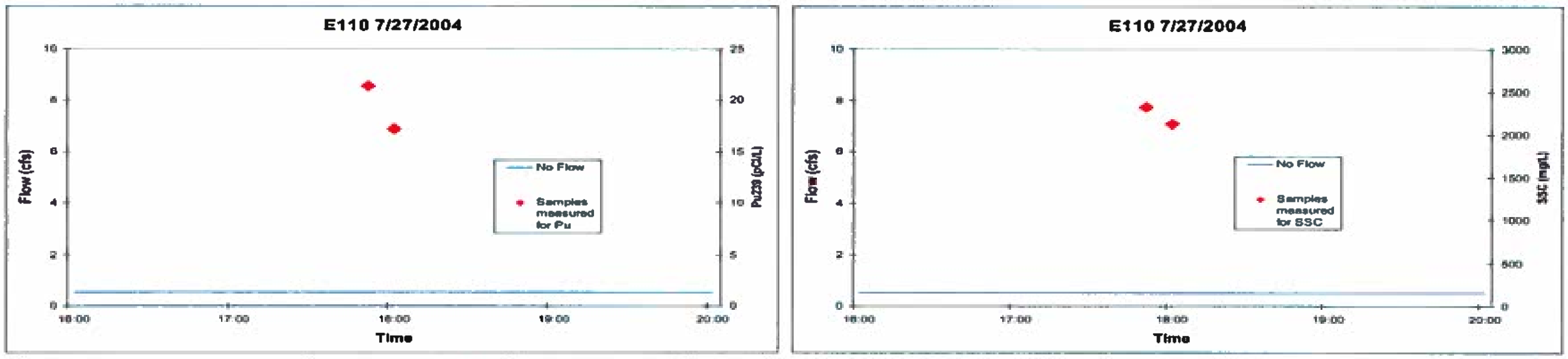




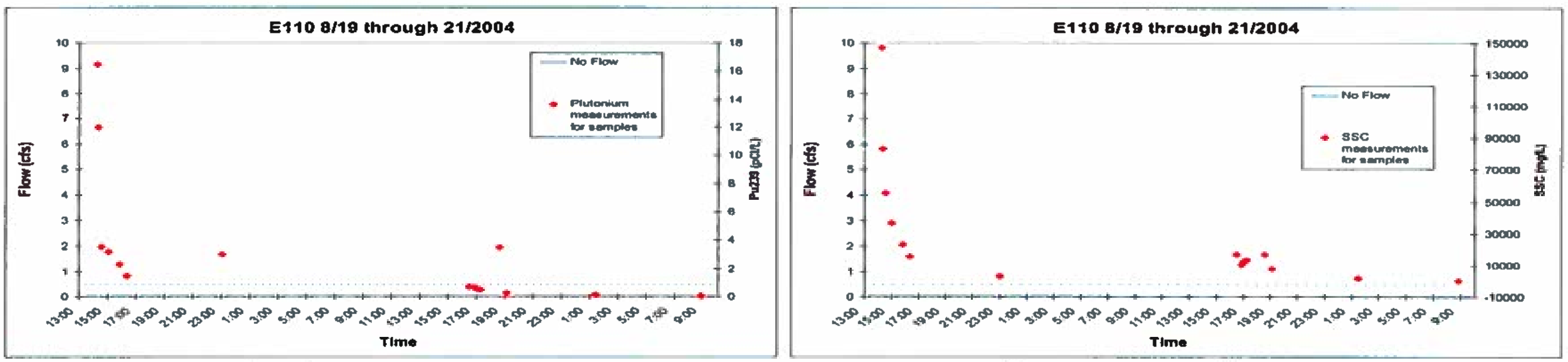




Seven samples were collected from a 262 cfs event on July 27th, 2004. Flow duration is more than ten hours. All of the samples are collected near the peak of the hydrograph at ten minute intervals. The correlation appears to be poor due to the spacing of the samples near the peak of the hydrograph and extending the regression line through zero, and one isolated hysteresis sample at approximately 150 cfs that contains larger measurements than expected. Six samples demonstrate that flows around 250 cfs contain plutonium values near 25 pCi/L and SSC values near 3000 mg/L. The rational that concentrations diminish with discharge has been demonstrated and the equation that describes the association appears reasonable. We estimate 1.276 mCi of plutonium$^{239/240}$ was carried beyond this station in 171 tons of sediment. These estimates appear reasonable, although sediment transport may be underestimated. The slope factor for the SSC/Flow correlation is less than expected.

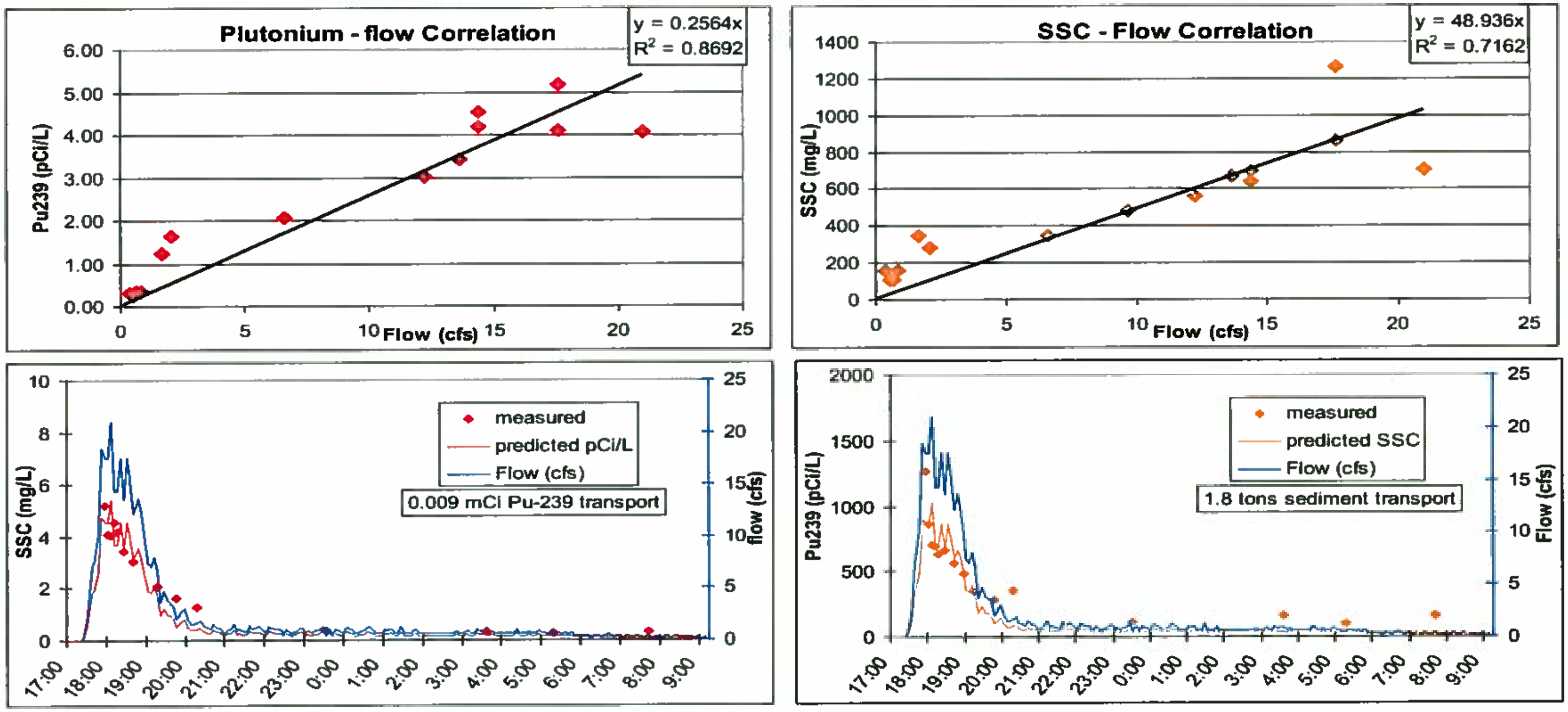


Plutonium concentrations in suspended sediment average 8.5 pCi/g; identifying Pueblo Canyon as runoff source.



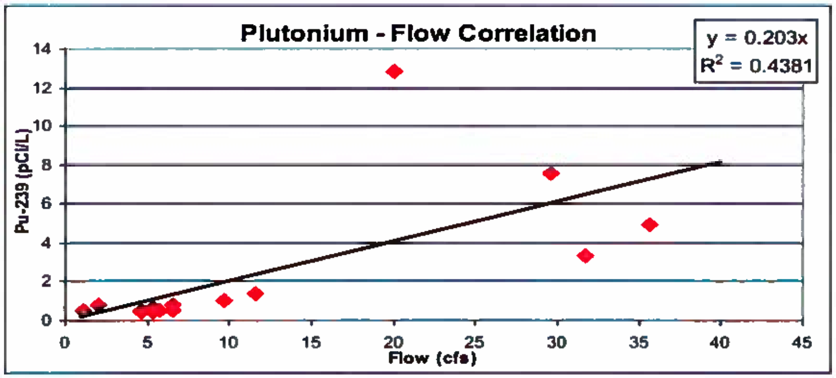
Plutonium concentrations in suspended sediment average 0.14 pCi/g; identifying Guaje Canyon as possible runoff source. Clear evidence of potentially large runoff events and examples of gages not functioning.

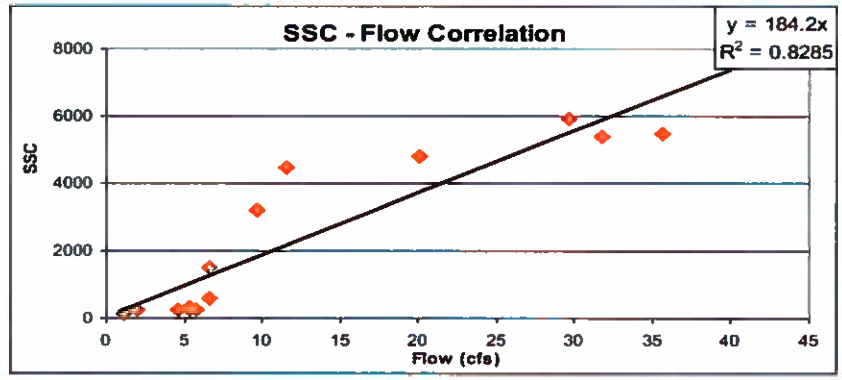
Event on 8/18/2004 at Station E060

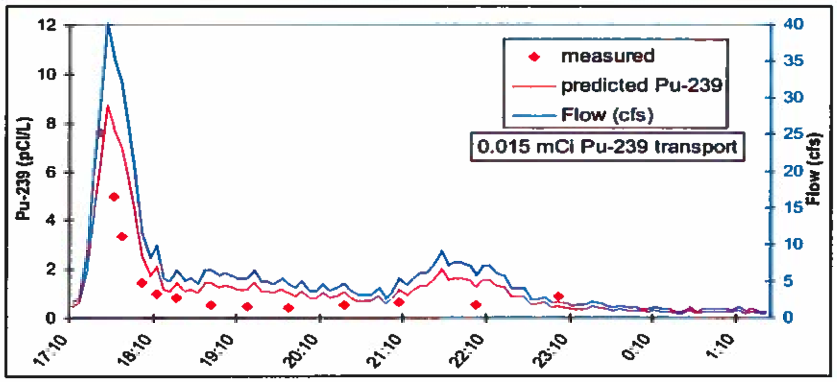


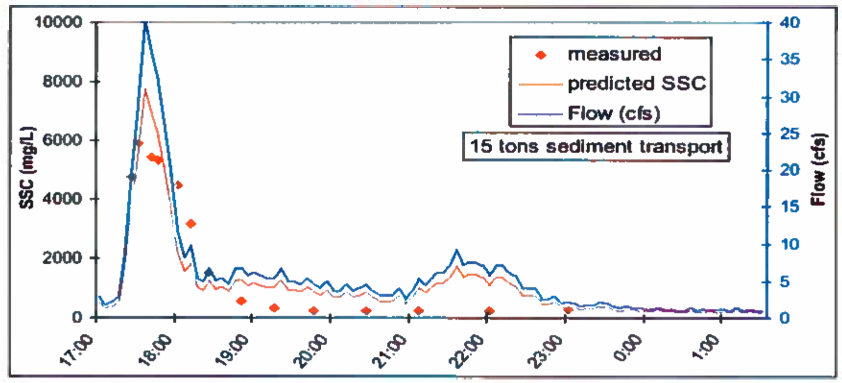
Fourteen samples were collected from a 21 cfs event on August 18th, 2004. Majority of flow occurs with the first four hours but continues for at least an additional 10 hours. The samples are collected throughout the hydrograph starting at close intervals near the peak, extending to three hour intervals near the tail end of the hydrograph. The correlations are good. We estimate 0.009 mCi of plutonium$^{239/240}$ was carried beyond this station in 1.8 tons of sediment. These estimates appear reasonable, although this event carries a small sediment load relative to other events. This could be due to the seasonal increase in wetland area above this location.

Event on 8/20/2004 at Station E060



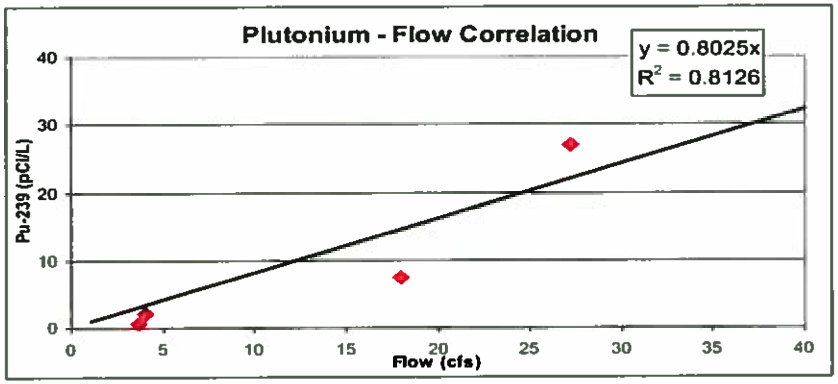


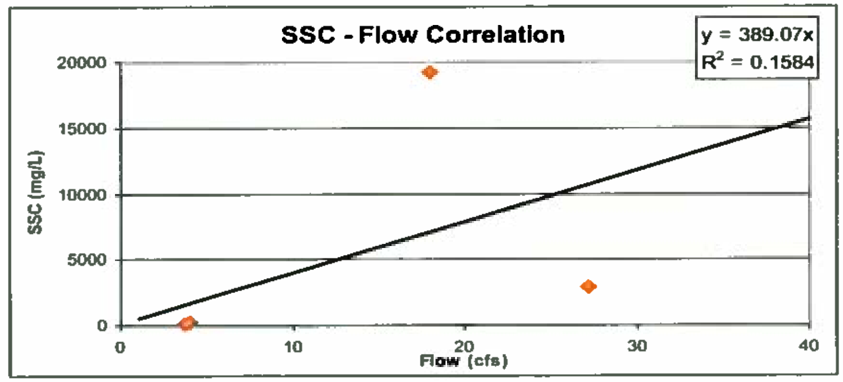


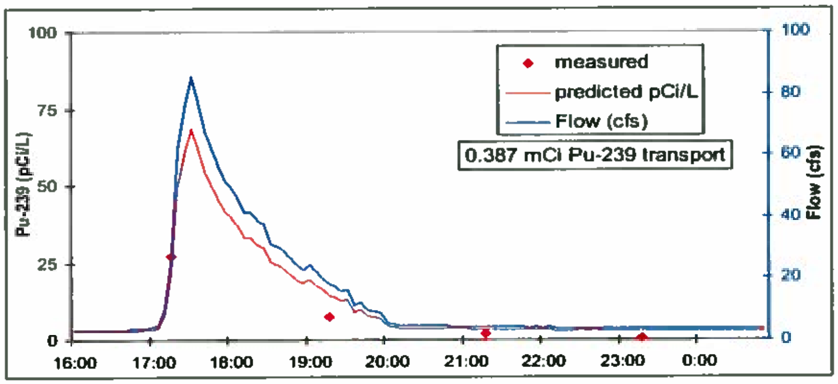


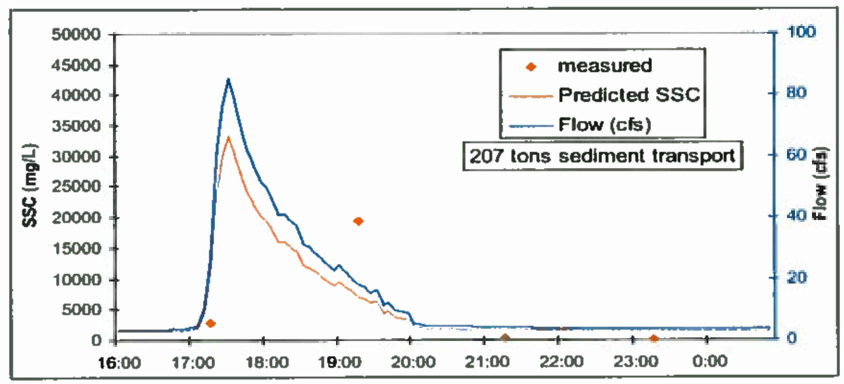
Fifteen samples were collected from a 40 cfs event on August 20th, 2004. The duration is greater than 7 hours. The samples are collected throughout the hydrograph starting at close intervals near the peak, extending to two and a half hour intervals near the tail end of the hydrograph. The correlation is fair with one overly influential value. The first sample collected on the rising leg of the hydrograph contains a plutonium value larger than expected. We estimate 0.015 mCi of plutonium$^{239/240}$ was carried beyond this station in 15 tons of sediment. These estimates appear low but reasonable.

Event on 8/24/2005 at Station E060



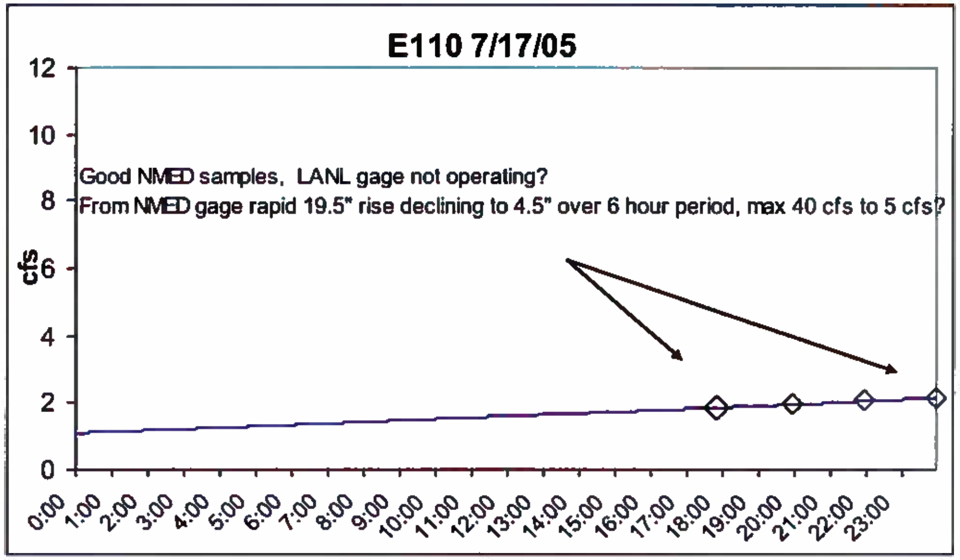






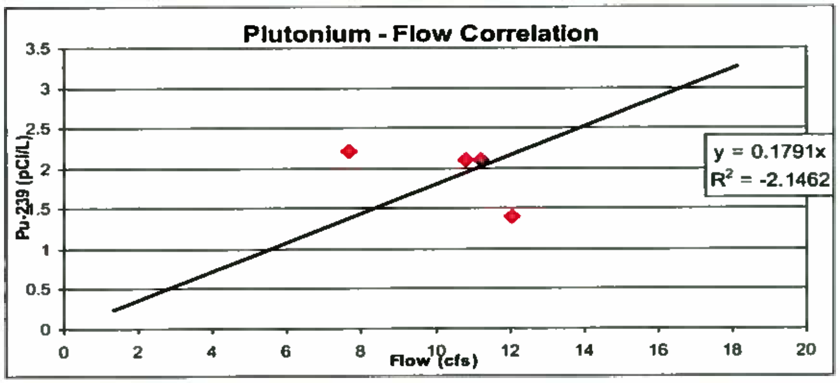
Four samples were collected from an 85 cfs event on August 24th, 2005. The duration is approximately 3.5 hours, although flow continued for many hours later at a rate large enough to collect samples. The first sample was collected near the beginning of the event on the rising leg, and continued throughout the hydrograph at two hour intervals. The correlation is good for the plutonium evaluation. The Sediment correlation contains an overly influential value. Field notes for this sample collection indicated that one of the bottles had overfilled; there was a substantial amount of water at the bottom of the collection tub. We suspect it may have been for the second sample and this estimate may overestimate the sediment load for the event. We estimate 0.387 mCi of plutonium$^{239/240}$ was carried beyond this station in 207 tons of sediment. These estimates remain reasonable.

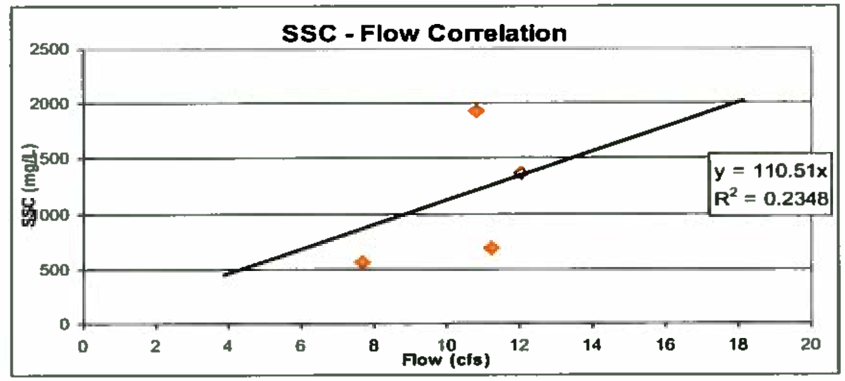
Event on 7/17/2005 at Station E110

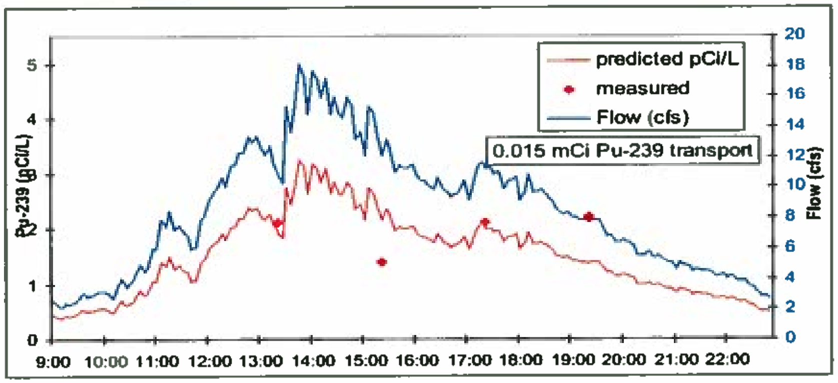


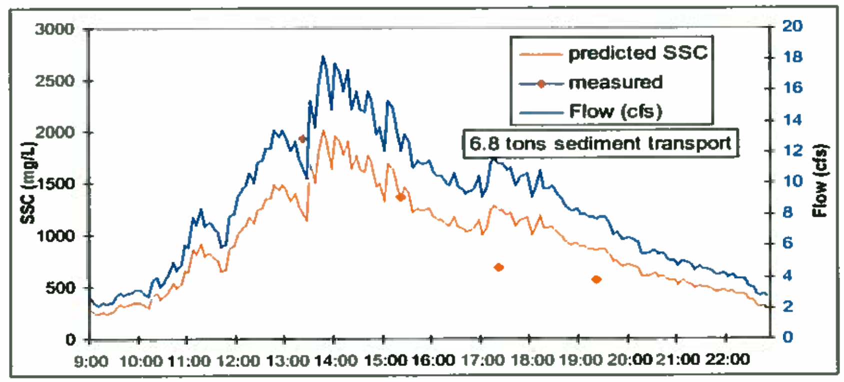
Four samples were collected from a late evening July 17th, 2005 event at the E110 station. LANL flow recording indicated a very gradual rise in discharge. The OB flow meter indicated a rapid 19.5 inch rise declining to 4.5 inches over a six hour period. We believe LANL's recording to be in error. Based on the channel dimensions we estimated a 40 cfs discharge at the peak declining to 5 cfs within a six hour period. Unfortunately a transport estimate cannot be made with this information.

Event on 8/12/2005 at Station E110



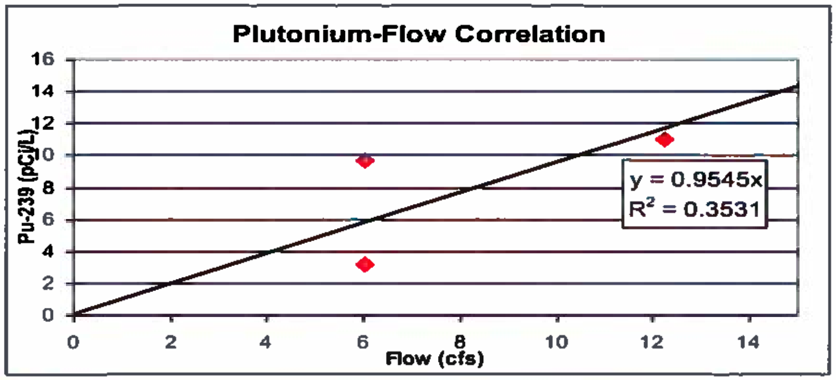


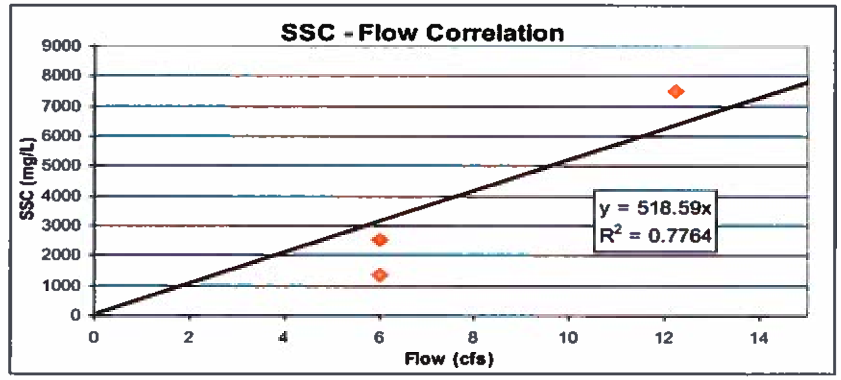


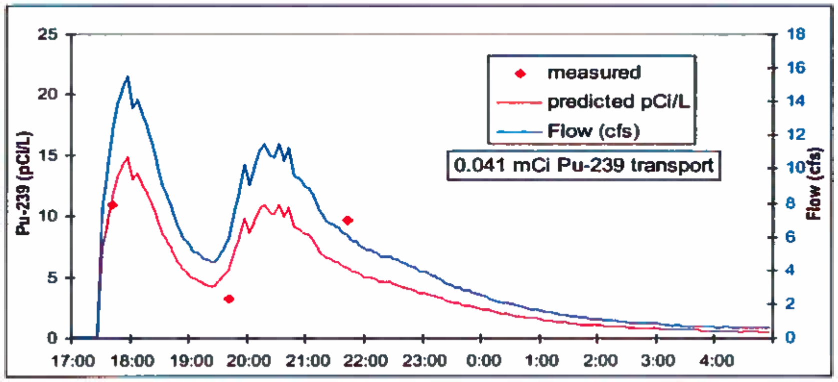


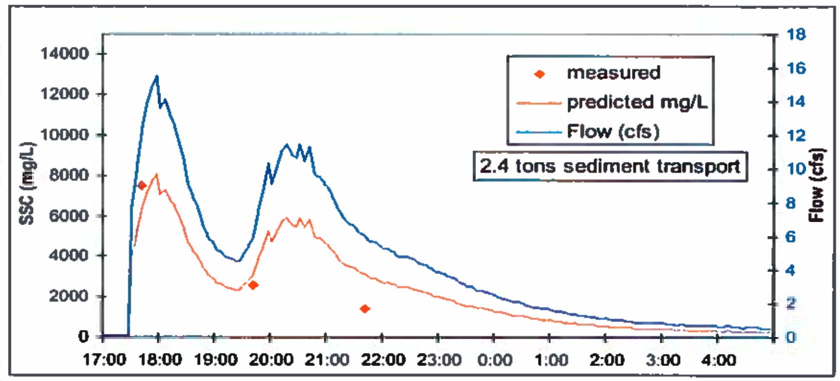
Four samples were collected from an 18 cfs event on August 12th, 2005. The flow duration is over 12 hours. The hydrograph shape is broad and symmetrical, unlike most flashy storm events. The storm surge was more gradual and did not trip the sampler until approximately 3 hours after the start of flow. The remaining samples were collected at two hour intervals. The correlations appear poor for both the plutonium and sediment evaluations. All samples were sampled within a narrow range of discharge, between eight to twelve cfs, and contain similar plutonium concentrations but more SSC variability. If it follows that constituent concentration diminishes with discharge, then allowing the trend line to pass through the zero intercept and the sample group provides an appropriate prediction. We estimate 0.015 mCi of plutonium$^{239/240}$ was carried beyond this station in 6.8 tons of sediment. These estimates remain reasonable.

Event on 8/24/2005 at Station E110



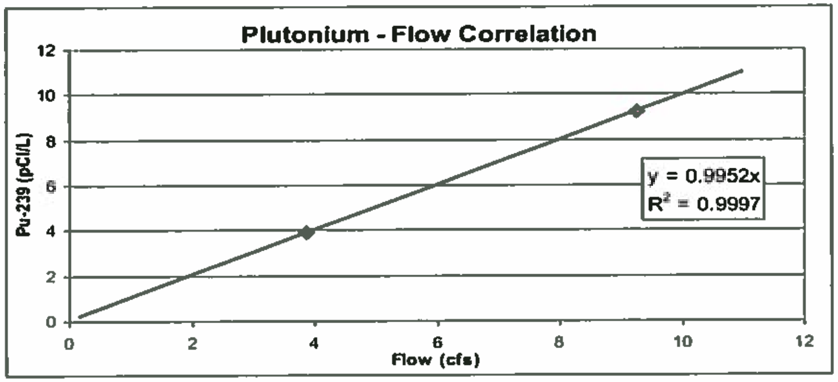


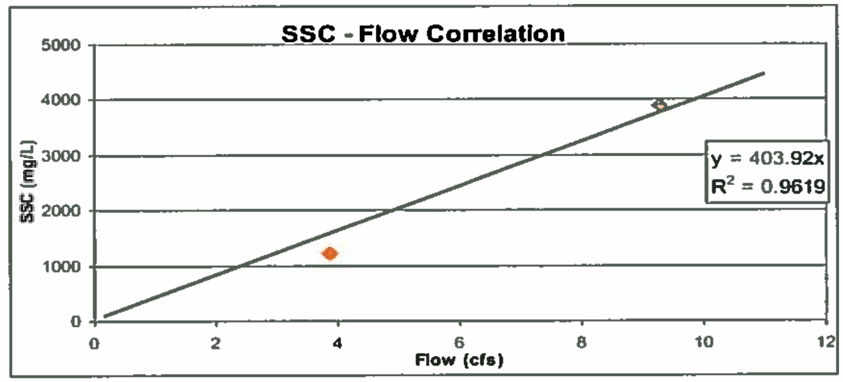


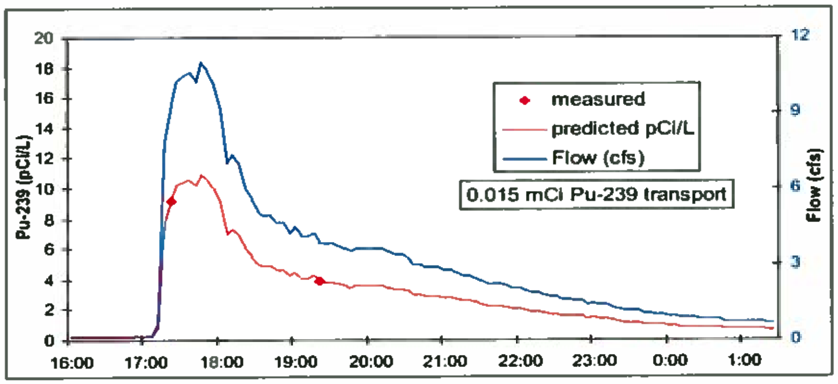


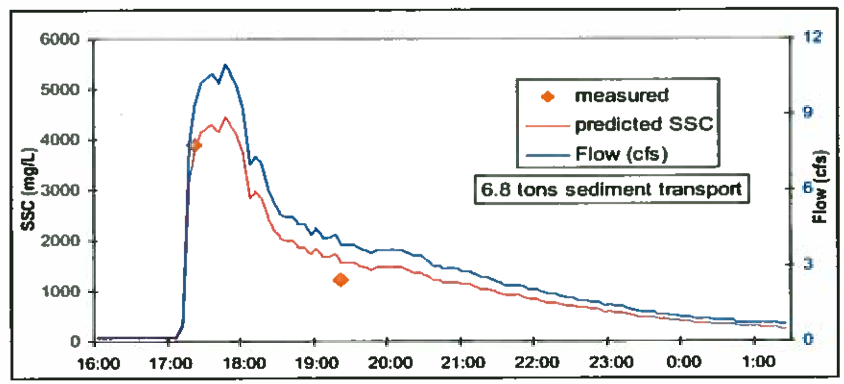
Three samples were collected from a 16 cfs event on August 24th, 2005. The flow duration is over 10 hours and contains two surges. The first sample was collected near the beginning of the event on the rising leg, and continued throughout the hydrograph at two hour intervals. A fourth sample was collected at 23:40 but the analytical laboratory failed to measure SSC and plutonium in water, only plutonium in sediments at 3.63 pCi/g. The correlation is good for the sediment evaluation. There appears to be a larger variability in plutonium in sediment measurements than normal that may affect the correlation. The concentrations range from 1.6 pCi/g to 7.1 pCi/g. The flood origin is from the Laboratory upper Los Alamos watershed containing larger plutonium concentrations. We estimate 0.041 mCi of plutonium$^{239/240}$ was carried beyond this station in 2.4 tons of sediment. These estimates remain reasonable.

Event on 8/25/2005 at Station E110



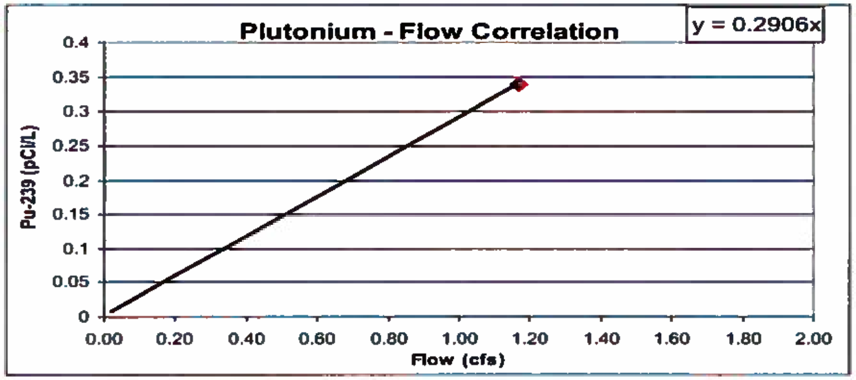


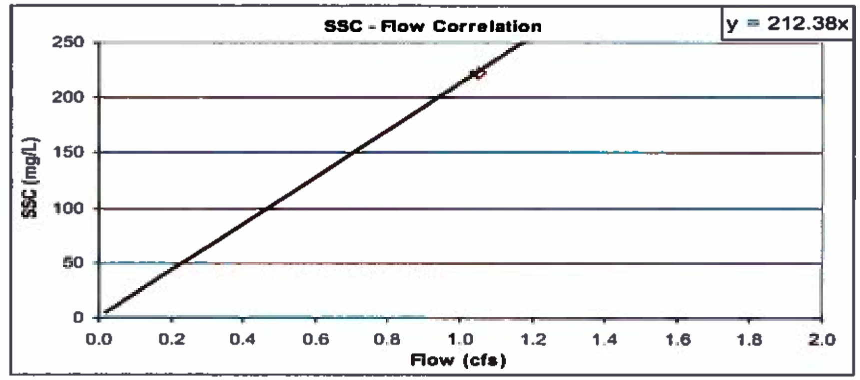


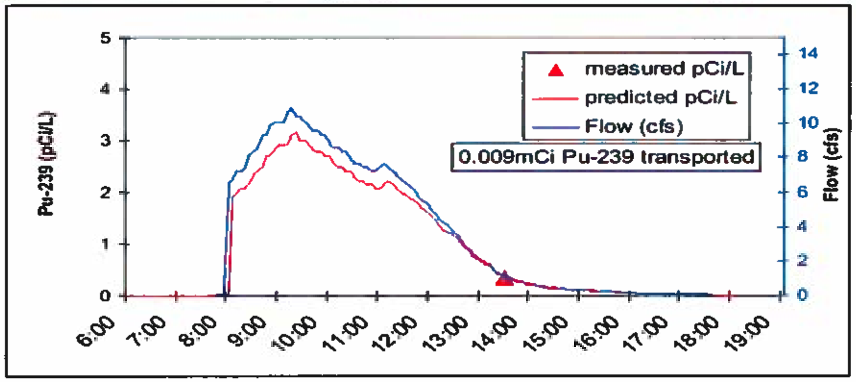


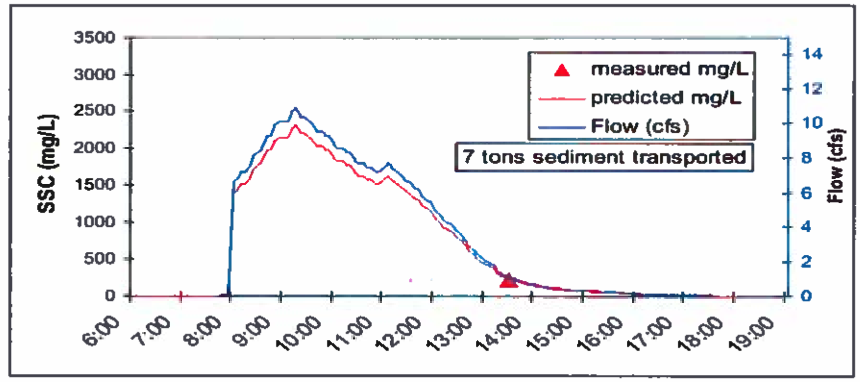
Two samples were collected from an 11 cfs event on August 25th, 2005. The flow duration is over eight hours and begins almost as the preceding event on the 24th ends. The first sample was collected near the beginning of the event on the rising leg and near the peak. The remaining sample was collected two hours later. The sampler failed to collect two more scheduled samples. Although the flood origin does not appear to be from the Laboratory, the contaminant source term may be remnants from the preceding event. Note the large slope factor. We estimate 0.015 mCi of plutonium$^{239/240}$ was carried beyond this station in 6.8 tons of sediment. These estimates are reasonable.

Event on 8/12/2005 at Station E030



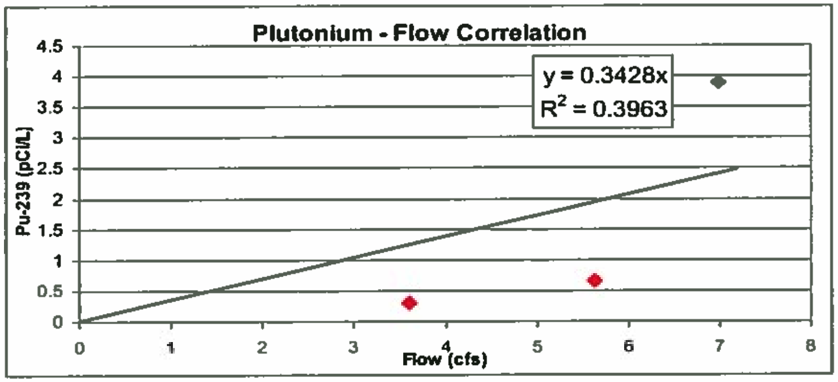


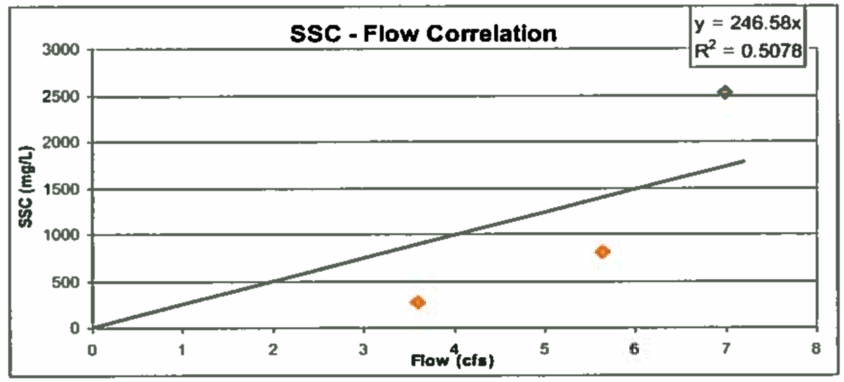


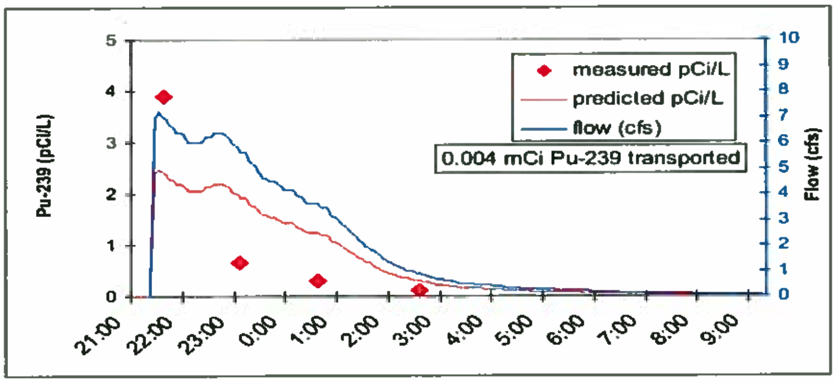


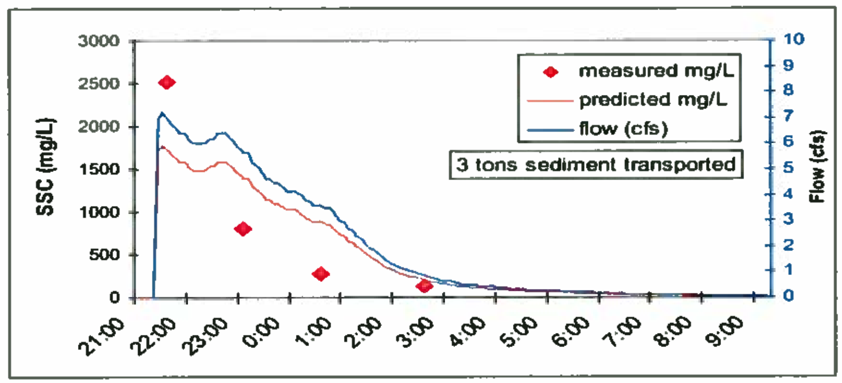
A single grab sample was collected late from this 11 cfs event on August 12th, 2005. The flow duration is over seven hours. Grab samples and evaluations were made at upper Los Alamos Canyon (E030 and E042) to estimate input from the upper part of the canyon. We estimate 0.009 mCi of plutonium$^{239/240}$ was carried beyond this station in 7 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. Based on the low SSC and plutonium concentration in water, its associated 1.3 pCi/g plutonium measurement in sediment and similar slope factors to other evaluations, this evaluation appears appropriate. E030 is used as a baseline condition in upper Los Alamos Canyon and low transport values are expected and substantiated by these estimates.

Event on 8/13/2005 at Station E030



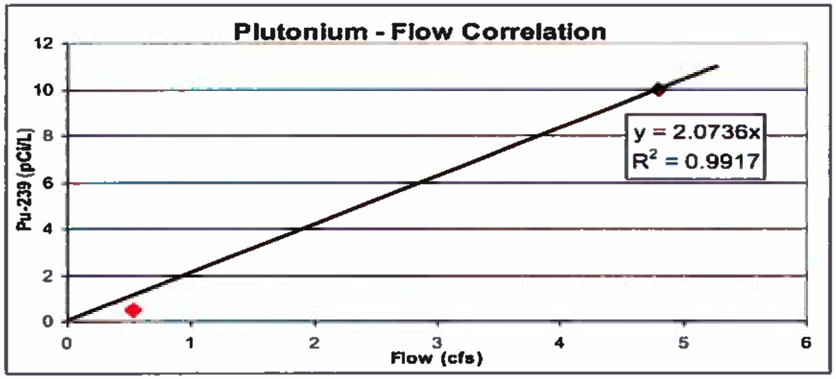


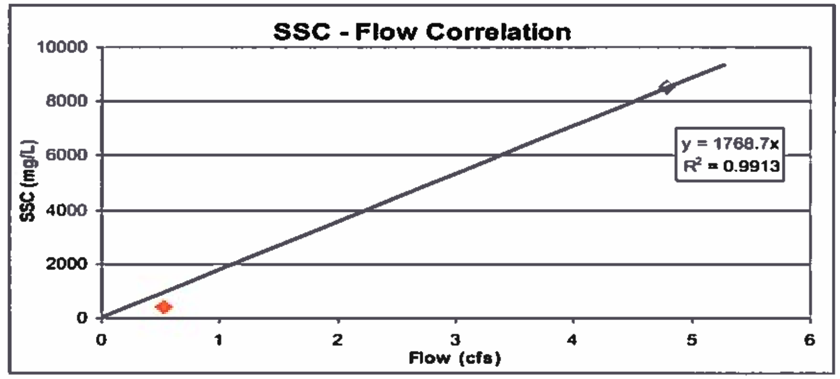


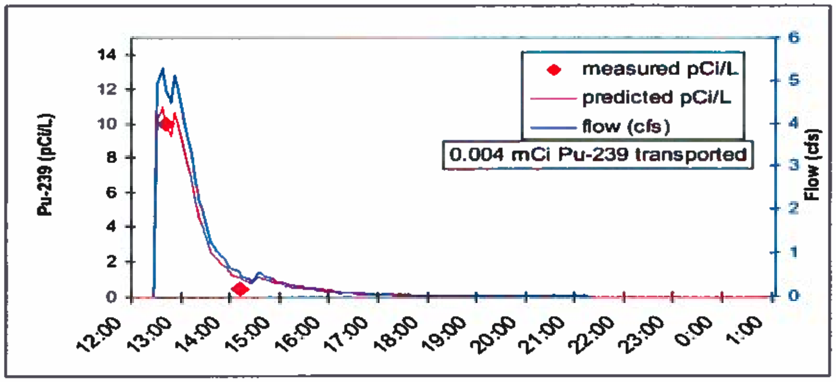


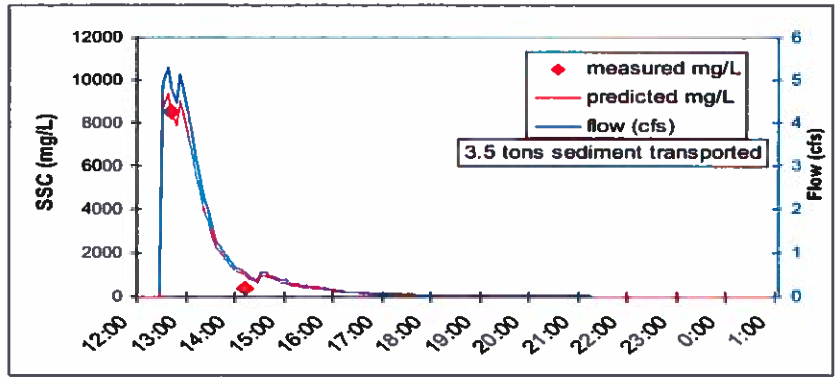
Four samples were collected from a seven cfs event on August 13th, 2005. The flow duration is over eight hours. The first sample was collected near the beginning of the event and peak. The remaining three samples were collected at 1.5 hour intervals. The first sample may be overly influential, in that a larger SSC was measured which also affected the plutonium value in water. Plutonium measurements in sediments were fairly consistent at 1 pCi/g. We estimate 0.004 mCi of plutonium$^{239/240}$ was carried beyond this station in 3 tons of sediment. These estimates remain reasonable.

Event on 8/22/2005 at Station E030



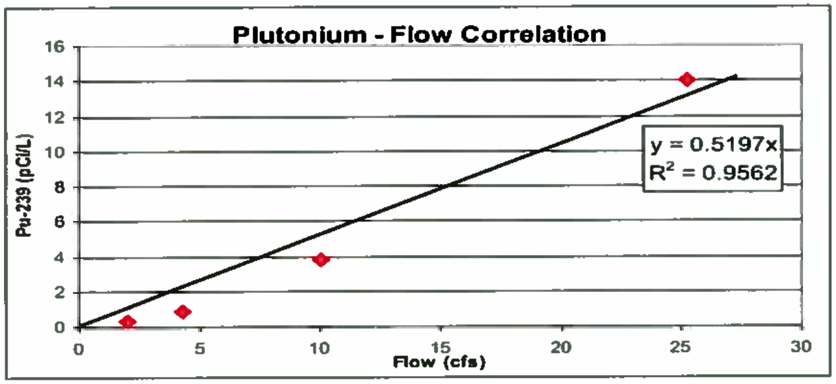


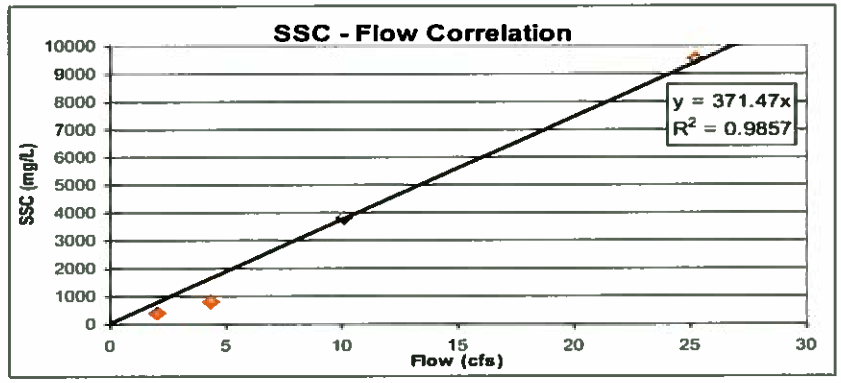


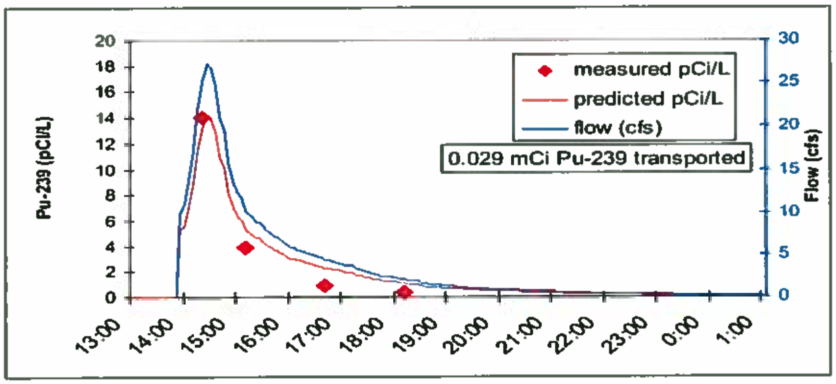


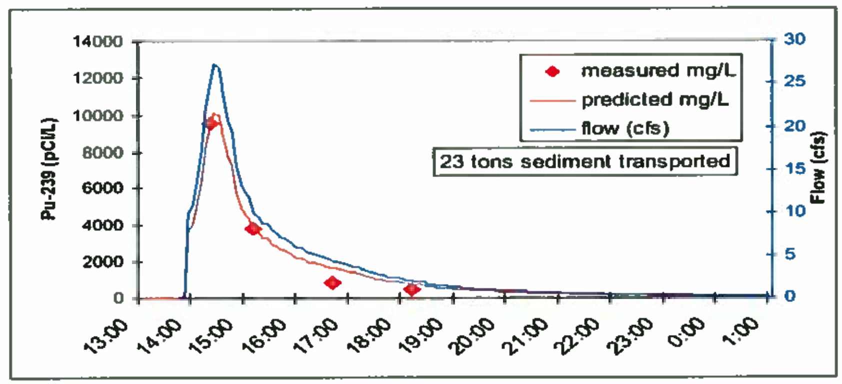
Two samples were collected from a small five cfs event on August 22nd, 2005. The flow duration is over four hours. The first sample was collected near the beginning of the event and near the peak. The remaining sample was collected 1.5 hours later. No liquid was available for a sample scheduled to be collected 1.5 hours later. The correlations are good, although the sediment supply was surprisingly large for the flow rate. Plutonium values for sediments are consistent with earlier samples at near 1 pCi/g. We estimate 0.004 mCi of plutonium$^{239/240}$ was carried beyond this station in 3.5 tons of sediment. These estimates are reasonable.

Event on 8/24/2005 at Station E030



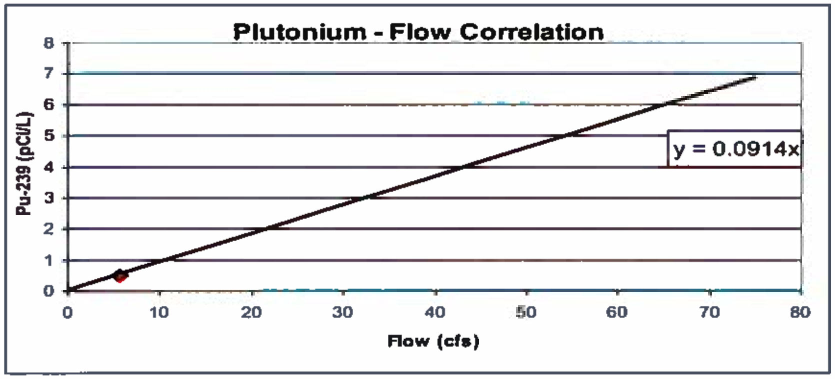


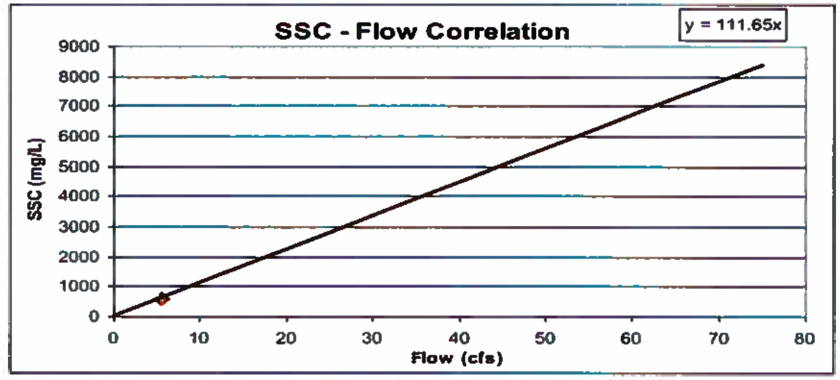


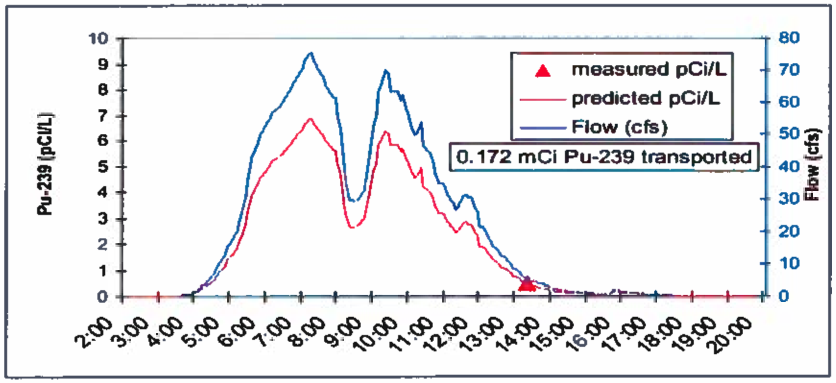


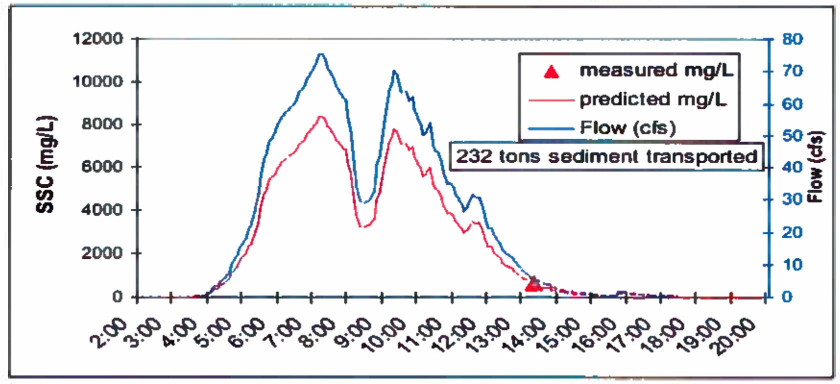
Four samples were collected from a 27 cfs event on August 24th, 2005. The flow duration is over six hours. The first sample was collected near the beginning of the event and peak, and the second was collected 50 minutes later. The remaining samples were collected at 1.5 hour intervals. The correlations are good, although the sediment supply was surprisingly large. Plutonium values for sediments continue to be consistent with earlier samples at near 1 pCi/g. We estimate 0.029 mCi of plutonium$^{239/240}$ was carried beyond this station in 23 tons of sediment. These estimates are reasonable.

Event on 8/12/2005 at Station E042



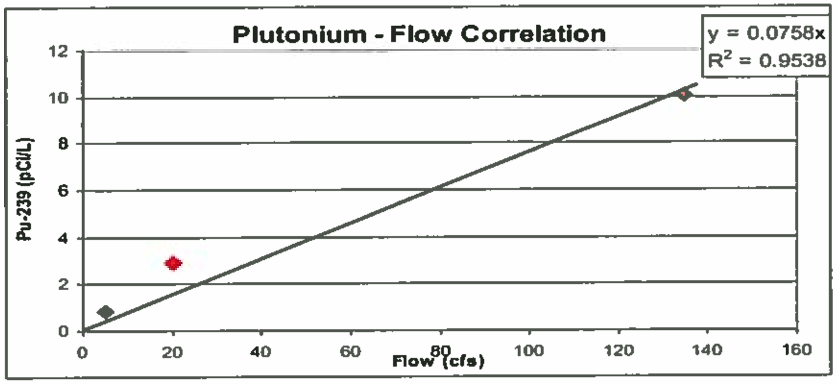


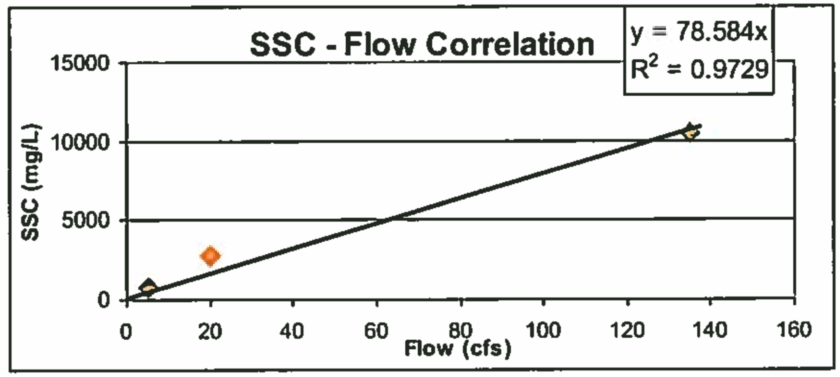


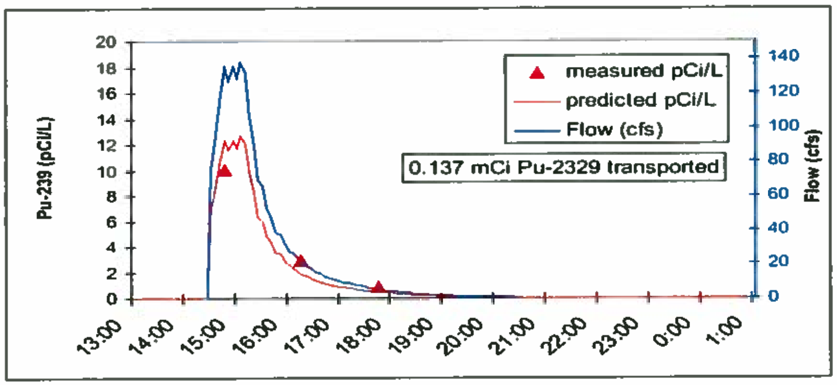


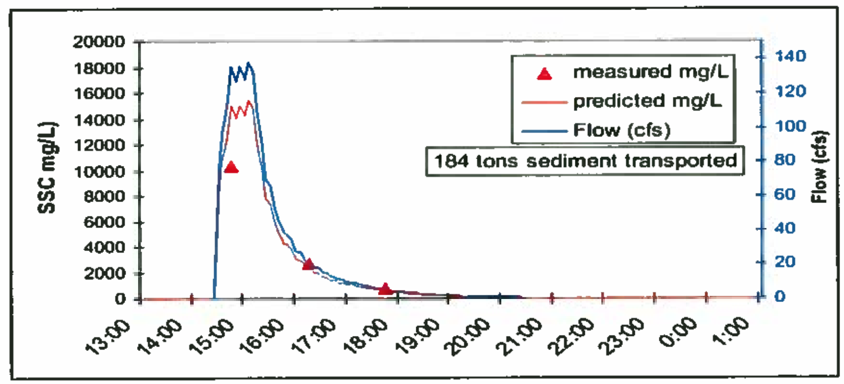
A single grab sample was collected late from this 75 cfs event on August 12th, 2005. The flow duration is over 11 hours and includes two surges. Grab samples and evaluations were made at upper Los Alamos Canyon (E030 and E042) to estimate input from the upper part of the canyon. We estimate 0.172 mCi of plutonium$^{239/240}$ was carried beyond this station in 232 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. Based on the low SSC and plutonium concentration measured in water, its associated 0.8 pCi/g plutonium measurement in sediment and similar slope factors to other evaluations, this evaluation appears appropriate.

Event on 8/24/2005 at Station E042



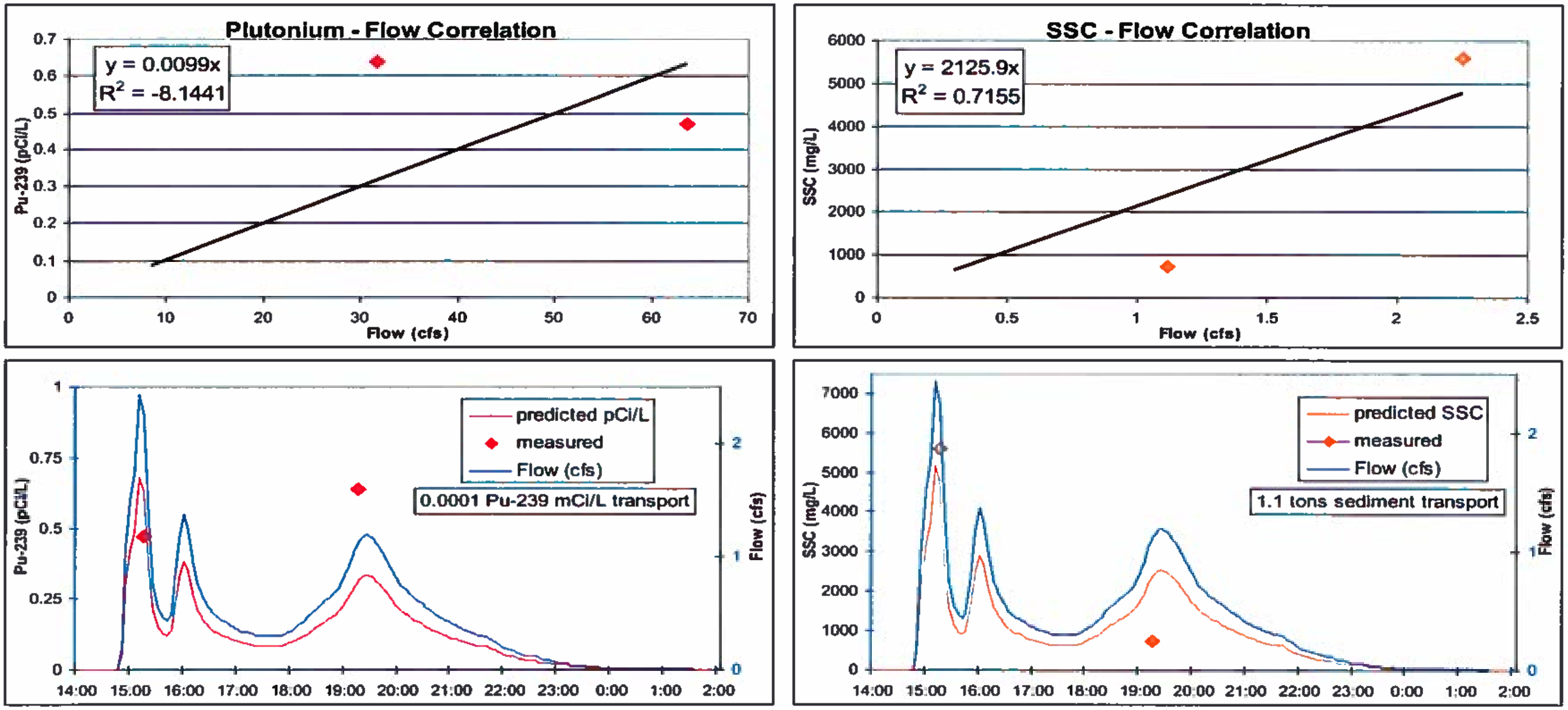






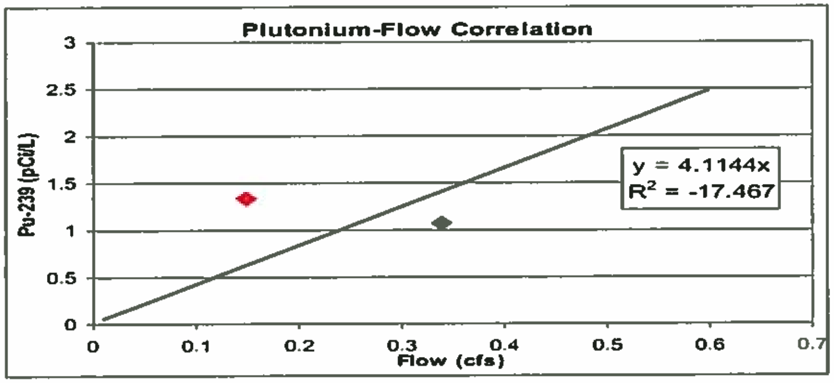
Three samples were collected from a 138 cfs event on August 24th, 2005. The flow duration is over four hours. The first sample was collected near the beginning of the event on the rising leg and near the peak. The remaining two samples were collected at 1.5 hour intervals. The correlations were good. The plutonium value for the first sample is 0.96 pCi/g, while the remaining two measurements were close to 2.5 pCi/g. If the first sample collected on the rising leg and during the largest discharge under-represents plutonium concentrations, the correlation may underestimate plutonium transport. We estimate 0.137 mCi of plutonium$^{239/240}$ was carried beyond this station in 184 tons of sediment. While the plutonium transport estimate may be underestimated, these values are reasonable.

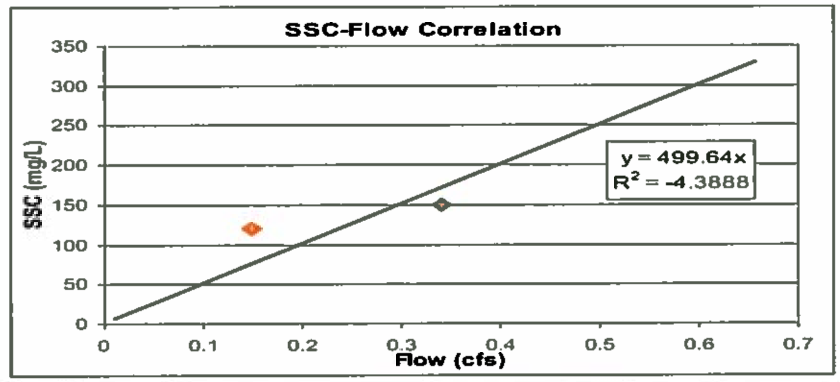
Event on 7/26/2006 at Station E060

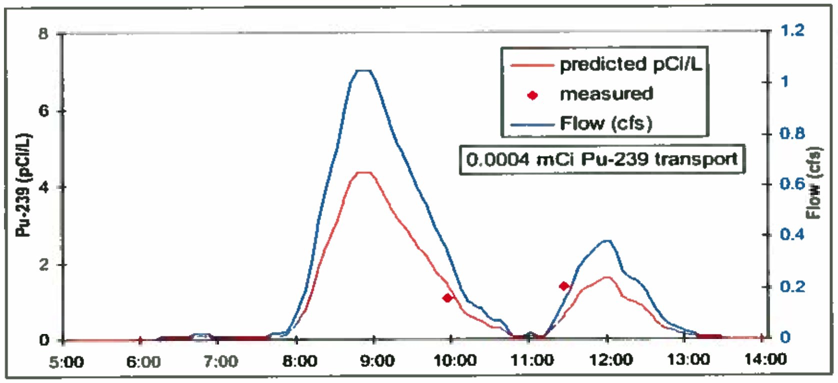


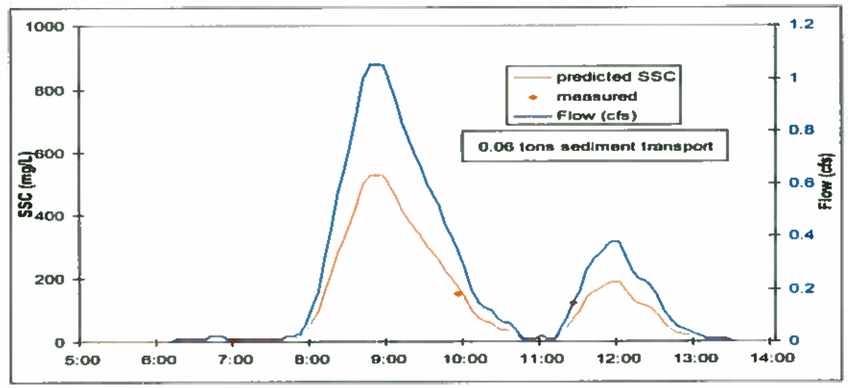
Two samples were collected from a small two cfs event on July 26th, 2005. The flow duration is over nine hours. The first sample was collected near the beginning of the event and the peak. The remaining sample was collected four hours later. The plutonium correlation does not appear to be useable. The plutonium in sediment value is 0.093 pCi/g and 0.9 pCi/g in the second sample. Based on other measurements in Pueblo Canyon this evaluation appears to underestimate plutonium transport. The SSC/Flow correlation is good. A 0.0001 mCi plutonium transport estimate may be an underestimation (based on sediment transport and past plutonium measurements in sediments, we might expect to see a value close to 0.003 mCi). The sediment transport of 1.1 tons is reasonable, and at this low discharge the proposed plutonium transport mass is small and would not affect continuing evaluations.

Event on 8/5/2006 at Station E060



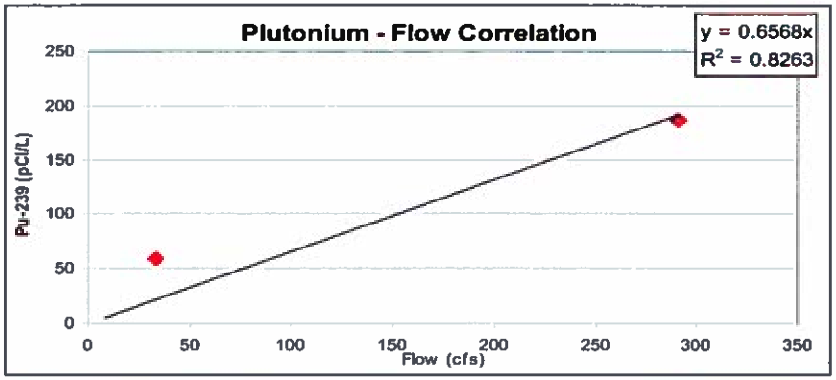


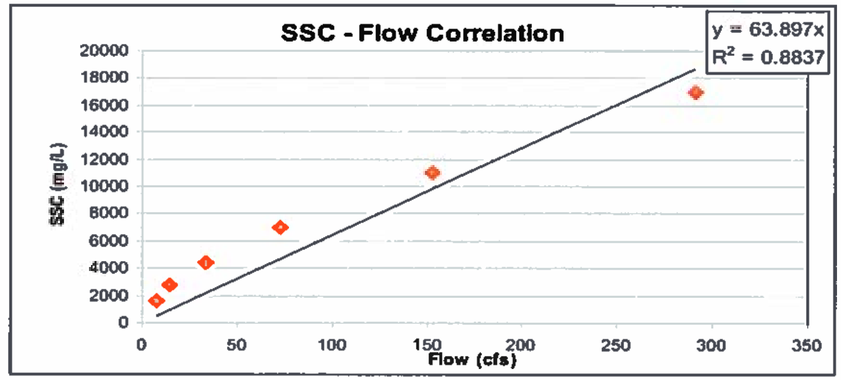


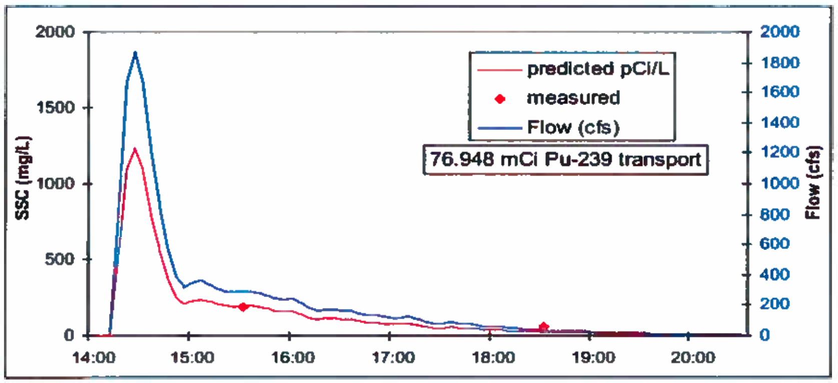


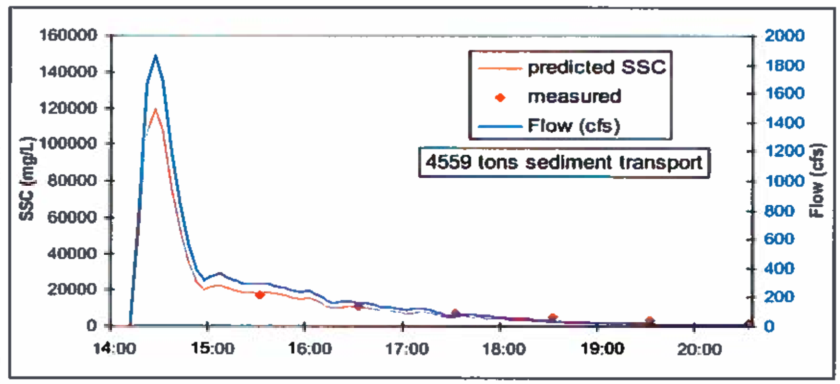
Two samples were collected from a small one cfs event on August 5th, 2005. The flow duration is over five hours, and may better be described as two events. The first sample was missed near the beginning of the event. The remaining samples were collected at 1.5 hour intervals. The correlations do not appear to be useable, partly due to the low discharge, multiple peaks, and much greater plutonium measurements in sediments. One sample contained 7.2 pCi/g and the other 11.2 pCi/g. This estimate was not used in further evaluations and although it demonstrates a much greater relative plutonium transport, at this low flow the mass of plutonium transport is relatively insignificant.

Event on 8/8/2006 at Station E060



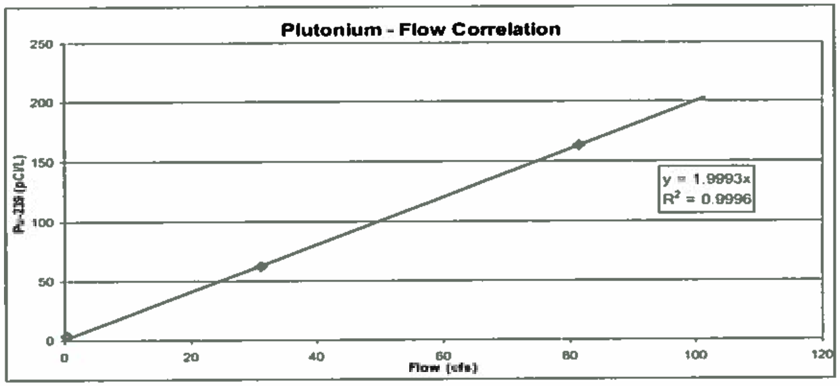


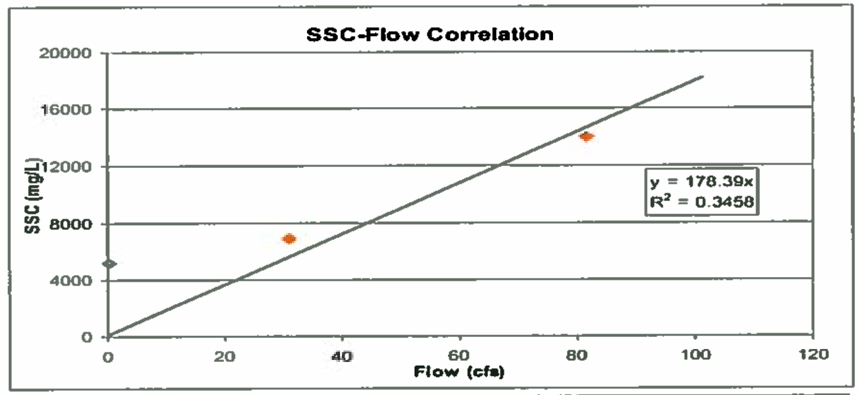


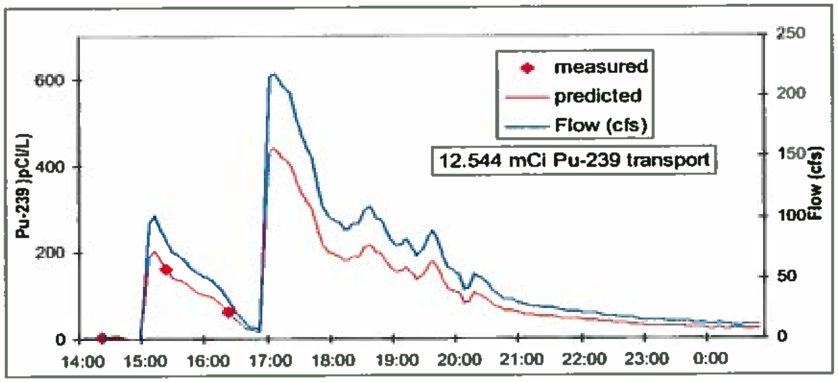


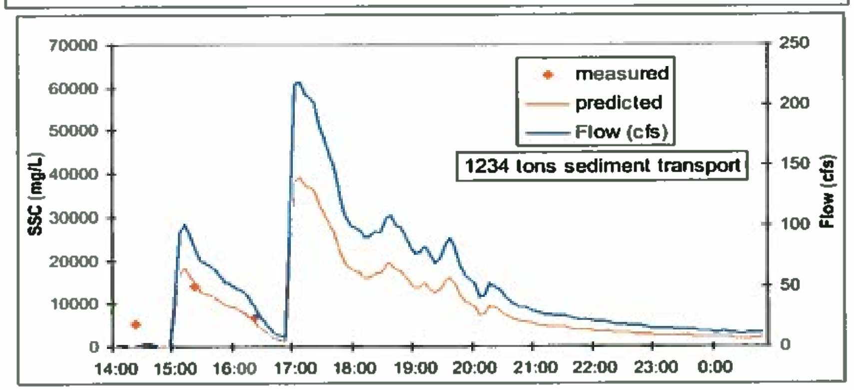
Six samples were collected from an approximate 1930 cfs event on August 8th, 2006, the most extraordinary flood during this study period. During this event the ISCO flow meter was not operating and the sampler was manually initiated at 15:30 by field personnel to collect at one hour intervals. The analytical laboratory successfully measured SSC in all samples but was unable to complete plutonium measurements in four of them. Flow duration is over seven hours. Plutonium in sediment measurements are 11 pCi/g and 13.5 pCi/g. The correlations are good and develop similar plutonium transport estimates relative to other smaller events. We estimate 76.9 mCi of plutonium$^{239/240}$ was carried beyond this station in 4559 tons of sediment. These estimates are reasonable.

Event on 8/25/2006 at Station E060



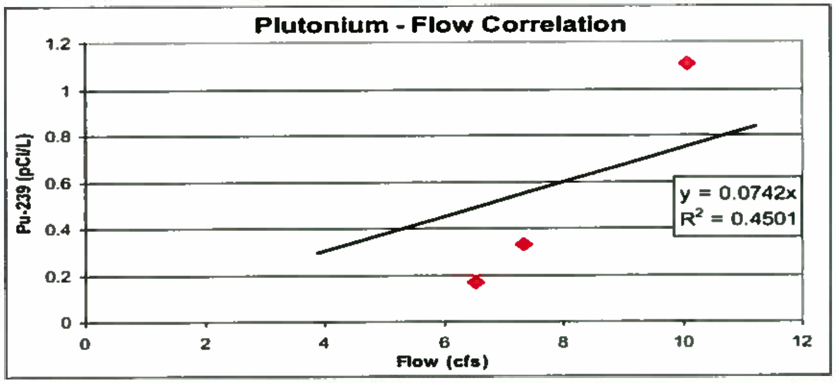


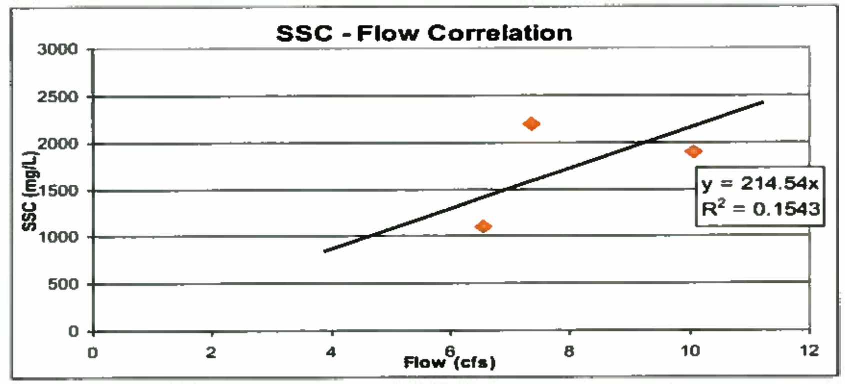


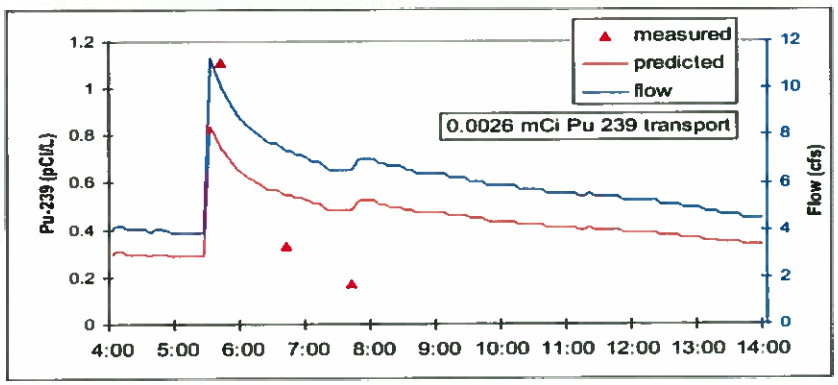


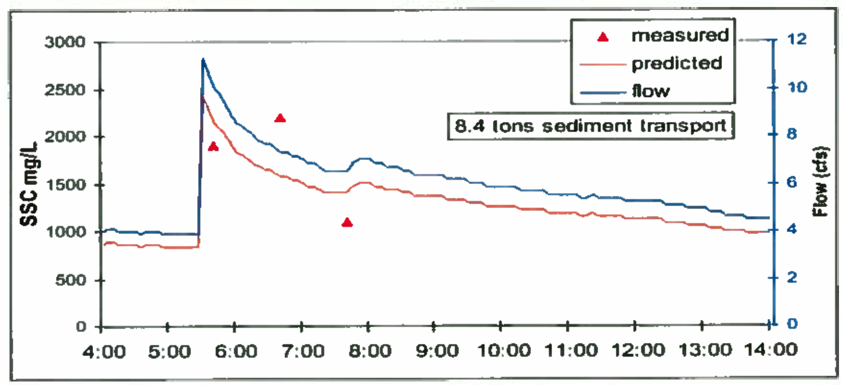
Three samples were collected from a 102 cfs multiple surge event on August 25th, 2006. The flow duration is three hours. The sample array was enabled at 14:10 by one cfs discharge preceding an abrupt 102 cfs rise at 15:20. The first sample was collected before this main rising leg of the surge and then an additional two samples were collected at one hour intervals along the falling leg of the first storm surge. Major changes of the channel form were taking place before and during this event. The channel floor had contained multiple channels with the primary channel on the south side of the floor. During and after this event the primary channel shifted again to the south side of the floor, where the gaging instruments are, and filled with up to 13 inches of sediment. The correlations are good. The plutonium value for suspended sediments in the first sample is 0.69 pCi/g, while the remaining two measurements were close to 10 pCi/g. We estimate 1.273 mCi of plutonium$^{239/240}$ was carried beyond this station in 125 tons of sediment. This estimate only includes the first three hour surge. Up to eight mCi in 1079 tons sediment is estimated in the following 220 cfs surge by other methods. The estimates appear reasonable.

Event on 7/6/2006 at Station E110



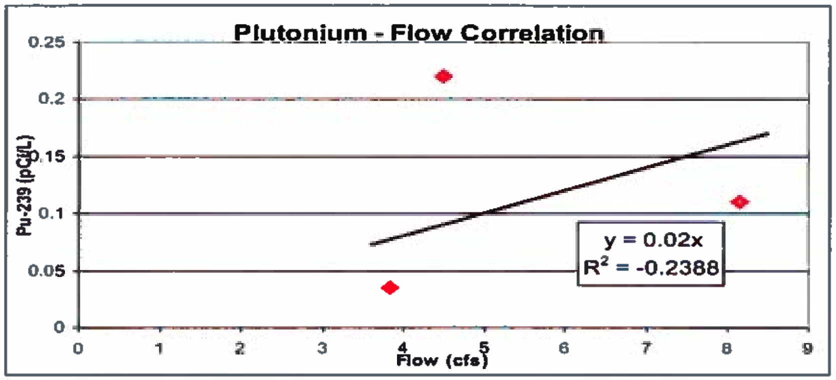


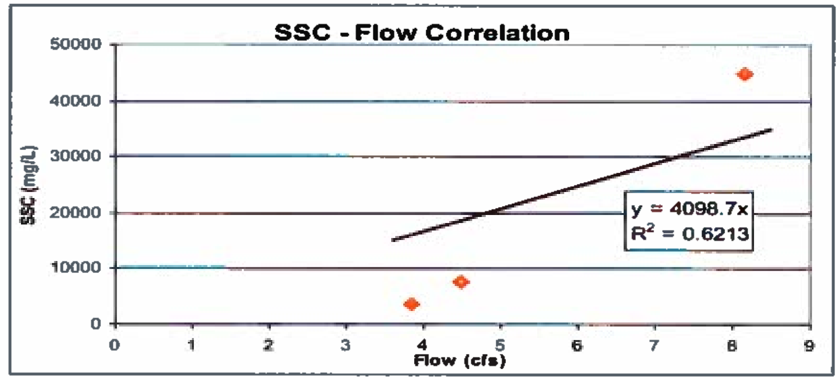


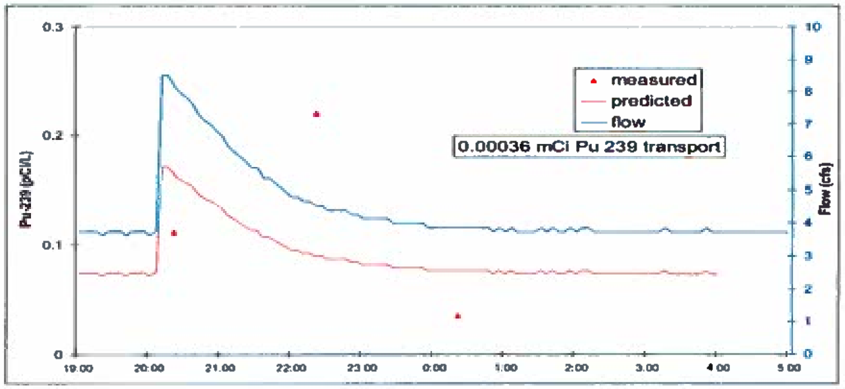


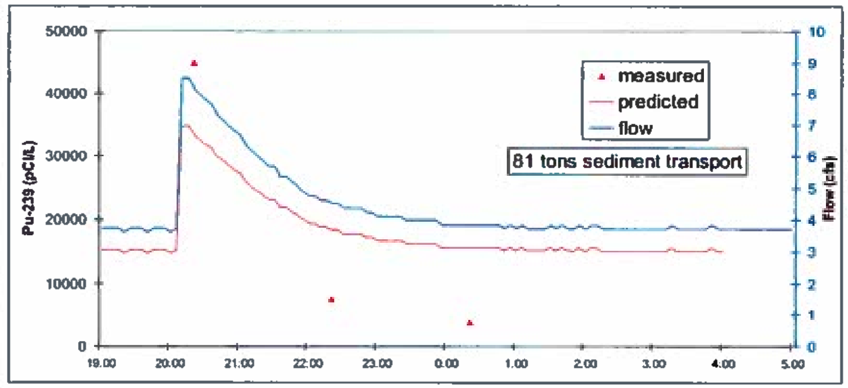
Three samples were collected from a reported 11 cfs event on August 5th, 2005. The flow duration is over nine hours. The first sample was collected near the beginning of the event and the peak. The remaining samples were collected at one hour intervals. We think potential errors in discharge measurements have produced misleading correlations. See the flow discussion for E110. Contradictory laboratory measurements for plutonium also exist in the first sample. The plutonium measurements in water and sediment are 1.11 pCi/L and 5.77 pCi/g and SSC is 1900 mg/L. The cross balance calculation indicates one of the measurements is off by an order of magnitude. Relative to the other two plutonium concentration in sediment values in this set (0.15 pCi/g) it appears that a more realistic value for the first sample is 0.58 pCi/g. It demonstrates small relative plutonium transport and at this flow rate the difference is relatively insignificant.

Second event on 7/6/2006 at Station E110



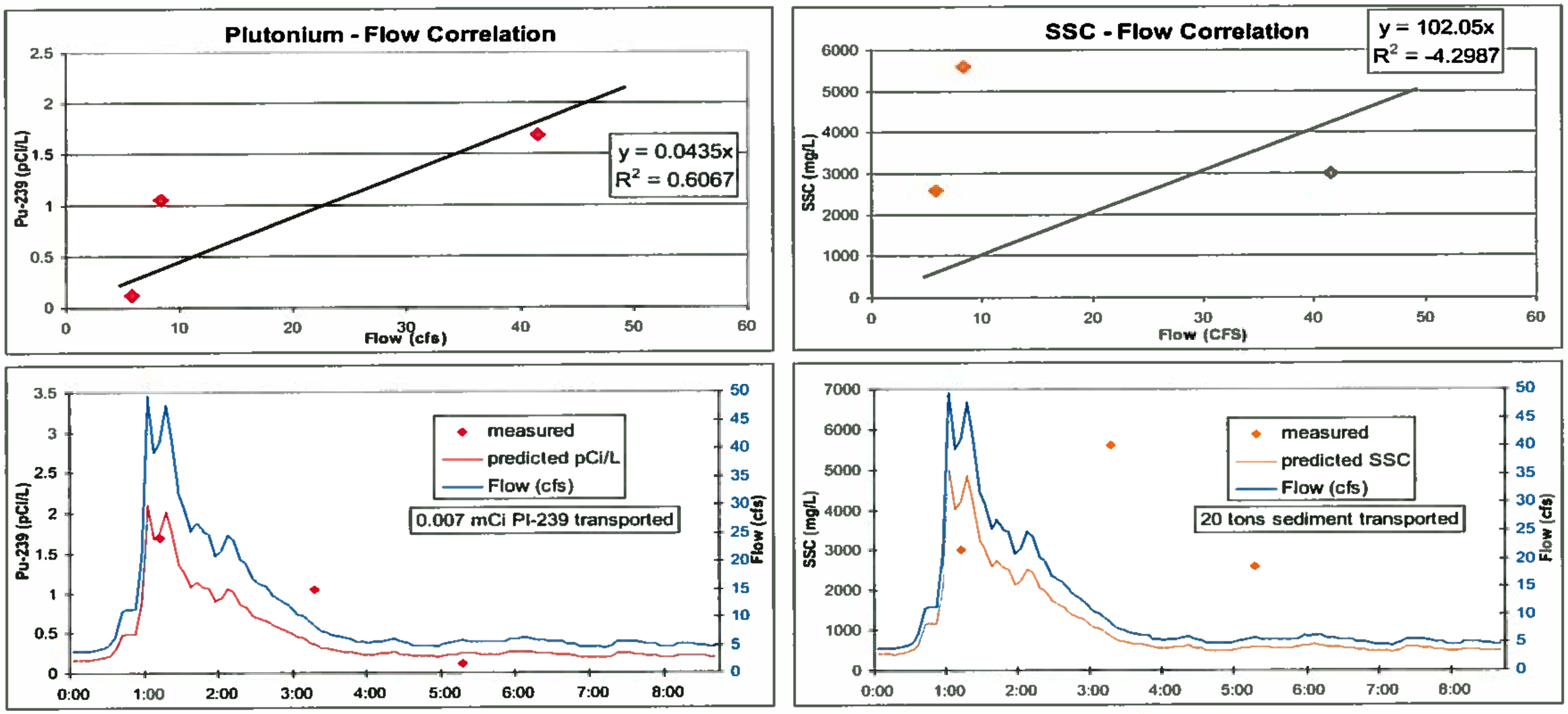






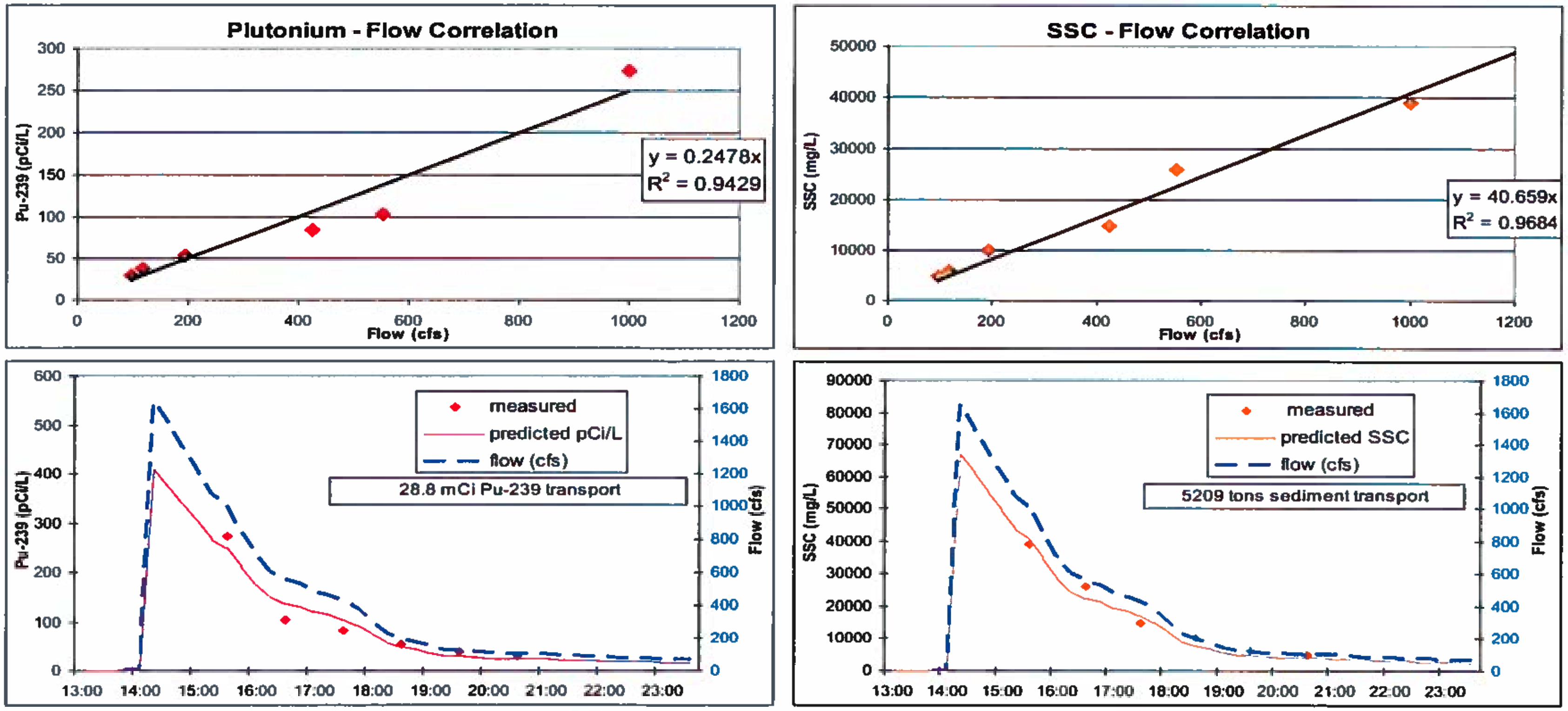
Three samples were collected from a second event on August 5th, 2005. A 10 cfs discharge was reported. The flow duration is approximately 3 hours. The first sample was collected near the beginning of the event and the peak. The remaining samples were collected at two hour intervals. We think potential errors in discharge measurements have produced misleading correlations. See the flow discussion for E110. Contradictory laboratory measurements for SSC exist in the first sample. The SSC measurement is 45000 mg/L, much greater than the 7700 and 3700 mg/L measurements for the other samples. A cross balance calculation from plutonium measurements in water and sediment also provide a more realistic 3000 mg/L SSC value and 14 ton sediment transport estimation. This estimate was not used in further evaluations.

Event on 8/6/2006 at Station E110



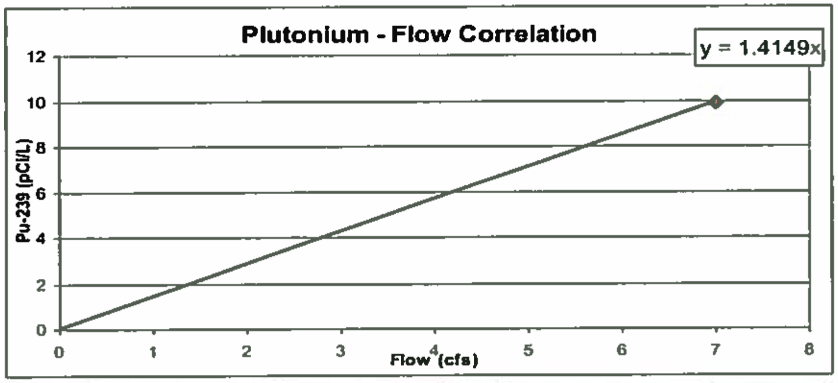
Three samples were collected from a 49 cfs event on August 6th, 2006. Flow duration is approximately four hours. The first sample was collected near the peak followed by two more samples collected at two hour intervals along the falling leg of the hydrograph. The plutonium/flow correlation is fair, but the sediment/flow correlation is poor. The average plutonium concentration in sediments is 0.24 pCi/g, ranging from 0.56 pCi/g to 0.045pCi/g. We estimate 0.007 mCi of plutonium$^{239/240}$ was carried beyond this station in 20 tons of sediment. These estimates appear low relative to other flows but reasonable.

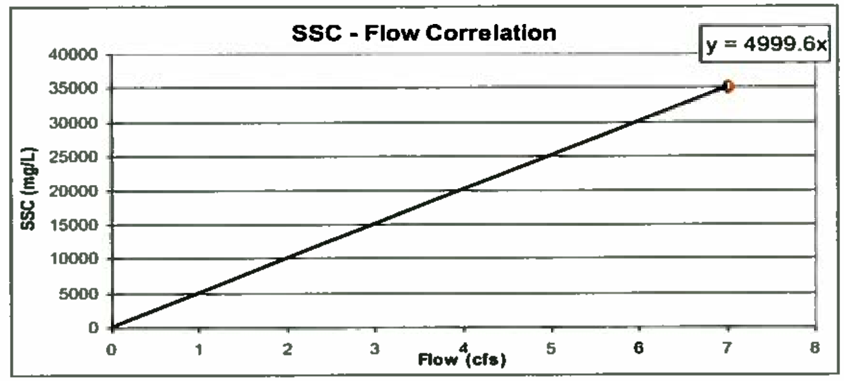
Event on 8/8/2006 at Station E110

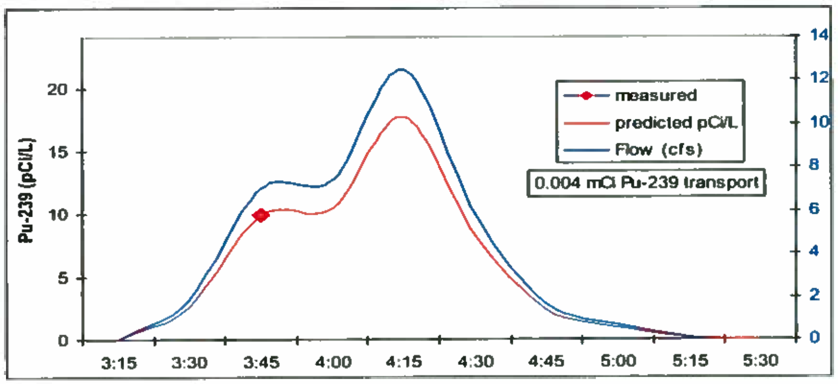


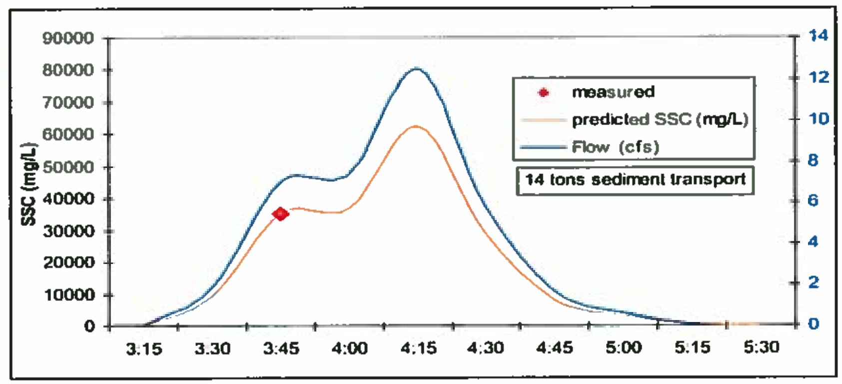
Six samples were collected from a 1642 cfs event on August 8th, 2006. It was the largest flood during this report period and sustained flow over a 10 hour period. The first sample was collected one hour and fifteen minutes after the peak followed by five more samples along the falling limb at one hour intervals. During the flood, the bore destroyed the gage station as it passed at 15:00 (DST) and OB field personnel re-set the flow meter and sampling tubing and manually started a sampling program at 16:30 (DST). The hydrograph was partially re-created from that recording and an extrapolation to the crest determined by flood debris along the banks. The first plutonium value in water is based on a 7 pCi/g plutonium measurement in sediments and its respective SSC 39000 mg/L measurement. The average plutonium concentration in sediments is 5.7 pCi/g, ranging from 4 pCi/g to 7 pCi/g. The correlations are good. We estimate 28.8 mCi of plutonium$^{239/240}$ was carried beyond this station in 5209 tons of sediment. These estimates appear reasonable, although the sediment load is smaller than other relative floods.

Event on 8/19/2006 at Station E110



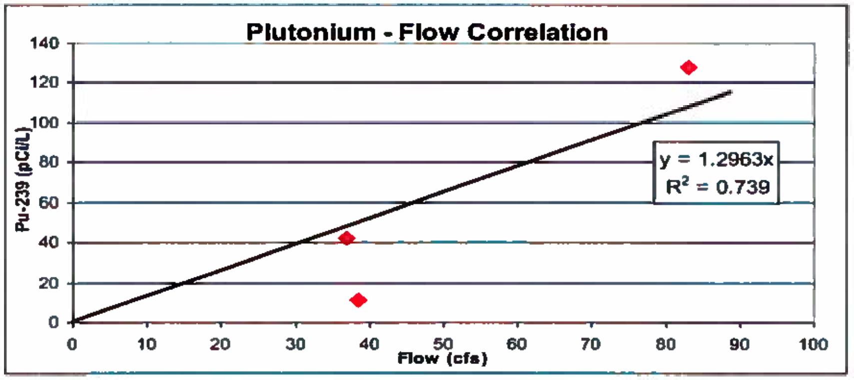


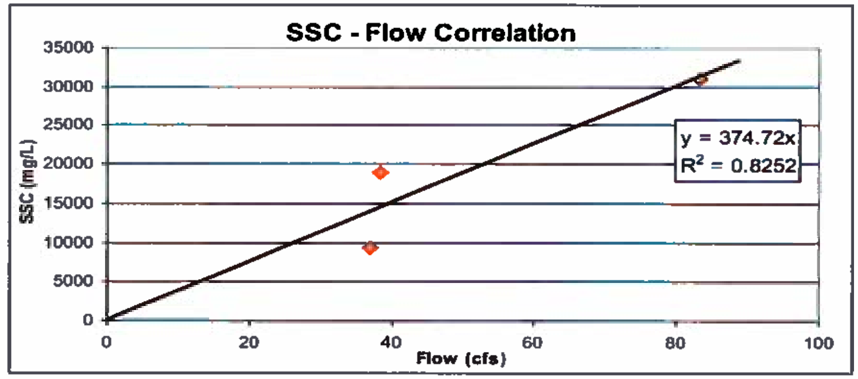


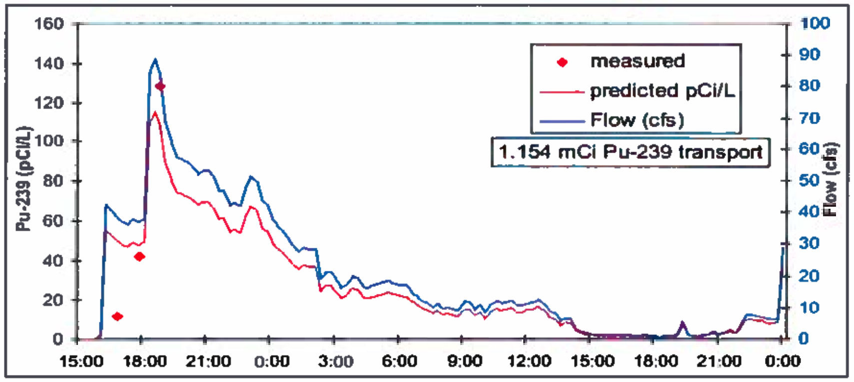


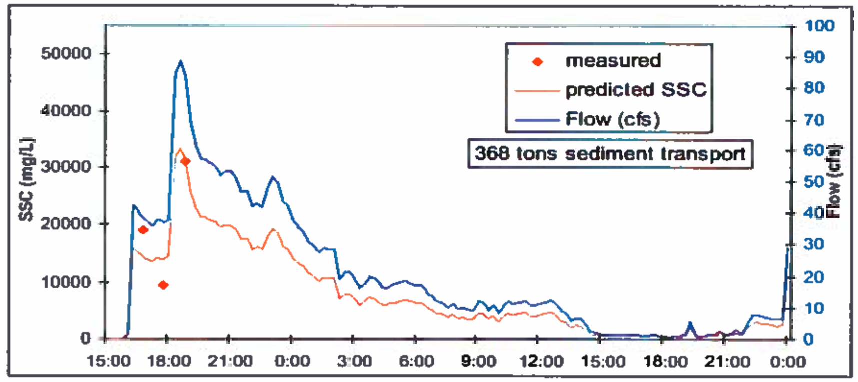
A single grab sample was collected from this 12 cfs event on August 19th, 2006 with flow duration over two hours. The hydrograph was re-created from OB stage recordings and LANL rating curves. The plutonium concentration in the sample sediments is 0.28 pCi/g. We estimate 0.004 mCi of plutonium$^{239/240}$ was carried beyond this station in 14 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. The SSC measurement appears to be almost an order of magnitude greater than expected, potentially an unusual environmental excursion (bank failure), or sampling or laboratory error. Although the slope factors appear relatively large relative to other events this evaluation appears reasonable.

Event on 8/25/2006 at Station E110



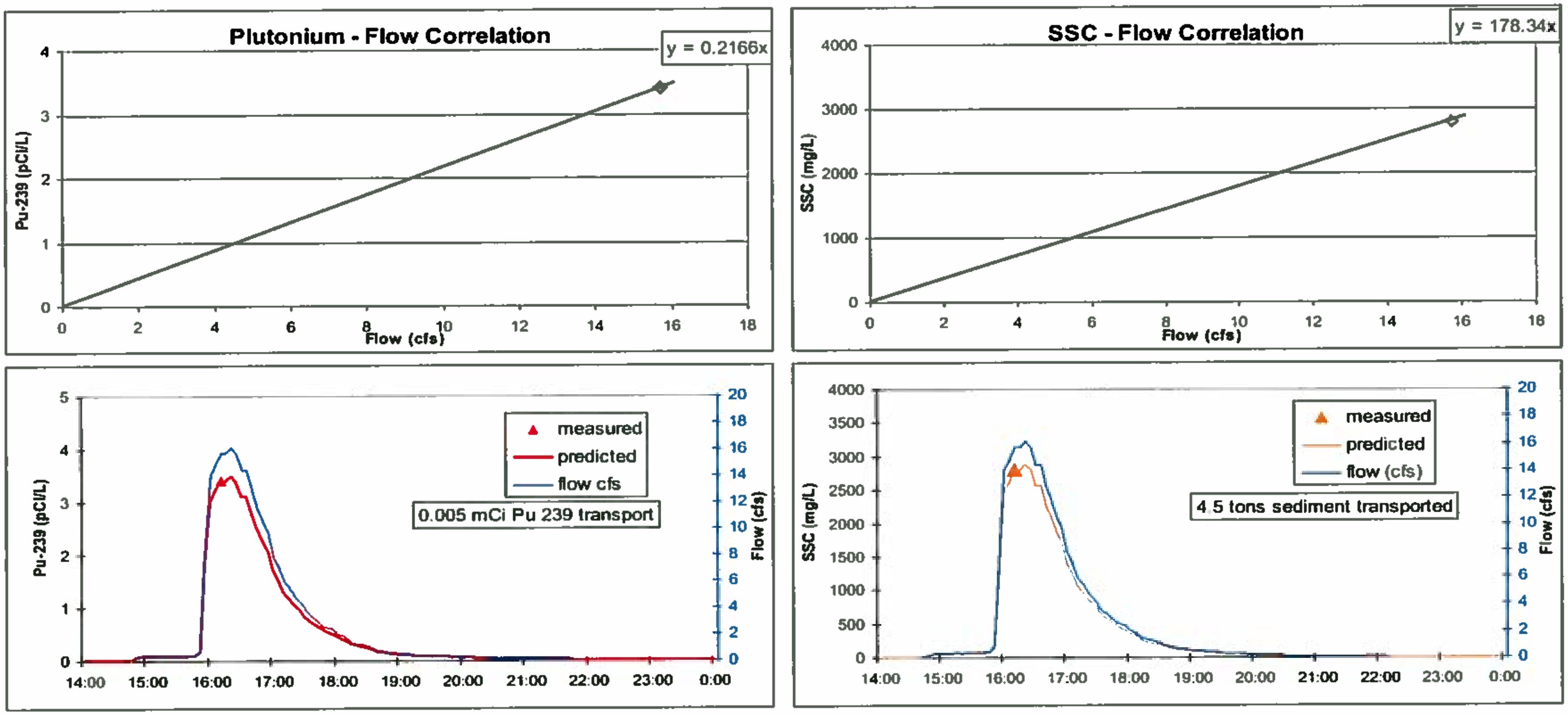






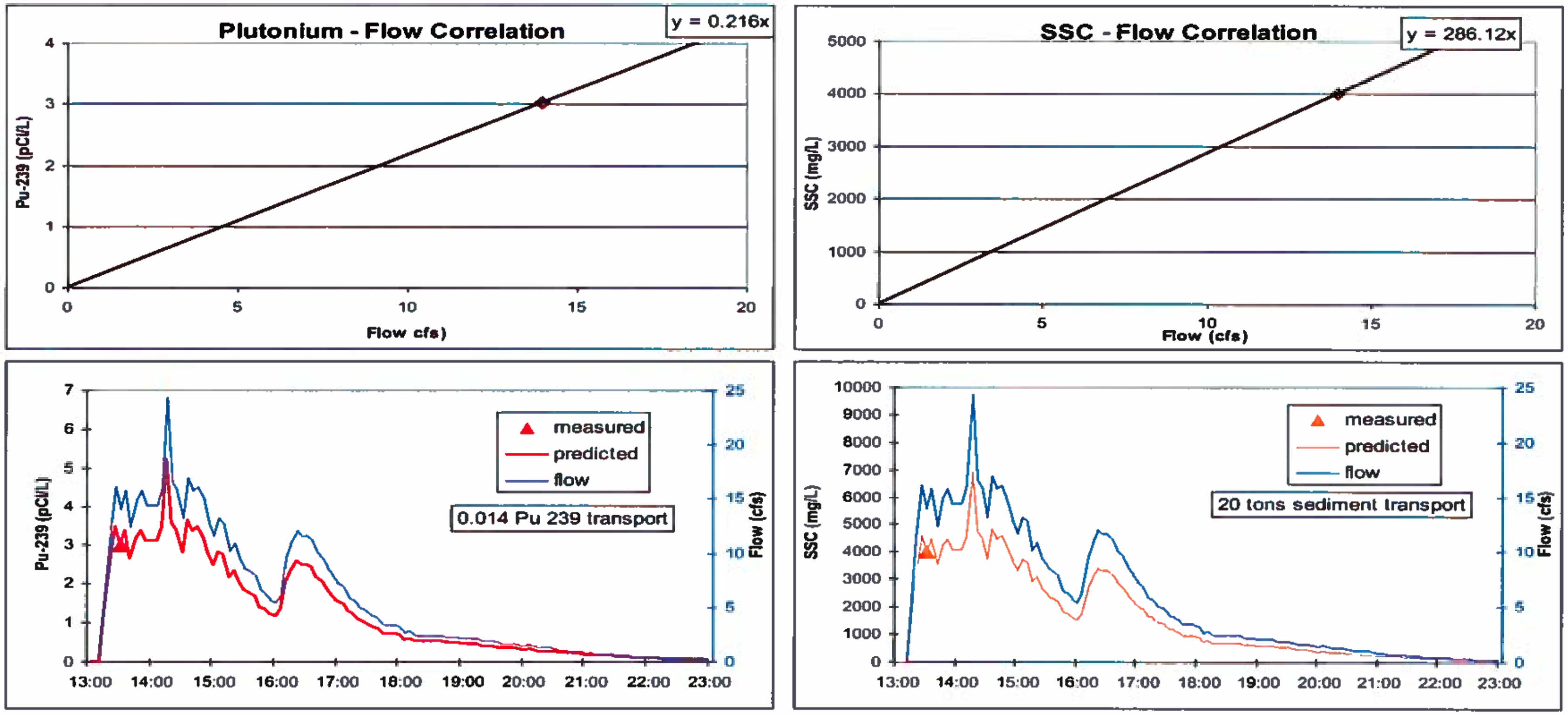
Three samples were collected from an 89 cfs event on August 25th, 2006 with flow duration over 24 hours. The first sample was collected near the beginning of flow and the first peak of a multiple surge flood. The remaining two samples were collected at one hour intervals of which the last sample was collected just after the largest peak passed. The correlations are good. We estimate 1.15 mCi of plutonium$^{239/240}$ was carried beyond this station in 368 tons of sediment. Plutonium values in sediments range from a measured 7 pCi/g to calculated 4 pCi/g values in the two remaining samples. Although the slope factor for plutonium appears relatively large relative to other events, the estimates appear reasonable. In this case the flood originates from Pueblo Canyon carrying larger plutonium concentrations than those that may originate from Guaje Canyon.

Event on 8/1/2006 at Station E050



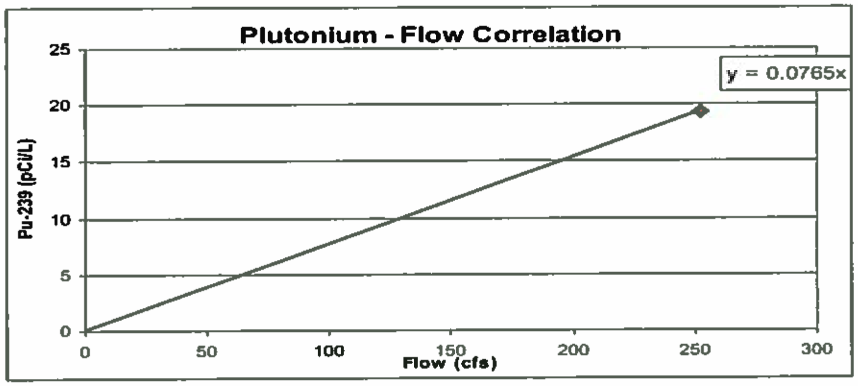
A single grab sample was collected from this 16 cfs event on August 1rst, 2006 with flow duration over three hours. The sample was collected near the beginning of the event and peak. The plutonium concentration in the sample sediments is 3.4 pCi/g. We estimate 0.005 mCi of plutonium$^{239/240}$ was carried beyond this station in 4.5 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. The slope factors appear similar to other events at E050 and this evaluation appears reasonable.

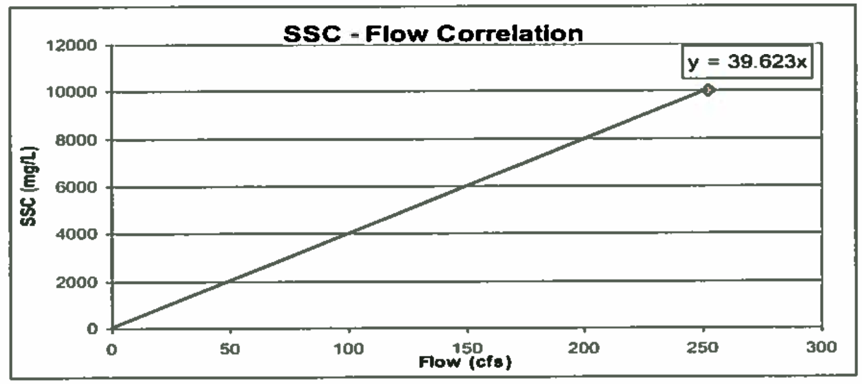
Event on 8/7/2006 at Station E050

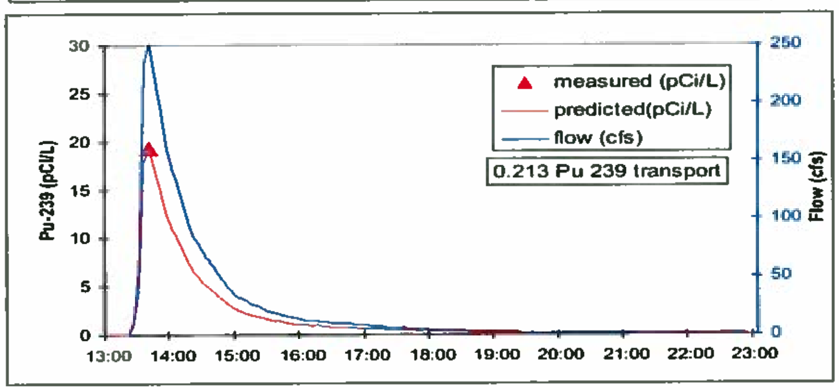


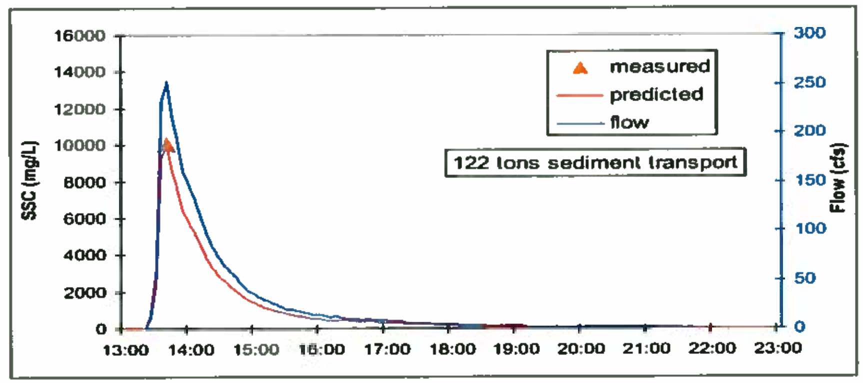
A single grab sample was collected from this 24 cfs event on August 1rst, 2006 with flow duration over ten hours. The sample was collected near the beginning of this multiple surge event but 45 minutes before the maximum peak arrived. The plutonium value calculated in the sample sediments is 0.8 pCi/g. We estimate 0.014 mCi of plutonium$^{239/240}$ was carried beyond this station in 20 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. The slope factors appear similar to other events at E050 and this evaluation appears reasonable.

Event on 8/8/2006 at Station E050



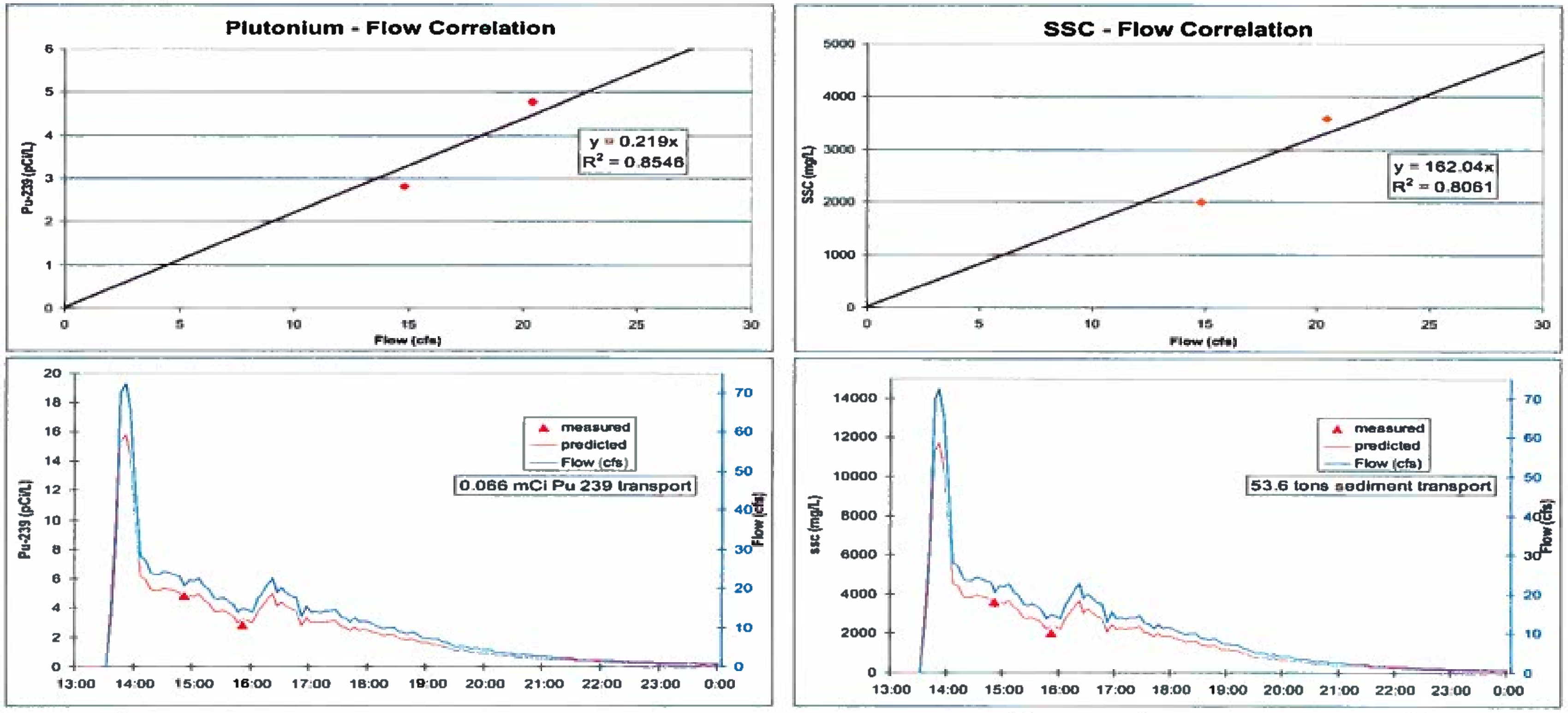






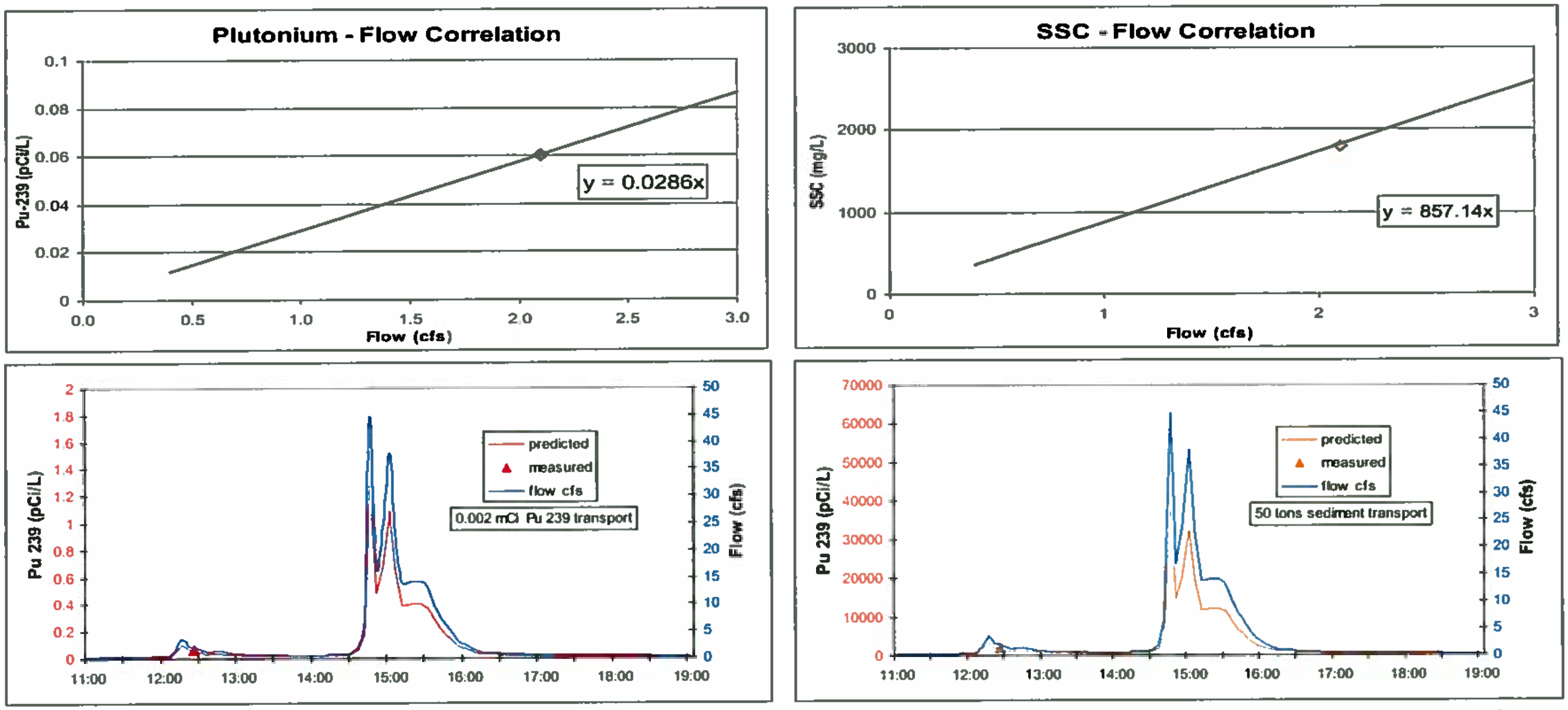
A single grab sample was collected from this 252 cfs event on August 8th, 2006 with flow duration over five hours. The sample was collected near the beginning this event and at the peak. This was the largest event at this station during the period of this report. The plutonium value calculated in the sample sediments is 1.9 pCi/g. We estimate 0.213 mCi of plutonium$^{239/240}$ was carried beyond this station in 122 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. Although the sediment slope factor appears smaller relative to other events, this evaluation appears reasonable.

Event on 8/25/2006 at Station E050



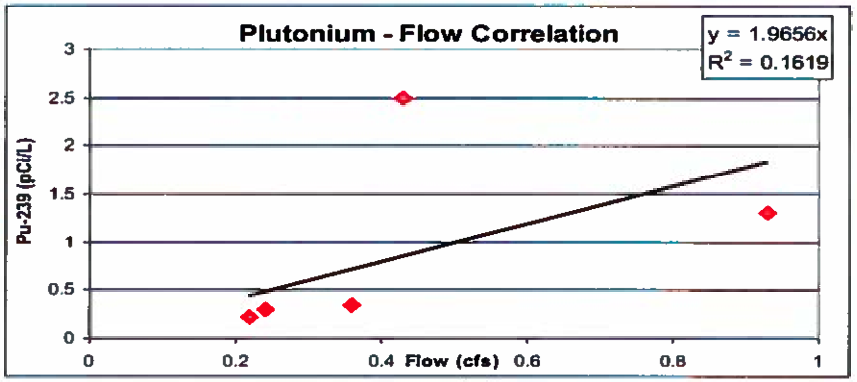
Two samples were collected from a 70 cfs event on August 25th, 2006 with flow duration over nine hours. A first sample attempt was made and failed at 13:50, followed by two successful collections at one hour intervals along the falling limb. The correlations are good. We estimate 0.066 mCi of plutonium$^{239/240}$ was carried beyond this station in 54 tons of sediment. Plutonium values in sediments are 1.3 pCi/g and 1.4 pCi/g. The estimates are reasonable.

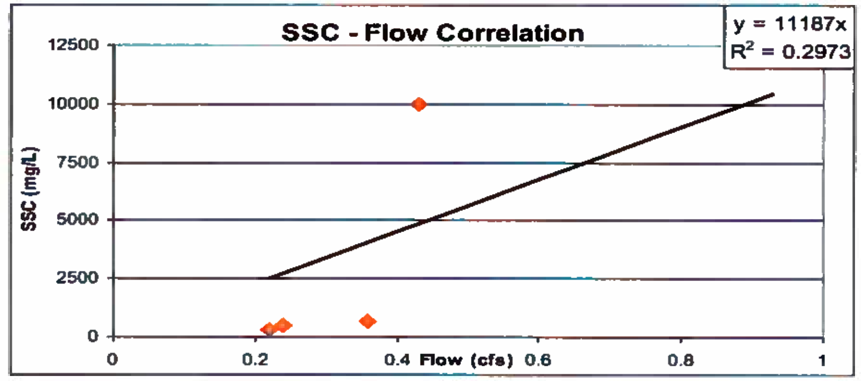
Event on 8/25/2006 at Station E055

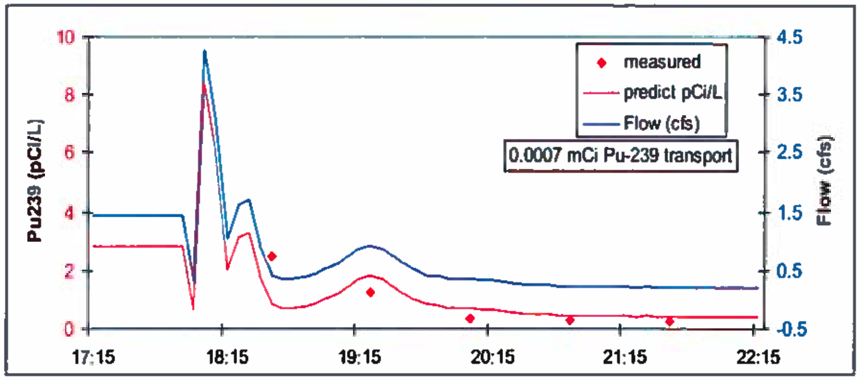


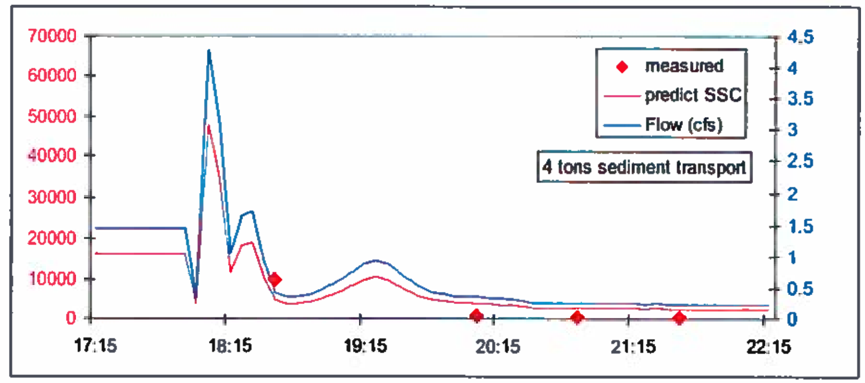
A single grab sample was collected from this 45 cfs event on August 25th, 2006 with flow duration over four hours. The sample was collected near the beginning of a preceding surge or bore. The plutonium value calculated in the sample sediments is 0.03 pCi/g. We estimate 0.002 mCi of plutonium$^{239/240}$ was carried beyond this station in 50 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. This evaluation appears reasonable but due to the separation of hydrographs is viewed with caution. E055 is used as a baseline condition in upper Pueblo Canyon and low transport values are expected and substantiated by these estimates.

Event on 8/6/2007 at Station E060



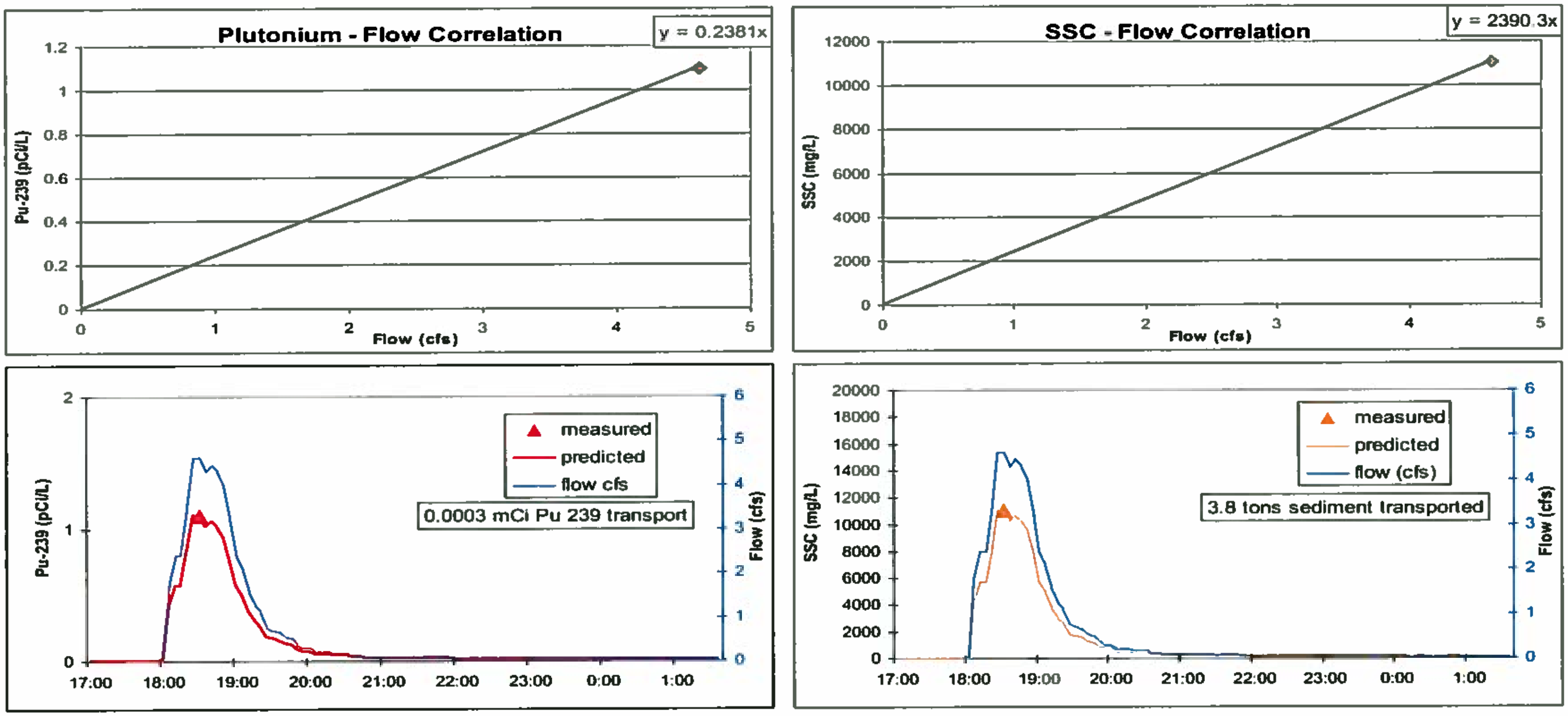






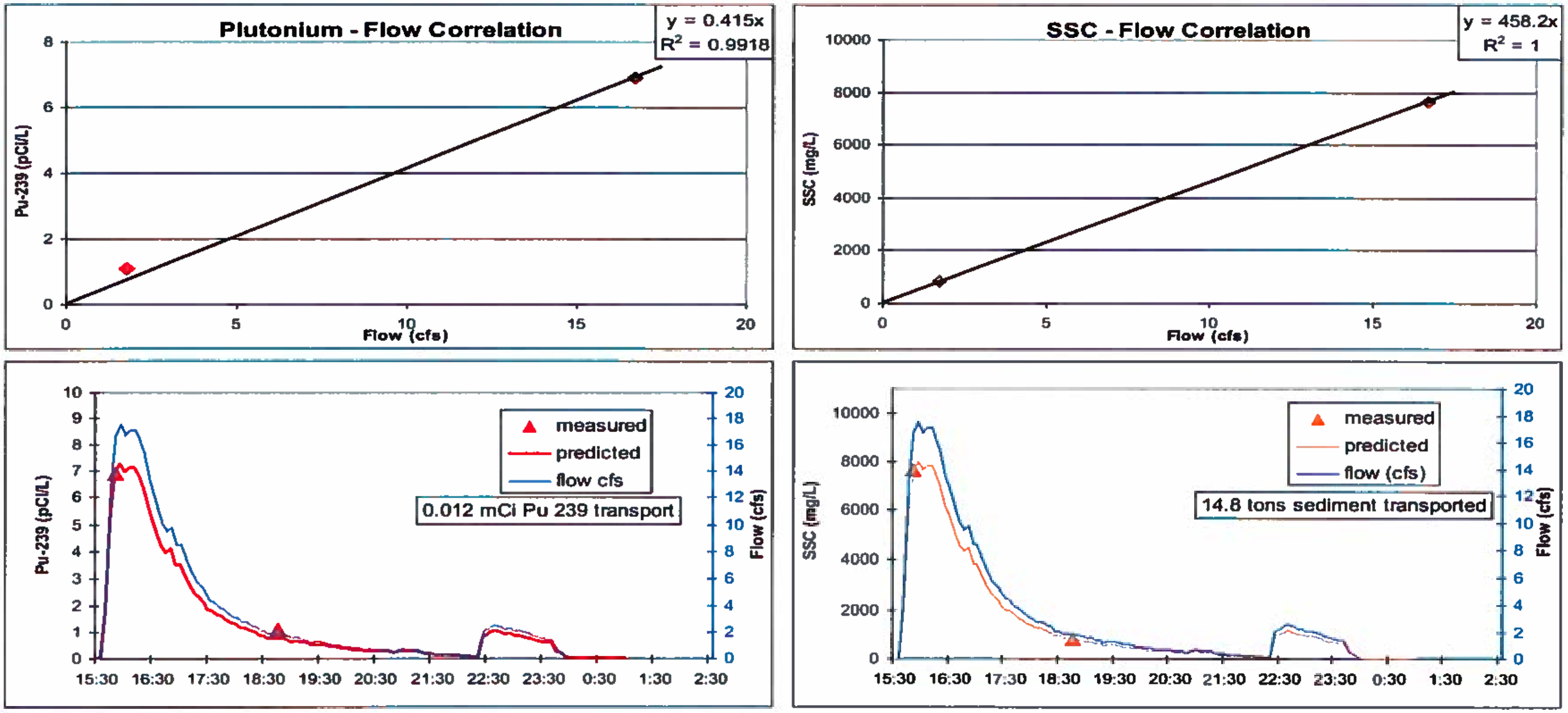
Five samples were collected from a 4 cfs event on August 6th, 2007. Flow duration is approximately two hours in the context of these evaluations, although samples were collected 3.5 hours after the sample program was enabled. A failed sample attempt occurred at 18:15, shortly after the event began. The first sample collected occurred 20 minutes later after the main surge of the event passed, followed by four more samples at 45 minute intervals. The correlations are poor, influenced by single plutonium and sediment measurements at 0.4 cfs. The plutonium values calculated for sediments average 0.5 pCi/g and range from 0.3 to 0.7 pCi/g. These values are less than normally observed at E060. We estimate 0.0007 mCi of plutonium$^{239/240}$ was carried beyond this station in 4 tons of sediment. Although the slope factors are greater than those for relative flows and the correlations are not good, based on the small peak discharge and duration and calculated low transport masses, these estimates appear reasonable.

Event on 8/6/2007 at Station E050



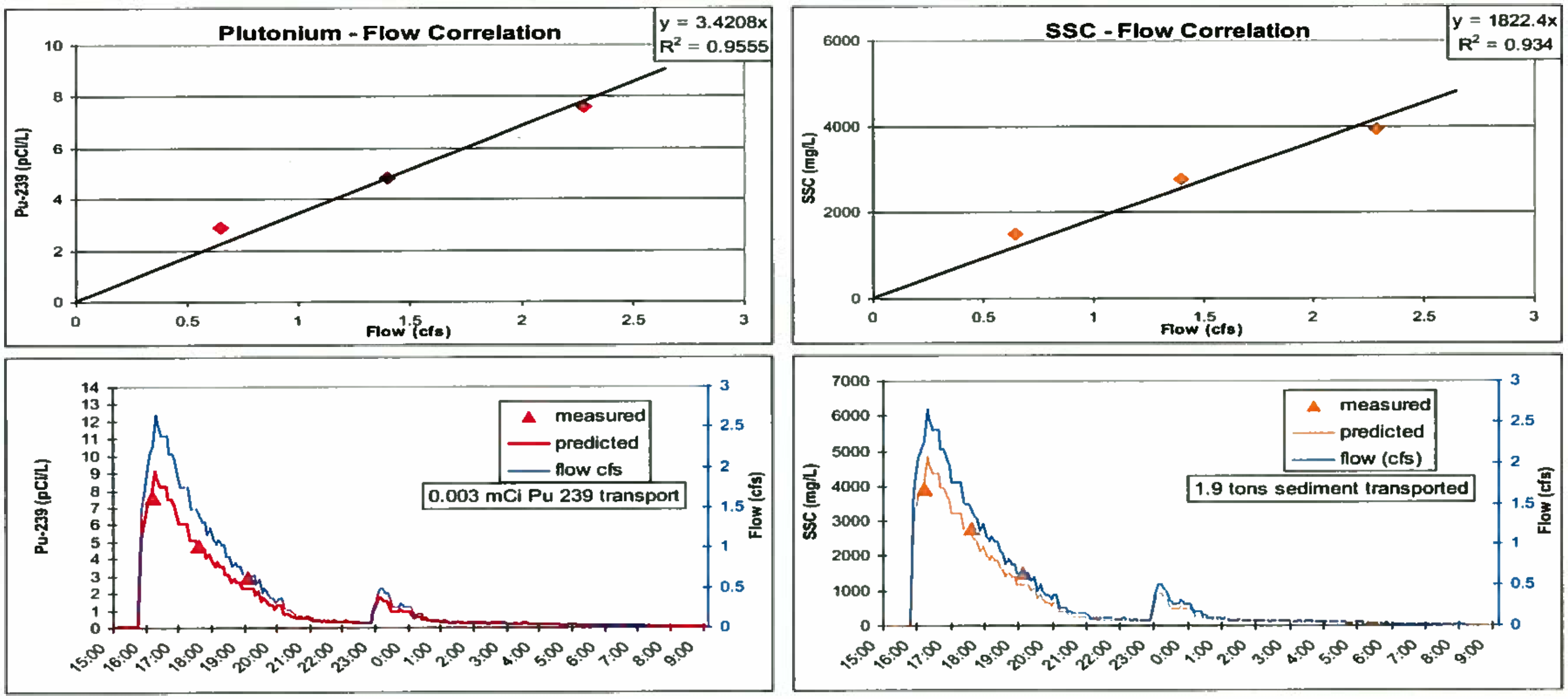
A single grab sample was collected from this 5 cfs event on August 6th, 2007 with flow of approximate three hour duration. The sample was collected near the beginning this event and at the peak. The plutonium measurement in the sample sediments is 0.12 pCi/g. We estimate 0.0003 mCi of plutonium$^{239/240}$ was carried beyond this station in 3.8 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. We suspect the sediment transport is an overestimation based on a larger sediment slope factor relative to other events at E050. The SSC value of 11043 mg/L is much larger than expected for a five cfs discharge and could be due to an environmental excursion like bank failures or more likely sampling error. On occasion, the sample tubes pick up larger masses of sediment due to proximity to an aggrading channel bottom. Due to the small discharge and estimated plutonium and sediment mass transport values this evaluation remains reasonable. .

Event on 8/29/2007 at Station E050



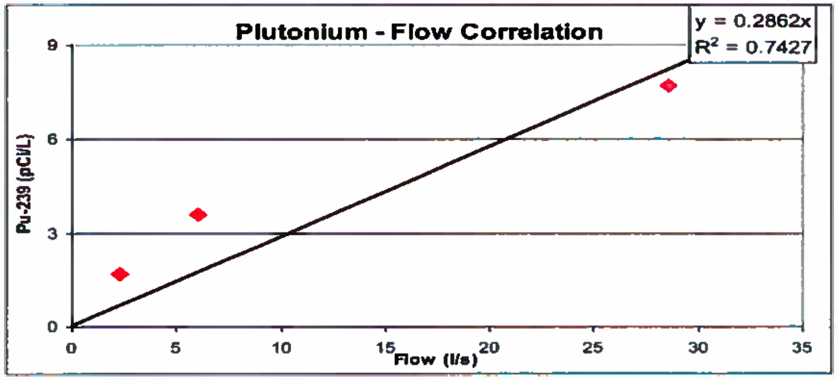
Two samples were collected from a 17 cfs event on August 29th, 2007 of more than eight hour flow duration. The first sample was collected on the rising leg of the hydrograph near the peak followed by one more sample collected two hours and 55 minutes later along the falling limb. The plutonium measurements in sediment are 0.9 and 1.2 pCi/g. The correlations are good. We estimate 0.012 mCi of plutonium$^{239/240}$ was carried beyond this station in 15 tons of sediment. These estimates appear reasonable.

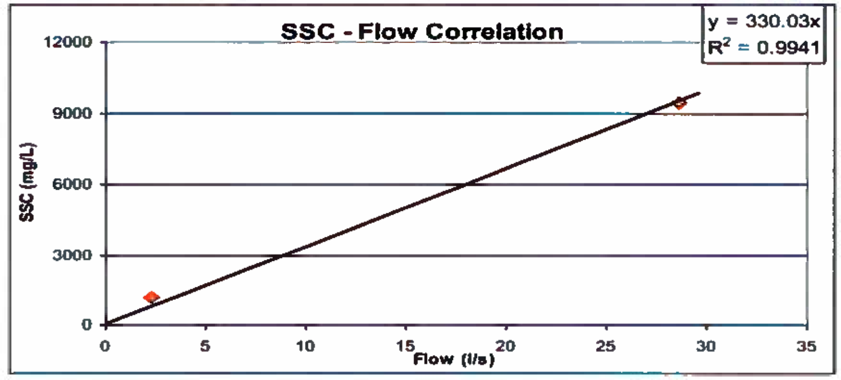
Event on 9/1/2007 at Station E050

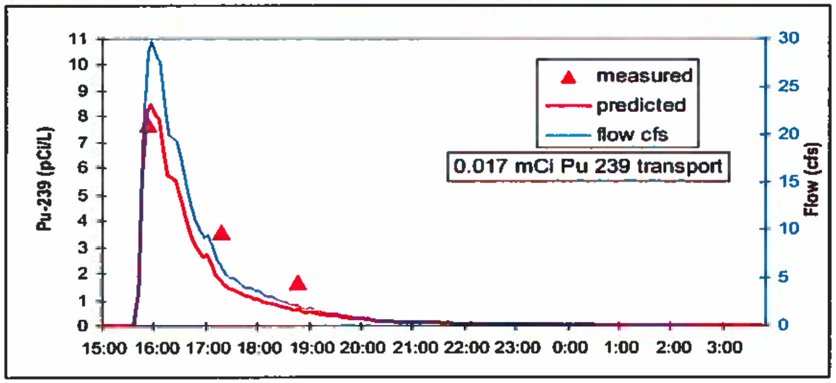


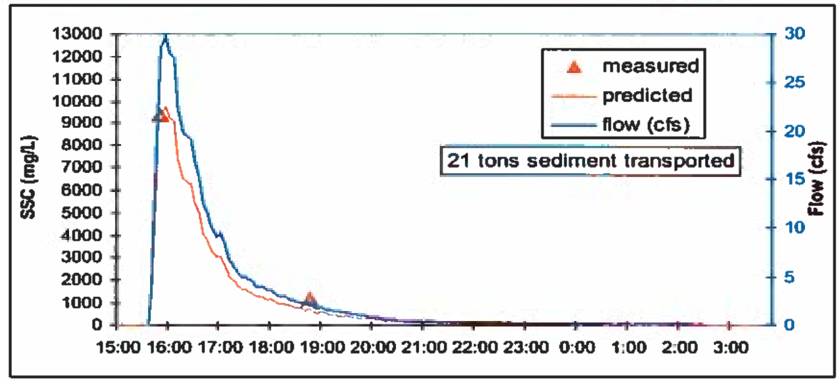
Three samples were collected from a small three cfs event on September 1rst, 2007 of more than ten hour flow duration. The first sample was collected on the rising leg of the hydrograph near the peak followed by two more samples collected at 1.5 hour intervals along the falling limb. The plutonium measurements in sediment average 1.7 pCi/g and range from 1.5 to 2 pCi/g. The correlations are good. We estimate 0.003 mCi of plutonium$^{239/240}$ was carried beyond this station in 1.9 tons of sediment. These estimates appear reasonable, although at this low discharge the SSC measurements were larger than expected. These values increased both the slope factors for sediment and plutonium correlations to discharge.

Event on 9/2/2007 at Station E050



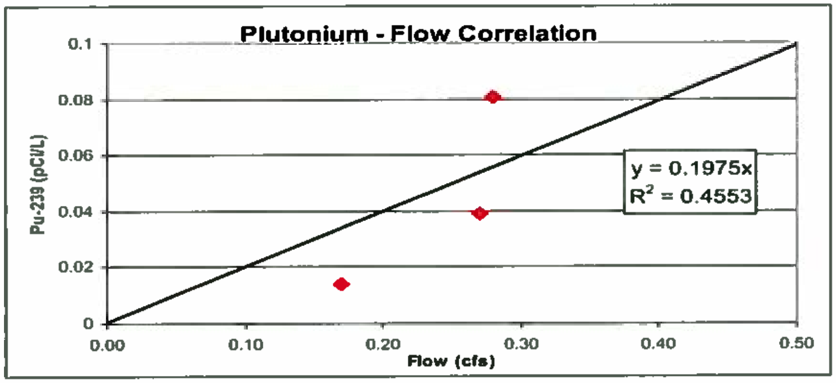


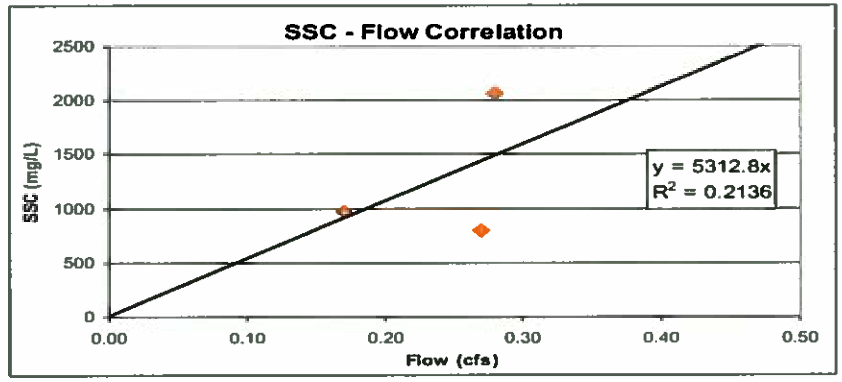


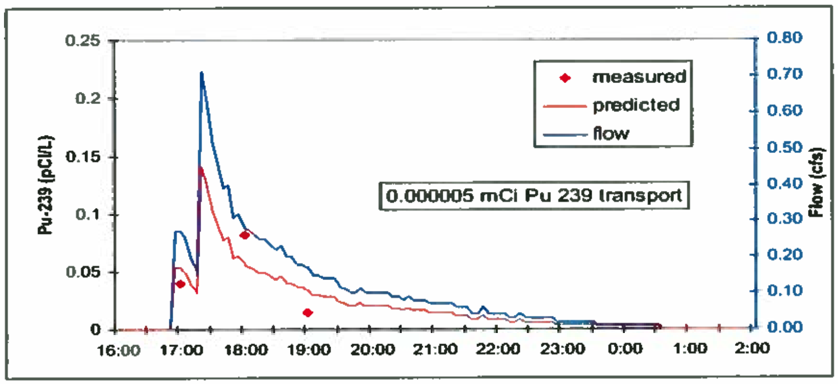


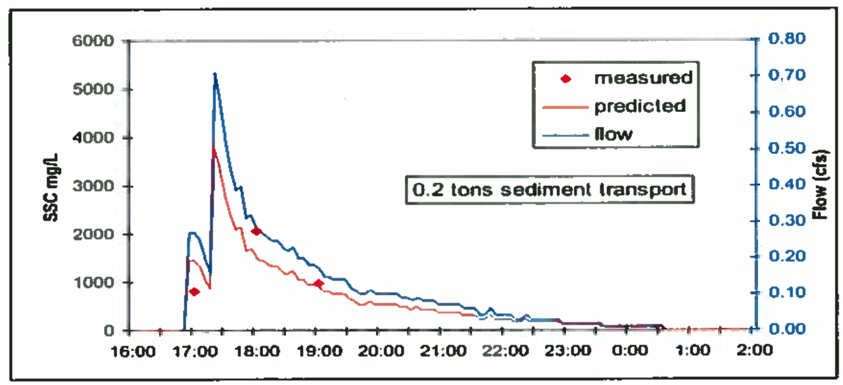
Three samples were collected from a 30 cfs event on September 2nd, 2007 of more than five hour flow duration. The first sample was collected on the rising leg of the hydrograph near the peak followed by two more samples collected at 1.5 hour intervals along the falling limb. Two values were calculated for plutonium in sediment and both are 0.2 pCi/g. The third value is unobtainable because an analytical measurement is not available for one of the second sample. The correlations are good. We estimate 0.017 mCi of plutonium$^{239/240}$ was carried beyond this station in 21 tons of sediment. These estimates appear reasonable.

Event on 7/14/2007 at Station E055



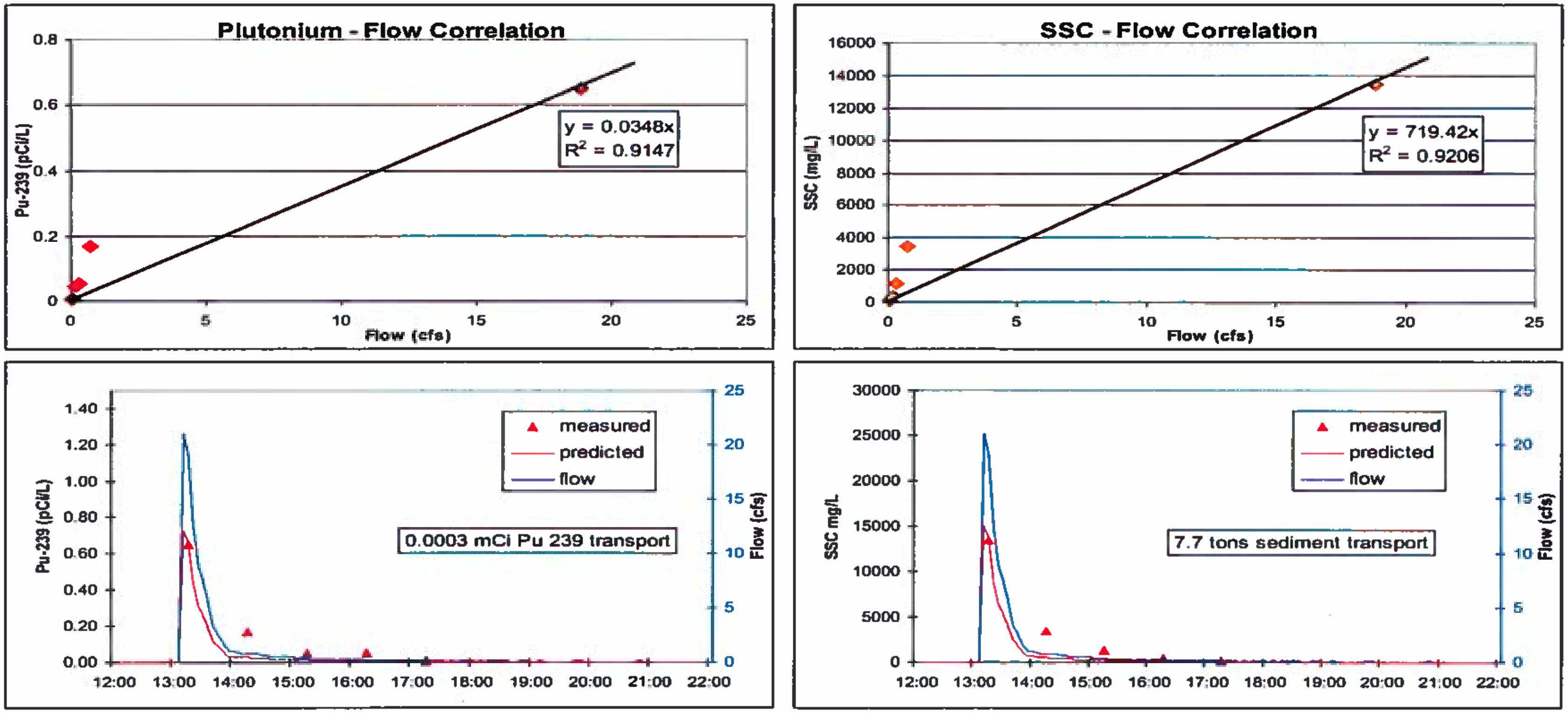






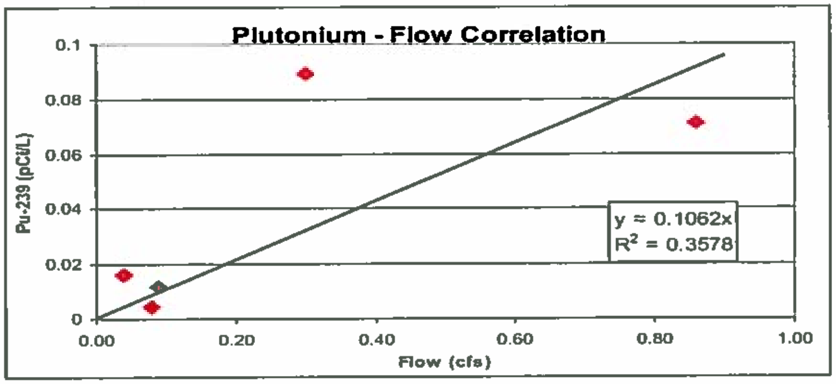
Three samples were collected from a small one cfs event on July 14th, 2007 of more than seven hour flow duration. The first sample was collected on the rising leg of the hydrograph near the first event surge followed by two more samples collected at one hour intervals along the falling limb after the peak. The average plutonium in sediment value is 0.03 pCi/g ranging from 0.015 to 0.049 pCi/g. The correlations are poor. We estimate 0.000005 mCi of plutonium$^{239/240}$ was carried beyond this station in 0.2 tons of sediment. At this discharge and the associated low transport levels, these estimates remain reasonable. E055 is used as a baseline condition in upper Pueblo Canyon and low transport values are expected and substantiated by these estimates.

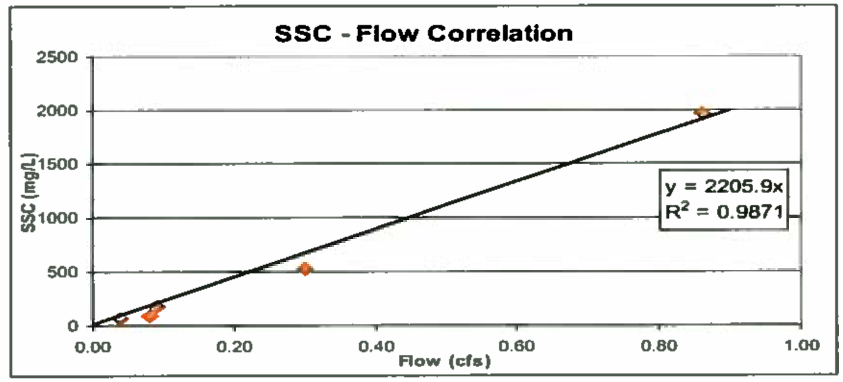
Event on 7/26/2007 at Station E055

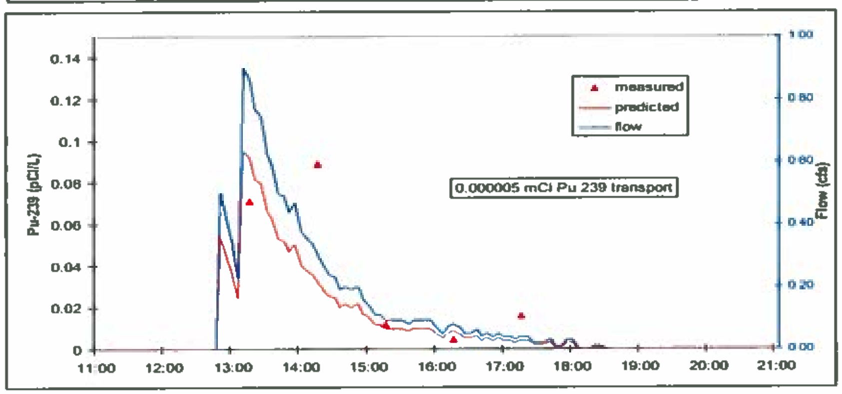


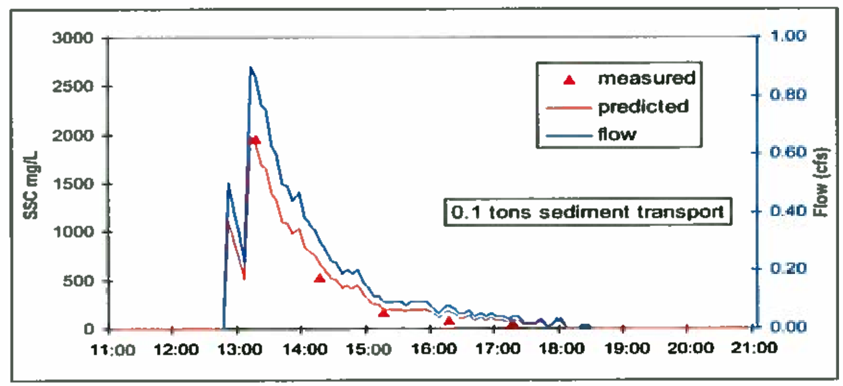
Five samples were collected from a 21 cfs event on July 26th, 2007 of more than two hour flow duration. The first sample was collected near the beginning of the event at the peak followed by four more samples collected at one hour intervals along the falling limb. The average plutonium in sediment value is 0.06 pCi/g ranging from 0.043 to 0.11 pCi/g. The correlations appear to be good but one influencing value at 19 cfs may facilitate this correlation coefficient. We estimate 0.0003 mCi of plutonium$^{239/240}$ was carried beyond this station in 7.7 tons of sediment. These estimates appear reasonable.

Event on 8/4/2007 at Station E055



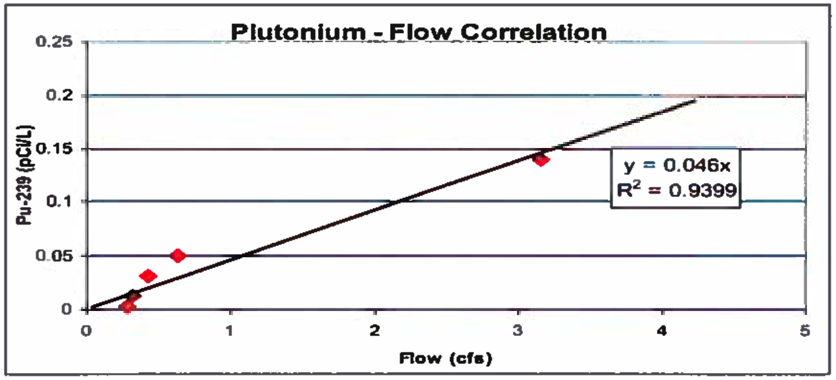


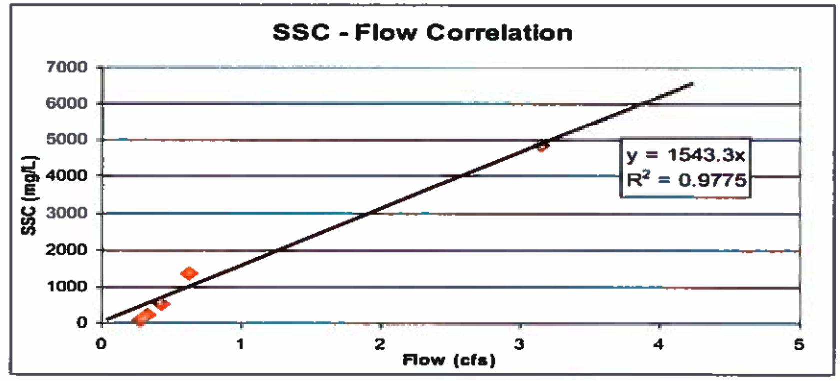


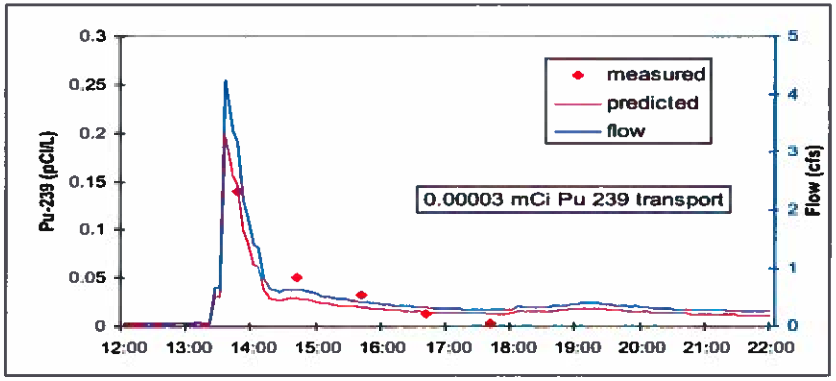


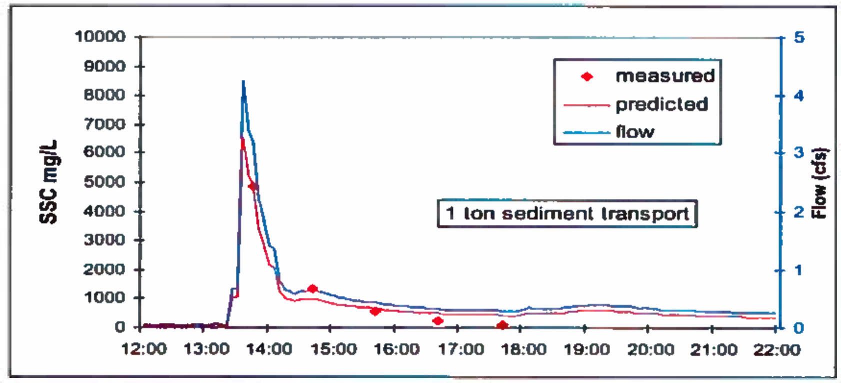
Five samples were collected from a small one cfs event on August 4th, 2007 of more than five hour flow duration. The first sample was collected 25 minutes after the start of the event and at the peak, followed by four more samples collected at one hour intervals along the falling limb. The average plutonium in sediment value is 0.12 pCi/g ranging from 0.04 to 0.28 pCi/g. The sediment correlation is good. The second and last samples have reported plutonium values slightly higher than expected for a background station and diminish the correlation. We estimate 0.000005 mCi of plutonium$^{239/240}$ was carried beyond this station in 0.1 tons of sediment. At this discharge and the associated low transport levels, these estimates remain reasonable. E055 is used as a baseline condition in upper Pueblo Canyon and low transport values are expected and substantiated by these estimates.

Event on 9/1/2007 at Station E055



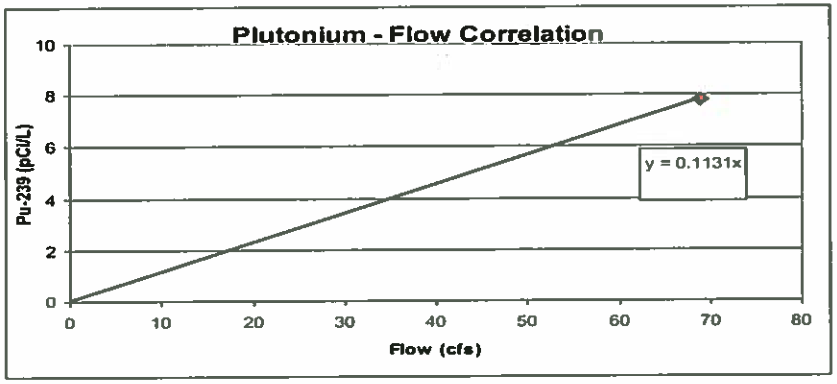


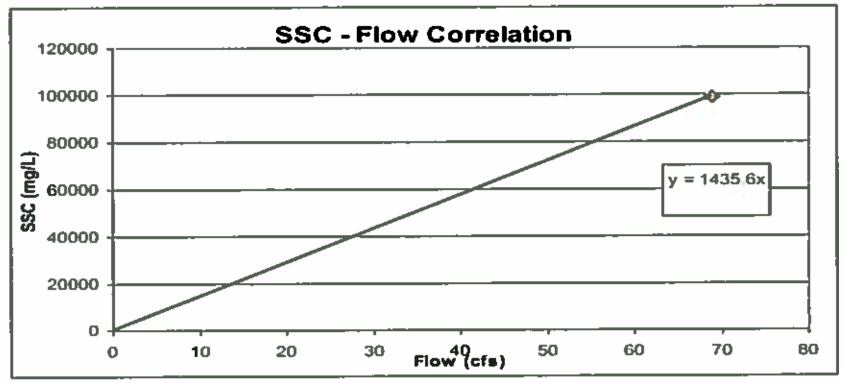


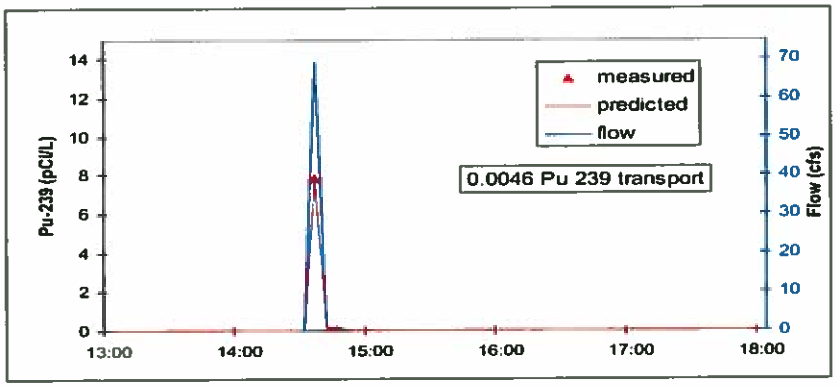


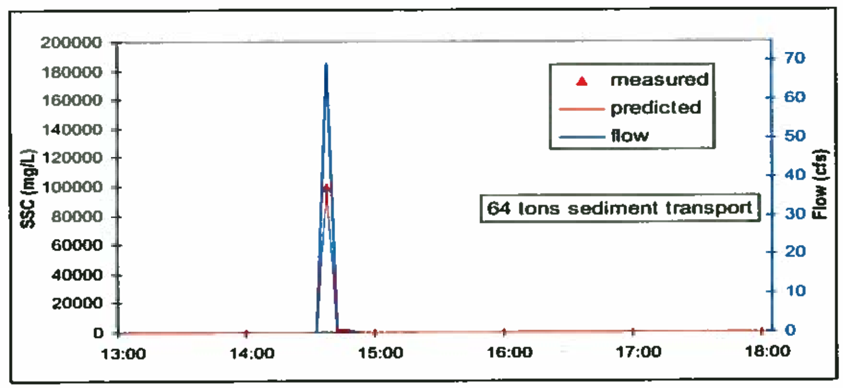
Five samples were collected from a four cfs event on September 1rst, 2007 of more than five hour flow duration. The first sample was collected near the start of the event and ten minutes after the peak, followed by four more samples collected at one hour intervals along the falling limb. The average plutonium in sediment value is 0.04 pCi/g ranging from 0.03 to 0.06 pCi/g. The correlations are good. We estimate 0.00003 mCi of plutonium$^{239/240}$ was carried beyond this station in one ton of sediment. At this discharge and the associated low transport levels, these estimates are reasonable. E055 is used as a baseline condition in upper Pueblo Canyon and low transport values are expected and substantiated by these estimates.

Event on 7/22/2008 at Station E110



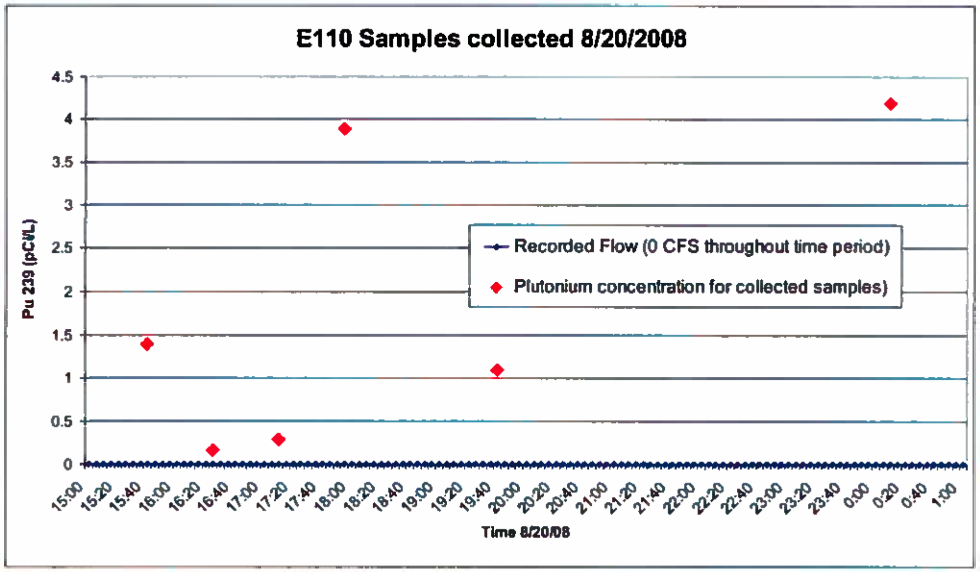






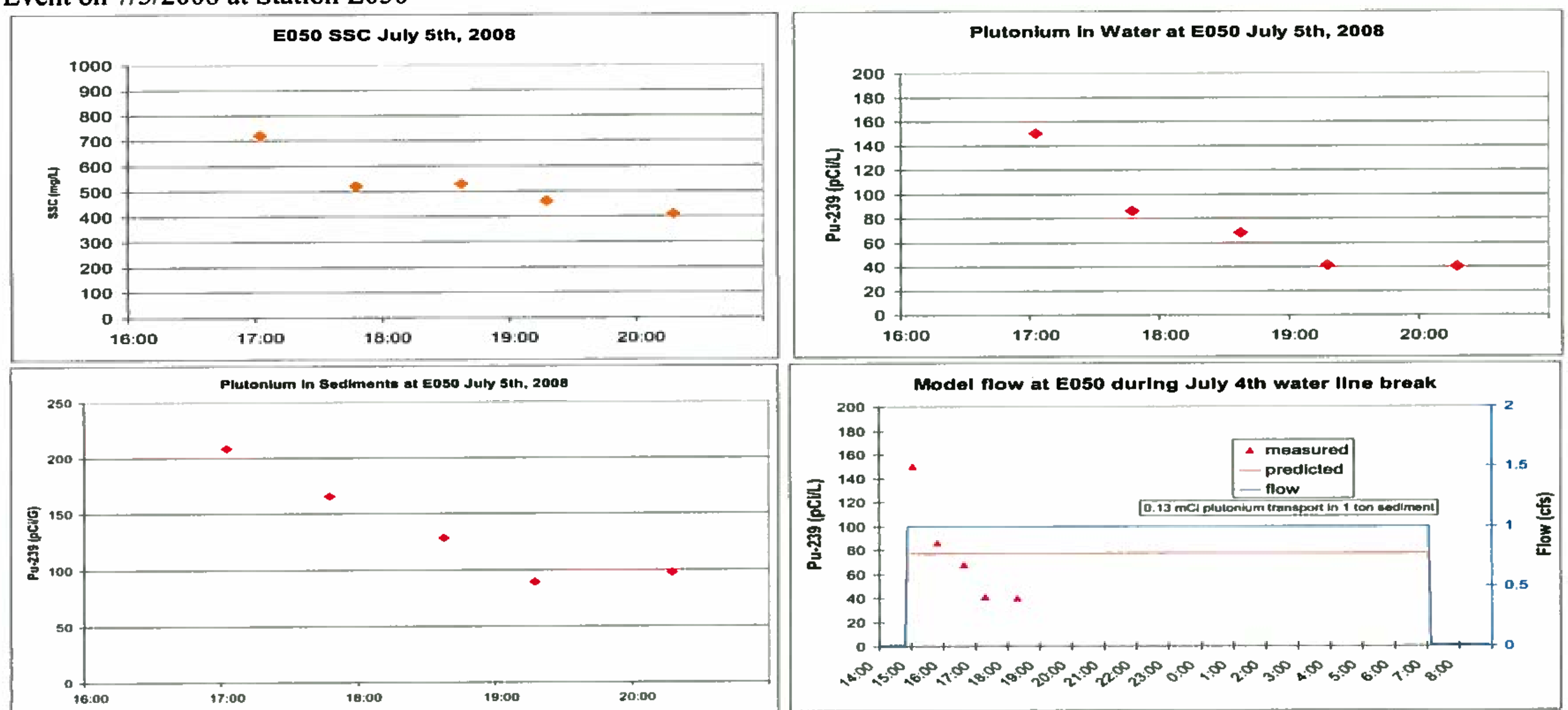
A single grab sample was collected from this 69 cfs event on July 22nd, 2008 with flow of less than one hour duration. The sample was collected near the beginning this event and at the peak. The plutonium measurement in the sample sediments is 0.08 pCi/g and probably originates from Guaje Canyon or residual contaminants from lower Los Alamos Canyon. We estimate 0.0046 mCi of plutonium$^{239/240}$ was carried beyond this station in 64 tons of sediment. Although estimating transport using one sample is more difficult, following the assumption that concentrations increase and decrease proportionately with discharge this evaluation was attempted. We suspect the sediment transport is an overestimation based on a larger sediment slope factor relative to other events at E050. The SSC value of 99000 mg/L is much larger than expected for a 69 cfs discharge and could be due to an environmental excursion like bank failures or more likely sampling error. On occasion, the sample tubes pick up larger masses of sediment due to proximity to an aggrading channel bottom. This evaluation remains reasonable. .

Event on 8/20/2008 at Station E110



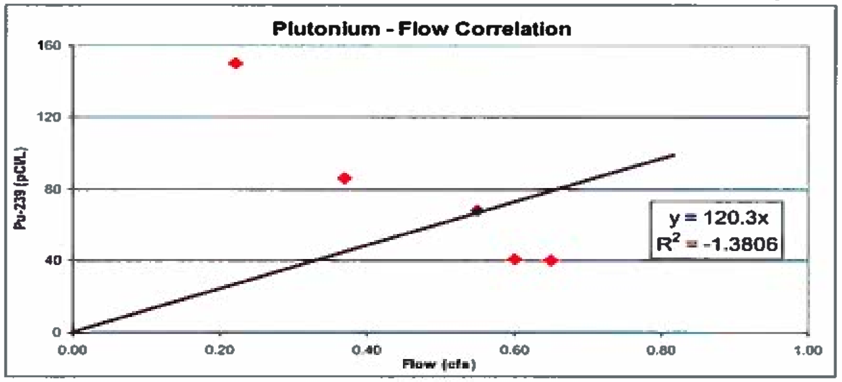
Six samples were collected from an August 20, 2008 event at the E110 station. LANL discharge recording indicated a zero cfs flow throughout this time period. Plutonium concentration measurements in water ranged from 0.16 to 4.2 pCi/L. Based on plutonium concentrations seen in other E110 events, this flow was relatively minor and peak discharge could have been between three and six cfs. A suspended sediment measurement of 13000 mg/L suggests a larger discharge. Unfortunately a transport estimate cannot be made with this information.

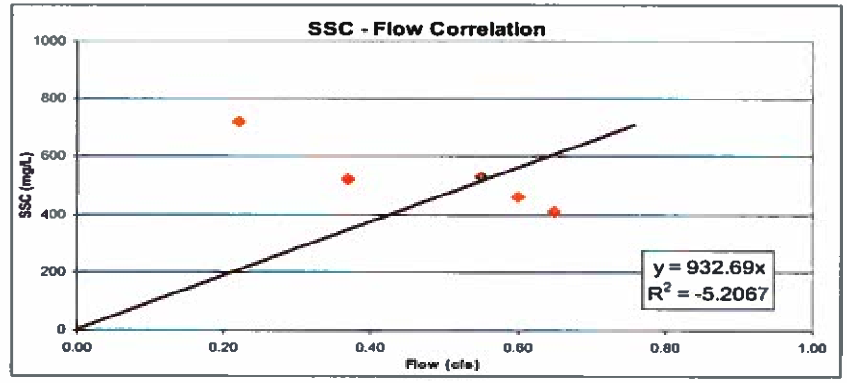
Event on 7/5/2008 at Station E050

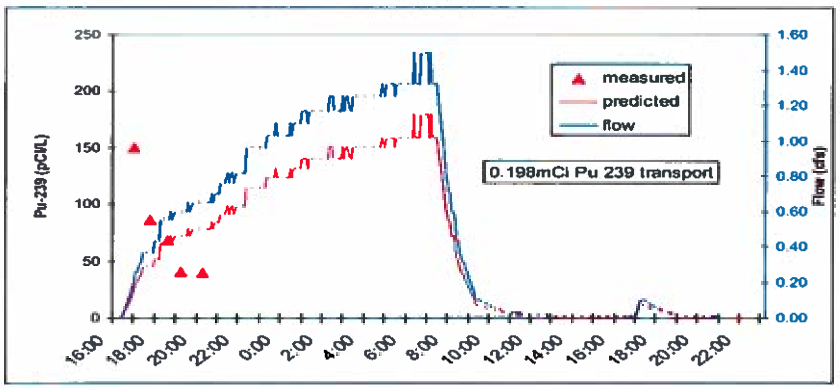


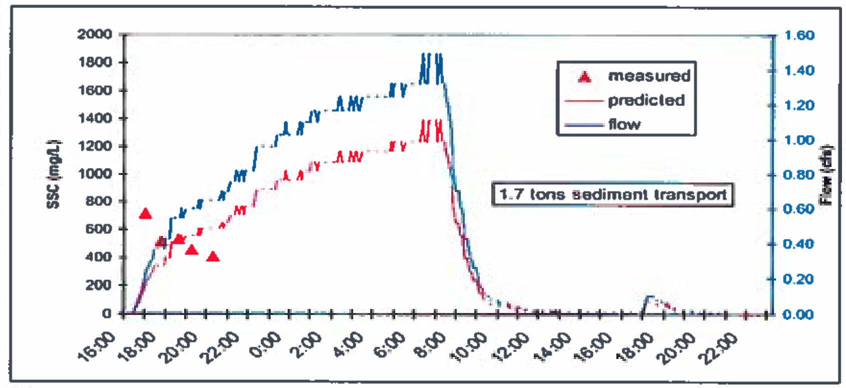
A break in a fire suppression waterline at TA-21 occurred on July 4-5, 2008 and released approximately 3.9 million gallons of potable water (1.3 ac-ft) that flowed over solid waste management unit (SWMU) 21-027(a), eroding sediment on the canyon wall and transporting it into the bottom of Los Alamos Canyon.(LANL ESR 2008) We collected five samples at one hour intervals at E050 starting 15:02 July 5th, but our sample times do not correlate with LANL discharge measurements. LANL E050 gage indicates flow began at 16:25 on July 4th, steadily increased to about 1.5 cfs and ended abruptly at 09:00 July 5th, an approximate 16 hour discharge. The hydrograph generated by our flow meter identified a quick increase to an approximate 5 inch stage or 1 cfs per the LANL rating curve. The narrow range of SSC concentrations (400 to 700 mg/L) substantiates a steady flow during this period. Plutonium concentrations in sediment average 138 pCi/g, ranging from 208 to 89 pCi/g. Based on a model 1 cfs discharge over 16 hours, we suggest as much as 0.13 mCi in 1 ton of sediments could have been transported. Unlike previous events where plutonium concentrations are consistent, the concentrations here appear to diminish with time. This evaluation may overestimate transport.

An alternate model is offered below based on LANL discharge recorded on July 4th.



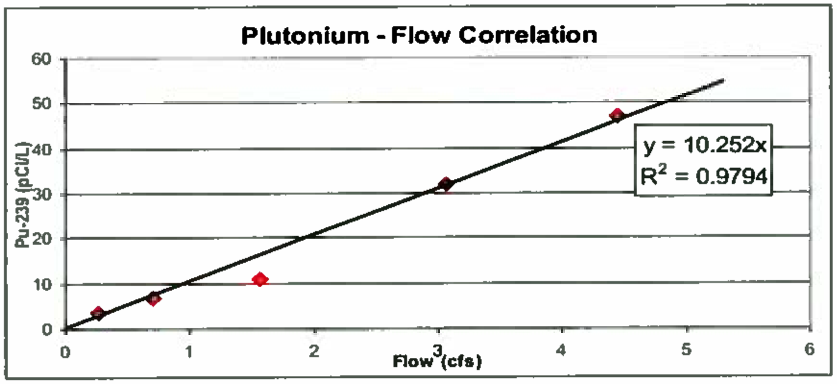


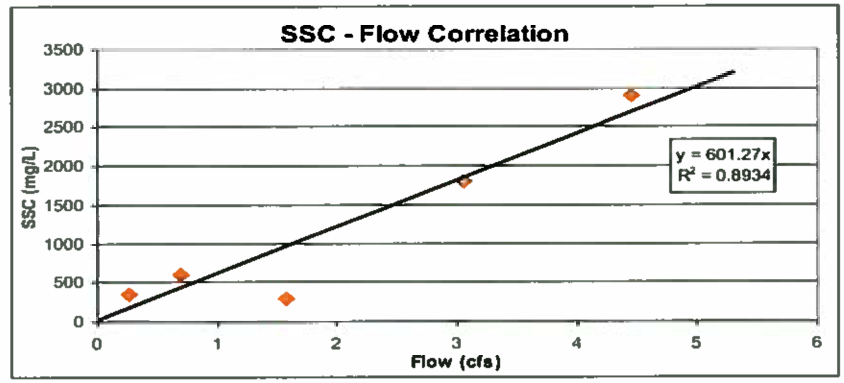


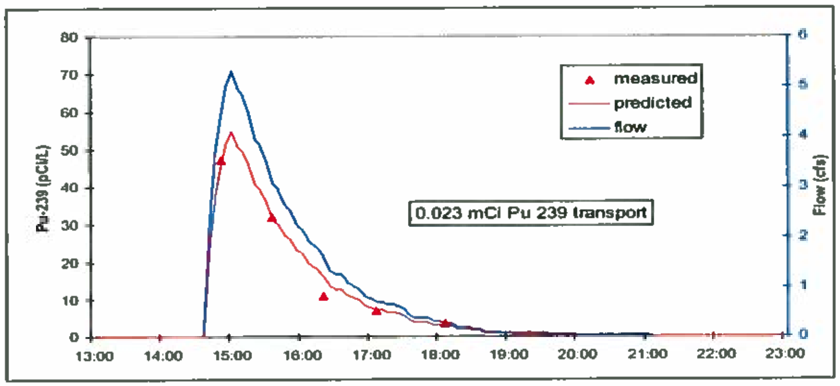


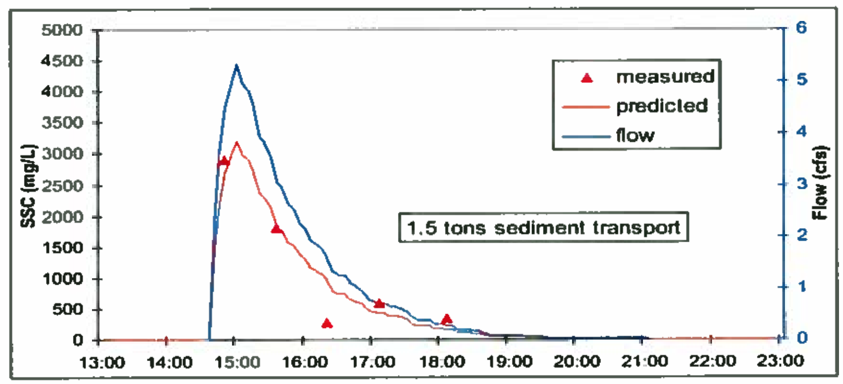
An estimate of 0.198 mCi plutonium in 1.7 tons of sediments is derived from this model.

Event on 8/9/2008 at Station E050



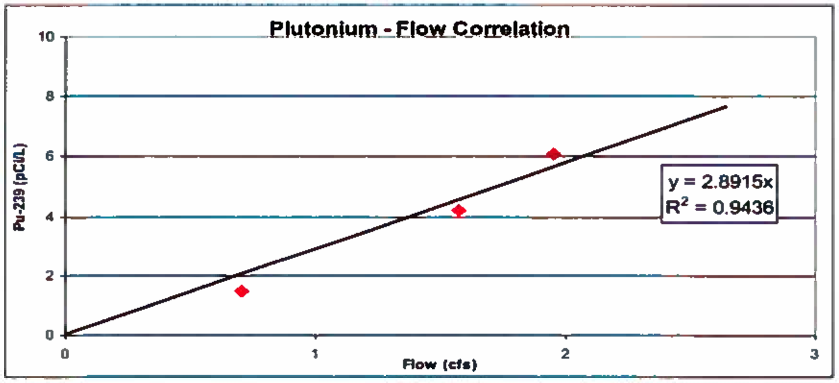


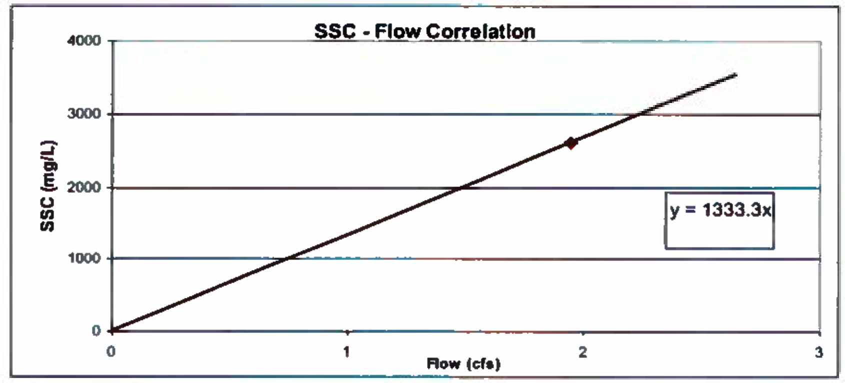


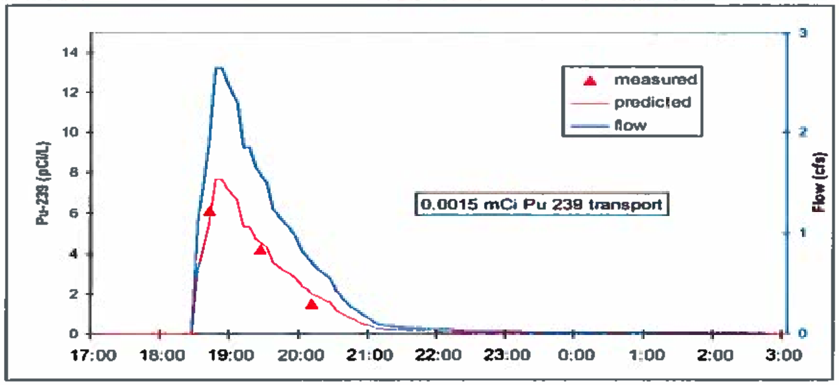


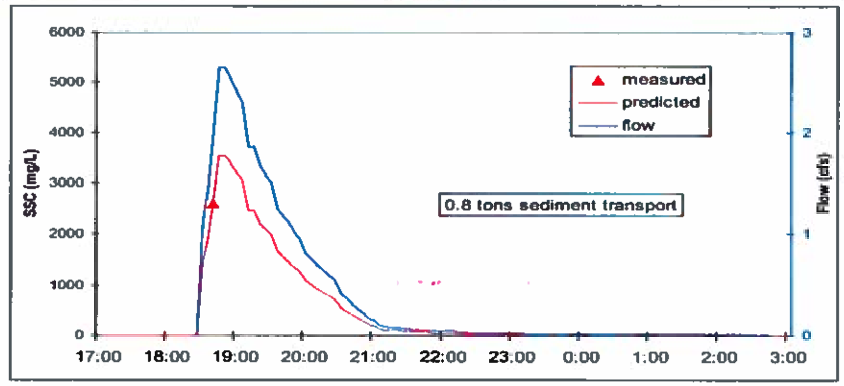
Five samples were collected from a five cfs event on August 9th, 2008 of more than five hour flow duration. The first sample was collected on the rising leg of the hydrograph near the peak followed by three samples collected at 45 minute intervals and the last sample collected after a one hour interval along the falling limb. The average plutonium in sediment value is 19 pCi/g ranging from 10 to 39 pCi/g. The high plutonium concentrations are residual from the July 5th TA-18 waterline break. The correlations are good. We estimate 0.023 mCi of plutonium$^{239/240}$ was carried beyond this station in 1.5 tons of sediment. These estimates are reasonable.

Event on 8/23/2008 at Station E050









Three samples were collected from a small three cfs event on August 23rd, 2008 of more than three hour duration. The first sample was collected on the rising leg of the hydrograph near the peak followed by two more samples collected at 45 minute intervals along the falling leg of the hydrograph. The plutonium in sediment value derived from the first sample point is 2.3 pCi/g. The high plutonium concentrations are residual from the July 5th TA-18 waterline break. Average plutonium concentration at E050 during July 5th was 137 pCi/g, ranging as high as 208 pCi/g. The concentrations have diminished from that level to an average 19 pCi/g in samples collected during an August 9th event, and finally to the 2.3 pCi/g seen in this event. This demonstrates that concentrations are continuing to diminish with each sequential storm event through Los Alamos Canyon. The correlation is good for the plutonium-flow evaluation. Only one value was obtained for SSC and the correlation was based on it and a zero intercept. We estimate 0.0015 mCi of plutonium$^{239/240}$ was carried beyond this station in 0.8 tons of sediment. These estimates are reasonable.

Table C-1. Storm-Event-Based Relationship Statistics

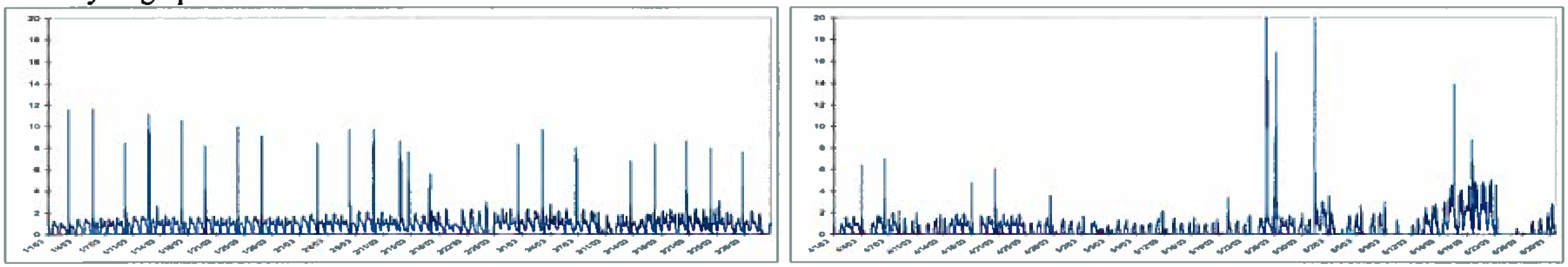
Station	Date	N	Degrees of Freedom (N - 2)	Peak Flow (cfs)	Pu Conc Pearson Product Moment Correlation	p values values less than 0.05 equal significant correlation	Pu / Flow Slope coefficient	SSC Pearson Product Moment Correlation	p values values less than 0.05 equal significant correlation	Sed / Flow Slope coefficient
E060	8/12/2003	4	2	60	0.917	0.080	0.486	0.979	0.021	133
E060	8/22/2003	3	1	90	0.985	0.110	0.033	(-)		162
E060	9/6/2003	3	1	243	0.921	0.250	0.578	0.997	0.049	167
E060	7/23/2004	6	4	21	0.955	0.003	0.282	0.946	0.004	50
E060	7/27/2004	7	5	262	(-)	NA	0.106	(-)	NA	13
E060	8/18/2004	14	12	21	0.965	0.0001	0.256	0.920	0.0001	49
E060	8/20/2004	13	11	40	0.814	0.001	0.203	0.954	0.0001	184
E060	8/24/2005	4	2	85	0.950	0.050	0.803	0.631	0.369	389
E110	8/12/2005	4	2	18	(-)	NA	0.179	0.696	0.304	111
E110	8/24/2005	3	1	16	0.771	0.440	0.955	0.939	0.224	519
E110	8/25/2005	2		11	0.999	NA	0.995	0.990	NA	404
E030	8/12/2005	1		11		NA	0.291		NA	212
E030	8/13/2005	4	2	7	0.793	0.207	0.343	0.844	0.156	247
E030	8/22/2005	2		5	0.998	NA	2.074	0.998	NA	1769
E030	8/24/2005	4	2	27	0.989	0.011	0.520	0.996	0.004	371
E042	8/12/2005	1		75		NA	0.091		NA	112
E042	8/24/2005	3	1	138	0.988	0.099	0.076	0.993	0.080	79
E060	7/26/2006	2		2		NA	0.010	0.920	NA	2126
E060	8/5/2006	2		1		NA	4.114		NA	500
E060	8/8/2006	2		1930	0.953	NA	0.657	0.970	NA	64
E060	8/25/2006	3	1	102	1.000	0.029	1.999	0.767	0.444	178
E110	7/6/2006	3	1	11	0.819	0.389	0.074	0.627	0.569	215
E110	7/7/2006	3	1	10	(-)	NA	0.020	0.888	0.304	4099
E110	8/6/2006	3	1	49	0.883	0.311	0.044	(-)	NA	102
E110	8/8/2006	6	4	1642	0.985	0.0003	0.248	0.992	0.0001	41
E110	8/19/2006	1		12		NA	1.415		NA	5000
E110	8/25/2006	3	1	89	0.927	0.245	1.296	0.953	0.196	374
E050	8/1/2006	1		16		NA	0.217		NA	178
E050	8/7/2006	1		24		NA	0.216		NA	286
E050	8/8/2006	1		252		NA	0.077		NA	40
E055	8/25/2006	3	1	45	0.938	0.225	0.029	(-)	NA	857
E050	8/25/2006	2		70	0.924	NA	0.219	0.898	NA	162
E060	8/6/2007	5	3	4	0.634	0.251	1.966	0.738	0.155	11187
E050	8/6/2007	1		5		NA	0.238		NA	2390
E050	8/29/2007	2		17	0.998	NA	0.415		NA	458
E050	9/1/2007	3	1	3	0.988	0.099	3.421	0.983	0.118	1822
E050	9/2/2007	3	1	30	0.928	0.243	0.286	0.998	0.040	330
E055	7/14/2007	3	1	1	0.822	0.386	0.198	0.680	0.524	5313
E055	7/26/2007	4	2	21	0.978	0.022	0.035	0.979	0.021	719
E055	8/4/2007	5	3	1	0.773	0.125	0.106	0.997	0.0002	2205
E055	9/1/2007	5	3	4	0.984	0.002	0.046	0.994	0.001	1543
E110	7/22/2008	1		69		NA	0.113		NA	1436
E050	7/4/2008	5	3	2	(-)	NA	120.300	(-)	NA	932
E050	8/9/2008	5	3	5	0.995	0.0004	10.252	0.972	0.008	601
E050	8/23/2008	3	1	3	0.985	0.001	2.892		NA	1333

Not applicable due to 0 degrees of freedom or negative correlation

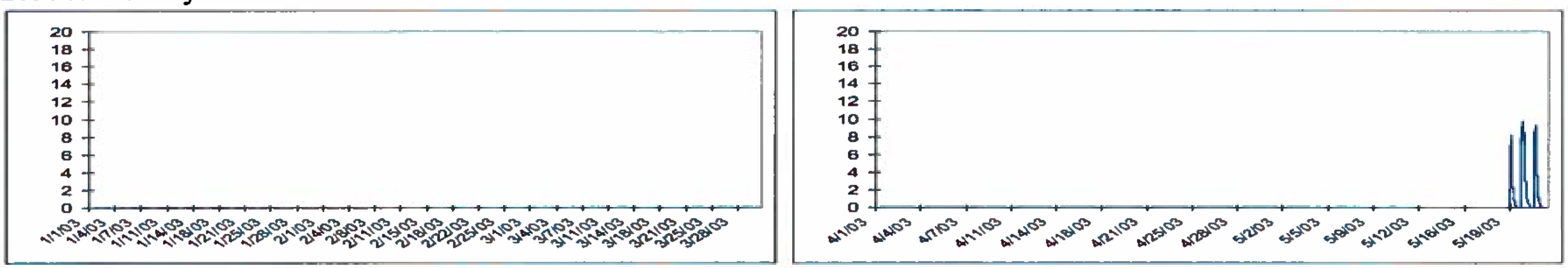
Appendix D
Hydrographs

The following hydrographs reflect discharge at E060, E050, and E110 from 2003 to 2008. Each chart presents a hydrograph for a three month period and uses a consistent 20 cfs vertical axis. For example, the first row of two charts demonstrates flow during January to June of 2003 at E060. The second set are for E050 and the third set are for E110 during the same time period. The July through December series is demonstrated in the following three sets of hydrographs and the sequence progresses for the following years. Some observations are made for clarity, but the hydrographs are presented primarily for the readers review.

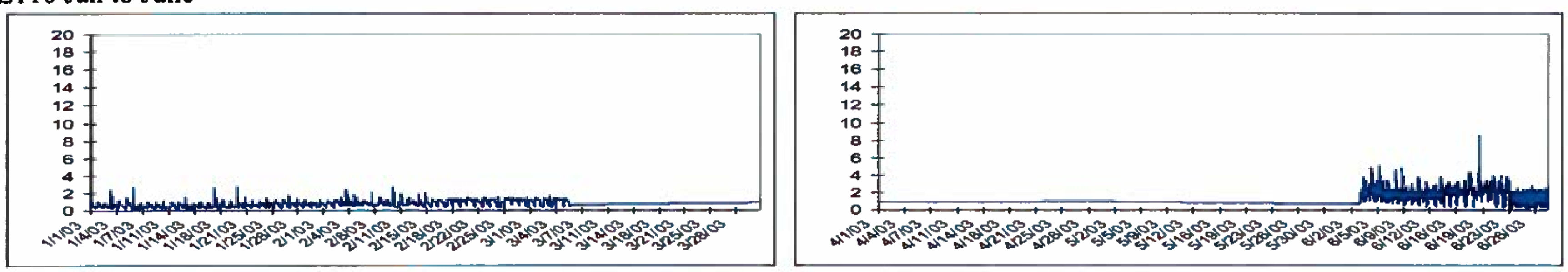
E060 Hydrograph for 2003 Jan to June



E050 Jan to May



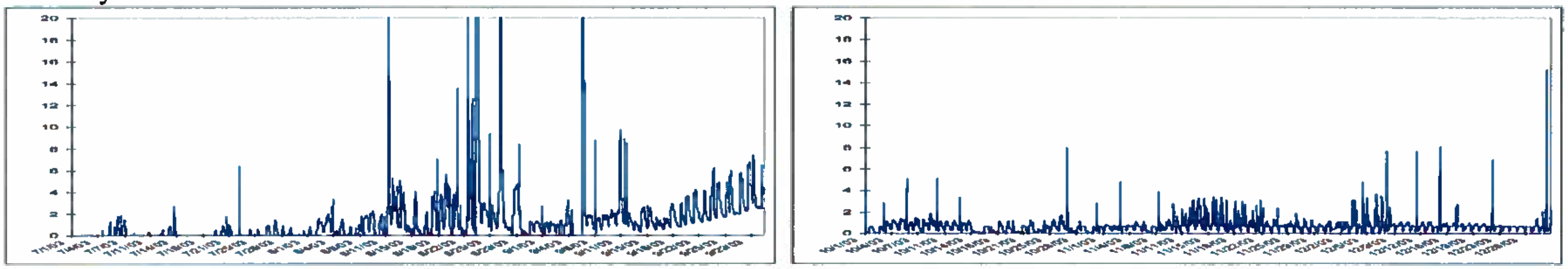
E110 Jan to June



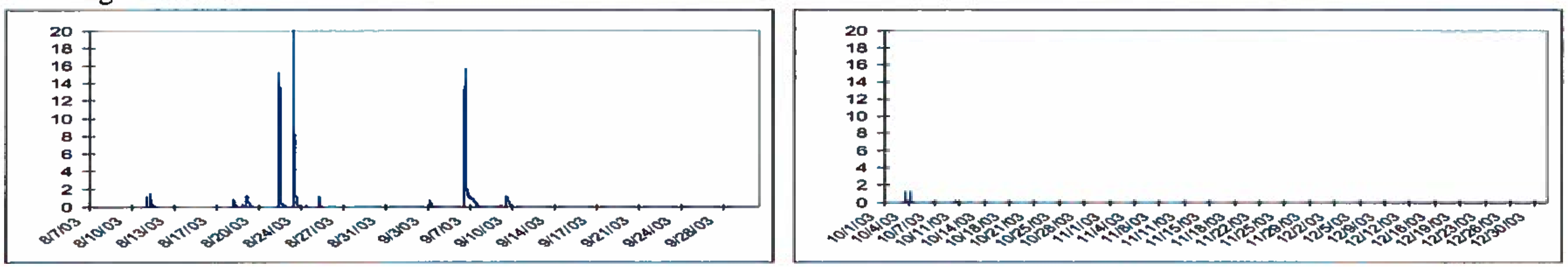
Flow events at E060 during the first four months of 2003 are daily Bayo POTW discharges. The flow is not maintained throughout the day and is diverted to city park irrigation later in the summer. Increased discharges are observed almost weekly and may be due to plant operators back flushing the trickling filters and generating regular discharge pulses. A series of events occur in May, one of which was

62 cfs. No flow is observed at E050 until three small flows in May. The LANL 2003 Surface Water report indicated that snow melt was non-existent. The gage at E110 does not appear to be operating during a period from March through May.

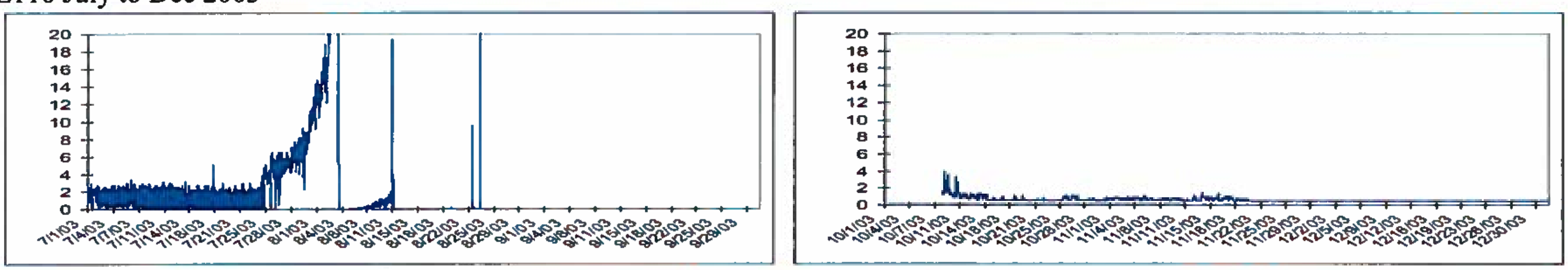
E060 July to December 2003



E050 August to Dec 2003

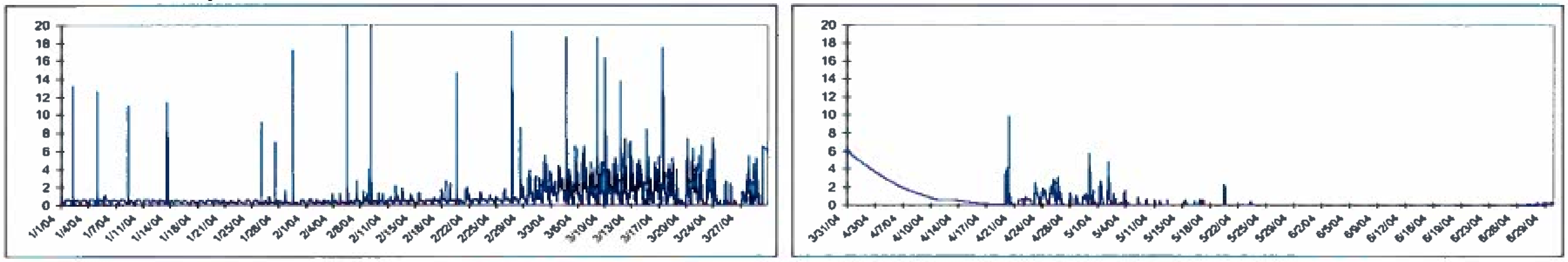


E110 July to Dec 2003

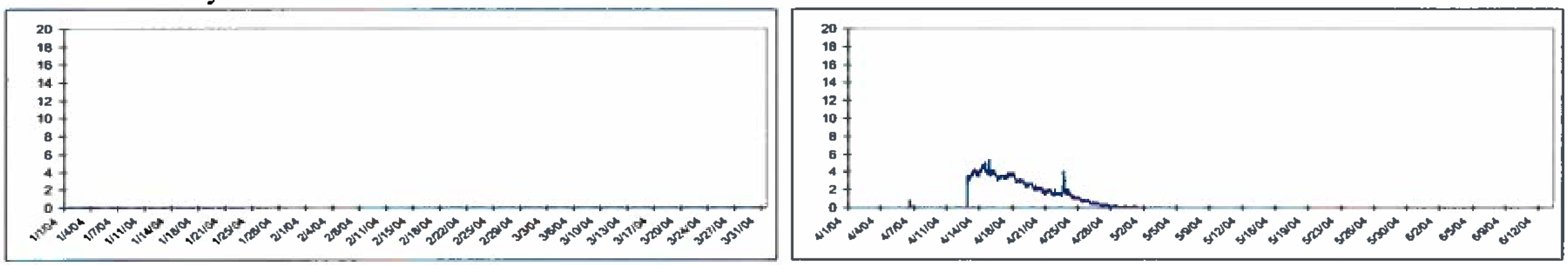


A series of events occur at E060 in August, the largest discharge of the year 749 cfs occurred August 23rd, followed by 243 cfs discharge September 6th. No data at E050 from May 22 to early August. The time scale of chart includes only August and September. E050 maximum discharge is 43 cfs August 23rd. E110 maximum discharge of 55 cfs also occurs August 23rd which appears low considering the 749 cfs discharge at E060. No data for period during late August to early October and unclear about type of event July 28th to August 8th.

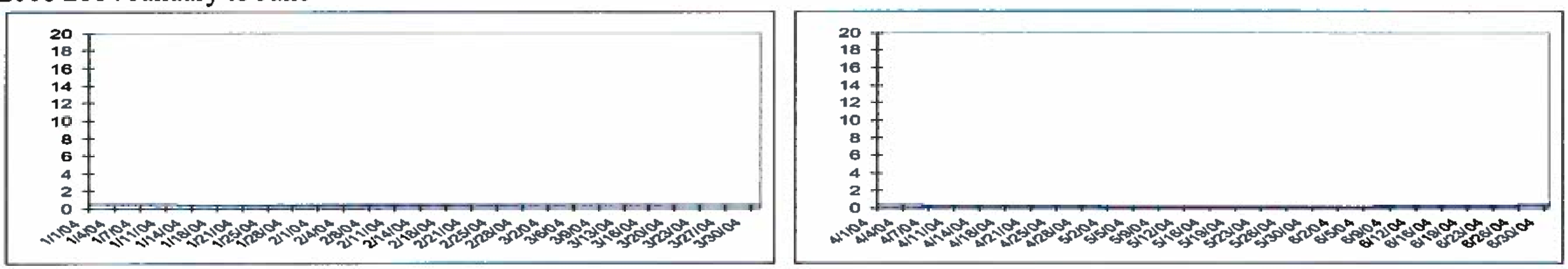
E060 2004 January to June



E050 2004 January to June

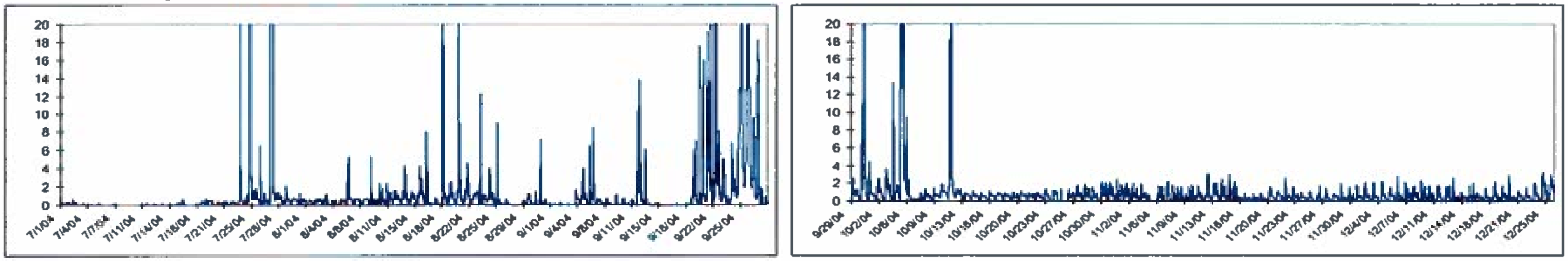


E110 2004 January to June

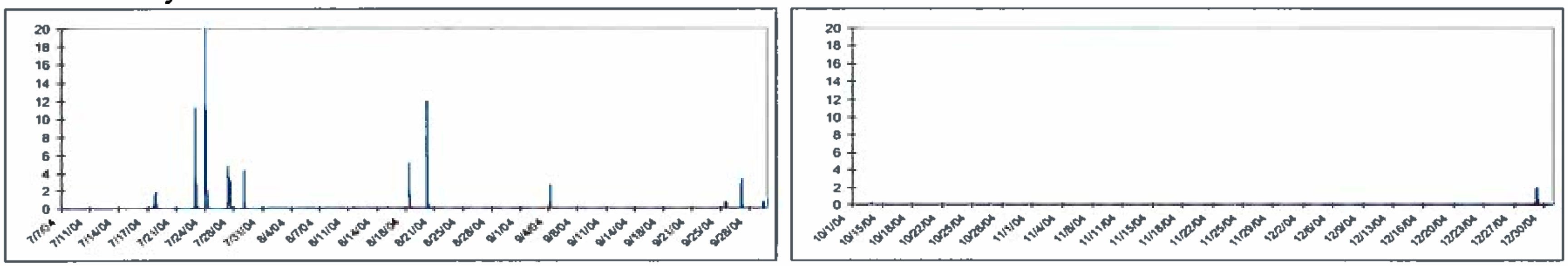


LANL reported that precipitation was normal in 2004, following six consecutive years of below-average amounts. (Shaull et al., 2005). Regular flow pulses up to 24 cfs from January to March may be Bayo wastewater discharges possibly from back flushing filters. Unclear about event at end of March to April 17th, field observations identified snowmelt at the time but periods of 0 discharge was also identified. There are no flows recorded at E050 from January to April 13th. Snowmelt flows from then to early May. Field observations confirmed stage at 0.68 feet on the 13th and 0.70 feet on the 19th. No flow is recorded at E110.

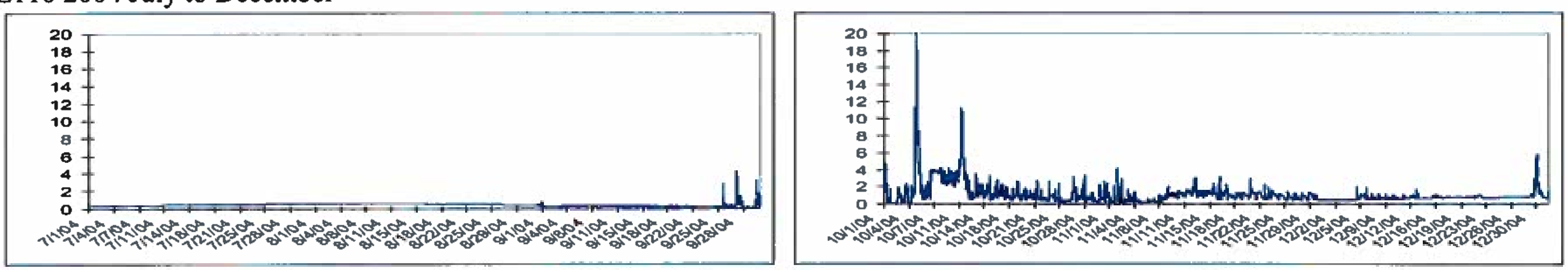
E060 2004 July to December



E050 2004 July to December



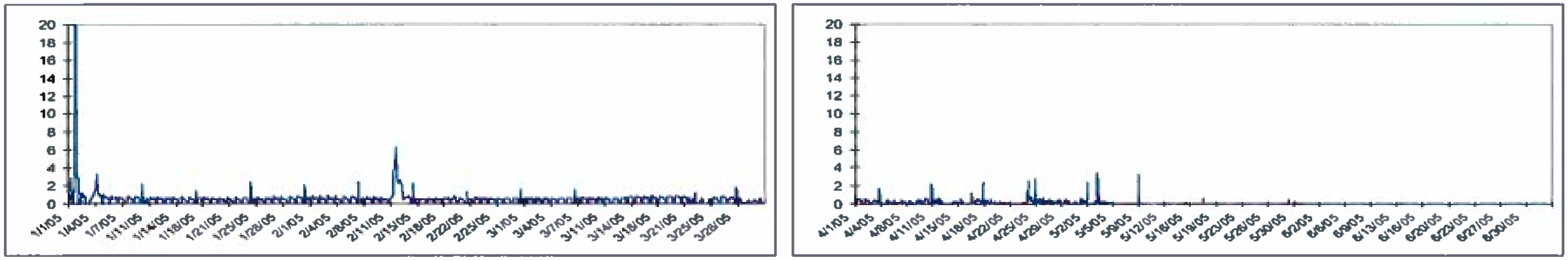
E110 2004 July to December



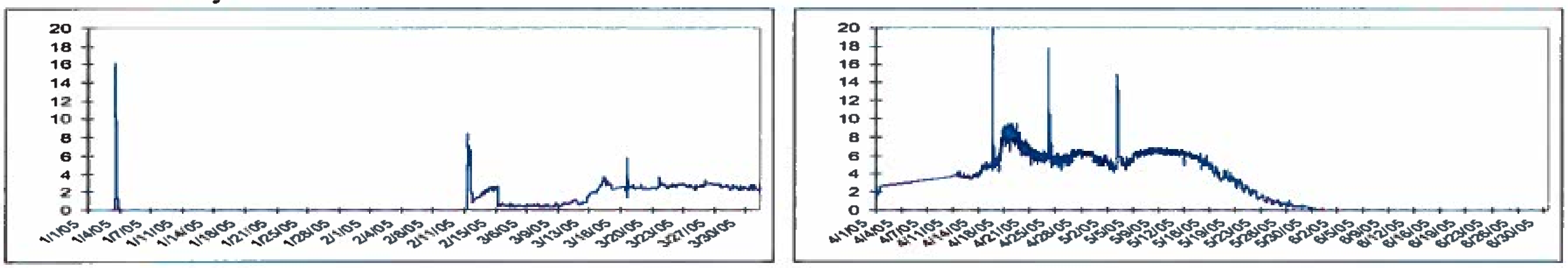
A series of monsoonal storm events begin June 23rd producing discharges at E060 up to 504 cfs June 24th ,the largest of the year, and 262 cfs June 27th. Storm events were fairly common to October. Infrequent and moderate discharge up to 34 cfs occurs at E050 during the monsoonal season and no flows are present during October to December. There are no flows recorded during July to September at

E110, although questions arise regarding 500 cfs discharge at lower Pueblo not arriving at this station. We suspect discharge as great as 200 cfs may have occurred and flow meter equipment may have failed. In addition, samples were collected during two substantial flows on August 19^{th} and August 20^{th}. Alternatively, October flow at E110 is as great as 49 cfs on the 5th, originating from 77 cfs discharge at E060.

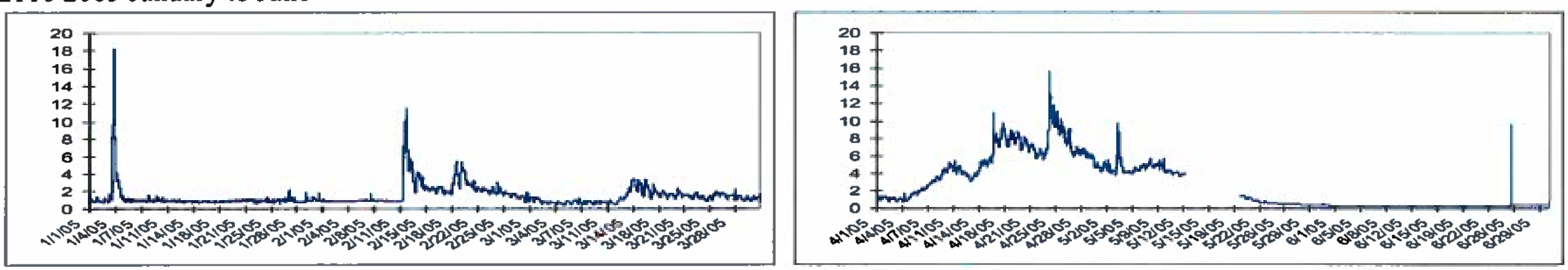
E060 2005 January to June



E050 2005 January to June

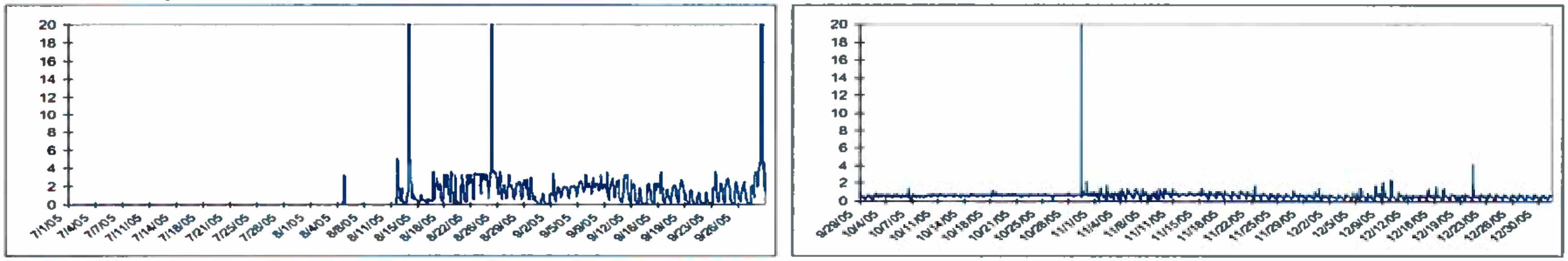


E110 2005 January to June

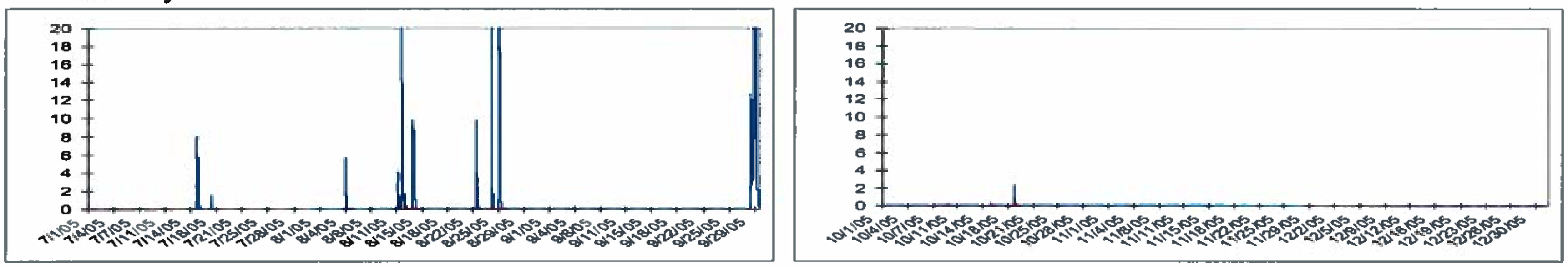


An apparent rain on snow event occurred January 1rst producing a 47 cfs discharge at E060, and later on the 4th, a 16 cfs discharge at E050 and an 18 cfs discharge at E110. Minimal flows are observed at E060 during the first six month period of 2005; particularly striking is absence of treatment plant discharge pulses. Snowmelt begins abruptly February 11th at both E050 and E110 and continues through end of May with occasional peak discharges exceeding 10 cfs from possible precipitation events; April 16th, April 24th, and May 3rd. LANL reported that approximately 710 and 680 acre feet of snowmelt flowed past E050 and E110 respectively during 2005.

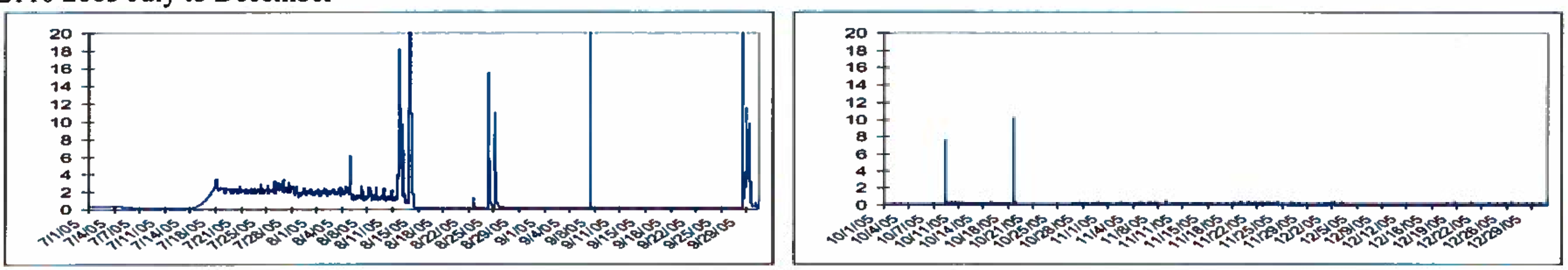
E060 2005 July to December



E050 2005 July to December



E110 2005 July to December

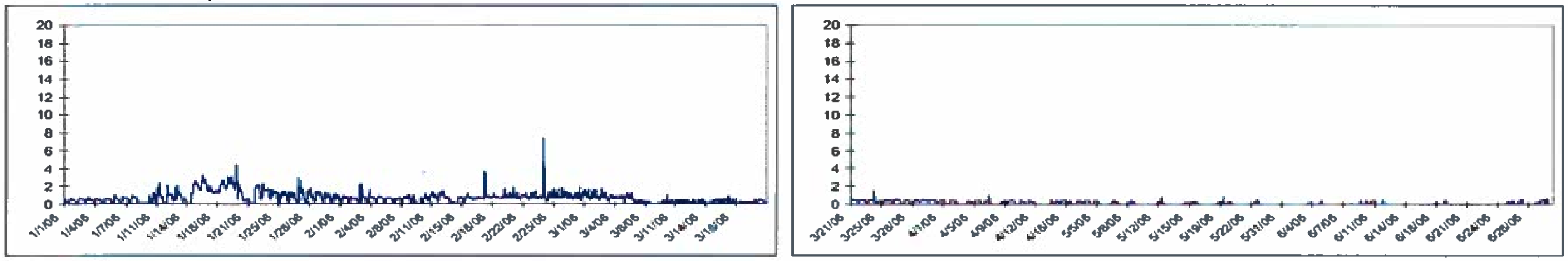


There are no flows recorded until August at E060. Flashy monsoonal events occur August 14th and August 24th; a longer duration flow on September 29th and a final event October 30th are recorded. LANL reported in their annual Surveillance report that the largest discharge of 2005 was 116 cfs at E060, although a shorter duration flow of 130 cfs is noted here at October 30th. The August and September events are somewhat replicated at these stations and demonstrate the influences from Pueblo and mid Los Alamos at E110.

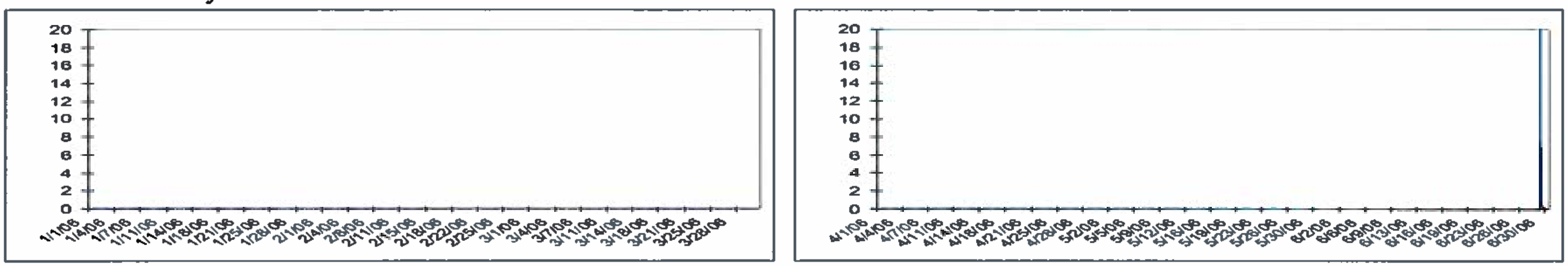
The largest E110 flow occurs August 12th through the 13th and September 28th with 36 and 37 cfs discharges. The August flows appear to originate from mid Los Alamos canyon while the September event probably originates from Guaje canyon although data is not available from that canyon.

Earlier events in July were recorded and sampled by the Bureau. On July 17th we identified and sampled an event at E110 that may have flowed up to 50 cfs (a 24 inch stage increase). We suspect the LANL bubbler line may have been buried by sediments, reflected by the consistent yet unlikely 2 to 4 cfs discharge until the channel was re-incised on August 12th by an 18 cfs discharge. We also noted flows up to 50 cfs at Bureau stations PU4.1 and PU3.1 were not observed at E060. The flows may have been dissipated by the wetlands or not recorded due to flow meter failure.

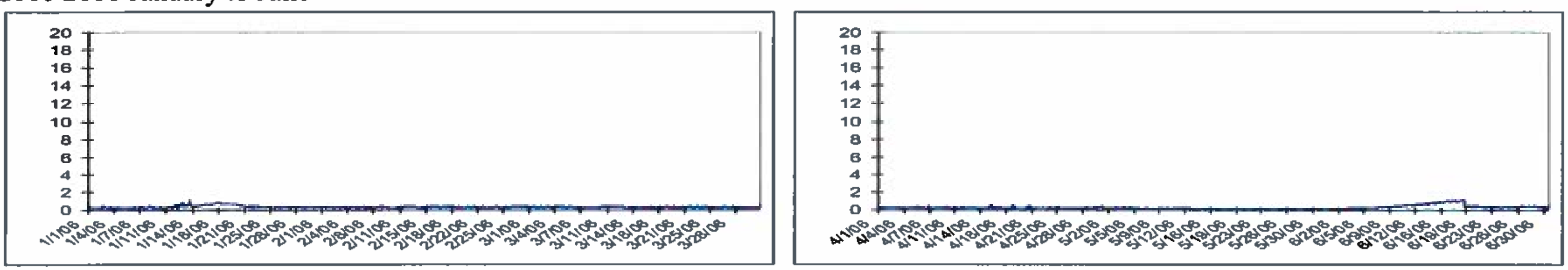
E060 2006 January to June



E050 2006 January to June

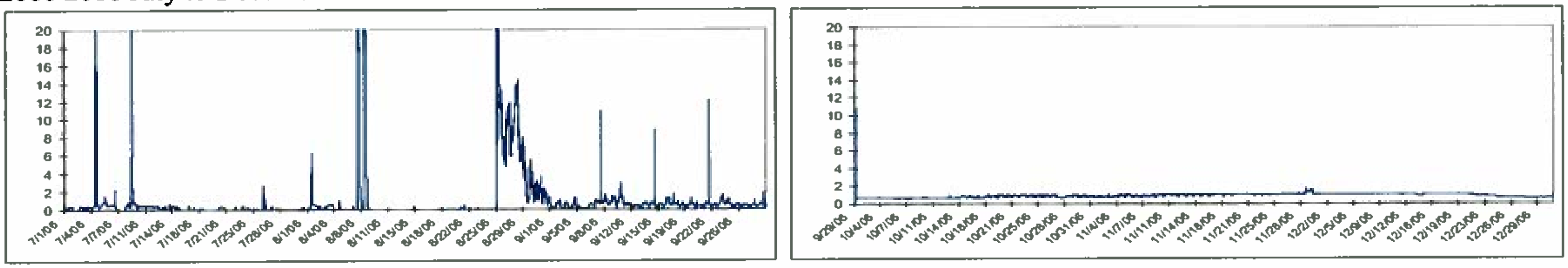


E110 2006 January to June

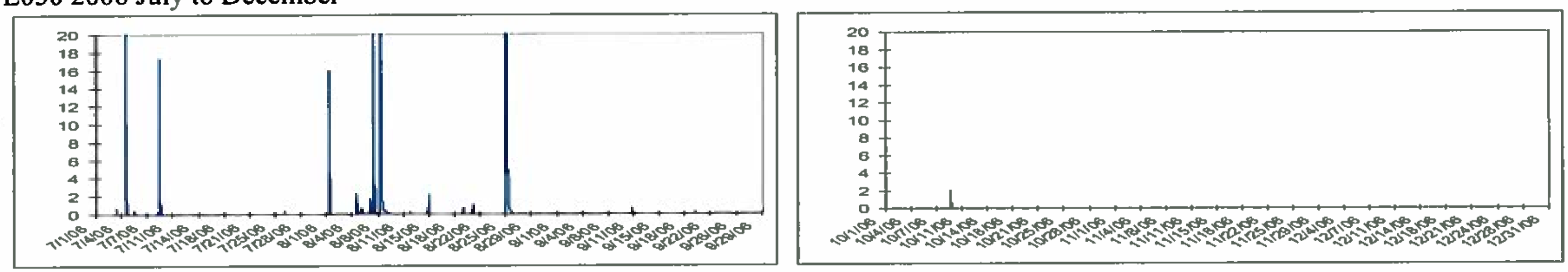


Flows during the first six months are unexceptional, minimal but regular discharge is evident from the treatment plant. The absence of snowmelt is evident. No flow is recorded at E050 or E110 until a June 29th 26 cfs discharge at E050.

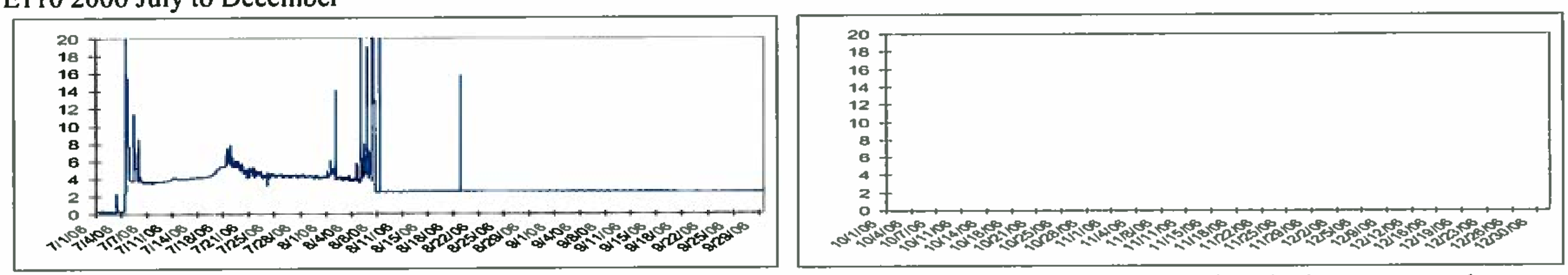
E060 2006 July to December



E050 2006 July to December



E110 2006 July to December



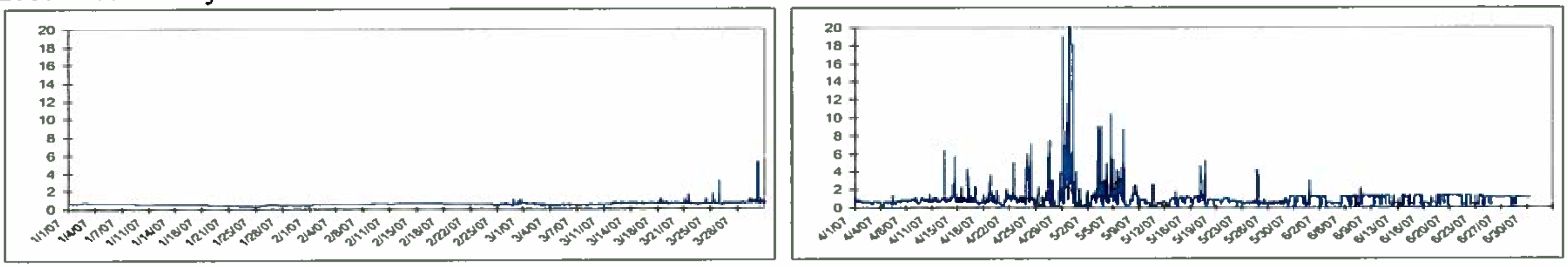
A series of monsoonal events occur in early July producing a combined 265 cfs discharge from E050 and E060 that progressed downstream to E110 generating a 68 cfs discharge there. The channel at E110 may have aggraded or water was impounded causing the flow meter to register a continuous and unlikely discharge of 4 cfs. Intermittent field observations from early July to mid August indicated zero discharge. Flows may be underestimated or not recorded. For example, Bureau flow meters identified two flows on July

6th, a 12.7 inch stage increase at 05:30 and 11 inch increase at 20:30, equivalent to approximate 23 cfs discharge. Here they are reported as near 10 cfs peak discharge. An approximate 70 cfs discharge (25 inch stage increase) was recorded by Bureau flow meters on July 9th, but not recorded by LANL. Flows were also noted on July 9th at E050 and E060.

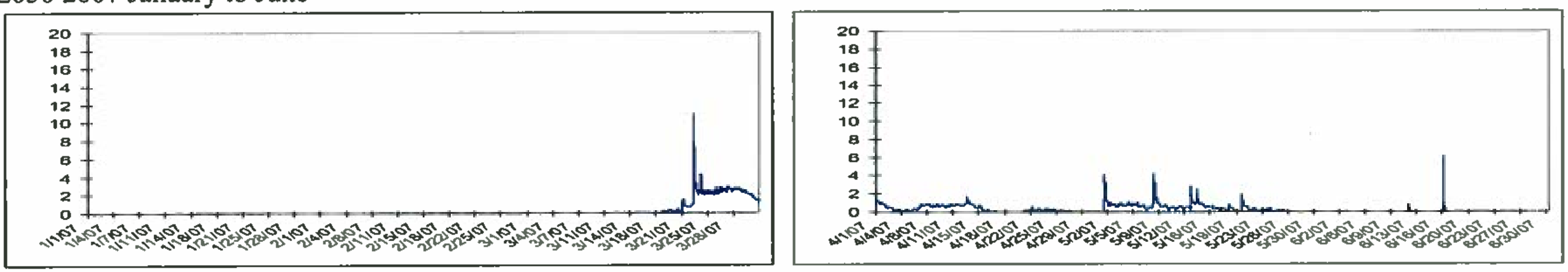
An extraordinary series of events begin in early August and end in late August. On August 8th, a combined discharge of approximately 2178 cfs, 1926 cfs from E060 and 252 cfs from E050, ripped through lower Los Alamos Canyon generating an estimate discharge at E110 of 1749 cfs. The flood destroyed the LANL gage, and only coincidently was Oversight Bureau field staff on site to replace the Bureau flow equipment for part of the event. Another event on the 25th of August generated a combined discharge below E050 and E060 of 292 cfs. Discharge was not identified by the LANL gage equipment at E110, but OB equipment recorded an approximate 89 cfs peak discharge there. LANL reported in the 2006 Environmental Surveillance report that the August 8 storm was centered over the community of Los Alamos and produced the largest peak runoff event of record in Pueblo Canyon at 1930 cfs (Romero et al. 2007). The storm delivered approximately two inches of rainfall in one hour, which corresponds to between a 50 and 100 year return interval (NOAA 2006). The August 25 storm was centered over the central part of the Laboratory producing 2.15 inches of precipitation in three hours, approaching the intensity for a 100-year rainfall event. (LANL ESR, 2006).

An additional four minor flows occurred in September and October at E060, while no flows were recorded at E050 and E110.

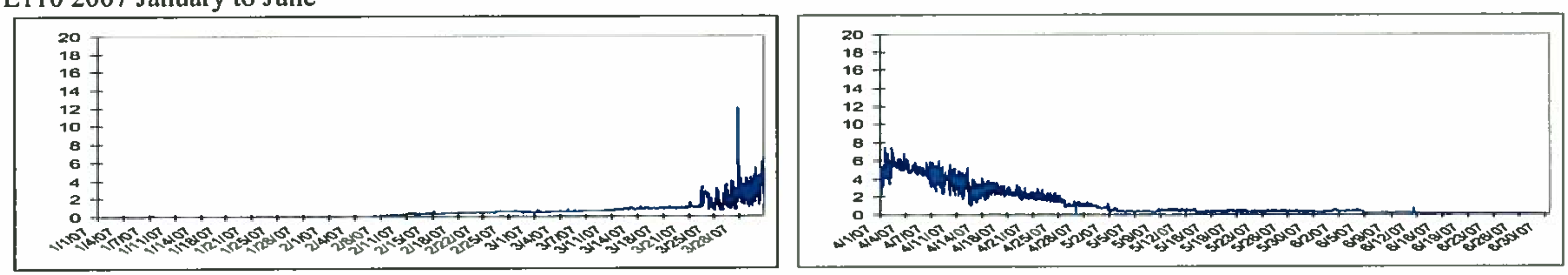
E060 2007 January to June



E050 2007 January to June

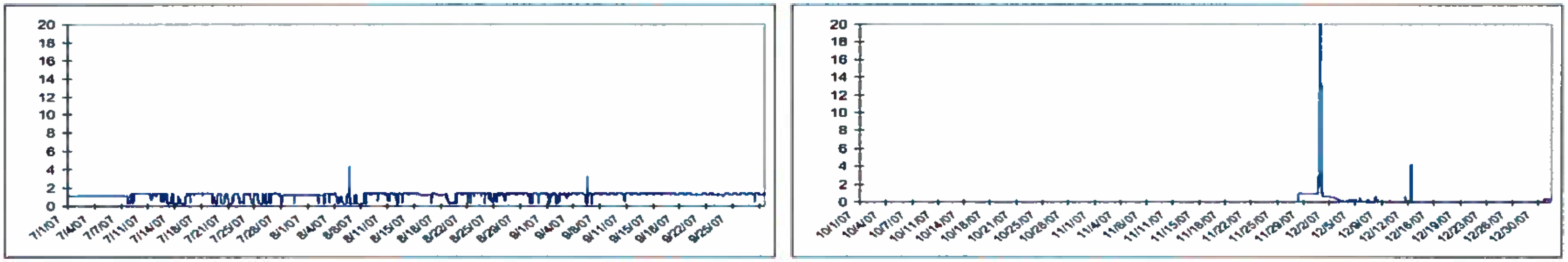


E110 2007 January to June

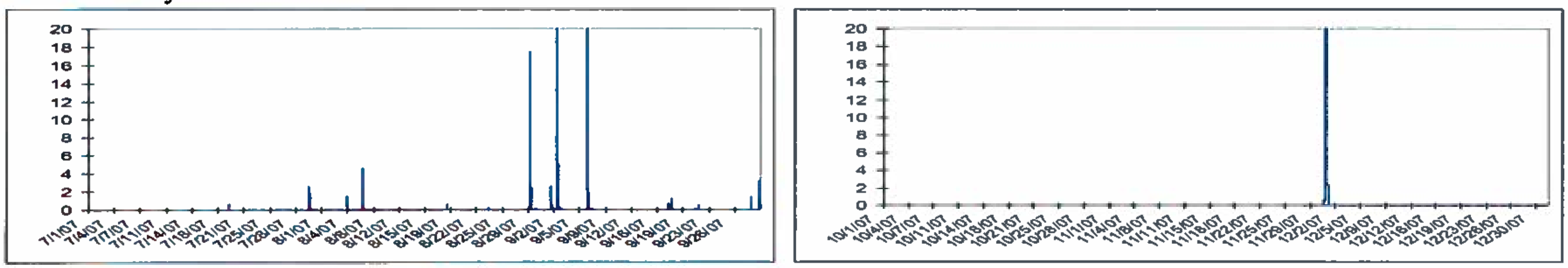


Flows during the first six months are unexceptional, regular discharge is minimal from the treatment plant. Snowmelt begins slowly during the middle of February at E110 possibly from Guaje. It begins in earnest at E050 and E110 by March and is largely finished by May. A series of four storm flows occur during April and May at E060. The largest discharge is 31 cfs April 30th.

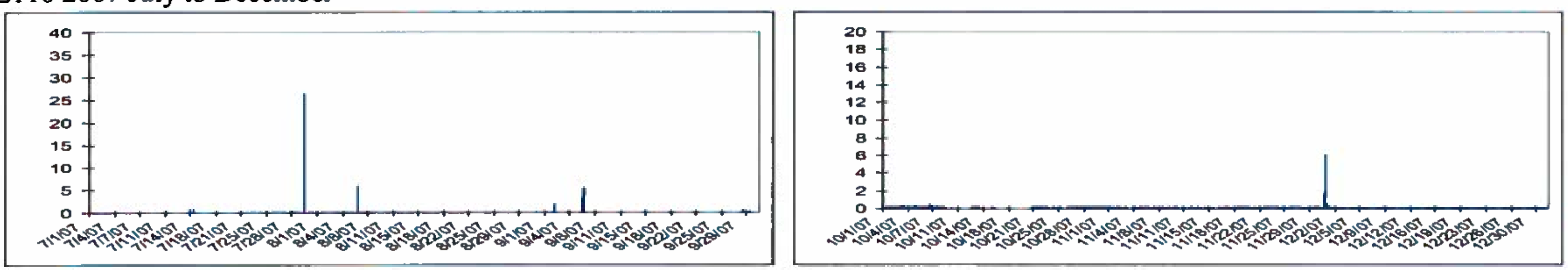
E060 2007 July to December



E050 2007 July to December

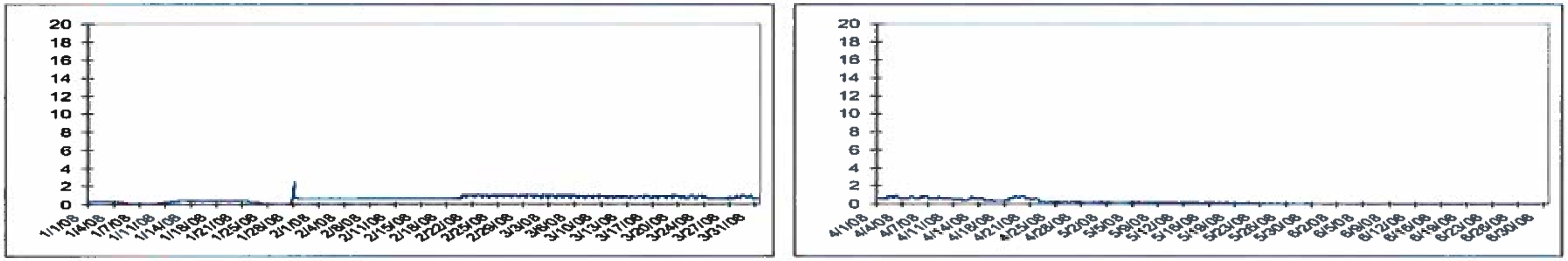


E110 2007 July to December

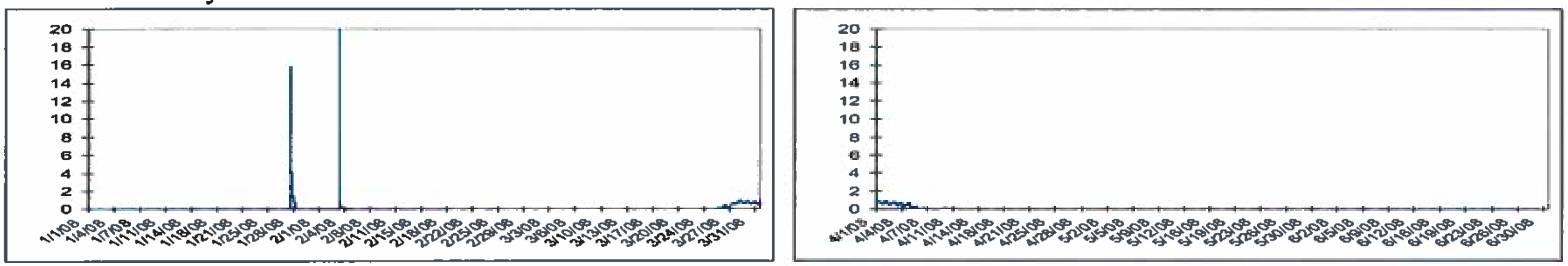


There are no flows recorded at E060 during the last six months of 2007 except a December 1rst event seen at all three stations. Combined discharge from E050 and E060 is 72 cfs, but measured less than 10 cfs at E110. A series of three flow events occur at E050 in late August and early September not exceeding 30 cfs. Of possible concern is multiple minor channels have developed within the valley floor at E060, and flows may have flowed around the gaging equipment at that site during this time. A new treatment plant has begun regular and substantial discharge October of 2007 and we would have expected occasional if not regular flow. This concern may be of little consequence due to lack of storm events.

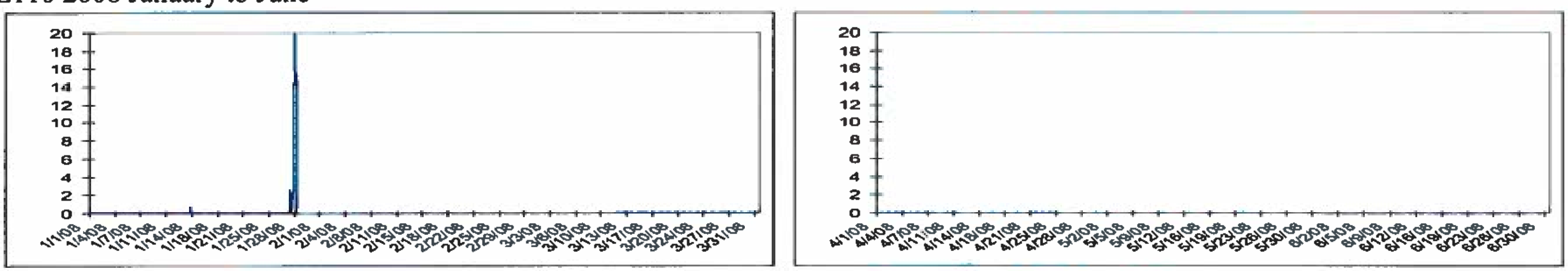
E060 2008 January to June



E050 2008 January to June

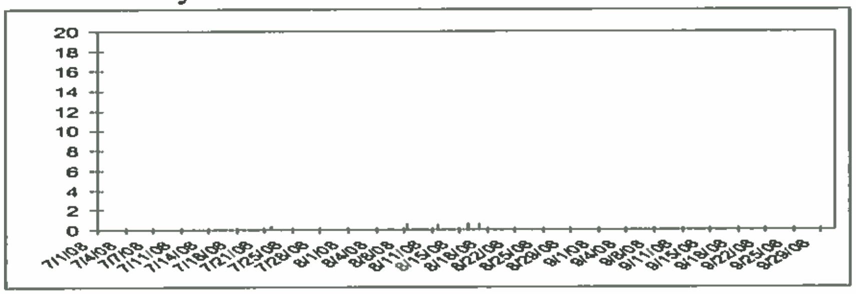


E110 2008 January to June

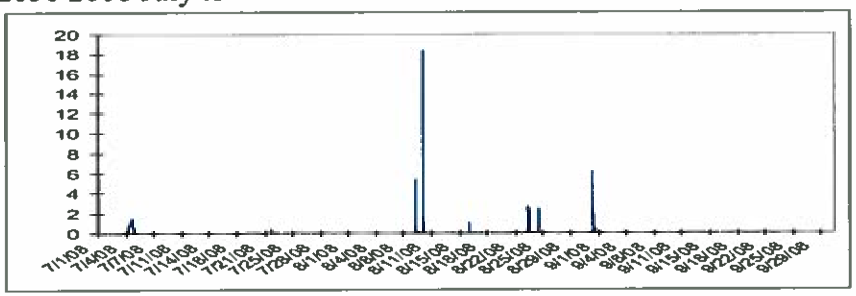


Flows during the first six months are unexceptional, regular discharge is evident from the treatment plant from February to end of April or May. Winter precipitation generates a 40 cfs discharge at E110 and 16 cfs at E050 January 28th, and a 23 cfs E050 discharge February 4th. Snowmelt is limited to a small duration in late March to early April at E050.

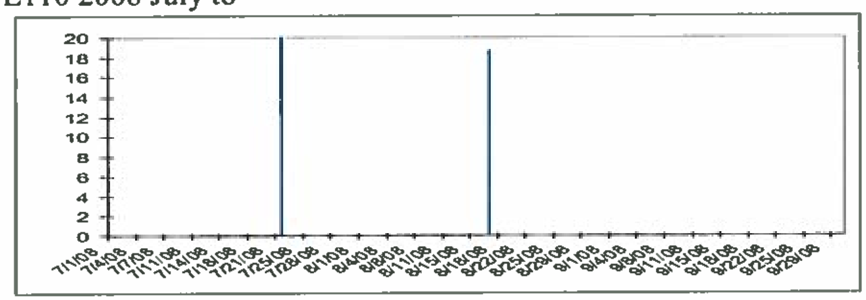
E060 2008 July to



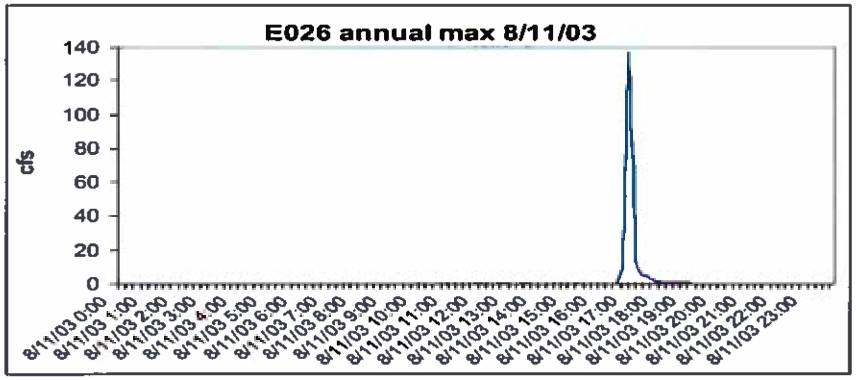
E050 2008 July to

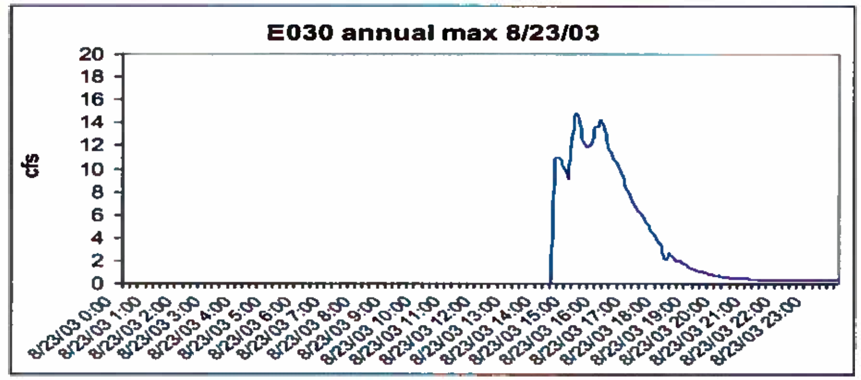


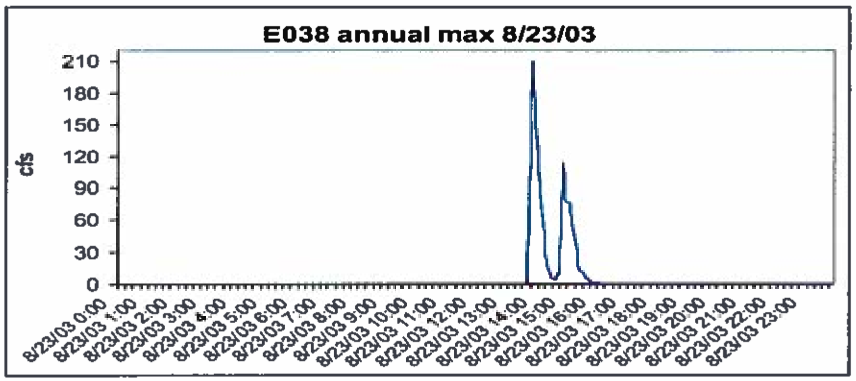
E110 2008 July to

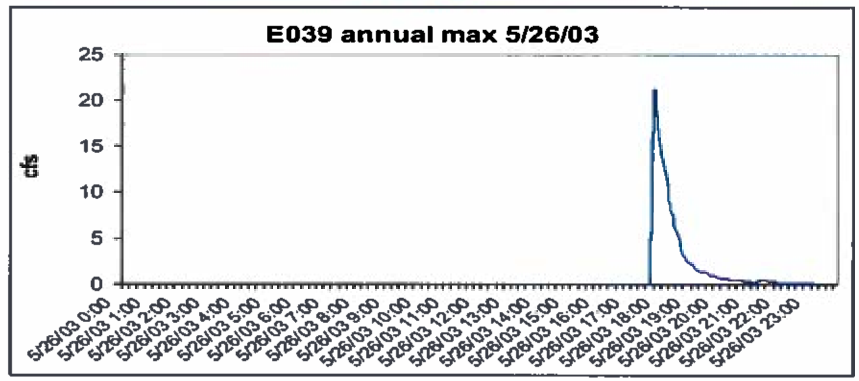


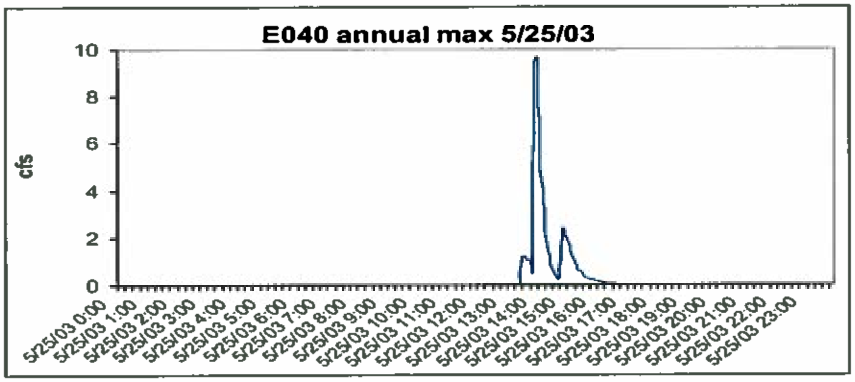
Max annual flows

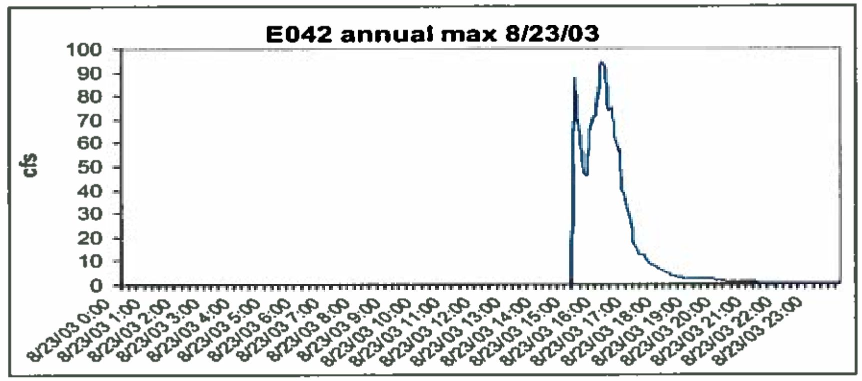


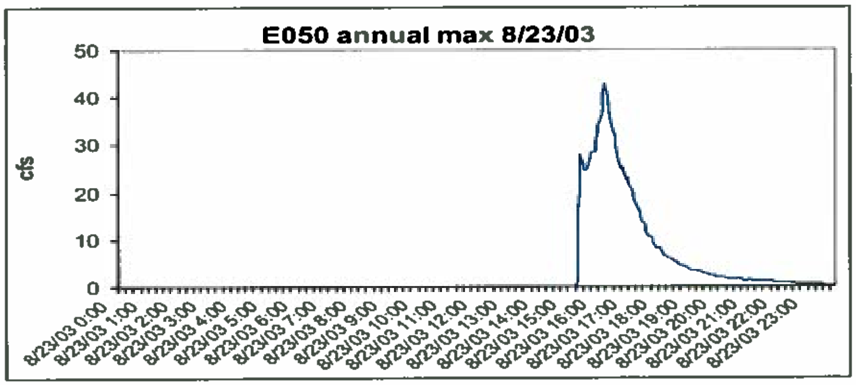


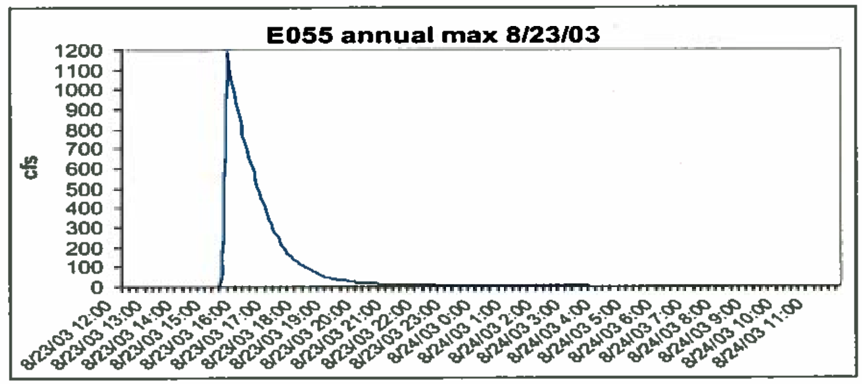


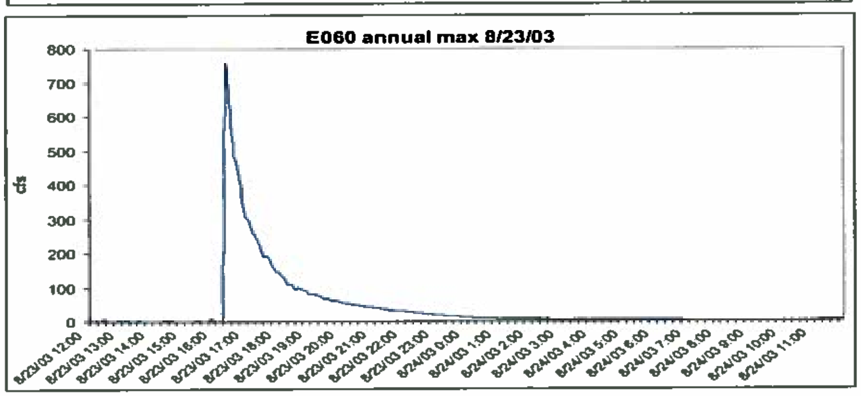


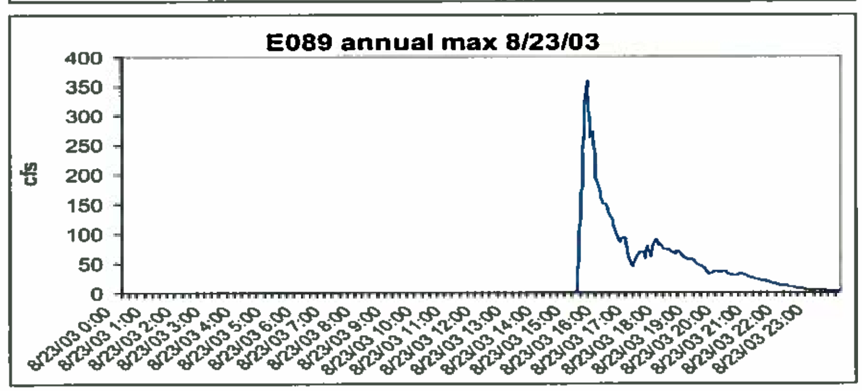

E040 annual max 5/25/03
cfs

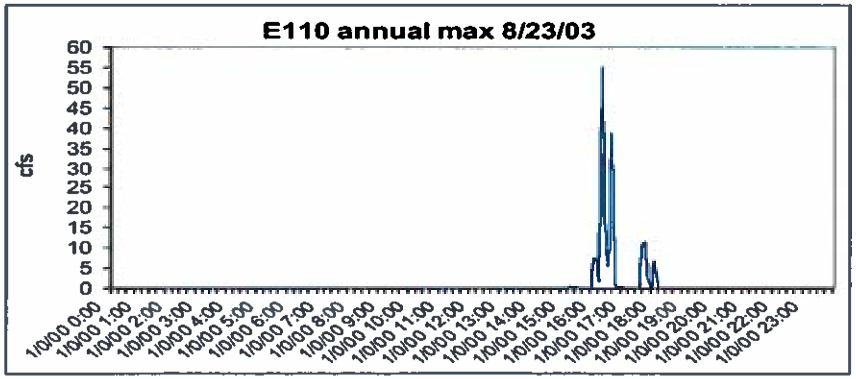

E042 annual max 8/23/03
cfs


E050 annual max 8/23/03
cfs


E055 annual max 8/23/03
cfs


E060 annual max 8/23/03
cfs


E089 annual max 8/23/03
cfs


E110 annual max 8/23/03
cfs
60
55
50
45
40
35
30
25
20
15
10
5
0
1/0/00 0:00
1/0/00 1:00
1/0/00 2:00
1/0/00 3:00
1/0/00 4:00
1/0/00 5:00
1/0/00 6:00
1/0/00 7:00
1/0/00 8:00
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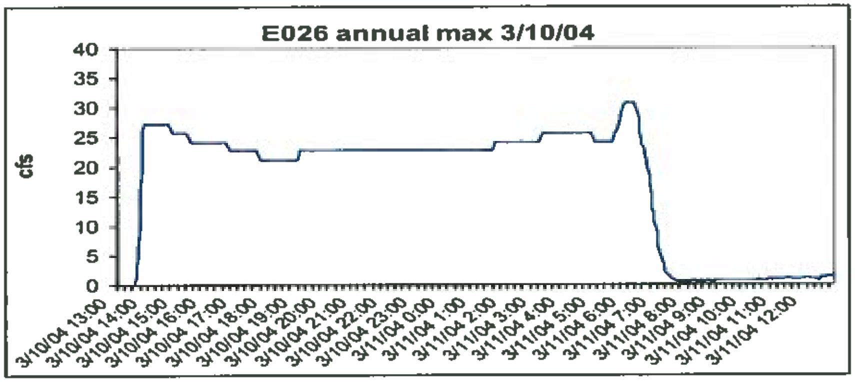
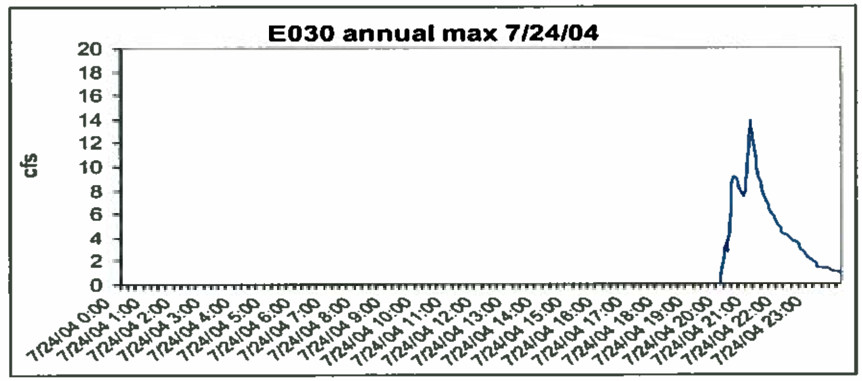
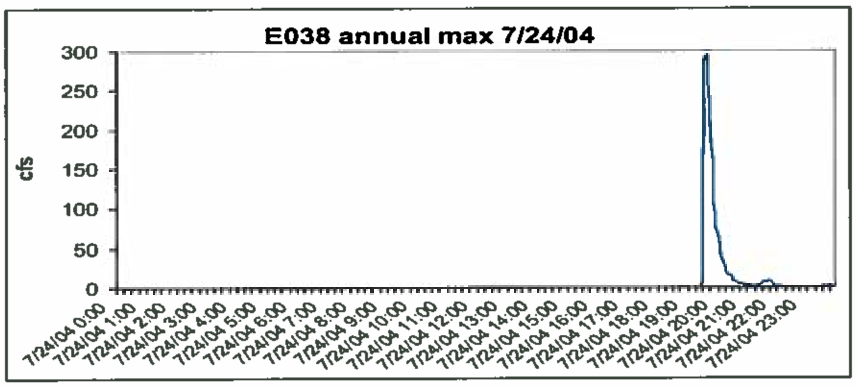
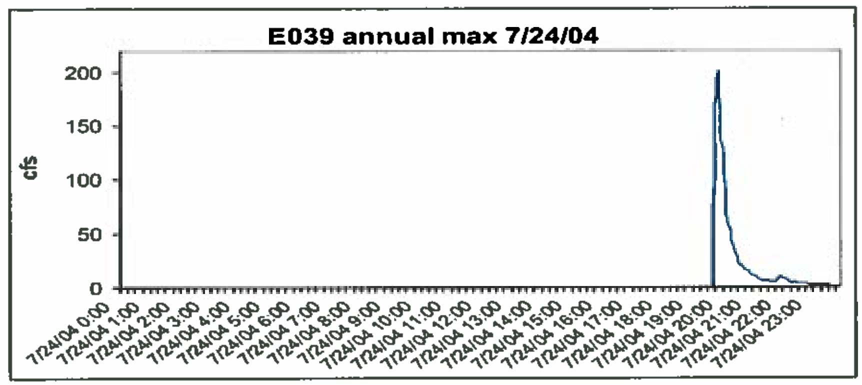
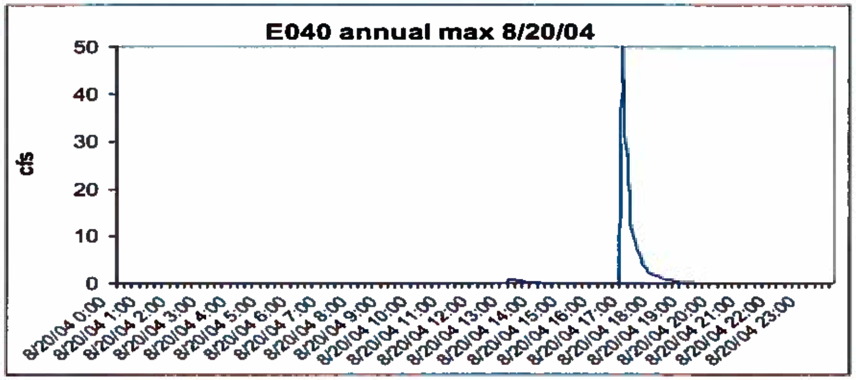
Max annual flows 2004

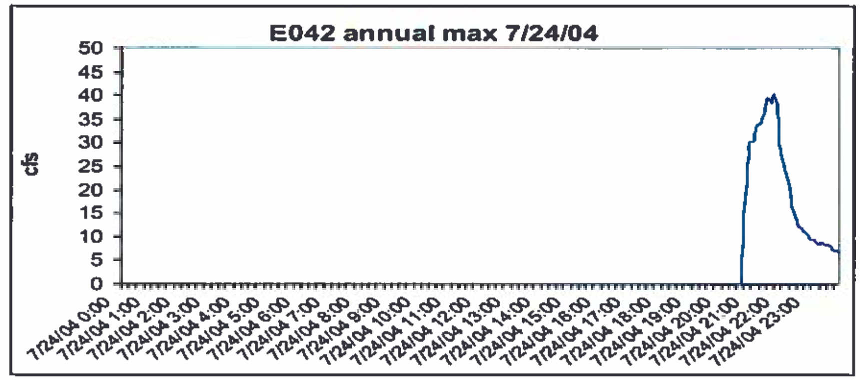


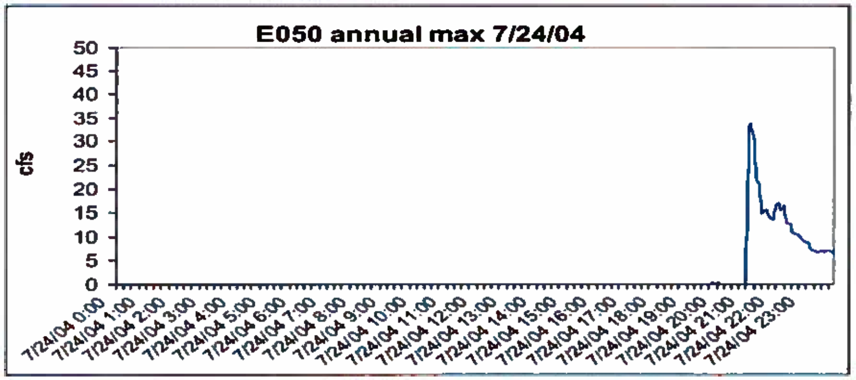


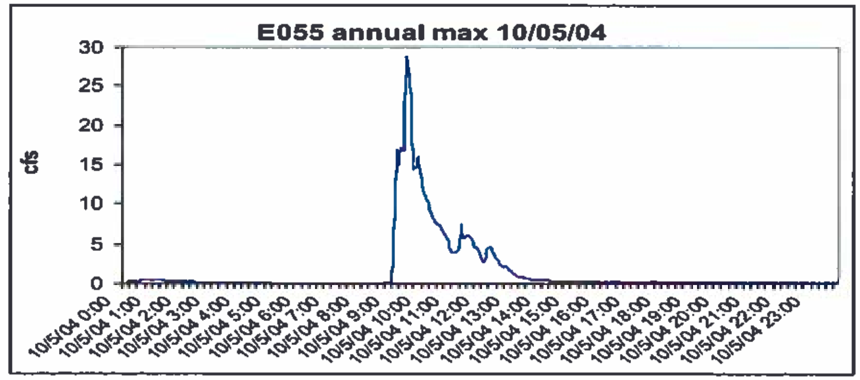


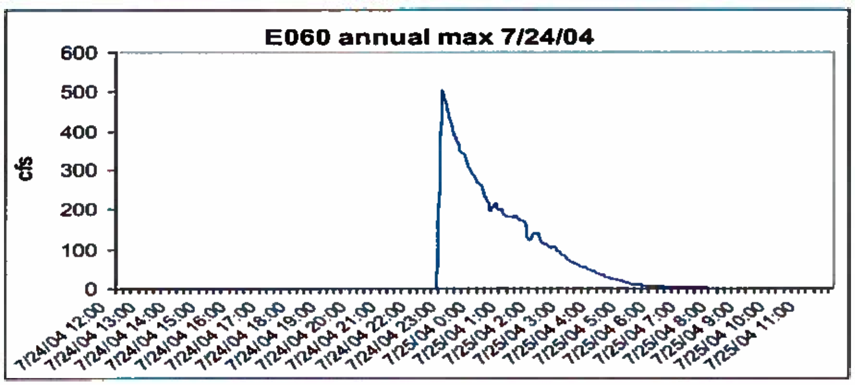


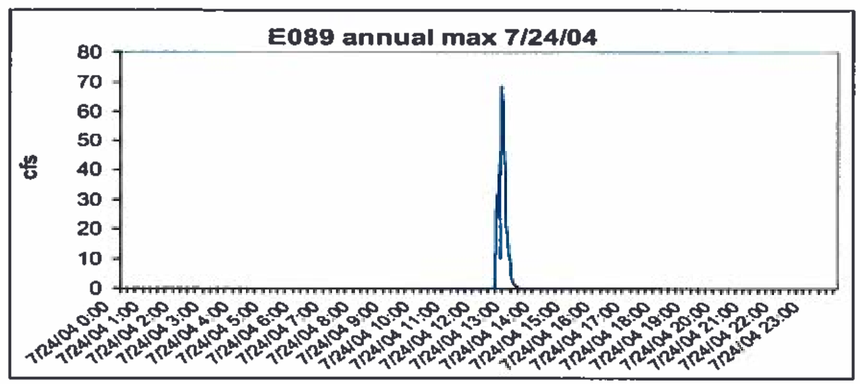

E040 annual max 8/20/04
cfs
50
40
30
20
10
0

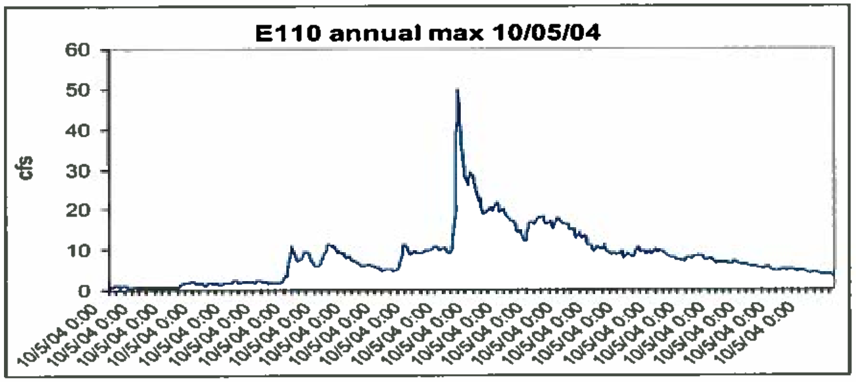

E042 annual max 7/24/04
cfs
50
45
40
35
30
25
20
15
10
5
0


E050 annual max 7/24/04
cfs
50
45
40
35
30
25
20
15
10
5
0

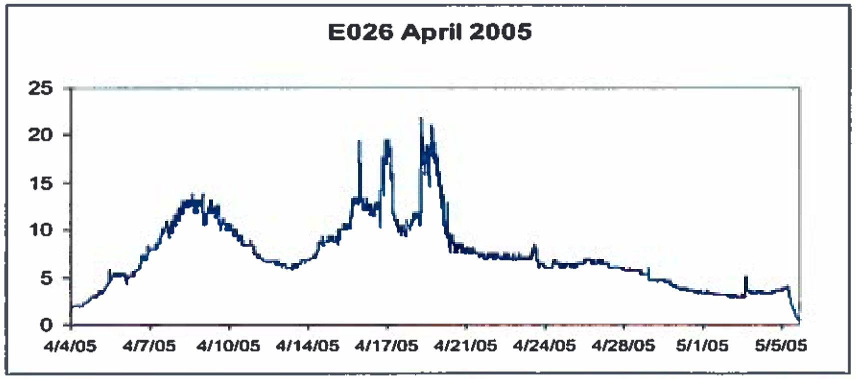

E055 annual max 10/05/04
cfs
30
25
20
15
10
5
0

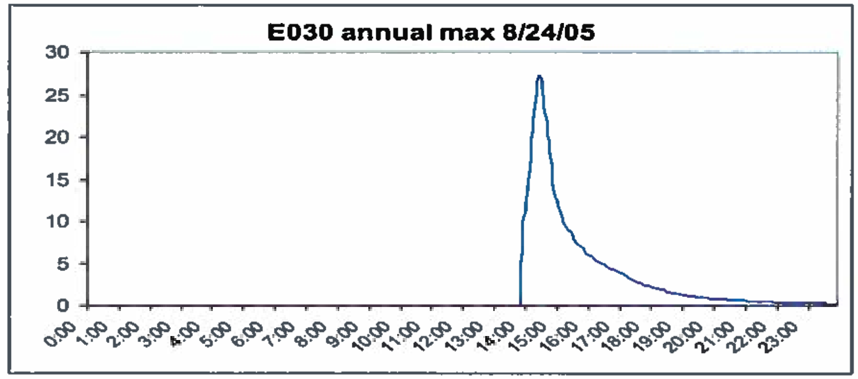

E060 annual max 7/24/04
cfs
600
500
400
300
200
100
0

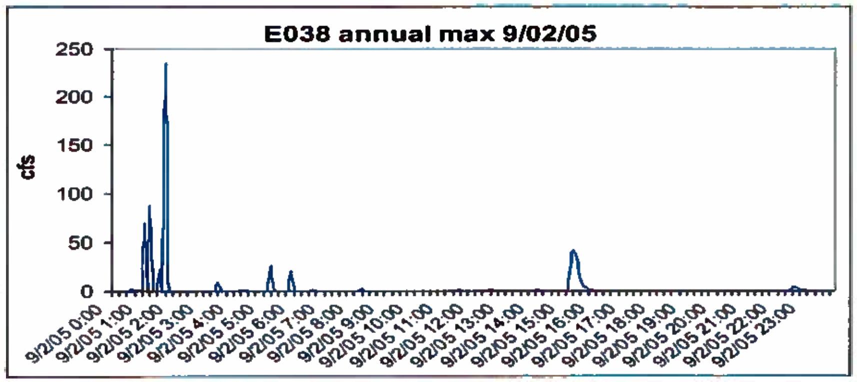

E089 annual max 7/24/04
cfs
80
70
60
50
40
30
20
10
0

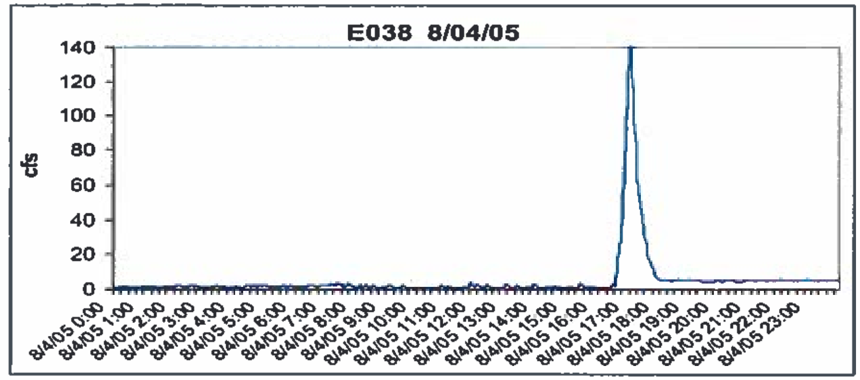

E110 annual max 10/05/04
cfs
60
50
40
30
20
10
0
10/5/04 0:00

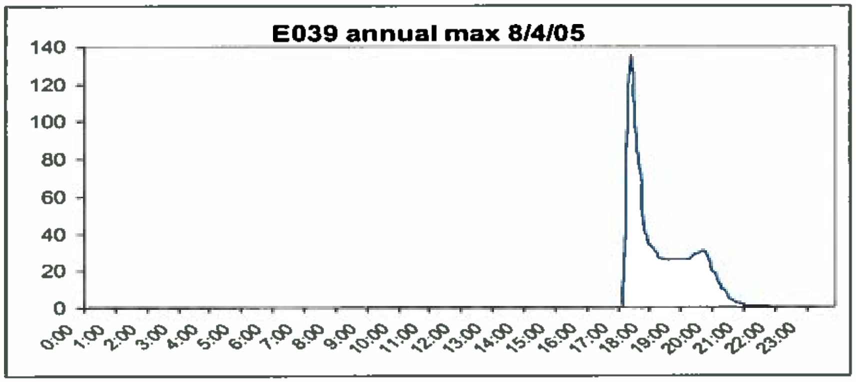
Max annual flows 2005

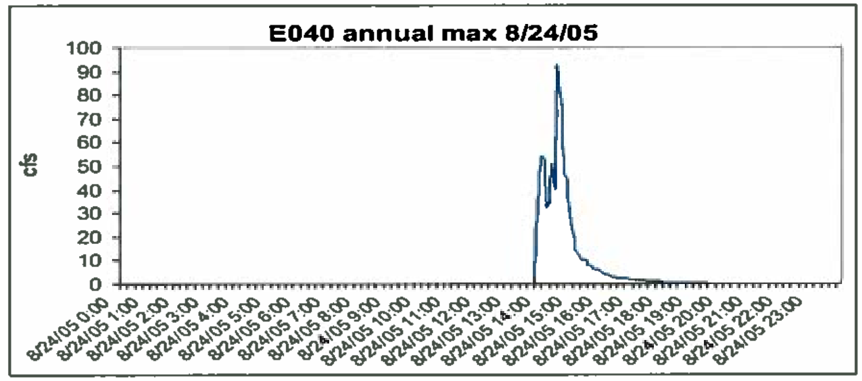


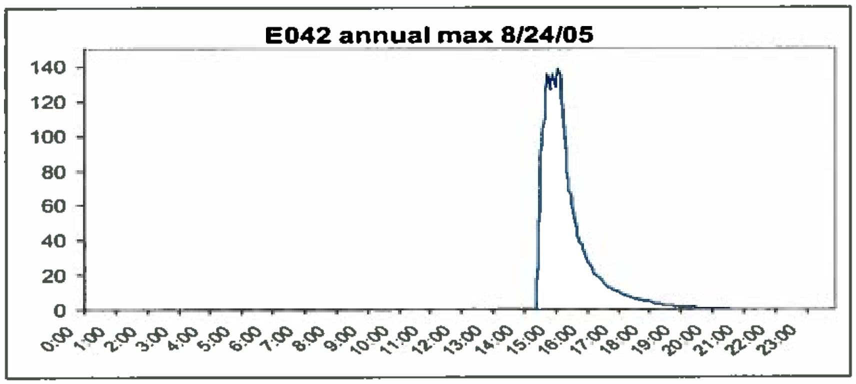


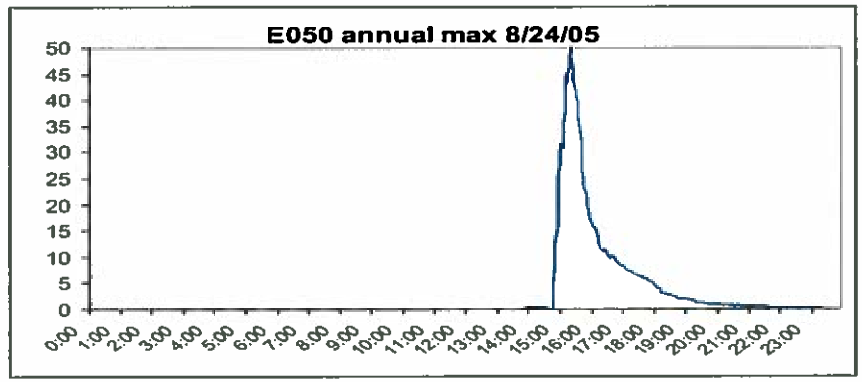


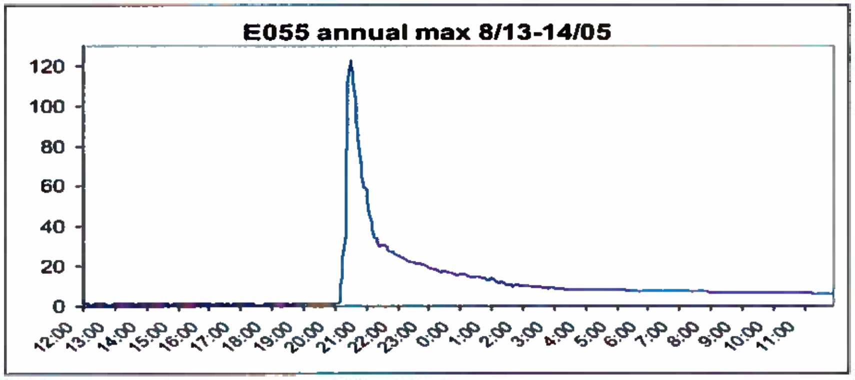


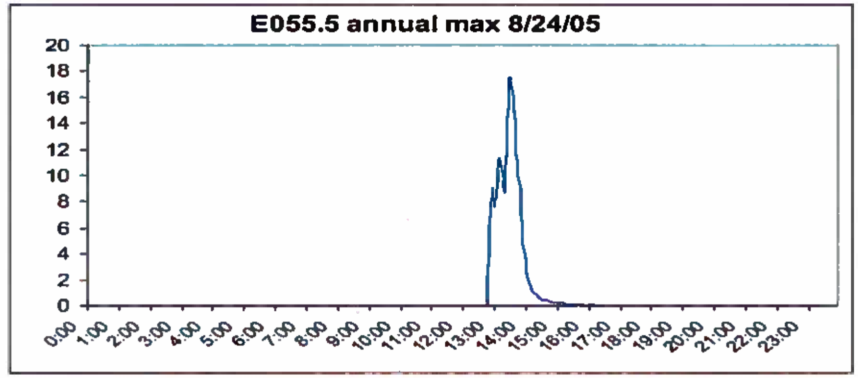

E039 annual max 8/4/05
140
120
100
80
60
40
20
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

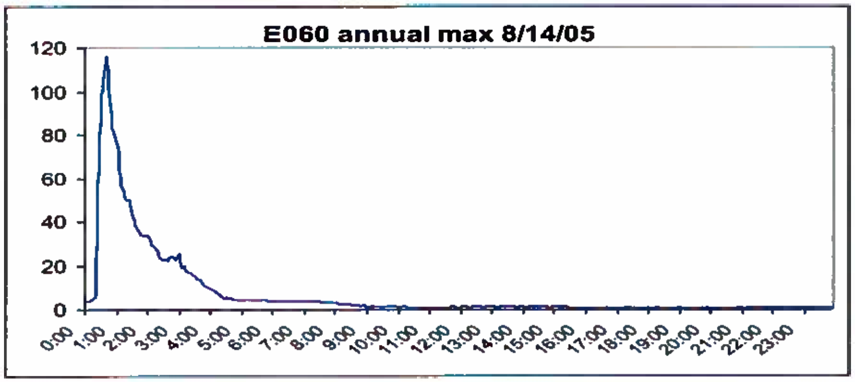

E040 annual max 8/24/05
cfs
100
90
80
70
60
50
40
30
20
10
0
8/24/05 0:00 8/24/05 1:00 8/24/05 2:00 8/24/05 3:00 8/24/05 4:00 8/24/05 5:00 8/24/05 6:00 8/24/05 7:00 8/24/05 8:00 8/24/05 9:00 8/24/05 10:00 8/24/05 11:00 8/24/05 12:00 8/24/05 13:00 8/24/05 14:00 8/24/05 15:00 8/24/05 16:00 8/24/05 17:00 8/24/05 18:00 8/24/05 19:00 8/24/05 20:00 8/24/05 21:00 8/24/05 22:00 8/24/05 23:00

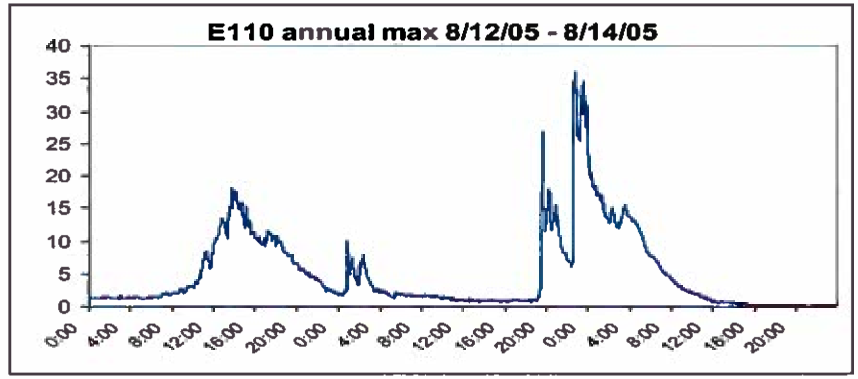

E042 annual max 8/24/05
140
120
100
80
60
40
20
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00


E050 annual max 8/24/05
50
45
40
35
30
25
20
15
10
5
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

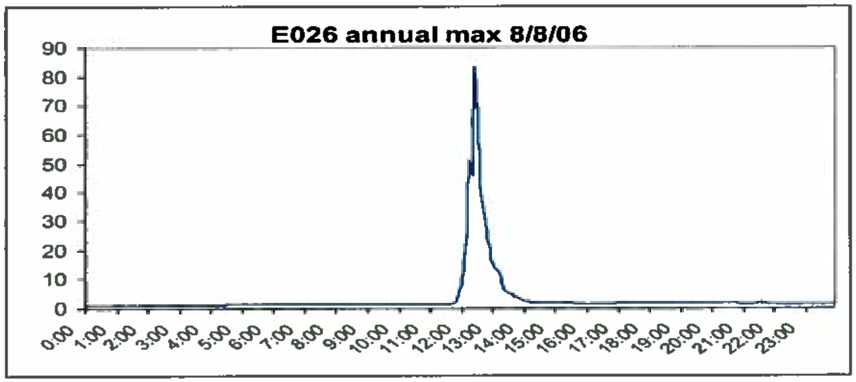

E055 annual max 8/13-14/05
120
100
80
60
40
20
0
12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00

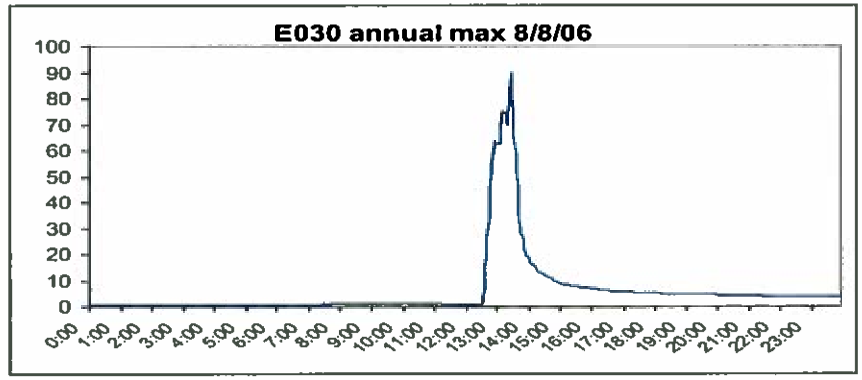

E055.5 annual max 8/24/05
20
18
16
14
12
10
8
6
4
2
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

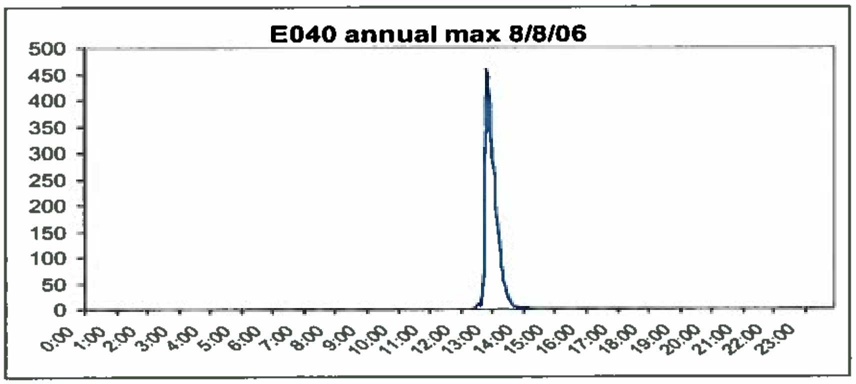

E060 annual max 8/14/05
120
100
80
60
40
20
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

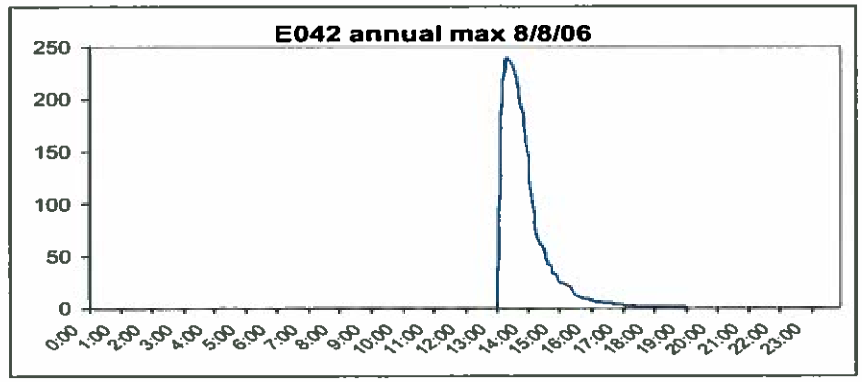

E110 annual max 8/12/05 - 8/14/05
40
35
30
25
20
15
10
5
0
0:00 4:00 8:00 12:00 16:00 20:00 0:00 4:00 8:00 12:00 16:00 20:00 0:00 4:00 8:00 12:00 16:00 20:00

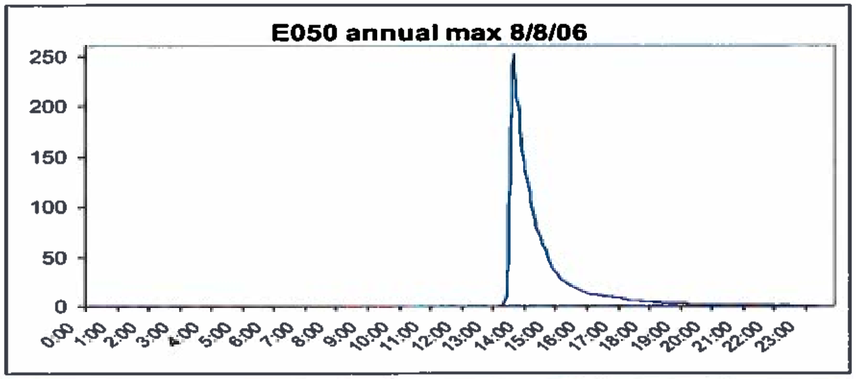
Max annual flows 2006

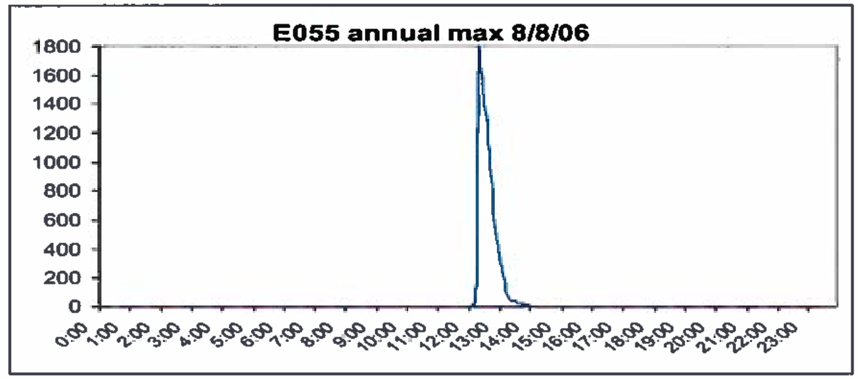


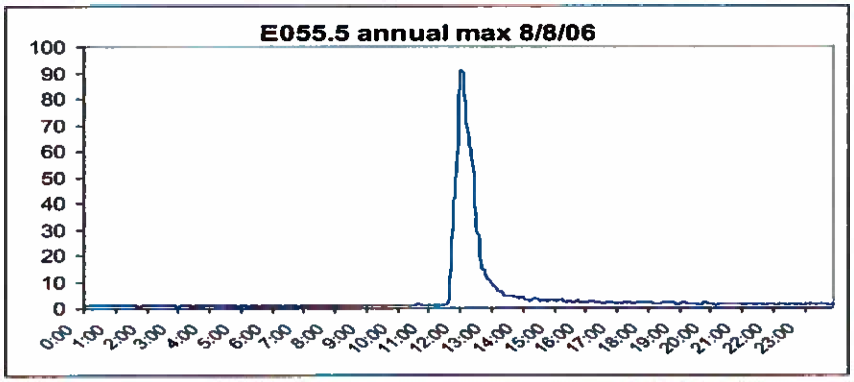


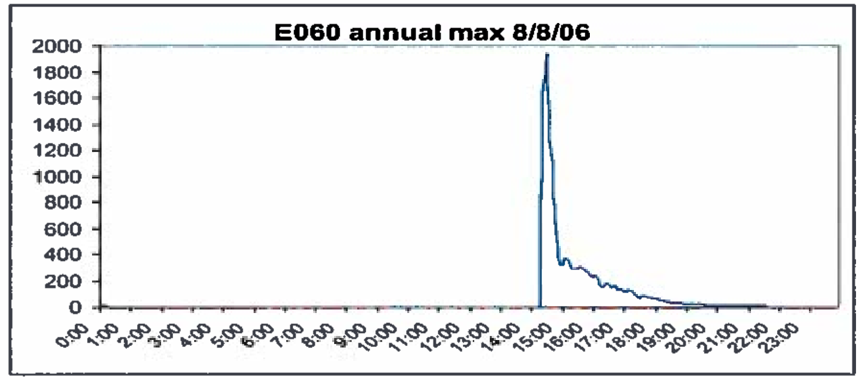


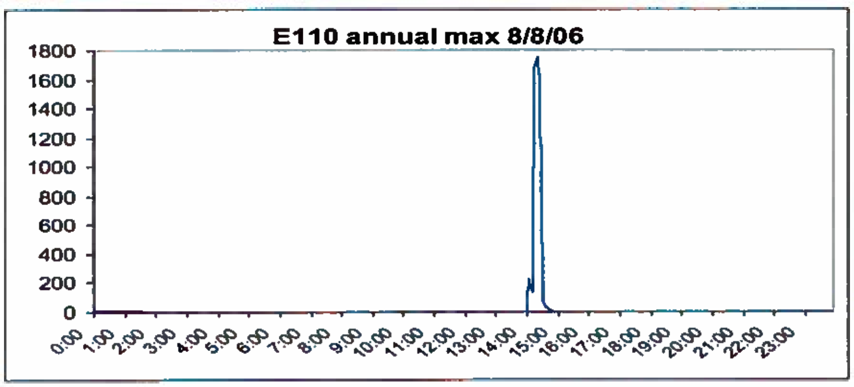



E050 annual max 8/8/06
250
200
150
100
50
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

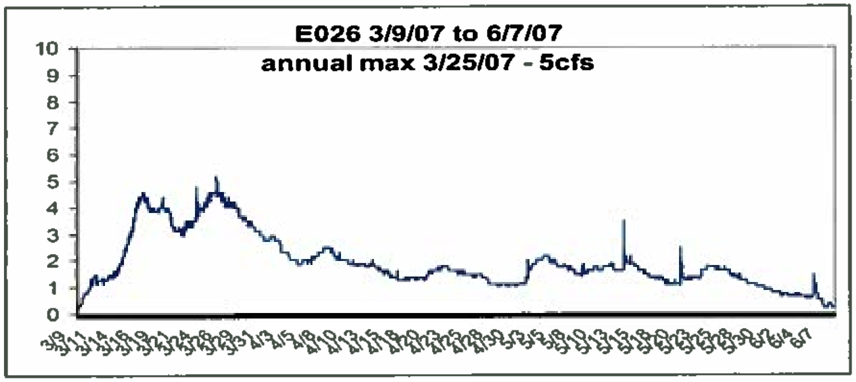

E055 annual max 8/8/06
1800
1600
1400
1200
1000
800
600
400
200
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

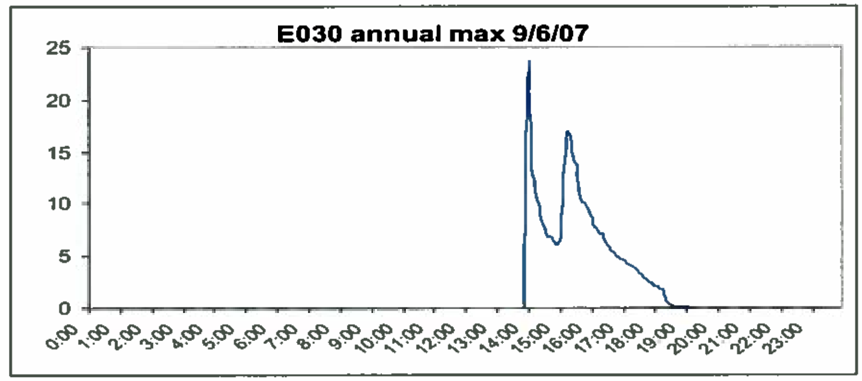

E055.5 annual max 8/8/06
100
90
80
70
60
50
40
30
20
10
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

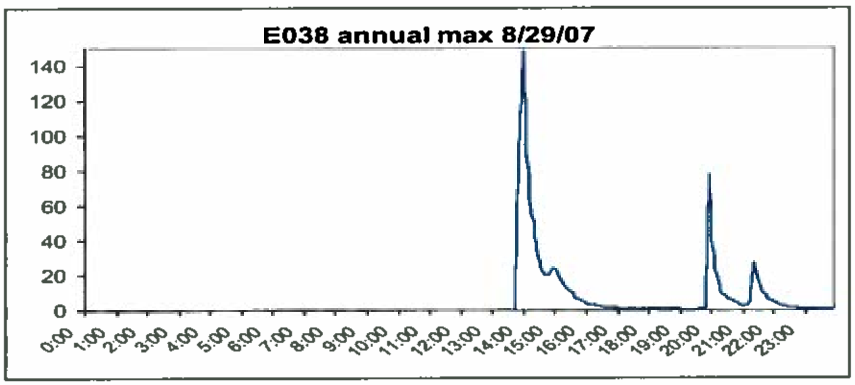

E060 annual max 8/8/06
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

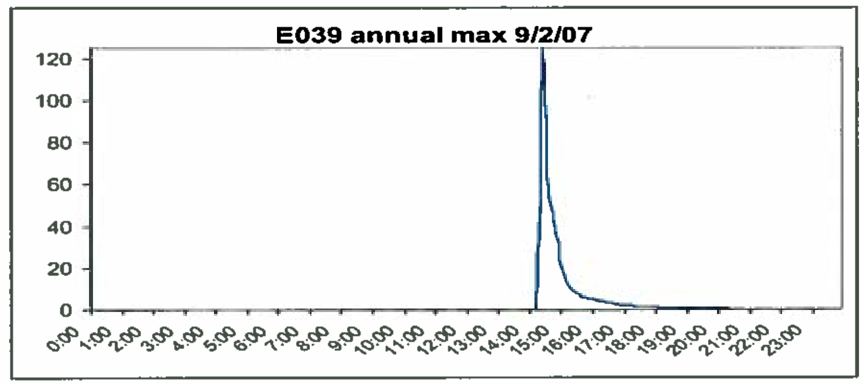

E110 annual max 8/8/06
1800
1600
1400
1200
1000
800
600
400
200
0
0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

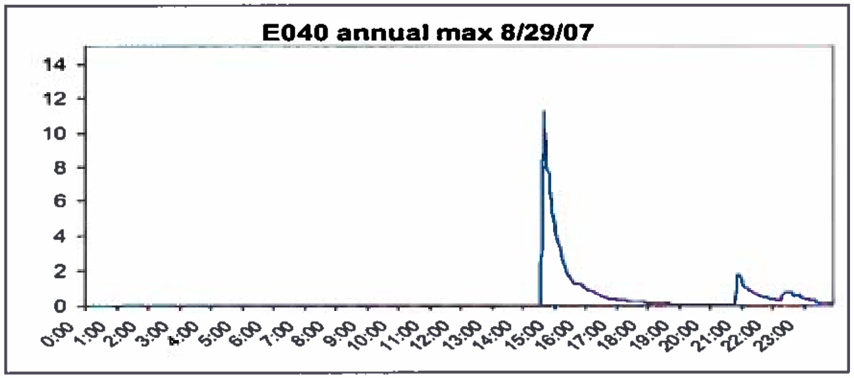
Max flows 2007

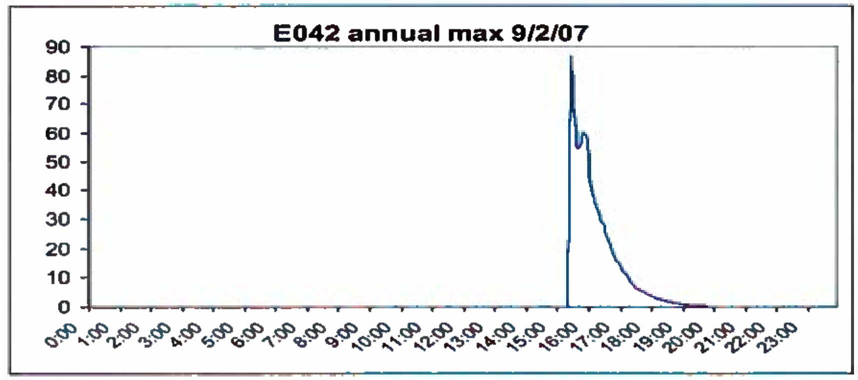


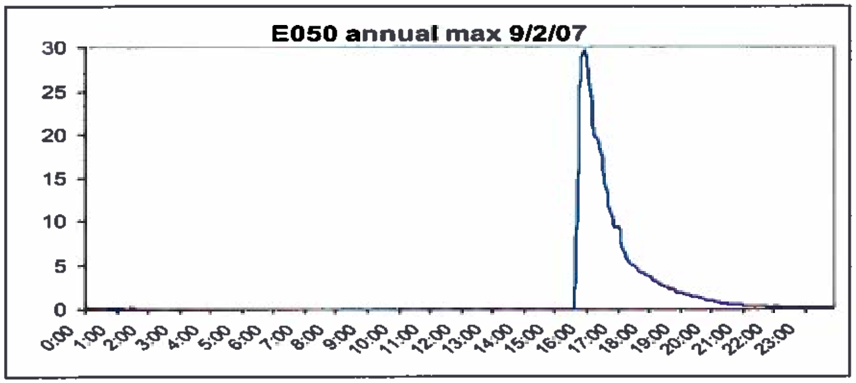


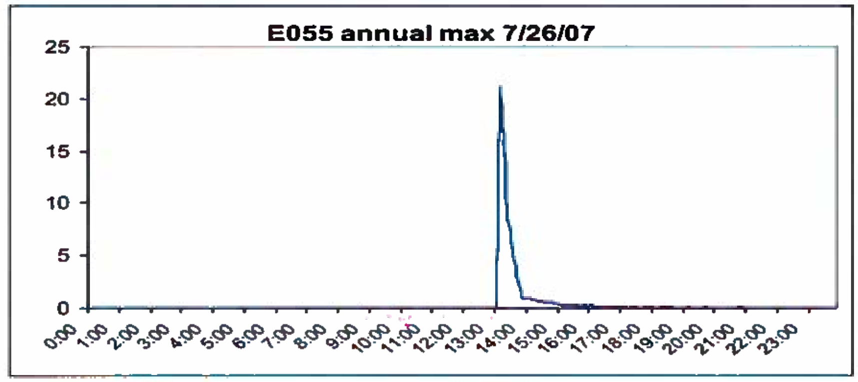


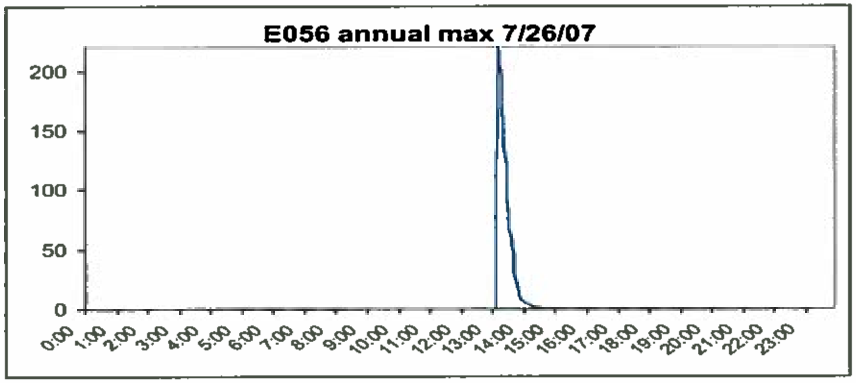


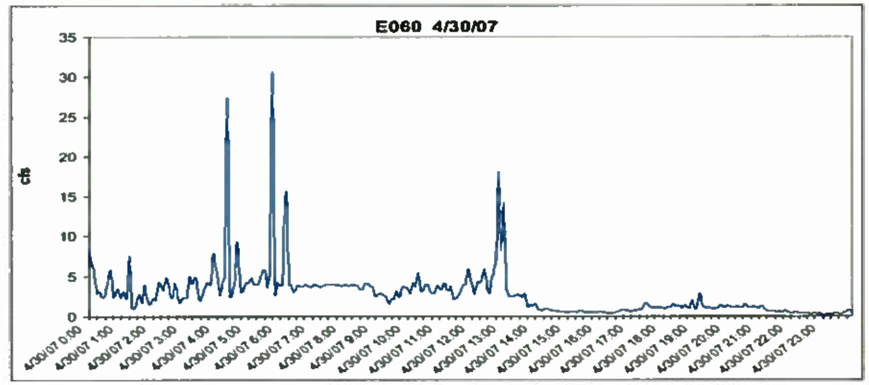

E040 annual max 8/29/07

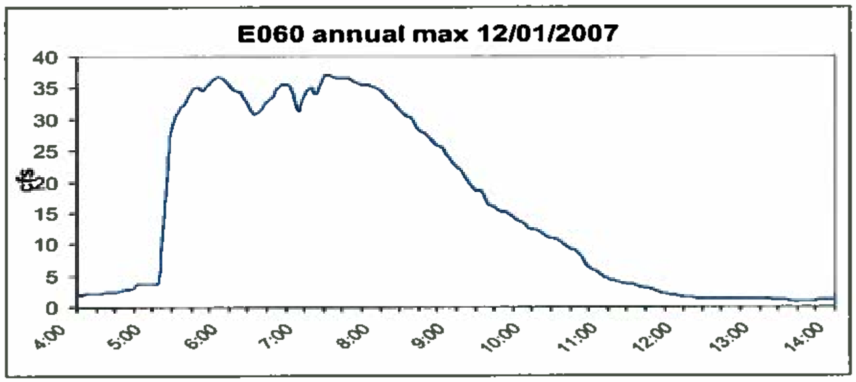

E042 annual max 9/2/07

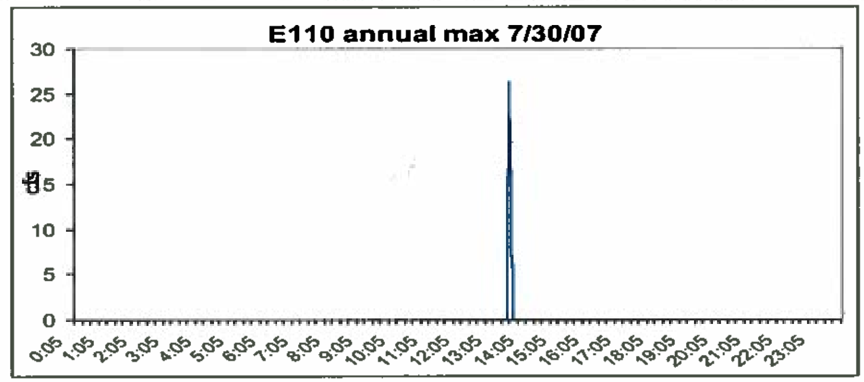

E050 annual max 9/2/07


E055 annual max 7/26/07

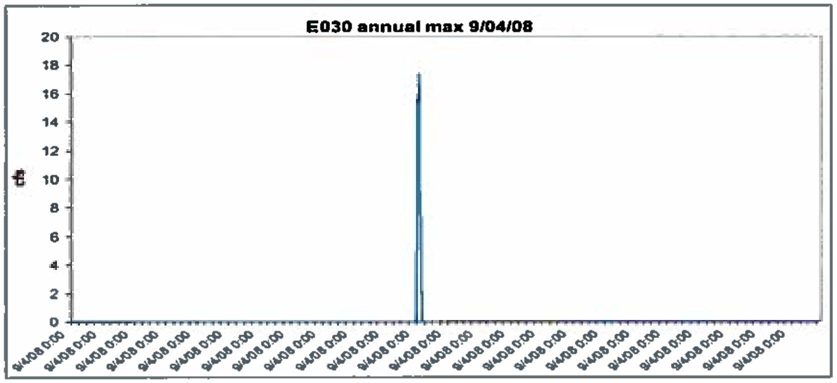

E056 annual max 7/26/07

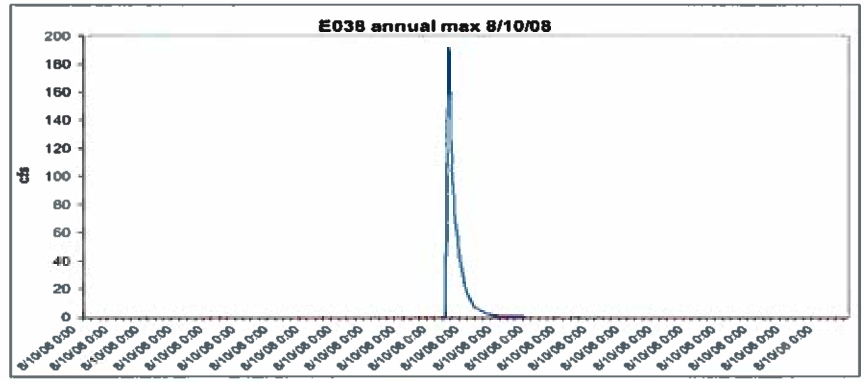

E060 4/30/07
cfs

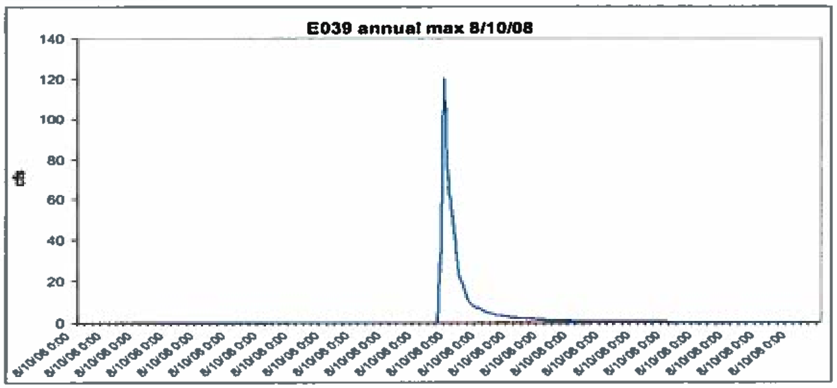

E060 annual max 12/01/2007
cfs

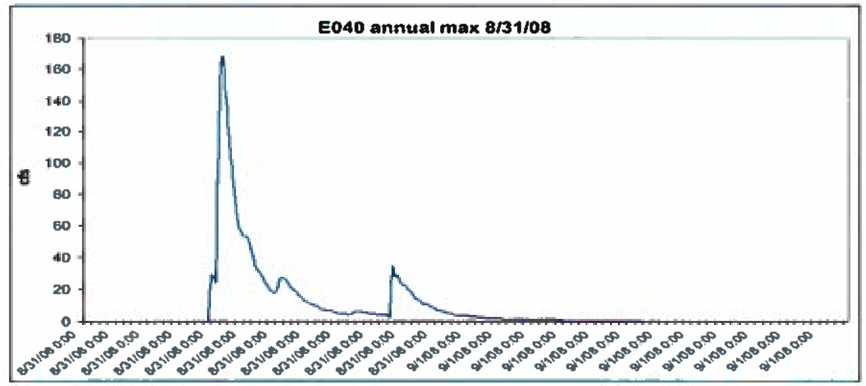

E110 annual max 7/30/07
cfs

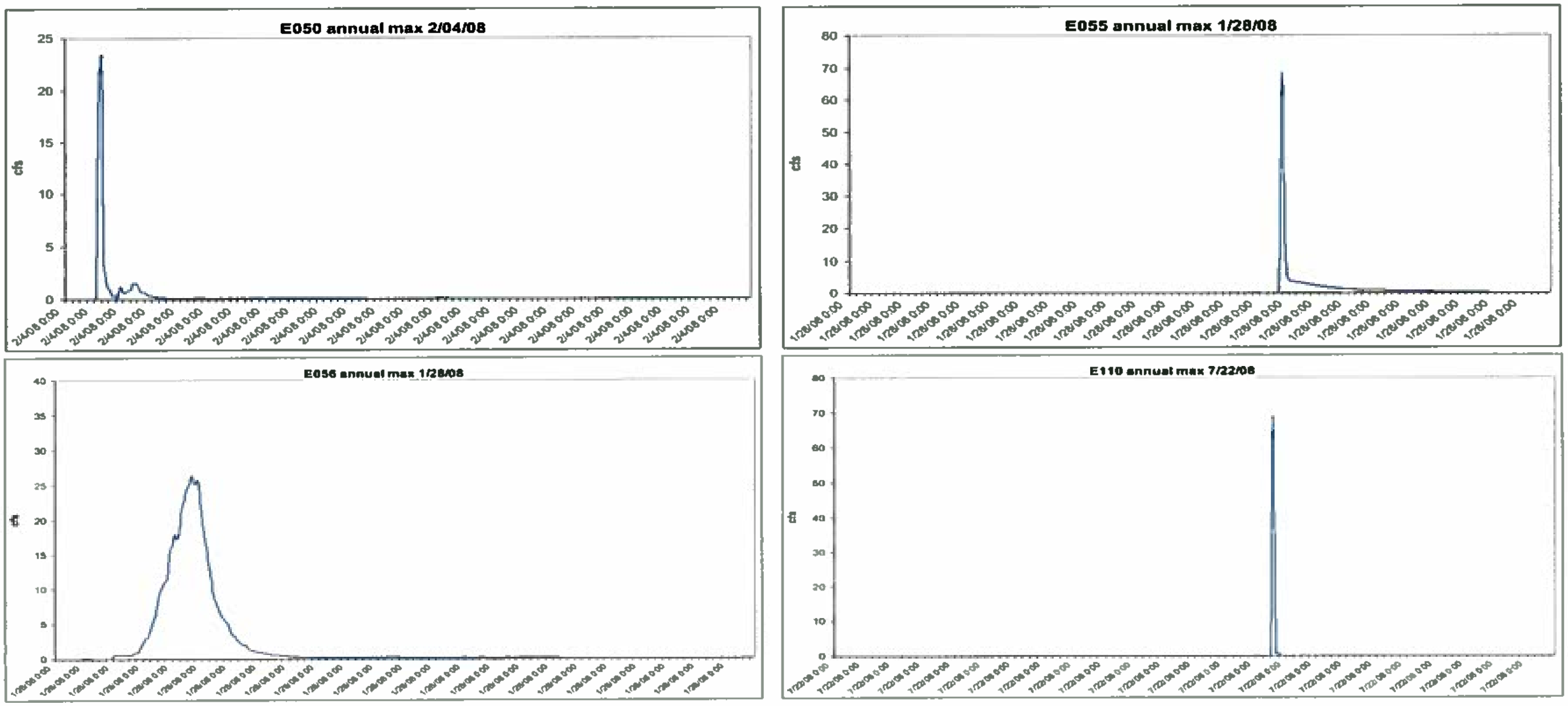
Max annual flows 2008

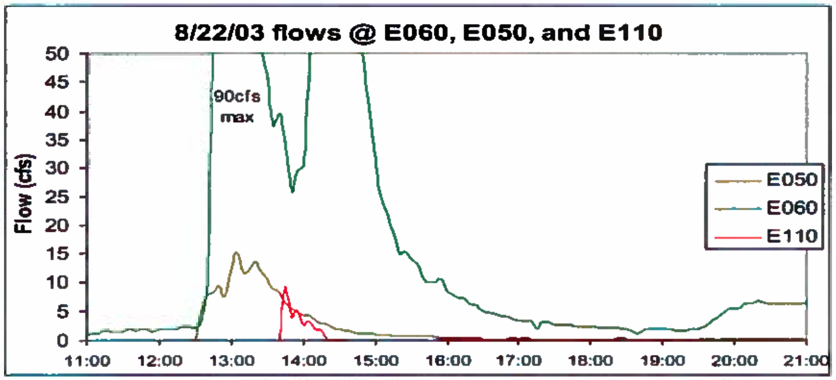


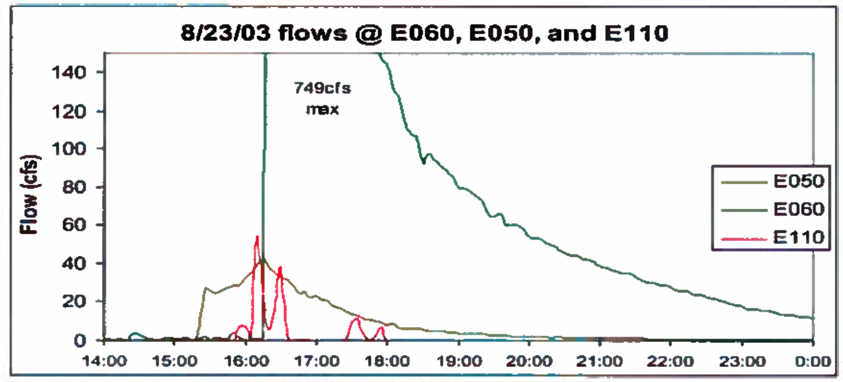


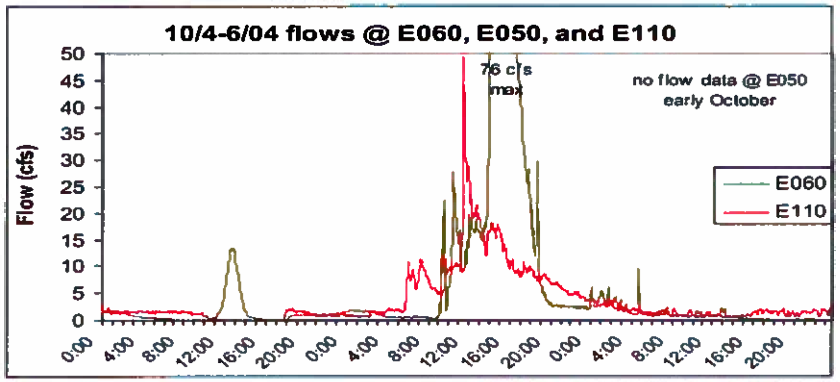


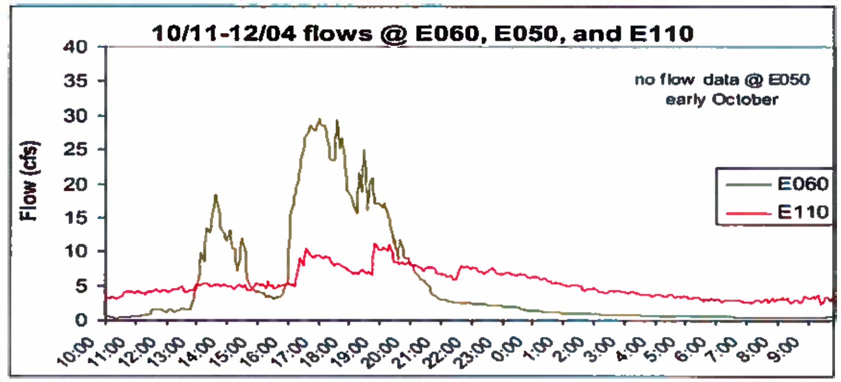


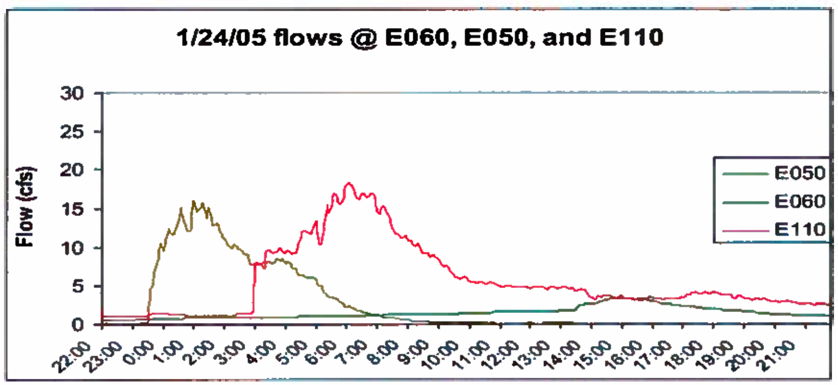

E050 annual max 2/04/08
cfs
E055 annual max 1/28/08
cfs
E056 annual max 1/28/08
cfs
E110 annual max 7/22/08
cfs

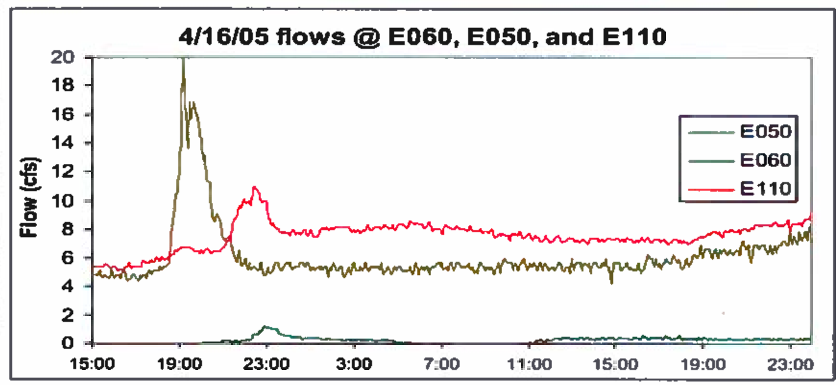

8/22/03 flows @ E060, E050, and E110
Flow (cfs)
90cfs max
E050
E060
E110
11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00

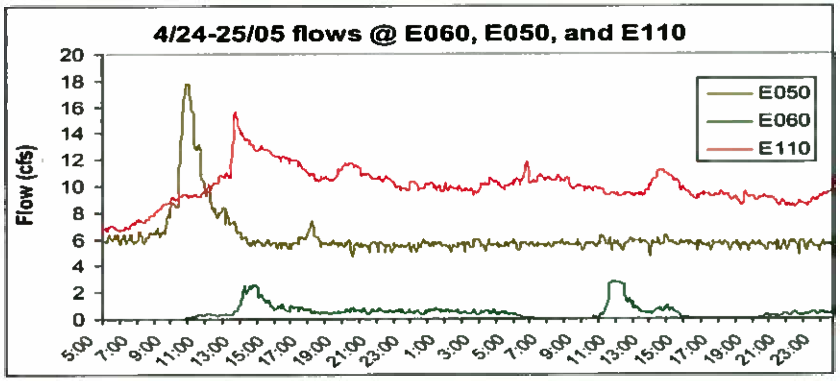

8/23/03 flows @ E060, E050, and E110
Flow (cfs)
749cfs max
E050
E060
E110
14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 0:00

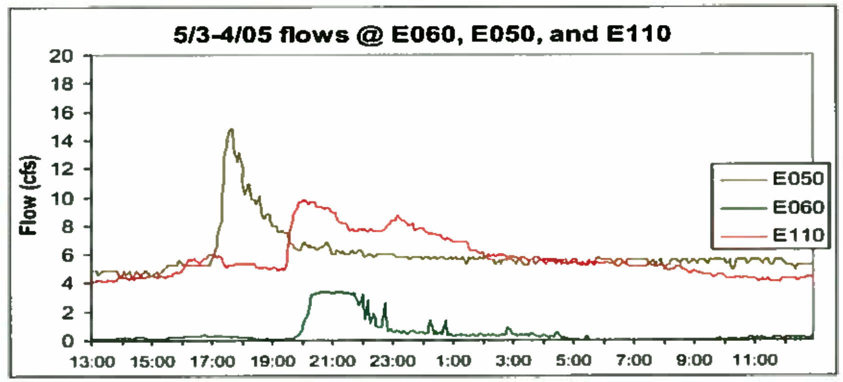

10/4-6/04 flows @ E060, E050, and E110
Flow (cfs)
76 cfs max
no flow data @ E050 early October
E060
E110

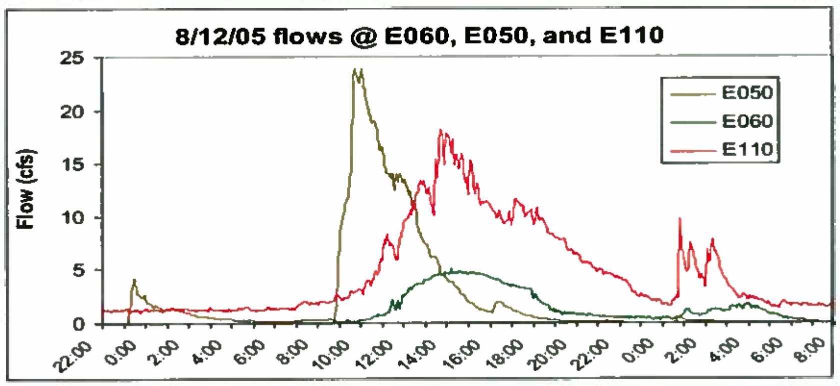

10/11-12/04 flows @ E060, E050, and E110
Flow (cfs)
no flow data @ E050 early October
E060
E110

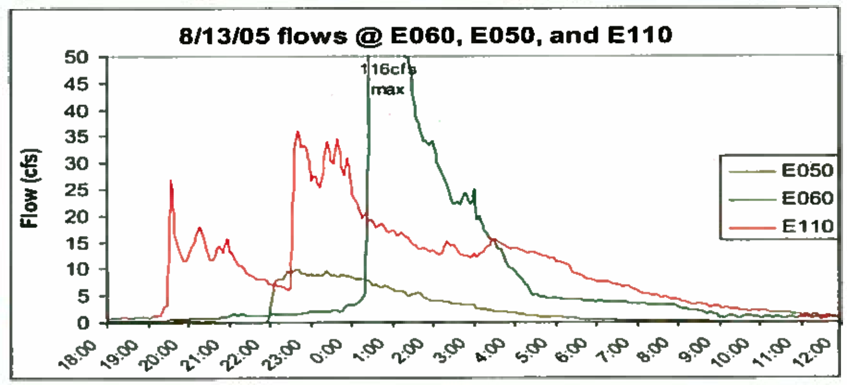

1/24/05 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110

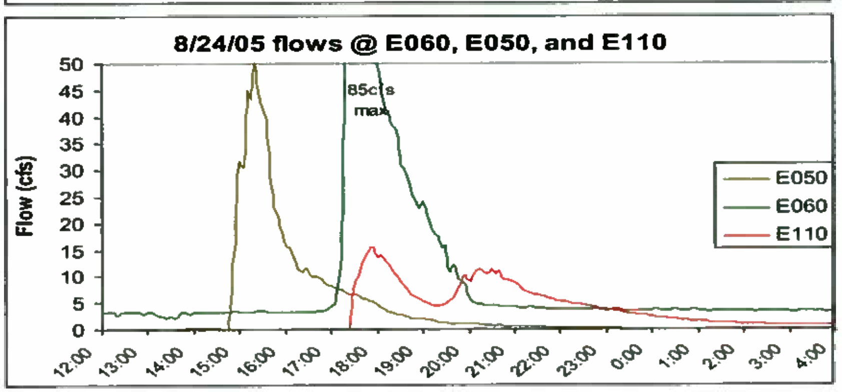

4/16/05 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110
15:00 19:00 23:00 3:00 7:00 11:00 15:00 19:00 23:00

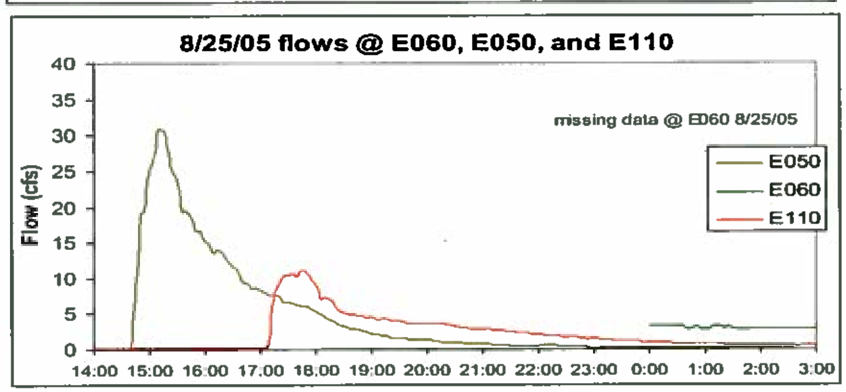

4/24-25/05 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110

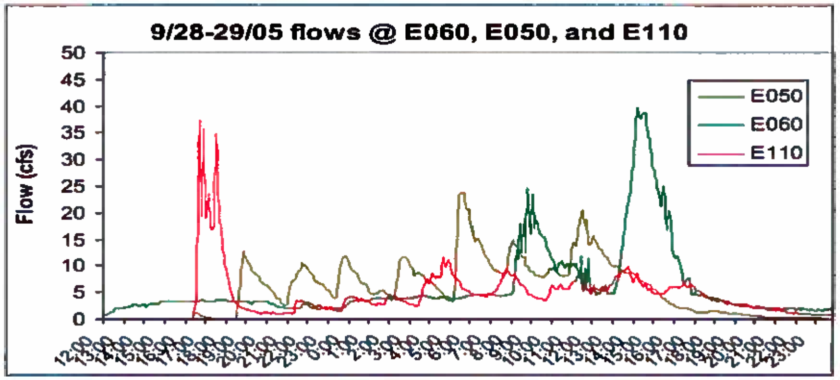

5/3-4/05 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110

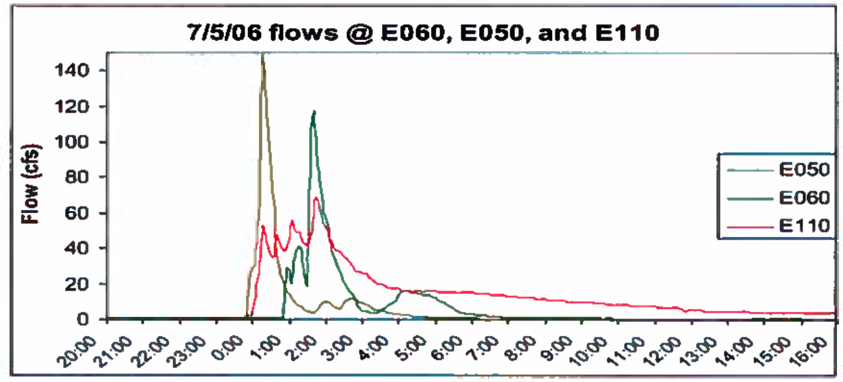

8/12/05 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110

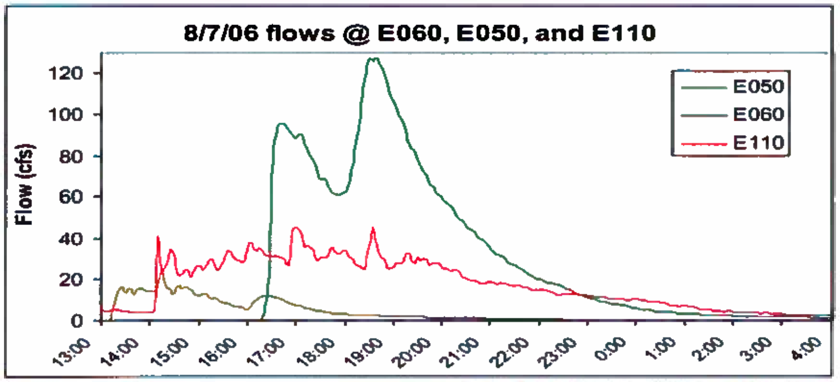

8/13/05 flows @ E060, E050, and E110
Flow (cfs)
116cfs max
E050
E060
E110

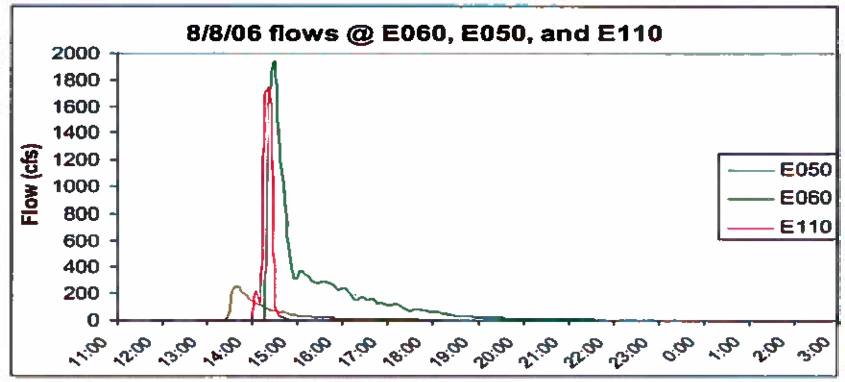

8/24/05 flows @ E060, E050, and E110
Flow (cfs)
85cfs max
E050
E060
E110

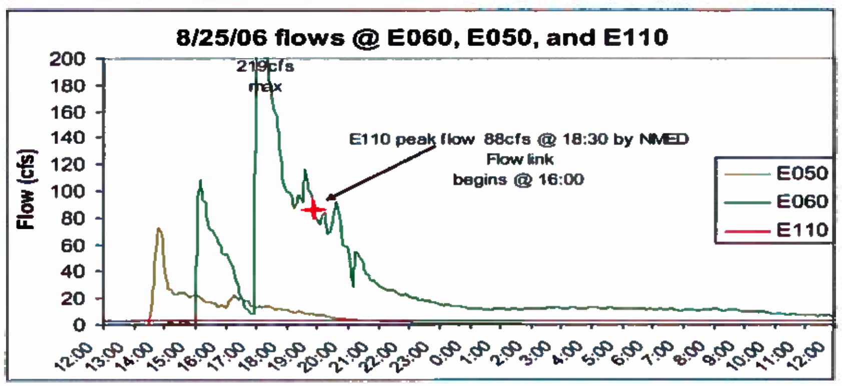

8/25/05 flows @ E060, E050, and E110
Flow (cfs)
missing data @ E060 8/25/05
E050
E060
E110

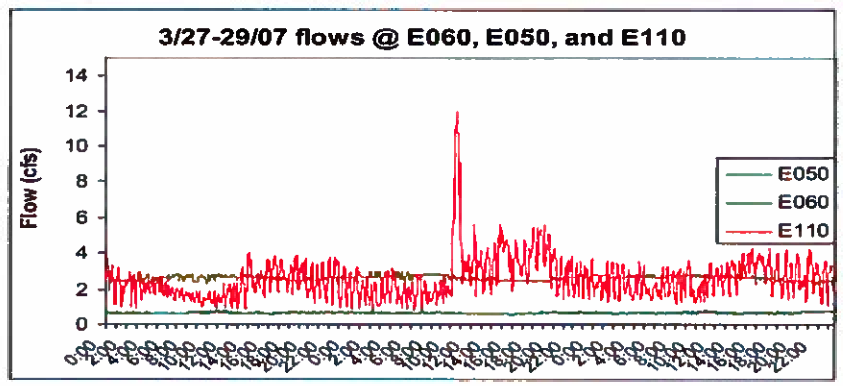

9/28-29/05 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110

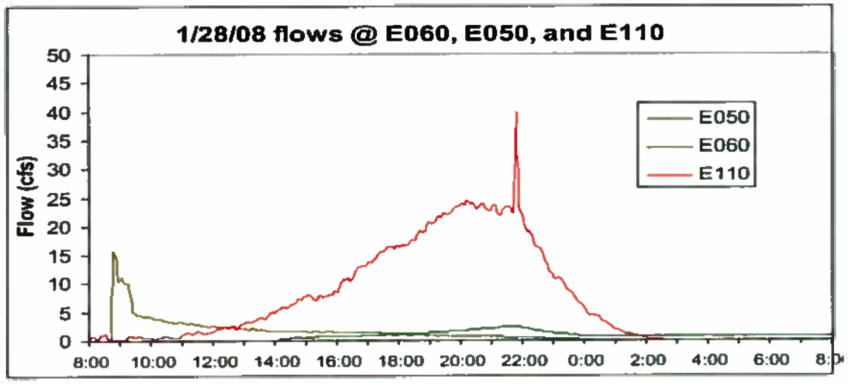

7/5/06 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110

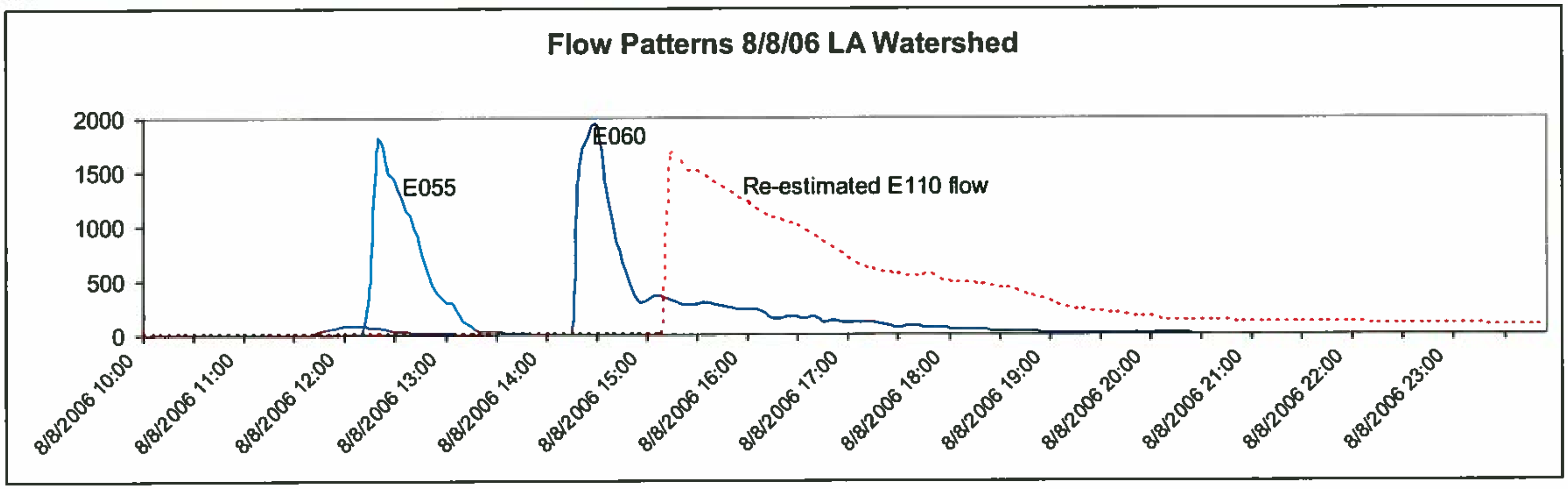

8/7/06 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110


8/8/06 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110


8/25/06 flows @ E060, E050, and E110
Flow (cfs)
219cfs max
E110 peak flow 88cfs @ 18:30 by NMED
Flow link
begins @ 16:00
E050
E060
E110


3/27-29/07 flows @ E060, E050, and E110
Flow (cfs)
E050
E060
E110


1/28/08 flows @ E060, E050, and E110
Flow (cfs)
50
45
40
35
30
25
20
15
10
5
0
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
E050
E060
E110


Flow Patterns 8/8/06 LA Watershed
2000
1500
1000
500
0
E055
E060
Re-estimated E110 flow
8/8/2006 10:00
8/8/2006 11:00
8/8/2006 12:00
8/8/2006 13:00
8/8/2006 14:00
8/8/2006 15:00
8/8/2006 16:00
8/8/2006 17:00
8/8/2006 18:00
8/8/2006 19:00
8/8/2006 20:00
8/8/2006 21:00
8/8/2006 22:00
8/8/2006 23:00